

**A MONOGRAPH OF THE GENUS PROTIUM  
AND SOME ALLIED GENERA (BURSERACEAE)**

by

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## INTRODUCTION

My revision of the Burseraceae in Pulle's Flora of Suriname is extended here to a monographic treatment of those Burseraceous genera of which representatives occur in Suriname. Engler's monograph of this family dates from nearly sixty years ago, and since that time many new species have been published. These additions and the large number of minor and major problems which presented themselves, doubtless justify the publication of this study. I am bound to admit however that not all problems could be solved.

The present paper is divided into a General Part and a Taxonomic Part. The critical remarks concerning the whole family and its tribes are dealt with in the General Part, and those referring to the separate genera and species are to be found in the appropriate place in the Taxonomic Part; to the former is added a list of general literature, and to the latter a list of collectors' numbers and indices of vernacular and scientific names.

The diagnoses in Latin of the new genus and of the new sections of genera, the new species and the new varieties, which are dealt with in this paper in exactly corresponding English text, have been published previously by the author under the title of "Novitates Burseracearum" in *Rec. Trav. bot. néerl.* XXXIX, p.189 (1942).

All specimens and literature mentioned in this work have been examined by me, unless indicated otherwise. Particulars not to be seen in the herbarium specimens themselves, as habit, colour of the flower and of the fruit, smell, application, vernacular names, etc., have been taken either from collectors' notes on the labels or from the literature.

In regard to the terminology, Jackson's "A glossary of botanic terms" ed. 4 (1928) and Pulle's "Compendium" (1938) served me as guides.

A great quantity of material, kindly lent by various herbaria to the "Botanisch Museum en Herbarium", Utrecht, made it possible to me to carry out this study. These herbaria are indicated in this monograph by the following abbreviations, which have been taken from the list published by Dr. J. Lanjouw, Hon. Secr. Int. Commission for Urgent Taxonomic Needs, in *Chronica Botanica* V, p.142 (1939).

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|---|-------|
| 1. Botanisches Museum, Berlin-Dahlem  | B     |
| 2. British Museum of Natural History, Dept. of Botany,<br>London                          | BM    |
| 3. Jardin Botanique de l'État, Bruxelles  | BR    |
| 4. Botanische Anstalten der Universität, Breslau  | BRSL  |
| 5. Herbarium en Museum voor systematische Botanie<br>van 's Lands Plantentuin, Buitenzorg | BZ    |
| 6. Universitetets Botaniske Museum, Copenhagen  | C     |
| 7. The Royal Botanic Garden and Herbarium, Calcutta                                       | CAL   |
| 8. Laboratorium voor Technische Botanie, Delft  | Delft |
| 9. Field Museum of Natural History, Chicago   | F     |
| 10. Institut de Botanique systématique de l'Université,<br>Généve                         | G     |
| 11. The Gray Herbarium of Harvard University, Cam-<br>bridge (Mass., U.S.A.)              | GH    |
| 12. Botanische Anstalten der Universität, Göttingen                                       | GOET  |
| 13. Herbarium Royal Botanic Gardens, Kew  | K     |
| 14. Rijksherbarium, Leiden  | L     |
| 15. Botanical Museum of the Acad. of Sciences, B.I.N.,<br>Leningrad                       | LE    |
| 16. Botanische Anstalten, München   | M     |
| 17. New York Botanical Garden, New York   | NY    |
| 18. Laboratoire de Phanérogamie du Muséum national<br>d'Histoire naturelle, Paris         | P     |
| 19. Naturhistoriske Riksmuseet, Stockholm   | S     |
| 20. Botanisch Museum en Herbarium, Utrecht  | U     |
| 21. U.S. National Herbarium, Smithsonian Institution,<br>Washington (DC., U.S.A.)         | US    |
| 22. Naturhistorisches Museum, Botanische Abteilung,<br>Wien                               | W     |

I wish to express here my gratefulness to the directors and keepers of the herbaria before mentioned for their valuable help.

A special word of thanks is due to the directors and staff of those herbaria and libraries which I have personally visited, for the hospitality and the assistance given to me during my stay, viz. the herbaria of Leyden, of the British Museum (Natural History), South Kensington, of the Royal Botanic Gardens, Kew and of the Botanisches Museum, Berlin-Dahlem.

I am also highly indebted to the "Van Eeden-Fonds", which enabled me to visit London and Berlin, and I greatly regret that my planned visit to Paris was made impossible by the outbreak of the war.

My most sincere thanks are due to Prof. Dr. A. A. Pulle, Director of the "Botanisch Museum en Herbarium", Utrecht, under whose direction this work was completed, for his continuous interest, his valuable advice and his great support, and for the hospitality which for such a long time was shown to me in his institute.

## I. GENERAL PART

### I. HISTORY OF THE FAMILY

When A. L. de Jussieu in 1791 created the family Terebinthaceae, the genera *Canarium* L., *Icica* Aubl. and *Bursera* Jacq. were included in the second of the five groups in which he divided the family. This group was raised to the rank of a family, Amyrideae, by R. Brown (1818). Kunth in his revision of the Terebinthaceae (1824) distinguished seven families, of which R. Brown's Amyrideae furnished three, viz. the Burseraceae, the Amyrideae and the Spondiaceae. The Burseraceae contained ten genera, first the three genera of De Jussieu's Terebinthaceae: *Canarium* L., *Icica* Aubl. and *Bursera* Jacq., further: *Elaphrium* Jacq., *Boswellia* Roxb., *Balsamodendrum* Kunth, *Protium* Burm., *Marignia* Comm., *Colophonia* Comm. and *Hedwigia* Swartz.

Afterwards various authors have dealt with the family Burseraceae in different ways.

It is treated as a mere tribe of the Terebinthaceae by A. P. de Candolle (1825), who referred to it the same genera as Kunth, with the exception of *Elaphrium* Jacq. only, and moreover two new ones: *Sorindeia* Dup.-Th. and *Garuga* Roxb.; by Meisner (1836—1843), who referred to it *Garuga* Roxb., *Fagarastrum* Don, *Barbylus* P. Brown, *Spathelia* L. and five genera of uncertain affinity; by Triana and Planchon (1872), and finally by Baillon (1874), who, also by referring *Protium* Burm., *Icica* Aubl., *Marignia* Comm. and *Elaphrium* Jacq. to the genus *Bursera* Jacq. and *Trattinickia* Willd. to the genus *Hedwigia* Swartz, reduced the number of genera to nine.

The Burseraceae are dealt with as a distinct family, with about the same delimitation as that of Kunth, by Don (1832), who also mentioned *Sorindeia* Dup.-Th., *Garuga* Roxb. and referred one new genus to it, namely *Fagarastrum* Don; by Endlicher (1836—1840), who suppressed *Colophonia* Comm. and added *Trattinickia* Willd., *Garuga* Roxb., *Hemprichia* Ehrenb. and seven genera of dubious affinity, whilst the Amyrideae, which contained but one genus, namely *Amyris* L., are subjoined as "Burseraceis affinis", and also by J. D. Hooker (1862) who quoted 18 genera, amongst

which *Crepidospermum* Hook.f., but this author changed R. Brown's name *Amyrideae* in that of *Burseraceae* for he distinguished two tribes, the *Bursereae* and the *Amyrideae*.

Lindley (1853) retains R. Brown's *Amyridaceae*, with the *Burserideae* and the *Amyrideae* as separate tribes, which are better defined by him than by either Endlicher or Hooker.

Since Marchand (1867—1868) amply discussed the *Burseraceae*, dealing with their morphology, their history, their affinities, their anatomy, their taxonomy and their resins and gums, nearly all authors have accepted the *Burseraceae* as a well defined family.

## 2. DIAGNOSIS OF THE FAMILY

Trees or shrubs; the inner bark always provided with resiniferous ducts. Leaves scattered, usually imparipinnate, sometimes trifoliate, rarely unifoliate, mostly exstipulate. Inflorescences usually axillary, and then sometimes pseudoterminal, rarely terminal, either paniculate with the ultimate ramifications cymous, or racemose, rarely pseudospicate. Flowers hermaphrodite or polygamodioecious, actinomorphic, 3- to 5-merous, with usually connate persistent sepals and free deciduous petals, both either valvate or imbricate in aestivation. Stamens usually obdiplostemonous, rarely isostemonous; the filaments free and inserted either below the disc or on its margin; the anthers introrse, longitudinally dehiscent. Disc usually intrastaminal, rarely extrastaminal. Carpels connate, usually isomerous with the corolla and then epipetalous, but sometimes meiomorous, forming a 5- to 2-celled pistil, each cell with 2 centrally collateral epitropous pendulous ovules. Fruit a drupe with free or more or less connate, always one-seeded pyrenes. Seed exalbuminous; embryo with superior radicle and usually lobed cotyledons.

About 17 genera with about 560 species in all tropical countries.

## 3. AFFINITIES OF THE FAMILY

Of the characters mentioned in the diagnosis given above the resiniferous ducts in the bast and the two collateral epitropous ovules deserve special attention as they distinguish the family from its nearest relatives, the *Rutaceae*, the *Simarubaceae*, the *Anacardiaceae* and the *Meliaceae*. The affinities of these families have amply been discussed by Marchand (1867—1868), Baillon (1874), Engler (1874, 1897, 1913, 1915 and 1931), Jadin (1894) and Guil-

laumin (1909). A careful consideration of their arguments has led me to the conclusion that Engler's opinion is the most plausible one. According to him there is a distinct difference between the Burseraceae, with two epitropous ovules in each cell of the ovary, and the Anacardiaceae, with a single, not epi-, but apotropous ovule in each cell, and as the position of the ovules is the differential character between Engler's orders Geraniales and Sapindales, the Burseraceae are referred to the former and the Anacardiaceae to the latter. Baillon, and afterwards Jadin, who united both families under the name Terebinthaceae, undervalued the importance of the differences in the number and in the position of the ovules. Jadin, and also Guillaumin, over-estimated the value of the presence of resiniferous ducts in the bast of both families. Guillaumin inserted, between the Burseraceae and the Anacardiaceae, only the Meliaceae, which however possess no resiniferous ducts in the bast, but are characterized by two epitropous pendulous ovules in each cell of their ovary, by their glanduliferous leaves and by their mostly monadelphous stamens.

By most authors the Burseraceae are considered nearly related to the Rutaceae, from which they differ by the presence of resiniferous ducts in the bast. The number and the position of the epitropous ovules, which in the Rutaceae is variable, is in the Burseraceae always of the same kind, and the carpels, which in the Rutaceae are at least partly free, are here always completely connate.

In recent times most authors, like did Engler, have expressed in the sequence of the families, which they mention, a closer affinity of the Burseraceae to the related families which possess one or two epitropous ovules in each cell of the ovary, like the Rutaceae, the Simarubaceae, the Meliaceae, the Polygalaceae and the Vochysiaceae, than to those families which possess apotropous ovules, like the Anacardiaceae and the Sapindaceae.

#### 4. SUBDIVISION OF THE FAMILY

Apart from the subdivisions proposed by Endlicher and Hooker, which have been mentioned already, the first attempt to divide the family in tribes was made by Marchand (1867—1868), who distributed the eleven genera, which he referred to the Burseraceae, over three tribes, viz.: the Hedwigieae, — gamopetalous with hypogynous stamens (*Hedwigia* Swartz and *Trattinickia* Willd.) —, the Protieae, — polypetalous with hypogynous stamens (*Protium* Burm.f., *Boswellia* Roxb., *Canarium* L., *Sonzaya* March., *Bursera*

Jacq. and *Crepidospermum* Hook.f.) —, and the *Garugeae*, — polypetalous with perigynous stamens (*Garuga* Roxb., *Balsamodendrum* Kunth and *Santiria* Bl.)

A second attempt was made by Engler (1874) in connection with his revision of the *Burseraceae* for Martius's *Flora Brasiliensis* (c.f. this work XII, 2, p. 247). He distinguished two tribes: the *Bursereae* (Benth. et Hook.) em. Engl., — embryo straight with contortuplicate cotyledons —, and the *Crepidospermeae* Engl., — embryo hipocrepiform with linear-oblong cotyledons —. Whereas the latter contained only the genus *Crepidospermum* Hook.f., the former tribe was divided in two subtribes, viz.: the *Protieae* March. em. Engl., with convex receptacle and hypogynous stamens, and the *Garugeae* March., with concave receptacle and perigynous stamens. In this subtribe *Protieae* were joined therefore the tribe *Protieae* March., except the genus *Crepidospermum* Hook.f., and the tribe *Hedwigieae* March. Obviously this division has not satisfied the author for in his papers on the *Burseraceae* published in 1883 and 1897 a division in tribes is omitted.

Later Engler (1913, 1915 and 1931) elaborated a new subdivision of the family. This time it was based on the degree of concrecence between the pyrenes; in this way three tribes were obtained: the *Protieae* Engl., — pyrenes free though sometimes in close contact (*Protium* Burm.f., *Crepidospermum* Hook.f., *Tetragastris* Gaertn., *Trattinickia* Willd. and *Garuga* Roxb.) —, the *Boswellieae*, — pyrenes partly connate but still recognizable on the outside by furrows and detachable from each other (*Aucoumea* Pierre, *Triomma* Hook. f., *Boswellia* Roxb., *Bursera* L. and *Commiphora* Jacq.) —, and the *Canarieae*, — pyrenes connate in a single plurilocular stone (*Canarium* L., *Canariellum* Engl., *Pachylobus* Don, *Santiria* Bl., *Santiriopsis* Engl. and *Scutinanthe* Thwaites).

Lam (1932, Bull.) in his comprehensive study on the Malayan *Burseraceae*, chiefly concerning the *Canarieae* Engl., accepts nearly the same classification as Engler. He restores the name *Bursereae* instead of Engler's *Boswellieae*. Besides some changes in the configuration of the genera of the *Canarieae*, Lam adds to the characters used in Engler's subdivision of the family the number of parts in the flowercycles and an anatomical one, viz.: the presence of resiniferous vascular bundles in the medulla of the petioles. There is apparently a correlation between the latter and the number of parts in the flowercycles, for they occur in all genera with trimerous flowers and nowhere else; they are to be found e.g. in the genus *Trattinickia* of the *Protieae* and in all genera of the *Canarieae*, the genus *Scutinanthe* alone excepted.



Although this subdivision of the Burseraceae is preferable to those given previously, it is not entirely satisfactory. It is also rather unfortunate that the name Protieae has been used in three different ways. The Protieae March. (1867—1868) and the Protieae March. em. Engl. (1874) both enclose the bulk of the genera of the Burseraceae. The Protieae March. em. Engl. (1913), however, form a quite different group, because the tribe is here actually confined to the large genus *Protium* Burm.f., the other genera being but small and specialized ones.

Engler and Lam take the characters by which the genera are separated from each other chiefly from the flower and the fruit, and in a few cases only from the cotyledons, from the leaves or from anatomical structures. The value of the anatomical characters however was strongly emphasized by Jadin (1894) and still more by Guillaumin (1909). The latter even elaborated several modes of classification, one based on anatomical characters only, one according to the features of the fruit, the embryo (cotyledons) and the seedling, one founded on the characters of the flower, and finally a general one based on a combination of all characters, in which however those taken from the flower prevail.

Although a division which has to be presented in the form of a key, and preferable a dichotomous one, has to rely on only one or a few characters, and therefore inevitably leads to artificialness, and the classification proposed by Engler, and modified by Lam, is but little different from such a division, it nevertheless seems to me to be the most correct expression of the natural affinities.

The genera which are treated in this monograph all belong to the tribe Protieae March. em. Engl. (1913), and it is therefore to this tribe that I will mainly restrict myself in the following chapters.

## 5. THE BURSERACEAE - PROTIEAE

The Protieae in their present delimitation chiefly consist of the large genus *Protium* Burm.f., which represents in its floral morphology but little specialization, and around which the other genera with more or less specialized flowertypes may be arranged. It is for this reason that Engler (1913), tacitly assuming that the structure of the flower in valuations of this kind is of greater importance than other structures, considered the *Protium*-type as the most primitive in this family.

As the morphology of the Burseraceae has already been extensively discussed by Lam (1932, Ann. and Bull.) and also in connection

with the anatomy by Guillaumin (1909), I will confine myself to some remarks on the morphology of the generative parts.

The inflorescences of the Protieae are of the mixed type; the main axes and the secondary, and, if present, the tertiary branchlets are racemosely arranged, but the flowers are produced in terminal, mostly dichasial, cymes. The inflorescences originally arise in the axils of normal leaves. However, both in the structure and in the position they sometimes show peculiarities which deserve attention.

First there is a tendency for crowding together at the end of the branchlets, and if these subterminal inflorescences originate in the axils of deciduous small bracts they form a pseudoterminal panicle or corymb in which the terminal bud is, as a rule, still present. In some cases only this terminal bud is not discernible, and the inflorescences are then indistinguishable from really terminal ones.

Secondly there is a tendency for the shortening of the axes. If this tendency is present in all axes, the flowers become ultimately glomerate in more or less densely clustered inflorescences; however all transitions from elongate, laxly paniculate inflorescences to densely clustered glomeruliform ones are present. If however this tendency is restricted to the main axis, this axis and the secondary branchlets become indistinguishable from each other and form axillary fasciculate inflorescences. Finally this tendency may manifest itself in the branchlets of the cymes and in the pedicels, but not in the main axis or axes; in this way pseudospicate inflorescences like those that are characteristic for the section *Icicopsis* of *Protium*, result (see fig. 4).

The flowers are mostly unisexual and dioecious, but occasionally hermaphrodite flowers may occur or flowers of both sexes may be found on the same tree. Generally male and female flowers are easily distinguishable from each other, but sometimes the difference is so slight that the sex may only be determined when flowers of both sexes are present.

A distinctly concave receptacle, on whose margin the sepals, the petals and the stamens are inserted, is to be found in *Garuga*. In all other genera the receptacle forms an intrastaminal disc.

Whereas the sepals, as in all *Burseraceae*, are more or less connate, the gamopetalous genera *Tetragastris* and *Trattinickia* represent in this respect specialized types which are however not nearly related to each other. The latter genus occupies also on account of its 3-merous flowers and the inverted vascular bundles in the medulla of its petioles an isolated position.

There are usually twice as many stamens as there are petals and they are inserted in a single whorl. It has been suggested that the epipetalous position of the carpels indicates that this single whorl originates from obdiplostemony, a state which is called by Lam (1932, Ann. p. 111) meta-obdiplostemony. In the genus *Trattinickia* I observed that in the female flowers, which possess a very large pistil, the stamens are inserted on the margin of the disc, a phenomenon described by Lam (l.c. p. 116) as "escape on the disc", and named by him pseudo-meta-obdiplostemony (see fig. 8c). Isostemony occurs in *Crepidospermum* only; the stamens are episepalous here. Generally the stamens are equal in length, but when they are didynamous the episepalous stamens are the larger ones. Didynamy is not frequent and occurs sporadically, but sometimes it is characteristic for a special group, in *Protium* e.g. for the sectio *Icicopsis* (see fig. 4 and 5a). In the female flowers the stamens are usually but slightly smaller than in the male flowers, but sometimes the difference is striking; their anthers are mostly empty. As a rule the filaments are inserted below the disc; their base is more or less dilated and flattened, sometimes to such a degree that they come into contact with each other.

The carpels are mostly isomerous with the sepals and placed alternately with them, but at times they may be meiomorous. The difference between the sexes is much more conspicuous in the pistil than in the stamens. Nevertheless the pistil in the male flower, though slightly reduced in size in regard to that of the female flower, may show a quite similar structure, possessing cells and ovules like that of the other sex (see fig. 1a and b). In such cases, which are met in various species of *Protium*, the sex can only be determined by comparing male and female flowers. In this regard the relative proportions of the organs too may give no hold (see fig. 3). In most species however the ovary in the male flower is distinctly smaller and more or less reduced in structure, with rudimentary or abortive ovules or, as I pointed out in a preliminary note on *Protium serratum* Engl. (Swart 1940), it may even be filled with a solid, structureless mass. In *Protium*, except in the sectio *Icicopsis*, the pistil in the male flower shows, as well outwardly as inwardly, more or less the same structure as that in the female one and in this regard also *Protium* is the less specialized of all *Burseraceae*. It frequently occurs in *Protium* that the reduction of the pistil in the male flower goes so far that its ovary is entirely immersed in the disc, so that only the style, when present, and the stigma are visible, whereas in the female flower the ovary is merely at the base, or at most in the basal half, surrounded by the disc (see fig. 2). Although

Engler used these features in his keys, he was apparently not guided by them, for they never induced him to misinterpret the species. In *Hemicrepidospermum*, in *Crepidosperrum* and in *Trattinickia* only a small cylindrical or conical, structureless rudiment of the pistil, surrounded by the disc, is extant in the male flowers (see fig. 8b). In the male flowers of some species of *Protium*, section *Icicopsis* I have observed an extremely small rudiment of the ovary, entirely embedded in the disc, and at the base confluent with it, but most species of this section show a depressed globuliform, pilose and inwardly structureless mass, formed by the confluence of the disc and the rudimentary ovary; Lam (1932, Ann. p. 129), who observed the same condition in several species of *Canarium*, has named this organ "ovario-discus"; in some cases this ovario-disc was crowned by a filiform style-rudiment (see fig. 4). A similar but conical and either glabrous or sparsely pilose ovario-disc, tapering in a remnant of the stigma, occurs in *Tetragastris* (see fig. 7c).

As to the fruit I got the impression that its dehiscence or indehiscence is of little importance. The fleshier the mesocarp is, and the farther the pyrenes are apart, the easier the fruit will split. In consequence the fruits of *Tetragastris*, which are distinctly lobed, and possess a thick and fleshy mesocarp, that also separates the pyrenes, readily dehisce, and those of *Trattinickia*, which have nearly connate pyrenes and only a thin mesocarp, never dehisce, whilst the fruit of *Protium* occupies in this respect an intermediate position.

Plicate cotyledons prevail in the family, and have been considered primitive. The plane-convex cotyledons of *Tetragastris* and the uncinately curved cotyledons of *Hemicrepidospermum* and *Crepidosperrum* would represent two different modes of development (see fig. 5b and 6). Special attention to the various aspects of the embryo has been paid by Guillaumin (1910).

On account of its general morphology, the occurrence of a certain number of well-established species, especially in palaeotropics, and its distribution over the tropics of the Old and New World, *Protium* is considered by Engler and by Lam as the genus from which the other Burseraceous genera may have been derived. On the other hand, however, I found that in the neotropics, and often in a more or less limited area, many species occur which are so nearly related to each other that their delimitation sometimes offers great difficulties. Such groups of nearly related species may sometimes be arranged around a central one, e.g.: around *Protium*

heptaphyllum March. and around *Protium Copal* Engl., but in other instances the various species of a group are all more or less equal in rank, for example in the section *Icicopsis* of *Protium*. Except the species of this section with outstanding and easily distinguishable characters, viz.: *P. fragans* Urb., *P. apiculatum* Swart and *P. subserratum* Engl., the other species show in so many aspects transitions to each other that it is difficult to separate them. Nevertheless, if the complete material is surveyed some quite distinct types can be singled out, which may be regarded as distinct species. However the allocation of the other specimens to these types has only been possible by distributing them according to the presence or absence of the characters used in the key to the species of this section, but these allocations are necessarily of a more or less artificial nature, because other characters have deliberately been left out of consideration.

## 6. GEOGRAPHICAL DISTRIBUTION

All the three tribes of the Burseraceae are pantropic, but the greater part of the Bursereae occur in Africa and the neighbouring part of Asia, that of the Canarieae occupies an area situated in eastern Asia and Australia, whilst the Protieae show their chief development in the American tropics. This distribution is plainly illustrated by the maps and figures produced by Lam (1932, Bull. p. 299 and 302).

Confining myself to the Protieae it is in the first instance the peculiar distribution of *Protium* which draws the attention. Of the 78 species, which I referred to this genus, 71 are inhabitants of the New World, 3 occur in eastern Asia only, and 4 are restricted to the isles of Madagascar and Mauritius. The latter four form a distinct section, the *sectio Marignia*, formerly a genus of its own. *P. obtusifolium* March. seems to be a common plant in Mauritius; the other three species, *P. Chapelierii* Guill., *P. madagascariense* Engl. and *P. Beandou* March., which are only incompletely known, occur in northern Madagascar.

The Asiatic species of *Protium*, however, are nearly related to the American ones, and the separation of the Old World species from the New World ones rests as yet on one conspicuous character only. The Asiatic section *Eu-Protium* is represented by but three well-defined species which occupy discontinuous areas; two of them show a wide range of variability. These species are: *P. serratum* Engl., in continental south-eastern Asia, from Madras and Bengal

to Cochin-China, *P. javanicum* Burm.f., in Java and some of the neighbouring isles, and *P. connarifolium* Merr., which seems to be restricted to the island of Palawan between Borneo and the Philippines, though there is a single, but not yet confirmed record from north-eastern New Guinea.

The curious distribution of *Protium*, combined with the morphological features of this genus, induced Lam (1932, Bull.) to elaborate a theory on the phylogeny of the Burseraceae.

A study of the distribution of the American *Protieae* proves that most of them occur in an area of equatorial South America, situated east of the Andes and extending from Venezuela, Colombia and northern Bolivia down to the Atlantic Coast, i.e. lying between about 12° N.L. and 12° S.L. The Guianas and the adjoining parts of Brazil, northern Amazonas and Para, are especially rich in species.

A small number of species extend their area outside these limits. An extension in south-eastern direction, to the Brazilian states Minas Geraes, Espirito Santo, Sao Paulo and Rio de Janeiro, is shown by the common and widely spread *Protium heptaphyllum* March., *P. Aracouchini* March. and *P. neglectum* Swart, but also by the less common *P. elegans* Engl. The territory of the just mentioned states shows also a number of species which are restricted to it, viz.: *P. brasiliense* Engl., *P. Icariba* March., *P. Widgrenii* Engl., *P. Warmingianum* March. and *Tetragastris breviacuminata* Swart. An area chiefly corresponding with this one, but enlarged in a northern and western direction, namely into the states Bahia, Goyaz and Matto Grosso and into eastern Bolivia and northern Paraguay, is occupied by *P. ovatum* Engl. and *P. Almecega* March. Most of these species are nearly related to each other and may be derived from species with a wider distribution extending their area to these provinces. Thus *P. brasiliense* Engl., *P. Icariba* March., *P. ovatum* Engl., *P. Widgrenii* Engl. and *P. Almecega* March. belong to the *P. heptaphyllum*-group, and *P. Warmingianum* March. is connected with *P. neglectum* Swart, but *Tetragastris breviacuminata* Swart occupies an entirely isolated position.

A curious disjunct area is shown by *Tetragastris panamensis* O.K., which partly occurs in Central America, from Br. Honduras to Panama, partly in the Guianas, but has never been recorded from the intervening countries.

Within the limits of the main area mentioned before there is a number of species restricted to the Andes-region of Peru and Ecuador, viz.: *Protium puncticulatum* Macbr., *P. glaucum* Macbr., *P. medianum* Macbr., *P. peruvianum* Swart, *P. ecuadorensis* Ben., *Crepidospermum multijugum* Swart, *Trattinickia peruviana* Loes.

and *T. laxiflora* Swart. A larger but similar area, extending from north to south along the eastside of the Andes possess *P. tenuifolium* Engl. and *Crepidospermum Goudotianum* Tr. et Pl.

Restricted to southern Amazonas, bordering on Peru, Bolivia and Matto Grosso are the areas of *Protium cuneatum* Swart, *P. pilosellum* Swart, *P. glabrescens* Swart, *P. pedicellatum* Swart, *P. pauciflorum* Swart, *P. nodulosum* Swart, *P. carnosum* Smith and *P. opacum* Swart.

Species only occurring in the countries along the northern coast of South America, the Guianas and Venezuela, are: *Protium octandrum* Swart and *P. decandrum* March.; *P. Hostmannii* Engl., *Tetragastris Hostmannii* OK. and *Trattinickia demerarae* Sandw., all three inhabiting the Guianas only; *Protium Melinonis* Engl. and *P. crassifolium* Engl., both known from Fr. Guiana only; *P. polybotryum* Engl., collected in Suriname only; *P. crenatum* Sandw. and *P. Altsonii* Sandw., recorded from Br. Guiana only and *P. tovariense* Pitt., restricted to Venezuela.

A rather large number of species inhabit Central America, none of which extends its, usually small, area further to the north or to the south. To this group belong: *Protium Copal* Engl. with its varieties and the related species: *P. panamense* Johnston, *P. multiramiflorum* Lundell, *P. nicaraguense* Swart, *P. Pittierii* Engl., *P. Schippii* Lundell and *P. costaricense* Engl.; further *P. neglectum* Swart var. *panamense* Swart and var. *sessiliflorum* Swart and *Trattinickia aspera* Swart.

Finally there are some species endemic to the Antilles. This are: *P. cubense* Urb., from Cuba, and the very similar *P. subacuminatum* Swart and *P. fragans* Urb., both restricted to eastern Cuba, and *P. attenuatum* Urb., from the Lesser Antilles, and further *P. glaucescens* Urb., from Haiti (S. Domingo), which belongs to the affinity of *P. heptaphyllum* March., and *Tetragastris balsamifera* OK. from Haiti and Porto Rico.

## 7. LITERATURE

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## II. TAXONOMIC PART

### BURSERACEAE KUNTH - PROTIEAE MARCH. EM. ENGL. (1913)

*Burseraceae* KUNTH - *Protieae* MARCH. in Adans. VIII, p.46 (1867—1868) pro minime parte.

*Burseraceae* KUNTH - *Protieae* MARCH. em. ENGL. in Mart. Fl. Bras. XII, 2, p.247 (1874) et id. in Abh. naturf. Ges. Halle XIII, 2, p.151 (1874) p.p.

*Burseraceae* KUNTH - *Protieae* ENGL. in Engl. Bot. Jahrb. XLVIII, p.443 (1913); id. in Engl. und Drude Veg. d. Erde IX, 3, I, p.779 (1915); id. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.410 (1931); Lam in Bull. Jard. bot. Btz. S.3, XII, p.297 (1932).

*Burseraceae* KUNTH - *Hedwigieae* MARCH. l.c.

*Burseraceae* KUNTH - *Crepidospemeae* ENGL. l.c. (1874).

Flowers 4- or 5-merous, rarely, — in *Trattinickia* —, 3-merous; calyx lobes imbricate in aestivation, petals subinduplicate-valvate in aestivation, usually with incrassate or inflexed-apiculate apex; pyrenes always separated by a more or less distinct layer of mesocarp, sometimes very near to each other but never connate. Except in *Trattinickia*, no resiniferous vascular bundles in the medulla of the petioles.

Key to the genera.

- 1a. - receptacle flat, forming an intrastaminal disc; stamens inserted either below the disc or on the margin of the disc
- 2a. - flowers 4- or 5-merous, polypetalous; pyrenes smooth, separated by a thin layer of mesocarp
- 3a. - flowers 4- or 5-merous, obdiplostemonous; embryo straight with contortuplicate and lobed cotyledons; palaeotropics and neotropics . . . . . I. **Protium** BURM.F. p.228
- 3b. - flowers 5-merous; embryo hippocrepiform with plane-convex, uncinately incurved and entire cotyledons; the latter both curved to the same side
- 4a. - flowers obdiplostemonous; inflexed part of the cotyledons short, that of the inner one  $\frac{1}{3}$ , that of the outer one at most  $\frac{1}{5}$  the length of the erect part; neotropics . . . . . II. **Hemicrepidosperrum** SWART p.395

- 4b. - flowers isostemonous; the apical and the basal part of the uncinately incurved cotyledons equal in length or nearly so; neotropics. . . . .
- . . . . . III. *Crepidospermum* HOOK.F. p.399
- 2b. - flowers 4- or 5-merous, gamopetalous, obdiplostemonous; fruits usually dehiscent; pyrenes smooth, separated by a thick layer of mesocarp; embryo straight with plane-convex and entire cotyledons; neotropics. . . . .
- . . . . . IV. *Tetragastris* GAERTN. p.403
- 2c. - flowers 3-merous, gamopetalous, obdiplostemonous; fruits indehiscent; pyrenes corrugate, separated by a very thin layer of mesocarp, nearly contiguous; embryo straight with contortuplicate and deeply incised cotyledons; neotropics . . . . .
- . . . . . V. *Trattinickia* WILLD. p.419
- 1b. - receptacle concave; calyx, corolla and stamens perigynous, inserted on the margin of the receptacle; pyrenes in contact with each other; embryo straight with contortuplicate and deeply incised cotyledons; tropics of eastern Asia . . . . .
- . . . . . VI. *Garuga* ROXB.

The genus *Garuga* Roxb., restricted to three eastern-Asiatic species, has been elaborated by Lam (1932, Bull.) and is left out of consideration in the present paper.

## I. PROTIUM BURM.F.

*Protium* BURM.F., Fl. Ind. p.88 (1768) nom. cons.; Kunth in Ann. Sc. nat. S.I, II, p.349 (1824); De Cand., Prodr. II, p.78 (1825); Reichenb., Consp. I, p.147 (1828); Don, Gen. Hist. Dichl. Pl. II, p.80, 83 (1832); Meisn., Pl. Vasc. Gen. I, p.77 et II, p.56 (1836—1843); Endl., Gen. Pl. p.1136 (1836—1840); Dietr., Syn. Pl. II, p.1271, excl. sp. W. et A. (1840); Blume, Mus. Bot. Lugd. Bat. I, p.229 (1849—1851); Miquel, Fl. Ned. Ind. I, 2, p.654 (1859); Marchand in Adans. VII, p.213 (1866) and p.264 (1867); id. in Adans. VIII, p.62 (1867—1868); id. in Vid. Medd. Kjbhn. 1873, p.54 (1873); Engl. in Mart. Fl. Bras. XII, 2, p.259 (1874); id. in DC. Mon. Phan. IV, p.60 (1883); id. in E.-Pr. Nat. Pfl. fam. III, 4, p.235 (1897) et ed.2, XIXa, p.411 (1931); id. in Engl. Bot. Jahrb. XLVIII, p.443 (1913); id. in Engl. und Drude Veg. d. Erde IX, 3, I, p.779 (1915); Boerlage, Handl. Fl. Ned. Ind. I, p.178 (1890); Koord. en Valetton in Med. 's Lands Plt. tuin. XVII,

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*Amyris* [P. Br.] L., Syst. Nat. ed.10, p.1000 (1758—1759) sensu Linn., Mant. Pl. p.65 (1767) p.p., nom. rej.; id., Syst. Nat. ed.12, II, p.260 (1767) p.p.; Reichard, Linn. Syst. Pl. ed. nov. II, p.158 (1779) p.p.; Murray, Linn. Syst. Veg. ed.14, p.361 (1784) p.p.; Persoon, Linn. Syst. Veg. ed.15, p.385 (1797) p.p.; id., Syn. Pl. I, p.414 (1805) p.p.; Willd., Linn. Sp. Pl. ed.4, II, p.333 (1799) p.p.; Sprengel, Linn. Syst. Veg. ed.16, II, p.170 (1825) p.p.; id., Linn. Gen. Pl. ed.9, I, p.306 (1830) p.p.

*Tingulonga* OK., Rev. Gen. Pl. I, p.107 (1891) nom. ill.

*Icica* Aubl., Hist. Pl. Gui. fr. I, p.337 (1775); Lam., Enc. méth., Bot. III, p.224 (1789); Jussieu, Gen. Pl. p.408 (1791); Kunth in Ann. Sc. nat. S.1, II, p.349 (1824); id. in H.B. et K. Nov. Gen. et Sp. Pl. VII, p.25 (1825); id., Syn. Pl. IV, p.161 (1825); De Cand., Prodr. II, p.77 (1825); Reichenb., Consp. I, p.147 (1828); Don, Gen. Hist. Dichl. Pl. II, p.80 (1832); Meisn., Pl. Vasc. Gen. I, p.77 et II, p.56 (1836—1843); Endl., Gen. Pl. p.1136 (1836—1840); Richard in De la Sagra Hist. Cuba, Hist. nat. X, p.159 (1845) p.p.; Blume, Mus. Bot. Lugd. Bat. I, p.207 (1849—1851); Berg und Schmidt, Offiz. Gew. IV, t.21c (1863); Griseb., Fl. Br. W. Ind. Isl. p.173 (1864); Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.297 (1872); Sagot in Ann. Sc. nat. S.6, III, p.292 (1882); Rose in N. Am. Fl. XXV, 3, p.258 (1911); Backer, Verkl. Wrdb. p.281 (1936).

*Dammara* Gaertn., Fr. et Sem. Pl. II, p.100 (1802).

*Marignia* Commers. ex Kunth in Ann. Sc. nat. S.1, II, p.351 (1824) nom. ill. nam includens Dammara; De Cand., Prodr. II, p.79 (1825); Reichenb., Consp. I, p.147 (1828); Sprengel, Linn. Gen. Pl. ed.9, I, p.344 (1830); Don, Gen. Hist. Dichl. Pl. II, p.80 (1832); Meisn., Pl. Vasc. Gen. I, p.77 et II, p.56 (1836—1843); Endl., Gen. Pl. p.1137 (1836—1840); Dietr., Syn. Pl. II, p.1372 (1840).

*Elaphrium* Jacq. sensu Sprengel, Linn. Gen. Pl. ed.9, I, p.306 (1830) p.p.; Dietr., Syn. Pl. II, p.1271 (1840) p.p.

*Bursera* Jacq., sectio *Marignia* (Kunth) Hook.f. et sectio *Icica* (Aubl.) Hook.f. in Benth. et Hook. Gen. Pl. I, 1, p.324 (1862); Baillon, Hist. d. Pl. V, p.260, 309 (1874); id., Dict. Bot. I, p.528 (1876).

*Icicopsis* Engl. in Mart. Fl. Bras. XII, 2, p.107 (1891).

Mostly trees, of small to large size, sometimes shrubs. Bark with balsamiferous ducts. Leaves scattered, exstipulate, imparipinnate, sometimes unifoliolate; leaflets petiolulate. Inflorescences axillary, rarely terminal, the main ramifications racemose but the flowers arranged in terminal cymes. Flowers polygamous or dioecious, bisexual or unisexual, small, 4- or 5-merous. Sepals usually short, more or less connate, imbricate in bud, persistent. Petals free, usually deciduous, subinduplicate-valvate in bud. Stamens obdiplostemonous, inserted under the disc; filaments subulate; anthers introrse, dorsifixed to basifixed. Disc intrastaminal. Pistil in the masc. fl. more or less reduced, in the fem. fl. well-developed; ovary in the fem. fl. 4- to 5-celled, containing in each cell 2 subapical, collateral, epitropus, pendulous ovules; style present or absent; stigma 4- to 5-lobed. Fruit a drupe with membranaceous epicarp, carnose, balsamiferous mesocarp and smooth, brittle, woody endocarp, sometimes septicidally dehiscent when ripe; pyrenes 4 to 5, or by abortion less, separated by a thin layer of mesocarp, 1-seeded. Seed exalbuminous with membranaceous to coriaceous testa; embryo straight; cotyledons contortuplicate.

Type-species of the genus: *Protium javanicum* Burm.f.

Distribution: tropics of the Old and New World, chiefly American, but also on Madagascar and the Mascarenes, in India, Siam and Indo-China and in the Malayan Archipelago.

The history of the genus *Protium* begins with the description of "Tingulong" (Rumph. Herb. Amb. VII, p.54, t.23, f.1 (1775)) under the name of *Amyris Protium* L., Mant. Pl. p.65 (1767) and

*Protium javanicum* Burm.f., Fl. Ind. p. 88 (1768); the diagnosis of Burm.f. is obviously an alteration and enlargement of that given by Linnaeus. The conception of Linnaeus is shared by Reichard l.c., Murray l.c., and Persoon l.c. (1797), whilst Willd. l.c. (1799), Persoon l.c. (1805) and Sprengel l.c. (1825) refer to the genus *Amyris* all the species of the genus *Icica* Aubl. l.c. (1775). The latter genus is not mentioned by the former authors. Lamarck l.c. (1789) and Jussieu (1791) on the contrary, conserve *Icica* as a separate genus. Sprengel l.c. (1830) however refers *Icica* Aubl. to *Elaphrium* Jacq. and Dietr. l.c. (1840) elaborates this view in regard to the species of *Icica*.

On the occasion of the foundation of the family Burseraceae Kunth l.c. (1824) creates the genus *Marignia*, an illegitimate name because he refers to it *Dammara* Gaertn. l.c. (1802), and puts it in the same group as the genera *Protium* Burm.f. and *Icica* Aubl. This view is supported by De Candolle l.c. (1825), Reichenbach l.c. (1828), Don l.c. (1832), Meisner l.c. (1836—1843) and Endlicher l.c. (1836—1840). Sprengel l.c. (1830) and Dietrich l.c. (1840) mention both *Marignia* and *Protium*, Blume l.c. (1849—1851) refers to *Protium* and *Icica* as separate genera and Miquel also mentions the genus *Protium*.

A special view is that of Hooker f., l.c. (1862) who describes *Bursera* Jacq., *Icica* Aubl. (including *Protium* Burm.f.), *Marignia* Kunth and *Elaphrium* Jacq. as sections to the genus *Bursera* Jacq. This view is supported by Baillon l.c. (1874, 1876), who in accordance with it names several species and describes the type-species of *Marignia* Kunth, *Protium obtusifolium* (Lam.) March., as the most completely known species of the genus *Bursera* Jacq.

Marchand l.c. (1866, 1867—1868) in his study of the Burseraceae unites *Protium* Burm.f., *Icica* Aubl. and *Marignia* Kunth in the genus *Protium* and this conception is shared by the authors of later publications, except by Triana and Planchon l.c. (1872) and Rose l.c. (1911) who conserve the genus *Icica* Aubl. In 1874 Engler l.c. creates a new genus *Icicopsis* nearly allied to *Protium* Burm.f.,—in accordance with the conception of Marchand he changes the name "*Icica*" which he originally put on the labels of the specimens in "*Protium*" —, but in 1883 Engler sinks the genus *Icicopsis* in *Protium* Burm.f.

A separate aspect of the genus *Protium* Burm.f. is the confusion originated by Wight and Arnott, who described in their Prodr. Fl. Penin. Ind. Or. I, p.176 (1834) three new species of *Protium* and also refer to this genus the type-species of *Balsamodendrum* Kunth l.c. (1824). Blume l.c. p.229 (1849—1851) puts these

three new species of *W. et A.* apart in a new genus, *Protionopsis* Bl., and conserves the monotypic genera *Protium* Burm.f. and *Balsamodendrum* Kunth. Hooker f., l.c. (1862), who reduces *Protium* Burm. and *Icica* Aubl. to the mere section *Icica* (Aubl.) Hook.f. of the genus *Bursera* Jacq., creates an illegitimate genus *Protium* W. et A. and reduces *Protionopsis* Bl. to a synonym of this. Marchand l.c. (1866) however, who re-establishes the genus *Protium* Burm.f., reduces *Protium* W. et A. to a section *Protionopsis* (Bl.) March. of *Balsamodendrum* Kunth, and by Engler l. c. (1883) the *Protium*-species of Wight and Arnott are referred to *Commiphora* Jacq.

*Protium* Burm. f. was placed in the list of "Nomina conservanda", cf. Briquet l.c. (1912, 1935) and *Protium javanicum* Burm.f. has been indicated as "Species lectotypica" cf. Green l.c. (1929.), Briquet l.c. (1935).

As the diagnosis of the genus *Protium* Burm.f. developed itself from the original conception of Linnaeus, who put the genus *Amyris* in his *Classis Octandria Monogynia*, to its present state the number of parts in the flowercycles lost all significance and especially the structure of the fruit became of more importance. The connate sepals, the free petals, the intrastaminal disc and the syncarpous pistil are constantly specified.

Aublet l.c. (1775) ascribes in his diagnosis to the genus *Icica* tetramerous flowers, but two out of the six species described by him, have pentamerous flowers; at the same time he mentions a fruit containing two to four pyrenes covered with a soft pulp.

Kunth l.c. (1824) ascribes the constant characters mentioned above and the pulp-covered pyrenes to *Icica* Aubl., *Protium* Burm. f. and *Marignia* Kunth; to these characters he adds the valvate aestivation of the petals, the monospermic pyrenes and the corrugate or plane cotyledons. Neither Kunth, nor De Candolle l.c. (1825), nor Don l.c. (1832) make the difference between this three genera clear. The difference between the sections of *Bursera* Jacq. in the sense of Hooker f. l.c. (1862) is still less clear. So Marchand l.c. (1867-1868) is quite justified in uniting these genera under the eldest valid name, that of *Protium* Burm.f. According this conception *Protium* Burm. f. is characterized by 4- or 5-, rarely 6-, merous flowers, convex receptacle, connate sepals with imbricate aestivation, free petals with valvate aestivation, free subobdiplostemonous stamens inserted under the disc, a syncarpous pistil and drupes containing 1 to 5, 1-celled, 1-seeded, free pyrenes.

The genus *Icicopsis* Engl. l.c. (1874) was said to differ from its nearest relation, *Protium* Burm.f., by its always pseudospicate

inflorescences, its inconspicuous disc, its persistent petals and its densely ferruginous pilose ovary which in the masc. fl. lacks a style and stigma. This genus enclosed 7 species of which only 2 were described before; that are: *I. insignis* Eng. (*Icica insignis* Tr. et Pl.) and *I. caudata* Engl. (*Icica caudata* Turcz.).

In his monograph of the Burseraceae Engler, l.c. (1883), refers *Icicopsis* to *Protium* Burm.f. and divides this genus into two sections, viz.: *Sectio Icica* (Aubl.) Engl., — leaflets contracted in a long to short petiolule which mostly is incrassate at the apex —, and *Sectio Marignia* (Kunth) Engl., — leaflets with a cuneate base narrowed in the petiolule —. In Engler's later publications (1897, 1931) this conception remains unchanged, and so does the key to the species. According to this division of the genus the *Sectio Marignia* Engl. includes all the African species, whereas the Asiatic ones are spread throughout the series of American ones.

Although the African species can be separated rather easily from the other ones and the Asiatic species, in regard to their general aspect, are more obviously related to the American ones, it would be improbable if the three Asiatic species, of which at least two are very similar in appearance, could be separated from the American ones only on geographic grounds. A careful comparison of the material proved that the Asiatic species are intermediate between the true "*Icica*"-types and the true "*Marignia*"-types of Engler's sections. Only the American species of the genus possess a really articulate petiolule which, however short it may be, is more or less distinctly nodose at both ends, whereas in the African and Asiatic species the petiolules are at most incrassate at the base only, the blade of the leaflets being never separated from the petiolule in the same distinct way as in the American species. This separation is rather distinct in *P. serratum* Engl., less distinct in *P. javanicum* Burm.f. and in *P. connarifolium* Merr., slightly distinct in *P. obtusifolium* March. and in *P. Chapelierii* Guill. and indistinct in *P. madagascariense* Engl. and in *P. Beandou* Engl.

Besides this there are other morphological features that separate the Asiatic species from the African ones; the latter remaining united in the *Sectio Marignia* Hook.f., however much the diagnosis of this section has to be changed. The three Asiatic species constitute the *Sectio Eu-Protium* Swart. By this way an agreement between the morphological and geographical aspects is possible.

On the other hand the American species can, on account of certain morphological features, be easily separated into two sections, viz.: one that includes the species of Engler's former genus *Icicopsis* and one that includes the *Icica*-species of Aublet.

**Vern. names** in general: Le Cointe, *Arvores e plantas uteis a Amazonia brasileira* III, p. 38, 63, 64, 74, 133 (1934); Sampaio in *Bol. Mus. nac. Rio Jan.* X, p. 6, 13, 23 (1934).

**Anatomy** in general: Solereder, *Syst. Anat. Dic.* p. 215 (1899); Guill. in *Ann. Sc. Nat.*, S. 9, X, p. 207 (1909); Pfeiffer in *Med. Kon. Kol. Inst.* XXII, p. 325 (1926).

**Uses** in general: Guillaumin in *Agr. Pays chauds* IX, 1, p. 358, 494 et 2, p. 142 (1909); Tschirch, *Handb. Pharmak.* II, p. 408 (1910) and III, 2, p. 1130 (1925); Record and Mell, *Timbers of trop. America* p. 334 (1924); Pfeiffer l.c.

**Key to the species.**

- 1a. - petiolules non-articulate; apical end never incrassate, basal end not or slightly incrassate; Old World species
  - A. *Gerontogae* . . . . . 2
- 1b. - petiolules articulate at both ends; New World species
  - B. *Neogae* . . . . . 3
- 2a. - vegetative parts very sparsely to densely puberulous; apex of the leaflets tapering and distinctly acuminate: Asia
  - Sectio **Eu-Protium** SWART (sp. 1—3). . . 4
- 2b. - vegetative parts glabrous; leaflets with obtuse to rounded or emarginate apex, rarely obtusely subacuminate, with distinctly decurrent to winged base and entire margin; flowers 5-merous, rarely 4-merous; Madagascar and Mascarenes
  - Sectio **Marignia** (COMM. EX KUNTH) HOOK.F. (sp. 4—7) 6
- 3a. - inflorescences thyrsoid; pedicels distinct; disc glabrous; ovary glabrous to pubescent; disc and ovary in the masc. flowers free
  - Sectio **Eu-Icica** SWART (sp. 8—67). . . 9
- 3b. - inflorescences pseudospicate, branched or not-branched; flowers usually sessile, sometimes pedicellate; disc and ovary pilose, in the masc. flowers represented by a globose rudiment
  - Sectio **Icicopsis** (ENGL.) SWART (sp. 68—78). . 7
- 4a. - leaves 2- to 4-jugate, rarely 5-jugate; petioles, rhachis and petiolules sparsely pilose to nearly glabrous, rhachis at the nodes with curved hairs; petiolules very short to short; leaflets with obtuse, short acumen, the latter 1 to 1½ times as long as wide, somewhat decurrent base and entire to subserrate margin; inflorescences more than half the length of the leaf, their parts sparsely pilosellous; pedicels as long as the flowers or longer; flowers 5-merous, sometimes 4-merous; ovary glabrous . . . I. **P. javanicum** BURM.F.



- 4b. - petiolules rather long; leaflets with rather long acumen, the latter 3 times as long as wide; ovary pilose . . . . 5
- 5a. - leaves 1- to 5-jugate, usually 2- to 4-jugate; petioles, rhachis, petiolules and nerves densely pilose; leaflets with obtuse, mucronulate acumen, not-decurrent base and subserrate, sometimes entire, margin; inflorescences half the length of the leaves, their parts rather densely pilose; pedicels about as long as the flowers; flowers 5-merous, rarely 4-merous. . . . . 2. **P. serratum** (WALL. EX COLEBR.) ENGL.
- 5b. - leaves 1- or 2-jugate, sometimes 3-jugate; petioles, rhachis, petiolules and prim. nerves sparsely pilose; leaflets with acute, mucronate acumen, somewhat decurrent base and entire margin; inflorescences  $\frac{1}{4}$  to  $\frac{1}{3}$  the length of the leaves; pedicel, calyx and corolla sparsely pilose; pedicels  $\frac{1}{3}$  the length of the flowers; flowers 4-merous, rarely 5-merous. . . . . 3. **P. connarifolium** (PERK.) MERR.
- 6a. - leaves 2- to 4-jugate; rhachis terete-striate; petioles at the base flattish above; petiolules distinct; leaflets with shortly decurrent base . . . . . 7
- 6b. - leaves 2- or 3-jugate, sometimes 1-jugate; petioles and rhachis narrowly winged; petiolules hardly distinguishable; leaflets obovate-oblong to obovate-lanceolate, with decurrent, subalate base and distinct tert. nerves; Madagascar . . . . 8
- 7a. - leaflets elliptic to suborbicular with obtuse to truncate apex, 8 to 9 pairs of sec. nerves and indistinct tert. nerves; pedicels half as long as the flowers; calyx-lobes as long as the tube or longer; ovary rather densely pilose; fruits obliquely ellipsoid, subtrigonus or 2- to 5-lobed, with remnant rudimentary stigma; Mauritius . . . . . 4. **P. obtusifolium** (LAM.) MARCH.
- 7b. - leaflets oblong to lanceolate, obtusely subacuminate, with 11 to 13 pairs of sec. nerves and distinct tert. nerves; calyx-lobes half the length of the tube; fruits ellipsoid-globose or biconvex, without remnant rudimentary stigma; Madagascar . . . . . 5. **P. Chapelierii** GUILL.
- 8a. - leaves 2- to 3-jugate, rather large (15 cm); leaflets with obtuse apex and 10 to 12 pairs of sec. nerves; inflorescences nearly as long as the leaves . . . . . 6. **P. madagascariense** ENGL.
- 8b. - leaves 2-jugate, sometimes 1-jugate, small (6.5 cm); leaflets

with emarginate apex and 6 to 7 pairs of sec. nerves; inflorescences  $\frac{1}{8}$  the length of the leaves. . 7. **P. Beandou** MARCH.

- 9a. - disc and ovary glabrous . . . . . 10  
 9b. - disc glabrous, ovary pubescent or puberulous . . . . . 41
- 10a. - petioles, rhachis, petiolules and leaflets glabrous (or provided with a few scattered hairs). . . . . 11  
 10b. - petioles, rhachis and petiolules pilose . . . . . 27
- 11a. - petioles twice as long as the interjuga, or in 1-jugate leaves twice as long as petiolules of the terminal leaflets; leaflets distinctly acuminate, tert. nerves on both sides distinct. 12  
 11b. - petioles longer than the interjuga, but never twice as long, or in 1-jugate leaves longer than but never twice as long as the petiolules of the terminal leaflets . . . . . 15  
 11c. - petioles usually shorter than the interjuga, at most equal in length, or in 1-jugate leaves shorter than the petiolules of the terminal leaflets, at most equal in length; petiolules short,  $\frac{1}{20}$  the length of the leaflets; leaflets obtuse (or broadly subacuminate); tert. nerves obscure; axes and branchlets of the inflorescences slender, scarcely to sparsely pubescent like the flowers . . . . . 8. **P. brasiliense** (SPRENG.) ENGL.
- 12a. - leaflets elliptic to oblong, not narrowed to the apex, abruptly acuminate; acumen as long as wide, tapering; peduncles and their branches robust . . . . . 13  
 12b. - leaflets lanceolate-oblong, narrowed to the apex, gradually acuminate; acumen at least twice as long as wide, linear . 14
- 13a. - leaves usually 2-jugate, small (20 cm long); petiolules  $\frac{1}{10}$  the length of the leaflets; inflorescences in all parts pilose . . . . . 9. **P. Icicariba** (DC.) MARCH.  
 13b. - leaves usually 3-jugate, large (55 cm long); petiolules  $\frac{1}{20}$  the length of the leaflets; inflorescences in all parts glabrous . . . . . 10. **P. marcophyllum** (H.B.K.) ENGL.
- 14a. - petioles, rhachis and petiolules when adult transversely rimose; leaflets ovate, gradually narrowed to the apex; inflorescences rather long, (4—6 cm), lax, robust; pedicels short (2—2 $\frac{1}{2}$  mm) calyx-lobes nearly as long as the tube . . . . .  
 . . . . . 11. **P. attenuatum** (ROSE) URBAN
- 14b. - petioles and rhachis smooth; leaflets generally narrowed at the apex; inflorescences very short, glomeruliform (0.5

- cm), axis slender; pedicels long (4 mm); calyx minutely 5-toothed . . . . . 12. **P. puncticulatum** MACBR.
- 15a. - leaves 1- to 3-jugate; leaflets small, abruptly acuminate; acumen 4 to 6 times as long as wide, linear; inflorescences twice as long as the petioles, lax; flowers small, 4-merous, glabrous; stigma sessile . . . . . 13. **P. Aracouchini** (AUBL.) MARCH.
- 15b. - leaflets rather abruptly to gradually acuminate; acumen tapering to linear, at most  $2\frac{1}{2}$  times as long as wide . . . 16
- 16a. - leaves generally small, on the average 15—20 cm long; rhachis above flattened and bisulcate . . . . . 17
- 16b. - rhachis terete, above slightly carinate; inflorescences lax, never glomeruliform. . . . . 22
- 17a. - leaflets ovate, narrowed from below the middle to the apex, with 8—10 pairs of sec. nerves; acumen short and wide, the length  $\frac{3}{4}$  of the breadth; flowers glomerate, 4-merous; style as long as the ovary . . . . . 14. **P. ovatum** ENGL.
- 17b. - leaflets with 10—16 pairs of sec. nerves; acumen at least twice as long as wide . . . . . 18
- 18a. - petiolules long,  $\frac{1}{10}$  the length of the leaflets; lateral leaflets oblong-lanceolate, distinctly narrowed at both ends; inflorescences lax, twice as long as the petioles; pedicels generally obconical; flowers 5-merous, minutely pilose to glabrous . . . . . 15. **P. Widgrenii** ENGL.
- 18b. - lateral leaflets not narrowed to the base, sometimes narrowed to the apex; flowers 4-merous, rarely 5-merous . . . . . 19
- 19a. - petiolules rather long,  $\frac{1}{15}$  the length of the leaflets (1 cm); leaflets linear-lanceolate, narrowed from the middle to the apex; inflorescences shortly paniculate, lax; style as long as the ovary . . . . . 16. **P. angustifolium** SWART
- 19b. - petiolules very short, especially those of the apical jugum,  $\frac{1}{40}$ — $\frac{1}{20}$  the length of the leaflets; leaflets oblong-elliptic to oblong-lanceolate, narrowed near the apex; inflorescences glomeruliform, at most half the length of the petioles . . . 20
- 20a. - calyx longer than  $\frac{1}{2}$  the length of the flower, its lobes 3 to 4 times as long as the tube; stigma sessile . . . . . 17. **P. macrosepalum** SWART
- 20b. - calyx at most  $\frac{1}{4}$  the length of the flower, from minutely 4-toothed to 4-fid . . . . . 21

- 21a. - style, at least in the fem. flowers, as long as the ovary, in the  
 masc. flowers always distinct. . . . . 18. **P. heptaphyllum** (AUBL.) MARCH.
- 21b. - style absent, stigma sessile . . . . . 19. **P. guianense** (AUBL.) MARCH.
- 22a. - flowers 4-merous; calyx-lobes about as long as the tube;  
 stigma sessile . . . . . 23
- 22b. - flowers 5-merous, small, 2.5—3.5 mm, glabrous . . . . . 25
- 23a. - leaves small (15—20 cm long), 1- to 2-jugate, sometimes  
 3-jugate; petiolules long,  $\frac{1}{5}$  the length of the leaflets; leaflets  
 elliptic to oblong, not or slightly narrowed at both ends,  
 gradually acuminate, coriaceous; acumen 1 to 2 times as  
 long as broad; inflorescences shorter than the petioles;  
 flowers small, pilose . . . . . 20. **P. cubense** (ROSE) URBAN
- 23b. - leaves 1- to 3-jugate, usually 3-jugate; petiolules rather short,  
 about  $\frac{1}{10}$  the length of the leaflets; flowers glabrous . . . . . 24
- 24a. - leaves large (35—40 cm long); lateral leaflets distinctly  
 narrowed from below the middle to the apex, ovate, gradually  
 acuminate, subcoriaceous to coriaceous; acumen as long as  
 wide or hardly so, rarely longer; inflorescences less than  
 $\frac{1}{2}$  the length of the petioles, rarely longer; flowers large  
 (4—4.5 mm) . . . . . 21. **P. panamense** (ROSE) JOHNSTON
- 24b. - leaves small (25 cm long), lateral leaflets not narrowed or  
 narrowed only near the apex, rather abruptly acuminate,  
 pergamentaceous; acumen usually more long than wide;  
 inflorescences as long as the petioles, much-branched, many-  
 flowered; flowers small (2.5—3 mm) . . . . . 22. **P. multiramiflorum** LUNDELL
- 25a. - leaves large (40 cm long), 3-jugate; leaflets oblong-lanceolate  
 to oblong, distinctly narrowed to the acutely cuneate base,  
 rather abruptly acuminate, subcoriaceous; sec. and tert.  
 nerves above prominent; acumen  $1\frac{1}{2}$  to 2 times as long  
 as wide, nearly linear; inflorescences half as long as the  
 petioles; calyx half the length of the flower, its lobes as long  
 as the tube; stigma sessile . . . . . 23. **P. cuneatum** SWART
- 25b. - leaves small (15—25 cm long); lateral leaflets not or slightly  
 narrowed with broadly cuneate to rounded base; inflores-  
 cences as long as the petioles or longer; calyx  $\frac{1}{5}$ — $\frac{1}{4}$  the  
 length of the flower, minutely 5-dentate . . . . . 26
- 26a. - leaves usually 1- to 2-jugate; petiolules long; leaflets elliptic,

- usually coriaceous; acumen about as long as wide; pedicels at most as long as the flowers; stigma sessile . . . . .
24. **P. tovariense** PITTIER.
- 26b. - leaves usually 3- to 4-jugate; petiolules short; leaflets oblong, subcoriaceous; acumen  $2\frac{1}{2}$ -times as long as wide; pedicels twice as long as the flowers; style as long as the ovary . . . . .
25. **P. laxiflorum** ENGL.
- 27a. - (10) leaves 1- to 2-jugate, rarely unifoliolate or 3-jugate; indumentum ferruginous villose, sometimes intermixed with minute fuscous hairs; leaflets rather abruptly acuminate, with 8—12 pairs of sec. nerves; prim. nerves on both sides villose; acumen  $2\frac{1}{2}$  times as long as wide; inflorescences as long as the petioles or shorter; flowers 4-merous, glabrous; stigma sessile . . . . .
26. **P. trifoliolatum** ENGL.
- 27b. - indumentum extremely short to short . . . . . 28
- 28a. - leaves unifoliolate; indumentum rather dense but minute; prim. nerves on both sides pilose; leaflets gradually acuminate, with 11—14 pairs of sec. nerves; acumen  $1\frac{1}{2}$  to 2 times as long as wide; inflorescences very short, glomeruliform; flowers 4-merous, glabrous; style longer than the ovary . . . . .
27. **P. unifoliolatum** ENGL.
- 28b. - leaves 1-jugate to multijugate. . . . . 29
- 29a. - leaves 2- to 3-jugate, rarely 1- or 4-jugate, minutely pilose, sometimes glabrescent; prim. nerves on both sides glabrous; leaflets shortly acuminate; inflorescences shorter than the petioles; ovary with sessile stigma or very short style . . . . . 30
- 29b. - leaves 1- to 4-jugate, minutely to shortly pilose, prim. nerves above pilose, beneath glabrous, leaflets with 10—13 pairs of sec. nerves, pergamentaceous; inflorescences lax, scarcely branched, longer than the petioles; ovary with sessile stigma or very short style . . . . . 32
- 29c. - prim. nerves above pilose or glabrous, beneath pilose 34.
- 30a. - leaves large (30—35 cm long); interjuga angulose, near the apex slightly bisulcate; leaflets lanceolate to oblong with 15—16 pairs of sec. nerves, subcoriaceous; acumen as long as wide; inflorescences paniculate; flowers 5-merous; pedicels robust, glabrous like the calyx and corolla . . . . .
28. **P. glaucum** MACBR.
- 30b. - leaves rather small (12—20 cm long); interjuga terete; leaflets hardly acuminate, with 9—12 pairs of sec. nerves; acumen half as long as wide; flowers 4-merous . . . . . 31

- 31a. - leaflets lanceolate to oblong, subcoriaceous; inflorescences paniculate; pedicels long and slender, glabrous like the calyx and corolla . . . . . 29. **P. glaucescens** URB.
- 31b. - leaflets oblong-elliptic, coriaceous; inflorescences hardly branched; pedicels short and robust, like the calyx and corolla minutely pilose . . . 30. **P. subacuminatum** SWART
- 32a. - leaves 3- to 5-jugate, large, sometimes glabrescent; interjuga terete, near the apex slightly bisulcate; petiolules rather long,  $\frac{1}{10}$  the length of the leaflets; leaflets oblong to oblong-elliptic, only the terminal ones narrowed to the base, base broadly cuneate; acumen 5 times as long as wide; inflorescences  $1\frac{1}{2}$  times as long as the petioles; flowers 4-merous; calyx glabrous, very short, minutely 4-dentate . . . . . 31. **P. Krukoffii** SWART
- 32b. - leaves rather small; interjuga above distinctly bisulcate and flattened; petiolules short,  $\frac{1}{20}$  the length of the leaflets; leaflets lanceolate to lanceolate-oblong, narrowed to both ends, base acutely cuneate; calyx  $\frac{1}{3}$  the length of the flower, its lobes as long as the tube, pilose . . . . . 33
- 33a. - leaves 1- to 2-jugate; rarely 3-jugate; acumen 2 to 4 times as long as wide; inflorescences twice as long as the petioles; flowers 4-merous . . . . . 32. **P. elegans** ENGL.
- 33b. - leaves 3-jugate, rarely 2-jugate; acumen as long as wide; inflorescences 3 to 4 times as long as the petioles; flowers 5-merous . . . . . 33. **P. Melinonis** ENGL.
- 34a. - leaves 4- to 6-jugate; interjuga at the base terete, at the apex usually bisulcate and subulate; petiolules short,  $\frac{1}{20}$ — $\frac{1}{15}$  the length of the leaflets; leaflets gradually acuminate; acumen 2 to 3 times as long as wide; flowers 4-merous, pilose . . . 35
- 34b. - flowers glabrous (rarely, — in *P. Almecega* March. —, calyx sparsely pilose) . . . . . 36
- 35a. - leaves shortly pilose, prim. nerves above pilosellous; petioles as long as the interjuga; leaflets with 10 pairs of sec. nerves, pergamentaceous; acumen linear; flowers glomerate; style as long as the ovary . . . 34. **P. pilosellum** SWART
- 35b. - leaves minutely pilose, glabrescent, prim. nerves above glabrous; petioles  $2\frac{1}{2}$  times as long as the interjuga; leaflets with 14—17 pairs of sec. nerves, coriaceous; acumen tapering; inflorescences laxly paniculate; style very short . . . . . 35. **P. glabrescens** SWART

- 36a. - leaves minutely to shortly pilose, prim. nerves above pilose; petioles  $1\frac{1}{2}$  to 2 times as long as the interjuga; interjuga terete, towards the apex slightly bisulcate and winged; leaflets more or less abruptly acuminate; acumen 5 to 10 times as long as wide, linear; stigma sessile . . . . . 37
- 36b. - acumen of the leaflets 1 to 3 times as long as wide . . . 38
- 37a. - leaves usually 4- or 5-jugate; petiolules of lateral leaflets as long as their acumen,  $\frac{1}{12}$ — $\frac{1}{10}$  the length of the leaflets, (1.25 cm); leaflets with 10—13 pairs of sec. nerves, subcoriaceous to coriaceous; inflorescences long, about twice as long as the petioles; pedicels  $1\frac{1}{2}$  times as long as the flowers; flowers 4-merous, small; calyx-lobes minute . . . . . 36. **P. pedicellatum** SWART
- 37b. - leaves 2- to 4-jugate; petiolules of the lateral leaflets half as long as their acumen,  $\frac{1}{20}$  the length of the leaflets (0.5 cm); leaflets with about 16 pairs of sec. nerves, pergamentaceous; inflorescences short, half as long as the petioles; pedicels as long as the flowers; flowers 5-merous, large; calyx-lobes as long as the tube . . . . . 37. **P. Spruceanum** ENGL.
- 38a. - petioles half as long as the interjuga or half as long as the petiolules of the terminal leaflets; leaflets with 8—10 pairs of sec. nerves, pergamentaceous; prim. nerves on both sides pilose; flowers glomerate, 4-merous; style longer than the ovary . . . . . 39
- 38b. - petioles longer than the interjuga; leaflets with 14—16 pairs of sec. nerves; stigma subsessile . . . . . 40
- 39a. - leaves 1-jugate, shortly pilose; terminal leaflets  $1\frac{1}{2}$  times as large as the lateral ones; acumen twice as long as wide, linear . . . . . 38. **P. Benthamii** SWART
- 39b. - leaves 2- to 3-jugate, minutely pilose; terminal leaflets as large as the lateral ones; acumen 3 times as long as wide, linear . . . . . 39. **P. pauciflorum** SWART
- 40a. - leaves 1- to 5-jugate, usually 2- or 3-jugate; interjuga above usually bisulcate and subalate; petiolules short,  $\frac{1}{20}$  the length of the leaflets; leaflets gradually to rather abruptly acuminate, subcoriaceous; prim. nerves above sometimes pilose, beneath distinctly pilose, especially at the base and the sides; acumen 1 to 2 times as long as wide; inflorescences shorter than the petioles, more or less glomeruliform; flowers 5-merous, rarely 4-merous . . . 40. **P. Almecega** MARCH.

- 40b. - leaves 1- or 2-jugate; petiolules long,  $\frac{1}{10}$  the length of the leaflets; prim. nerves on both sides pilose; inflorescences half as long as petiole and rhachis together; flowers 4-merous . . . . . 41. **P. ecuadorensis** BENOIST
- 41a. - (9) petioles, rhachis and petiolules glabrous or with some scattered hairs only . . . . . 42
- 41b. - petioles, rhachis and petiolules pilose . . . . . 55
- 42a. - acumen of the leaflets short,  $\frac{1}{2}$  to 2 times as long as wide. 43
- 42b. - acumen of the leaflets 4 to 5 times as long as wide . . 49
- 43a. - lateral leaflets distinctly narrowed to the apex, subovate, gradually acuminate, with 10—14 pairs of sec. nerves, pergamentaceous to subcoriaceous; acumen tapering . . 44
- 43b. - lateral leaflets not distinctly narrowed, neither to the apex nor to the base . . . . . 45
- 44a. - petioles short; petiolules very short; leaflets ovate to cordate; with rounded to cordate base; inflorescences dense, glomeruliform, less than half the petioles in length . . . . . 42. **P. cordatum** HUBER
- 44b. - terminal leaflets distinctly narrowed to the base, obovate; base of the leaflets cuneate; inflorescences longer than, or as long as the petioles . . 43. **P. Copal** (s. et c.) ENGL.
- 45a. - leaflets more or less abruptly acuminate; acumen linear; inflorescences robust, with rigid branches, calyx and corolla rather densely pilose, rarely sparsely pilose . . . . 46
- 45b. - petioles about as long as the interjuga; leaflets gradually acuminate, on the average with 12—14 pairs of sec. nerves; acumen tapering; terminal leaflets usually slightly narrowed to the base; corolla sparsely pilose to glabriusculous . . 47
- 46a. - leaves 2- to 4-jugate; petioles twice as long as the interjuga, 4 times as long as the petiolules of the terminal leaflets; leaflets oblong with 14—18 pairs of sec. nerves, 16 on the average; terminal leaflets not or slightly narrowed to the base; flowers 4-merous . . . 44. **P. giganteum** ENGL.
- 46b. - leaves 1- to 3-jugate; petioles longer than the interjuga, twice as long as the petiolules of the terminal leaflets; leaflets, lanceolate to lanceolate-oblong, with 14 pairs of sec. nerves, subcoriaceous; terminal leaflets narrowed from the middle to the base; flowers 5-merous . . 45. **P. nodulosum** SWART



- 47a. - leaves 1- to 4-jugate, usually 3-jugate; leaflets with serrate margin; acumen about as long as wide; inflorescences about as long as the leaves, lax; flowers 4-merous, rarely 5-merous; calyx pilose; ovary scattered with long hairs . . . . . 46. *P. crenatum* SANDWICH
- 47b. - leaves 1- to 2-jugate; leaflets with entire margin; acumen twice as long as wide . . . . . 48
- 48a. - inflorescences short, glomeruliform, shorter than the petioles; flowers 4-merous; calyx pilose; ovary scattered with long hairs . . . . . 47. *P. octandrum* SWART
- 48b. - inflorescences long, paniculate, laxly branched, usually more than twice as long as the petioles; flowers 5-merous; calyx glabrous; ovary rather densely pilosellous . . . . . 48. *P. decandrum* (AUBL.) MARCH.
- 49a. - leaves 4- or 5-jugate, rarely 3-jugate; inflorescences always less than half the length of the leaves; flowers 4-merous pedicels, calyx and corolla pilose; ovary rather densely pilosellous . . . . . 50
- 49b. - leaves 2- or 3-jugate, rarely uni- or trifoliolate but in this case flowers 5-merous; petioles at most half the length of the leaflets; inflorescences half as long as to longer than the leaves, their peduncles and branchlets slender to rather slender; pedicels, calyx and corolla pilose; flowers 4-merous, rarely 5-merous, rather large (3 mm long) . . . . . 52
- 49c. - leaves 1-jugate, sometimes 2-jugate; leaflets abruptly acuminate; acumen long, linear; peduncles and their branchlets slender; pedicels, calyx and corolla glabrous; flowers 4-merous . . . . . 53
- 50a. - petioles and rhachis very robust; petioles half the length of the leaflets, semiterete, subalate; leaflets with 14—16 pairs of sec. nerves, thickly coriaceous; acumen tapering; peduncles and their branchlets very robust; flowers rather large (4 mm long), in terminal clusters; petals subcarnose . . . . . 49. *P. crassifolium* ENGL.
- 50b. - petioles and rhachis slender; petioles about as long as the leaflets, terete, but near the base somewhat flattened above; leaflets with 8—12 pairs of sec. nerves, subcoriaceous; acumen linear, inflorescences laxly branched . . . . . 51
- 51a. - leaves slender, 30—35 cm long; petioles 6—10 cm long; lateral leaflets not narrowed to the base; peduncles and their

- branchlets slender and much-branched; flowers small (2—2½ mm long); petals carnose . . . . . 50. **P. polybotryum** (TURCZ.) ENGL.
- 51b. - leaves robust, 47—60 cm long; petioles 15—25 cm long; lateral leaflets distinctly narrowed to the base; peduncles and their branchlets robust; peduncle half the length of the few-branched inflorescence; flowers large (4 mm long); petals extremely carnose . . . 51. **P. carnosum** SMITH
- 52a. - petioles nearly twice as long as the interjuga; leaflets gradually acuminate, with 13—16 pairs of sec. nerves, subcoriaceous to coriaceous, nitidous; acumen slightly tapering; calyx-lobes as long as the tube; ovary rather densely pilosellous . . . . . 52. **P. paniculatum** ENGL. em. SWART
- 52b. - petioles as long as the interjuga; leaflets rather abruptly acuminate, with 10 pairs of sec. nerves, pergamentaceous, dull; acumen linear; calyx-lobes twice as long as the tube; ovary scattered with rather long hairs . . . . . 53. **P. medianum** MACBR.
- 53a. - leaves small (10—20 cm long); leaflets not narrowed to the base, with 9—10 pairs of sec. nerves; inflorescences at most half the length of the leaves, few-flowered; ovary very sparsely pilosellous . . . . . 54. **P. plagiocarpium** BENOIST
- 53b. - leaves large (30—40 cm long); leaflets narrowed to the base, with 13—15 pairs of sec. nerves; inflorescences longer than the leaves; flowers abundant; ovary rather densely pilosellous . . . . . 55. **P. divaricatum** ENGL.
- 53c. - leaves rather large (15—28 cm long); leaflets narrowed to the base, with 11—12 pairs of sec. nerves; inflorescences shorter than the leaves . . . . . 54
- 54a. - inflorescences  $\frac{3}{4}$  the length of the leaves, many-flowered; pedicels longer than the flowers; ovary rather densely pilosellous . . . **P. divaricatum** ENGL. var. **Krukoffii** SWART
- 54b. - inflorescences  $\frac{1}{5}$  the length of the leaves, few-flowered; pedicels shorter than the flowers; ovary rather sparsely pilosellous . . . . . **P. divaricatum** ENGL. var. **intermedium** SWART
- 55a. - (41) indumentum extremely short to very short, rarely short . . . . . 56
- 55b. - indumentum rather long to long . . . . . 65
- 56a. - leaves 4- to 6-jugate, sometimes 3-jugate . . . . . 57

- 56b. - leaves 1- or 2-jugate, rarely unifoliolate or 3-jugate; leaflets with 9—14 pairs of sec. nerves . . . . . 61
- 57a. - petioles distinctly longer than the interjuga; leaflets lanceolate to lanceolate-oblong, with 14—18 pairs of sec. nerves; flowers 5-merous . . . . . 58
- 57b. - petioles about as long as the interjuga; leaflets oblong, with 11—12 pairs of sec. nerves; acumen 5 times as long as wide; inflorescences somewhat shorter than the petioles; flowers 4-merous . . . . . 56. *P. nicaraguense* SWART
- 58a. - leaflets with 16—17 pairs of sec. nerves; acumen 5 to 6 times as long as wide . . . . . 59
- 58b. - leaves 4-jugate, sometimes 3- to 5-jugate; acumen of the leaflets 2 to 3½ times as long as wide; inflorescences usually twice as long as the petioles . . . . . 60
- 59a. - leaves small, (24—32 cm long), 4- to 6-jugate; lateral leaflets not narrowed to the broadly cuneate base, coriaceous; inflorescences short, nearly glomeruliform, much-branched, half the length of the petioles . . . . . 57. *P. Altsonii* SANDWITH
- 59b. - leaves large, (about 55 cm long), 3- to 4-jugate; lateral leaflets distinctly narrowed to the acutely cuneate base, subcoriaceous; inflorescences rather long, about as long as the petioles, sparsely branched . . . . . 58. *P. Poeppigianum* SWART
- 60a. - leaves small (20—25 cm long); petiolules short; leaflets oblong-lanceolate, rather abruptly acuminate, with 14 pairs of sec. nerves; acumen linear; pedicels shorter than the flowers . . . . . 59. *P. Llewelynii* MACBR.
- 60b. - leaves large (30—50 cm, on the average 40 cm long); petiolules rather long; leaflets lanceolate, gradually narrowed in a tapering acumen, with 16—19 pairs of sec. nerves; pedicels longer than the flowers . . . . . 60. *P. grandifolium* ENGL.
- 61a. - leaves 2-jugate, sometimes 1-jugate; leaflets large, elliptic, base rounded, with 10—12 pairs of sec. nerves; acumen as long as broad, tapering; petioles longer than the interjuga . . . . . 61. *P. Pittierii* (ROSE) ENGL.
- 61b. - leaflets oblong to lanceolate, base broadly to narrowly cuneate; acumen 2 to 6 times as long as wide . . . . . 62
- 62a. - leaves 2- to 3-jugate, rarely 4-jugate; petioles twice as long as the interjuga, semiterete, distinctly winged; leaflets with 12—14 pairs of sec. nerves; acumen 4 to 6 times as long as

- wide; inflorescences usually more than half the length of the leaves,  $1\frac{1}{2}$  to 3 times as long as the petioles, much-branched. . . . . 62. *P. opacum* SWART
- 62b. - petioles usually shorter than the interjuga, at most slightly longer; acumen of the leaflets 2 to 3 times as long as wide; inflorescences much less than half the length of the leaves . . . . . 63
- 63a. - leaves 1-jugate, sometimes unifoliolate or 2-jugate; leaflets narrowed at both ends, with 12—14 pairs of sec. nerves; inflorescences about twice as long as the petioles, sparsely branched, robust; flowers 5-merous . . . . . 63. *P. Schomburgkianum* ENGL.
- 63b. - leaflets narrowed to the apex; inflorescences at most as long as the petioles; peduncles and branchlets very slender; flowers 4-merous . . . . . 64
- 64a. - leaves 2-jugate, sometimes 1- or 3-jugate; leaflets with 8—12, on the average 10, pairs of sec. nerves; inflorescences short, much-branched; pedicels as long as the flowers; calyx-lobes short . . . . . 64. *P. Hostmannii* ENGL.
- 64b. - leaves 1-jugate, sometimes unifoliolate or 2-jugate; leaflets with 11—12 pairs of sec. nerves; inflorescences rather long, sparsely branched; pedicels very short; calyx-lobes as long as the tube. . . . . 65. *P. Schippii* LUNDELL
- 65a. - (55) leaves 2- to 3-jugate; inflorescences rather long, lax, about as long as the petioles. . . . . 66. *P. costaricense* (ROSE) ENGL.
- 65b. - leaves unifoliolate to 4-jugate; inflorescences short, glomeruliform, 1 cm in diam. . . . . 67. *P. pilosissimum* ENGL.
- 66a. - (3) flowers distinctly pedicellate . . . . . 67
- 66b. - leaves 2- to 12-jugate; petiolules short to rather long; acumen of the leaflets obtuse; flowers sessile to subsessile . . . . . 68
- 67a. - leaves 1-jugate; petioles, rhachis and petiolules glabrous; petiolules long; leaflets with 6—7 pairs of sec. nerves; acumen acute . . . . . 68. *P. fragans* (ROSE) URB.
- 67b. - leaves 2- to 5-jugate; petioles, rhachis and petiolules pilose; leaflets with 10—15 pairs of sec. nerves; acumen obtuse, mucronulate . . . . . 69. *P. apiculatum* SWART
- 68a. - terminal leaflets and leaflets of the apical juga narrowed from the middle to the base, the other ones distinctly narrowed

- to the base; acumen very long and very narrow, 10 to 15 times as long as wide, linear; corolla glabrous. . . . . 69
- 68b. - acumen of the leaflets rather long and rather narrow, 2 to 5 times as long as wide . . . . . 70
- 69a. - leaves usually 4-jugate; acumen of the leaflets 15 times as long as wide; inflorescences slender, laxly branched, fasciculate in the axil, all about equal in length, up to 10 cm long . . . . . 70. *P. Sagotianum* MARCH.
- 69b. - leaves 5- to 6-jugate, rarely 2- to 4-jugate; acumen of the leaflets 10 times as long as wide; inflorescences robust, stiffly and divaricately branched, solitary in the axil . . . . . 71. *P. insigne* ENGL.
- 70a. - acumen of the leaflets usually rather short, 2 to 3 times as long as broad; inflorescences fasciculate in the axil, all about equal in length, up to 10 cm long . . . . . 71
- 70b. - inflorescences paniculate-divaricate or sometimes racemose unbranched (but in this case the acumen of the leaflets 4 to 6 times as long as wide), solitary in the axil . . . . . 72
- 71a. - leaves 3- to 4-jugate; basal interjuga as long as the other ones (rarely somewhat shorter, in this case leaves 4-jugate, leaflets narrower, with 15—19 pairs of sec. nerves and with longer acumen); petioles, rhachis and petiolules glabrous and smooth; terminal leaflets and leaflets of the apical juga slightly narrowed near the base; leaflets with 12—16 pairs of sec. nerves, pergamentaceous; peduncles and branchlets slender . . . . . 72. *P. tenuifolium* ENGL.
- 71b. - leaves 3-jugate, sometimes 2-jugate; basal interjuga as long as the other ones; petioles, rhachis and petiolules glabrous, when adult rugose; terminal leaflets narrowed from the middle to the base; leaflets with 8—10 pairs of sec. nerves, pergamentaceous; peduncles and branchlets short, robust . . . . . 73. *P. peruvianum* SWART
- 71c. - leaves 4- to 5-jugate; basal interjuga much shorter than the other ones; petioles, rhachis and petiolules when young pilose, when adult rugose; terminal leaflets and leaflets of the apical juga narrowed from the middle to the base; leaflets with 12—18 pairs of sec. nerves, subcoriaceous; peduncles and branchlets robust . . . . . 74. *P. Warmingianum* MARCH.
- 72a. - leaflets lanceolate to oblong, pergamentaceous to subcoriaceous; inflorescences usually long (the masc. ones more than 10 cm, the fem. ones usually shorter) . . . . . 73

- 72b. - leaves 2- to 5-jugate; leaflets oblong-lanceolate to ovate, gradually acuminate, subcoriaceous, with entire margin; acumen 4 to 5 times as long as wide; inflorescences short (less than 5 cm), racemose; calyx and corolla rather densely puberulous or tomentose . . . . . 74
- 73a. - leaves 3- to 5-jugate, rarely 2- or 6-jugate; leaflets not narrowed or sometimes slightly narrowed to the apex, abruptly to rather abruptly acuminate; acumen 1 to 5 times as long as wide; margin entire; inflorescences stiffly paniculate; calyx and corolla sparsely and minutely pilose to nearly glabrous, corolla inside glabrous . . . . . 75. **P. neglectum** SWART
- 73b. - leaves 8- to 12-jugate; leaflets distinctly narrowed to the apex, gradually acuminate; acumen 5 to 6 times as long as wide; margin serrate; inflorescences not or slightly branched; calyx and corolla outside puberulous; petals inside villose . . . . . 76. **P. subserratum** ENGL.
- 74a. - leaves 3- to 4-jugate; leaflets oblong-elliptic to elliptic, not narrowed to the apex, on the average 10 cm long and 4 cm wide and with 10 pairs of sec. nerves; calyx  $\frac{1}{4}$  the length of the flower . . . . . 77. **P. ferrugineum** ENGL.
- 74b. - leaves 5-jugate; leaflets oblong-elliptic-ovate, narrowed from the middle to the apex, on the average 6.5 cm long and 2.5 cm wide and with 7 pairs of sec. nerves; tert. nerves beneath distinct by their pale colour; calyx half the length of the flower . . . . . 78. **P. reticulatum** ENGL.

Sectio **Eu-Protium** SWART in Rec. Trav. bot. néerl. XXXIX, p. 189 (1942).

Trees with imparipinnate densely to very sparsely puberulous leaves. Petiolules at the apical end never incrassate, at the basal end at most slightly incrassate. Leaflets tapering, distinctly acuminate. Species from south-eastern Asia.

I. **Protium javanicum** BURM.F., Fl. Ind. p.88 (1768) nom. cons.; De Cand., Prodr. II, p.78 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832); Dietr., Syn. Pl. II, p.1271 (1840); Blume, Mus. Bot. Lugd. Bat. I, p.229 (1850); Walp., Ann. II, p.288 (1851—1852) excl. syn.; Miquel, Fl. Ned. Ind. I, 2, p.654 (1859) excl. syn.; Hassk. in Abh. naturf. Ges. Halle IX, 2, p.333 (1866); Marchand in Adansonia VIII, p.52 (1867—1868); Filet, Plantk.

Wrd. Ned. Ind. p.159, 290 (1876); Engl. in DC. Mon. Phan. IV, p.70, t.2, f.8—10 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931); Boerlage, Handl. Fl. Ned. Ind. p.178 (1890); Koorders in Med. 's Lands Pltt. XII, p.23 (1894); id., Exk.fl. v. Java II, p.432 (1912); Koorders en Valetton in Med. 's Lands Pltt. XVII, 4, p.22 (1896) excl. syn. *Icica* et Clausena; Backer in Med. Dept. Landb. Ned. Ind. IV, p. 262 (1907); id., Schoolfl. v. Java p. 196 (1911); De Clercq, Nieuw Pltk. Wrd. Ned. Ind. p.311 (1909); Merrill, Interpr. Rumph. Herb. Amb. p.305 (1917); Heyne, Nuttige Pl. v. Ned. Ind. ed.1, III, p.27 (1917) and ed.2, II, p.873 (1927); Pulle in De Clercq, Pltk. Wrd. Ned. Ind. ed.2, p.185 (1927); Green in Prop. Nomencl. intern. bot. Congr. 1930 p.104 (1929); Lam in Ann. Jard. bot. Buitenz. XLII, p.201, f.129 (1932); id. in Bull. Jard. bot. Buitenz. S. 3, XII, p.322, t.IV, f. 6a-e (1932); Briquet in Intern. Rules bot. Nomencl. p.101 (1935).

*Amyris Protium* L., Mant. Pl. p. 65 (1767) nomen rej.; id., Syst. Nat. ed.12, II, p.266 (1767); Reichard, Linn. Syst. Pl. ed. nov., II, p.158 (1779); Murray, Linn. Syst. Veg. ed.14, p.361 (1784); Persoon, Linn. Syst. Veg. ed.15, p.385 (1797); id., Syn. Pl. I, p.414 (1805); Willd., Linn. Sp. Pl. ed.4, II, p.337 (1799); Sprengel, Linn. Syst. Veg. ed.16, II, p.218 (1825).

*Bursera javanica* Baillon, Hist. d. Pl. V, p.296 (1874).

*Tingulonga Protium* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium Zollingerii* Engl. in DC. Mon. Phan. IV, p.71 (1883); id. in E.-Pr. Nat. Pfl. fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulonga Zollingerii* OK., Rev. Gen. Pl. I, p.108 (1891).

"*Tingulong*" Rumph., Herb. Amb. VII, p.54, t.23, f.1 (1755).

Small and shrublike to large-sized tree. Branchlets slender, terete, striate, when young minutely ferruginous-tomentose, when adult glabrous and grey to brownish; the young plants armed with short to rather long axillary spines. Leaves 2- to 4-, rarely 1- or 5-jugate, 16—19 (15—24) cm long; petioles slender, terete, the base slightly flattened and incrassate, 4 (3.5—5) cm long; interjuga semiterete, above sulcate and subulate, 3 (2—3.5) cm long; rhachis, like the petiole and the petiolules nearly glabrous to sparsely and minutely, rarely rather long, pubescent, but near the incrassate nodes always with more or less numerous curved hairs, which are also present on the margins of the canaliculate, transversely rimose, 1—7 mm long, only basally articulate-incrassate petiolules; petiolules of the terminal leaflets 15—20 (10—35) mm long; leaflets lanceolate

to elliptic, usually 7—9 (5—9.5) cm long and 2.5—3 (2—3.75) cm wide, but the terminal ones larger and narrowed to the base, the lateral ones oblique, those of the basal jugum much smaller; apex subacuminate; acumen obtuse, 5—7 mm long and 4—6 mm wide; base acute, slightly decurrent; margin mostly entire, sometimes in the apical part rather densely serrate; chartaceous, glabrous and smooth, above nitidous, beneath dull; with 10—11 pairs of sec. nerves; prim. and sec. nerves above prominulous, beneath distinctly prominent, tert. ones above visible, beneath prominulous, the prim. ones above near the base with curved hairs, beneath glabrous or nearly so, similar to the sec. and tert. ones. Inflorescences axillary, mixed, the fem. ones lax and few flowered, the masc. ones mostly many-flowered, 10—15 (8—16) cm long; sec. branchlets few, in the fem. infl. up to 2 cm long; the axes glabrous to rather densely puberulous. Pedicels once to twice as long as the flowers, 2.5—4 mm, slender, terete, striate, provided with some scattered minute hairs; bracts oblong-triangular, acute, glabrous, 0.5 mm long. Flowers 5-merous, rarely 4-merous, 2—2.5 mm long. Calyx cupuliform, 0.5 mm high, glabrous to rather densely puberulous; its lobes about as long as the tube, triangular, acute. Petals oblong-triangular, acute, with small inflexed apiculum, outside sparsely and minutely, rarely rather long, pubescent, inside glabrous. Stamens 1.5—2 mm long; filaments subulate, at the base dilated, 1 mm long; anthers in the masc. fl. 1 mm, in the fem. ones 0.5 mm long. Disc annular, glabrous, 0.25—0.5 mm high. Pistil at the base surrounded by the disc, glabrous, about 1.5 mm high; ovary globose-ovoid, slightly 5-lobed, 5-celled; style short; stigma 5-lobed. Drupe either oblique-ovoid and monopyrenous or globose-ovoid, 2- to 4-lobed and 2- to 4-pyrenous, top acute, glabrous, 7.5—15 mm long; mesocarp rather thick, carnose; endocarp rather thick, woody.

**Type:** Tungalung in Rumph., *Herb. Amb.* VII, t. 23, f. 1 (1755)

**Distribution:** Malay Archipelago: isl. of Java, Bawean, Madoera, Kangean, Bali and Soembawa.

JAVA, prov. West Java: res. Krawang, reg. Batavia, Edeling 14424 (1878) fl. masc. Aug. (BZ, M); id., Pasir Poetih, Backer 33603 (1904) fl. fem. and fr. June (BZ); id., Kramat Sentiong, Backer 33601 (1904) (BZ); id., Tandjong Priok, Backer 33605 (1905) fl. masc. June (BZ, L); id., Kajoe Poetih, Backer 33604 (1904) fl. masc. June (BZ); id., Kliphof, Backer 23 (1904) fl. fem. and fr. June (L, U); id., between Kliphof and Pepango, Backer 33602 (1904) fl. masc. May (BZ, L); res. Buitenzorg, reg. Soekaboemi, Pelaboeharatoe, Koorders 1011b (1890) fl. fem. and fr. June (BZ, L); res. Priangan, reg. Soemedang, Tomo, Koorders 1010b (1890) (BZ); res. Cheribon, reg. Cheribon, Backer 4708 (1912) fl. fem. Oct. (BZ).

Id., prov. Midden Java: res. Banjoemas, reg. Tjilatjap, Noesa Kambangan,



Koorders 1023b (1891) (BZ); id., Koorders 1024b (1891) (BZ); id., id. 20041b (1895) (BZ); id., id. 26861b (1897) fr. Jan. (BZ); res. Pekalongan, reg. Brebes, Backer 15414 (1914) (BZ); id., Kalisalak, Koorders 1020b (1897) (BZ); id., reg. Tegal, Docters v. Leeuwen-Reynvaan (1909) fl. masc. Sept. (BZ); id., Proepoek, Noltée 4037 (1919) fl. masc. Oct. (BZ); id., Margasari, Koorders 1021b (1891) (BZ); id., Beumée 115, 251 and 517 (1915) (BZ); id., Boschproefstation 4037 (1926) fr. Apr. (BZ); id., Tjipero, Beumée 4475 (1919) fl. masc. Sept. (BZ); id., reg. Pekalongan, Batang Keboemen, Koorders 1022b (1891) fl. masc. Oct. (BZ, L); id., Soebah, Koorders 11415b (1892) fl. masc. et fr. Dec. (BZ, L); id., id. 13374b and 13375b (1893) (BZ); id., id. 13377b (1893) fr. June (BZ, L); id., id. 14212b (1893) fl. masc. June (BZ, L); id., id. 27313b (1897) fl. masc. Apr. (BZ); id., id. 36789b and 36887b (1899) (BZ); res. Semarang; reg. Semarang, Bangkong, Docters v. Leeuwen-Reynvaan (1910) (BZ); id., Manggar, Jansen 4674 (1922) fl. masc. Sept. (BZ); id., Pempoeran, Beumée 5125 (1920) fr. March (BZ); id., near Prigi-Tengoeran, Koorders 25471b (1896) fl. masc. Oct. (BZ); id., reg. Grobogan, Kedoengdjati, Koorders 1012b, 1014b and 1015b (1888) (BZ); id., id. 1013b (1894) (BZ); id., id. 1016b (1888) fl. masc. July (BZ, L); id., id. 1017b (1888) fl. masc. Sept. (BZ); id., id. 24889b (1896) (BZ); id., id. 25034b (1896) fl. masc. Oct. (BZ, K, L); id., id. 25176b and 25190b (1896) (BZ); id., id. 25530b (1896) fr. Nov. (BZ); id., id. 27224b (1897) fr. Apr. (BZ, L, U); id., id. 27241b (1897) fr. Apr. (BZ); id., id. 28090b (1897) (BZ); id., Telawa, Koorders 1018b (1888) (BZ); id., Boschwezen K 22 (1917) (BZ); id., Vincent 4674a (1923) fl. masc. Oct. (BZ); res. Djapara-Rembang, reg. Djapara, Koorders 17 (1885) (BZ); id., Pasokan, Koorders 31762b (1899) (BZ); id., Doerentoempang, Boschproefstation Ja 1905 (1929) (BZ); id., reg. Pati, Djoewono, Tajoe, Koorders 35021b (1899) (BZ); id., Karangasem, Koorders 1019b (1892) fr. Febr. (BZ); id., id. 28214b (1897) (BZ); id., id. 33221b (1900) (BZ, U); id., reg. Rembang, Ngoroenoeng, Beumée 1104 (1919) fl. masc. Sept. (BZ); id., Kalshoven 49 (1918) fl. masc. (BZ); id., Banjoe Oerip, Beumée 985 (1915) fl. masc. Aug. (BZ); id., Sedan, Ngandang, Koorders 36135b and 36162b (1899) (BZ); id., Tjileboeng, Boschproefstation Ja 1639 (1927) (BZ); id., Tjermeo, Altona 6305 (1923) (BZ).

Id., Gouv. Jogjakarta, reg. Goenoeng Kidoel, Kloempit, Burger 2057 (1922) (BZ).

Id., prov. Oost Java: res. Bodjonegoro, reg. Bodjonegoro, Tambakredja, Atasagen, Boschproefstation Ja 1542 (1927) (BZ); id., Klino, Boschproefst. Ja 1696 (1927) (BZ); id., id. 2024 (1913) (BZ); res. Madioen, Kendeng, Elbert 362 (no date) (L); id., reg. Madioen, Goenoeng Pandan near Saradan, Koorders 1025b (1892) (BZ); id., near Klangoen, Thorenaar 135 (1919) fl. masc. Oct. (BZ); id., east of Madioen, Wisse 663 (1921) fl. masc. July (BZ); res. Kediri, reg. Kediri, Soekaradja, Gadoengan Pare, Koorders 22642b (1896) (BZ); id., reg. Blitar, Lodaja, Warburg 4513 (1887) (B); id., Siwalan, Warburg 4524 (1887) fr. Jan. (B); res. Malang, reg. Malang, Kaliparé, Kalshoven 19 (no date) fl. masc. (BZ, L); id., Mt. Tengger, Buysman 421 (1907) fl. masc. Nov. (BM, U); id., reg. Pasoeroean, Klangrong, Mousset 1085 (1913) fr. (BZ); id., Goenoeng Semongkrong, Backer 9447 (1913) fl. fem. Oct. (BZ); res. Besoeki, reg. Djember, between Kali Tanggoel and Kali Petang, Menté 1689 (1920) fr. June (BZ); id., Djatilawang, Kalshoven 56 (1919) fl. masc. Nov. (BZ); id., Poeger, Zollinger 655 (1845) fl. masc. Febr. (BZ); id., Backer 17895 and 17896 (1914) fr. Dec. (BZ); id., Poeger-Watangan, Koorders 12517b, 12518b, 12519b, 12520b, 12524b and 13263b (1889) (BZ); id., id. 12526b (1889) fl. masc. Aug. (BZ); id., id. 12695b, 12750b and 12751b (1892) fl. masc. Nov. (BZ); id., id. 12839b, 12954b and 13056b

(1892) (BZ); id., id. 12840b (1892) fr. Jan. (BZ); id., id. 12844b, 12922b and 12930b (1892) fl. masc. Oct. (BZ); id., id. 12909b (1892) fr. Dec. (BZ); id., id. 20534b and 20988b (1895) fl. masc. Oct. (BZ); id., id. 30052b and 30075b (1898) (BZ); id., Kali Poeger, Rambli, Koorders 12523b (1889) fl. masc. Sept. (BZ); id., id. 13264b (1889) (BZ); id., Kandang Sapi, Korthals (no date) fl. fem. (L, U); id., reg. Panaroekan, Wonoredjo, Boschproefstation Ja 2274 (1931) (BZ); id., Pradjekan, Pantjoer-Idjen, Koorders 14366b (1893) fl. masc. Nov. (BZ) id., id. 14367 (1893) fl. masc. Oct. (BZ, K, L) id., reg. Bondowoso, north-slope Goenoeng Idjen, Backer 24956 (1918) (BZ); id., reg. Banjoewangi, Gradjagan, Koorders 1026b (1889) (BZ); id., Rogodjampi, Koorders 12837b (1892) fr. Febr. (BZ, K, L).

Id., without locality: herb. Burmann (no date) fl. masc. and fem. and fr. (L); Horsfield 506 (no date) fl. fem. and fr. (K); Horsfield 530 (no date) fl. fem. (BM); Horsfield (no date) fl. masc. (CAL, GH); Kollmann (no date) fl. fem. and fr. (M); Leschenault (no date) fl. masc. and fem. (P); Reinwardt (no date) (M); Zollinger 1698 (no date) fl. fem. (B, G) (type of *P. Zollingerii* Engl.); without name of collector various sheets (BZ, L, LE, NY, U, W).

Id., cultivated: Pasoeroean, Altmann 133 (1932) fl. fem. Aug. (BZ); Kendal, Backer 16405 (1914) (BZ); Pekalongan, Margasari, Burger (1922) seedlings (BZ); Hort. Bog. VI B 77 (various dates) fl. fem. and fr. (BZ, CAL, K, NY); Teysmann (1860) fr. (B, L, M, NY).

BAWEAN: Goenoeng Batoe, Boschproefstation Ja 4244 (1937) (BZ).

MADOERA: reg. Bangkalan, Kamal, Backer 19192 (1915) (BZ); reg. Pamekasan, Sampang, Backer 19549 (1915) (BZ); id., Ketapang daja, Backer 21170 (1916) fl. masc. July (BZ, L); id., Pagantenan, Backer 20458 (1915) (BZ); reg. Soemenep, Soemenep, Backer 20931 (1915) (BZ).

KANGEAN ARCH.: Kangean, Kalisangka, Backer 27002 (1919) fr. March (BZ, L); id., Kajoe Waroe, Backer 28117 (1919) (BZ); id., Kalikatak, Dommers 100 (1919) fl. masc. Sept. (BZ); Sepapan, Backer 28523 (1919) (BZ); Saboenting, Backer 29919 (1919) (BZ); Paliat, Backer 29446 (1919) (BZ); Sepangjang, Backer 28763 (1919) fr. Apr. (BZ).

BALI: Prapatagoeng, Becking 28 (1920) (BZ, L); Tjandikoesama, Becking 153 (1920) fr. Apr. (BZ); n.w. Bali, Van der Paardt 52 (1926) (BZ).

SOEMBAWA: Keli, Boschproefstation bb 12019 (1927) (BZ); Moengkin, Boschproefst. bb 14029 (1928) (BZ); without locality, Colfs 135 (1914) fr. Febr. (L).

CULT: Lane (1918) (CAL).

**Vern. Names:** JAVA: tanggoeloen, tangoelong, tenggoeloeng, katos (Soend.); tenggoeloen, tenggoelon, tinggoeloen, tinggoeloeng, tinggoelon, tengolon, tranggoeloen, trenggoeloen, trenggoelon, trenggoeloen, goeloen, goeloen bernang, bernang, katos, ketos (Jav.); tanggoeloen, tanggoelon, tangkhoeloen, tengkhoeloen, trengkhoeloen (Mad.); BAWEAN: tenggoeloen, KANGEAN: tanggolon, tangkhoelon; BALI: trenggoelon; SOEMBAWA: ketimis, loa, Iowa.

*Protium javanicum* Burm.f. has been indicated by the Intern. bot. Congres 1935 as the type-species of the genus *Protium* Burm.f. (cf. Green l.c.; Briquet l.c.).

*Protium javanicum* Burm.f. and *P. serratum* Engl. are much alike in regard to their general aspects and also in the occurrence of curved hairs on the margins at the upper side of the interjuga and on the petiolules near the rachidial nodes; only in these two

species this feature is present. *P. serratum* Engl. differs from *P. javanicum* Burm.f. by its strongly developed indumentum, its pilose ovary and by the long acumen, the less numerous sec. nerves and the mostly serrate margin of its leaflets.

The abundant material of this species shows a wide range of variability. The petiole, rhachis and petiolules are usually glabrous or nearly so, the curved hairs mentioned above excepted, but there are all transitions to specimens with a rather long scattered indumentum. Zollinger 1698, is one of the latter and has been made the type of *Protium Zollingerii* Engl. The margin of the leaflets is mostly entire, but in young plants it is near the top usually distinctly serrate; this feature however occurs in some adult plants more or less too. The shape of the leaflets, generally oblong, is in some specimens lanceolate or elliptic. The leaflets are mostly chartaceous, but in some specimens subcoriaceous. Neither from a morphological, nor from a geographic point of view I can find any reason for a subdivision of this species.

The synonyms cited by Walpers l.c.: *Icica? dentata* DC., *Amyris nana* Roxb. and *Clausena nana* W. et Arn., those cited by Miquel l.c.: *Icica? dentata* DC., *Amyris dentata* Willd., *Clausena Willdenowii* W. et Arn. and *Clausena javanica* M.J. Roem., and those cited by Koorders en Valeton l.c.: *Icica? dentata* Willd. and *Clausena javanica* Roem. all are referred to *Clausena dentata* (Willd.) Roem. (Rutaceae).

**M o r p h o l o g y :** Guill. in Ann. Sc. nat. S.9, X, p. 209, f.2, 1, f. 3—5 (1909); id. in Rev. Gén. Bot. XXII, p.454, f.4 (1910); id. in Not. Syst. II, p.265 (1913); Lam l.c.

**A n a t o m y :** Solereder, Syst. Anat. Dic. p.216 (1899); Moll und Janssonius, Mikrogr. d. Holzes der auf Java vork. Baumarten II, p.98, f.90 (1908); Guill. l.c. (1909); Den Berger in Med. Proefst. v. Thee XCVII, p.68 (1926).

**U s e s :** The wood is said to possess a close and fine grain, to be firm and hard and not to be attacked by termites; as straight and long boles are rare, it is generally recommended as suitable for small tools. Nevertheless it is not much used as it occurs frequently in the same districts where *Tectona grandis* L. (teak, djati) grows.

The fruits are sometimes said to be sweet and edible but others say that they are inedible and that they are used for making an aromatic oil similar to turpentine.

The young leaves are mentioned as a vegetable and a decoct of the adult leaves as a medicine.

Cf. Rumphius l.c.; Filet l.c.; Koorders l.c. (1894); Koorders en Valeton l.c.; De Clerq l.c.; Guill. in Agr. Pays chauds IX, 1, p. 360 (1909); Berkhout

in v. Gorkom's Oost Indische Cultures ed. 2, III, p. 193 (1913); Den Berger l.c.; Heyne l.c.; Pulle l.c.

2. *Protium serratum* (WALL. ex COLEBR.) ENGL. in DC. Mon. Phan. IV, p.88 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931); Radlkofer in Abh. K. Bay. Ak. Wiss. 2e Cl. XVI, I, p.60 (1886); id. in Engl. Pflanzenreich XCVIII, p.879 (1933—1934); Guill. in Agr. Pays chauds IX, I, p.359 tab. (1909); id. in Lecomte Fl. gén. Indo-Chine I, 2, p.722, f.77, 7—12 (1911); Craib, Fl. Siam. Enum. I, p.247 (1931); Lam in Ann. Jard. bot. Buitenz. XLII, p.201 (1932); id. in Bull. Jard. bot. Buitenz. S.3, XII, p.321 (1932); Gamble, Fl. Pres. Madras I, p.171 (1936); Swart in Journ. of Bot. LXXVIII, p.74, f.1—2 (1940).

*Bursera serrata* Wall. ex Colebr. in Trans. Linn. Soc. XV, p. 361, t. IV, f. 1 (1827); Don, Gen. Hist. Dichl. Pl. II, p. 83 (1832); Kurz in Journ. As. Soc. Bengal XXXIX, 2, p. 61 (1870); Brandes, Forest Fl. of N.-W. and Centr. India p. 61 (1874); id., Indian Trees p. 132 (1906); Bennett in Hook.f. Fl. Brit. India I, p.530 (1875).

*Icica indica* Wight et Arnott, Prodr. Fl. Pen. Ind. or. I, p.177 (1834) nom. nov. ill.; Wallich, A numerical list of dried specimens of plants in the East India Company's Museum (Catalogue), no. 8492, p.287 (1847—1849).

*Burseria serrata* Wall. in errore Dietr., Syn. Pl. II, p.1408 (1840).

*Tingulona serrata* OK., Rev. Gen. Pl. I, p. 108 (1891).

*Limonia pentagyna* W. Roxb., Hort. Bengalensis or a Catalogue of the Plants growing in the Hon. E. India. Comp. Bot. Garden at Calcutta p.32 (1814) nomen nud.; id., Fl. Ind. II, p.382 (1832).

*Limonia polygyna* Roxb. in errore Radlk. in Abh. K. Bay. Ak. Wiss. 2e Cl. XVI, I, p.61 (1886).

*Schinus Saheria* Hamilton in Trans. Linn. Soc. XVII, p.193 (1837).

*Schinus bengalensis* Hamilton l.c., p.194.

*Schinus Niara* Hamilton l.c., p.194.

*Ailanthus lanceolata* J. Roxb. ex Wall., Catalogue, no. 8492 A, p.287 (1847—1849) nomen.

*Schleichera* ? sp. Beddome, Fl. sylvatica II, 13, p.72 (1871); Hiern. in Hook.f. Fl. Brit. Ind. I, p.681 (1875).

Usually large tree. Branchlets slender, terete, striate, young densely canescent puberulous, when adult glabrescent, scabridulous and lurid. Leaves 2- to 4-jugate, rarely 1- or 5-jugate, 22—27 (14—30) cm long; petiole semiterete, 5.5—6.5 (4—8) cm long, like the rhachis and the petiolules densely and shortly to minutely,

fuscous pubescent; interjuga terete, 3—3.5 (2—4) cm long, the basal ones shorter than the other ones, near the nodes like the petiolules with curved hairs; petiolules semiterete, subcanaliculate, at the ends not incrassate, 7.5 (5—12) mm long, the terminal ones 20 (15—25) mm; leaflets oblong to lanceolate, usually 8—12 (6—14) cm long and 2.5—4 (2—5) cm wide, but the terminal ones wider and narrowed to the base, the lateral ones suboblique and slightly narrowed to the apex and those of the basal jugum shorter and nearly ovate; apex gradually narrowed in a tapering acumen; acumen 8—12 mm, rarely only 5 mm long and 3 mm wide, ending obtusely, mucronulate; base cuneate to nearly rounded; margin usually near the apex more or less indistinctly and remotely serrate, sometimes entire or distinctly serrate; chartaceous to subcoriaceous, sparsely and minutely puberulous, smooth, above nitidous, beneath dull; with 8—10 (7—12) pairs of sec. nerves; prim. nerves sunken above, prominent beneath, rather densely and minutely puberulous; sec. nerves above hardly prominent, beneath prominulous and sparsely puberulous, tert. nerves above invisible, beneath prominulous and nearly glabrous. Inflorescences axillary, pseudoterminal, much-branched, lax, the masc. ones 10—12.5 cm, the fem. ones 6—12 cm long; the branchlets up to 2.5 cm long, patent, like the peduncles and the pedicels terete, striate, rather densely tomentellous, in the masc. infl. slender, in the fem. ones rather slender. Pedicels about as long as the flowers, 1.5—2.5 mm; bracts and bractlets oblong-triangular, obtuse, 0.5 mm long. Flowers 5-merous, rarely 4- or 6-merous, 2—2.5 mm long, the fem. ones slightly larger than the masc. ones. Calyx cupuliform, 0.5—0.75 mm high, like the petals rather densely but minutely puberulous outside; its lobes triangular to elliptic, obtuse, about as long as the tube. Petals elliptic-ovate, subcarnose; apex acute with small inflexed apiculum. Stamens in the masc. fl. 1.5—1.75 mm, in the fem. ones 0.8—1 mm long; filaments subulate, dilated; anthers elliptic, 0.4 mm long. Disc annular to urceolate, glabrous, 0.35 mm high. Pistil surrounded by the disc, sparsely puberulous, in the masc. fl. rudimentary, shorter than the filaments, 0.5—1 mm high, consisting of a cylindrical to conical ovary containing none to few, 1- or 2-ovulate cells, in the fem. fl. surpassing the stamens, about 1.5 mm high, consisting of a globose-conical, sub-5-lobed, 5-celled ovary, 1 mm high, and a short style with 5-lobed stigma. Drupe either oblique-ovoid and monopyrenous, with excentric style, or globose, 2- to 4-lobed and 2- to 4-pyrenous, with central style; base subacute; apex obtuse; glabrescent, 10—12.5 mm long and 8—12 mm in diam.

**Type (neo-type):** Wallich 8492 F, first sheet, in Herb. E. Ind. Comp. in h.K.

**Distribution:** south-eastern Asia: Brit. India (Eastern Gaths, the Circars, Orissa, eastern Bengal, Assam, Chittagong, Burma), Siam and Indo-China (Cambodge, Cochin-China).

**BRITISH INDIA:** Coromandel, Roxburg 176 (no date) fl. masc. (BM); Madras, Samulcottah, Wallich 8492 B and 8492 D (ex Herb. Wight) (1795) fl. masc. Apr. (K); id., Rampa-distr., Maradumatti, Narayanaswami 330 and 393 (1920) (CAL); Kalahandi-state, Haselfoot Haines 5529 (1918) (K); id., Rampur, Haselfoot Haines 5531 (1918) fl. fem. (K); Sam Valpur, Haselfoot Haines 5529a (1917) (K); eastern Bengal, Griffith 1138 (no date) fl. fem. and fr. (B, C, LE, M, S, W); Rajmahal, Wallich 8492 E (1820) (K); Dooars, Mann 14 (no date) (W); Lower Assam, Brahmapoetra-plains, Kurz 50 (1876) (BZ); Garrow-hills, Goalpara, Wallich 8492 C 54 (ex Hamilton) (1808) fr. Aug. (K); Gowhatti, Clarcke 43234 (1886) fl. masc. March (B, LE); id., Prain (1888) fr. July (B, BM); Assam, Fisher (1880) fl. masc. (LE); id., Jenkins (no date) fr. (BZ, M, NY, P); Amjor Ghat, Wallich 8492 C 54a (ex Hamilton) (1811) fl. masc. Apr. (C, K); Lakardewani, Wallich 8492 (ex Hamilton) (1810) fl. masc. Nov. (B); Rangamatia, Wallich 8492 C 54b (ex Hamilton) (1808) fl. masc. Apr. (K); Chittagong-hills, King 469 (1886) fl. masc. (B, BM, BZ); Upper Burma, Kalay-hills, Prazer (1894) (BZ); without locality, De Candolle (1816) fl. masc. (G); id., Roxburg (no date) fl. masc. (BM); id., Voigt (no date) fl. fem. (B, C); id., Wallich (no date) (C).

**SIAM:** Payap, Muang Fang, Kerr 5224 (1921) alt. c. 600 m, scrub jungle, fl. masc. Apr. (B, P); id., Chiengdao, Winit, 77, alt. 450 m (ex Craib); id., Chiengmai, Mè Chém, Kerr 5397 (1921) alt. c. 600 m, scrub jungle, fr. May (P); id., Chiengmai, Kerr 581 (1909) eng jungle, fl. masc. Apr. (B); id., Lampun, Mè Ta, Kerr 3192, alt. 450 m, deciduous jungle (ex Craib); id., Lampun, Mè Li, Winit 127, alt. 360 m (ex Craib); Maharat, Prè, Hui Paten, Vanpruk 402, alt. 300 m (ex Craib); Udawn, Lôi, Koa Krading, Kerr 8753 (no date) alt. c. 800 m, deciduous forest, fl. masc. (B, C); without loc., Kerr 20300 (1931) (B, C).

**INDO-CHINA:** Phu-quoc, Thorel (1862—1868) (B, CAL, LE); Mt. Chaudoc, Harmand 615 (1876) fr. July (B, P); prov. Bien-hoa, Bao Chung, Pierre 1798 (1877) fr. (NY).

**CULT.:** Bot. Gard. Buitenzorg: Treub (1891) fl. masc. (B, U); Bot. Gard. Calcutta: Wallich 8492 A (ex Roxburg) (no date) fl. masc. (K); Wallich 8492 F, first sheet (no date) fl. masc. (K, G) (type); id. 8492 F, sec. sheet (no date) fl. masc. (K); id. 8492 (no date) fr. (LE, W); id. 8492 (no date) fl. masc. (LE, W); Wallich "100" A (1815) fl. masc. May (BM, C); Wallich "100" B (1815) fl. fem. (BM, C); Wallich (no date) fl. masc. (BR, G, W); Herb. Wight (no date) fl. masc. (B); Anderson 28 (1866) fr. (P); Gaudichaud 352 (1837) fr. (G, P); Pierre 4250 (1863) fl. fem. (BM, BR, BZ, G); Hort. Bot. Calc. (no date) fl. masc. (BZ, M, NY, P)

Without locality: Herb. Benth. (no date) fl. masc. (NY).

**Cultivated in** Bot. Gardens Calcutta and Bot. Gard. Buitenzorg (VII, D, 69 and 69a, fl. masc. and XI, B, V, 46).

**Vern. names:** BR. IND.: najor, néyor (Assam), neyar (Beng.), Chitreka (Teling.), sorupotri moi (Uriya), kandior (Kol.), thadi (Lower Burma),

yit padi (Upper Burma); SIAM (ex Craib): kapok ma (Siam.); mafèn (N. Loa); fèn som (Lao, Loi); pi sè (Karen, Chiangmai); INDO-CHINA: maï pheu (Laot.).

In a previous publication (Swart l.c.) I tried to make clear that Colebrooke made his diagnosis from living material in the Botanic Gardens at Calcutta where it was grown from seeds provided in 1808 by Dr. F. Buchanan Hamilton. Wallich proposed the name *Bursera serrata*, but in his Catalogue l.c. he only mentions *Icica indica* W. et A. In the Catalogue, and also in the Herbarium of the East India Company at Kew, the no. 8492 consists of six parts, marked A to F. Wallich 8492 C 54, collected by Hamilton in 1808 is the only fruiting one and may be considered as the source of the seed from which originated the tree which provided Colebrooke with flowering material for his diagnosis. Wallich 8491 F, first sheet, marked "*Bursera serrata* Wall. H.B.C." in Wallich's handwriting and showing typical male inflorescences with rudimentary ovaries containing two ovule-rudiments in each cell (and also some detached fruits), agrees entirely with the original diagnosis and also with Wallich 8492 C 54. It seems probable therefore that Wallich 8492 F, first sheet, originated from the same tree from which Colebrooke drew up his diagnosis; therefore I have considered Wallich 8492 F, first sheet, as neo-type.

W. Roxburg l.c. (1814) mentions "*Limonia pentagyna* Roxb. Chitreka". In the Herbarium of the British Museum I met with a specimen "W. Roxburg, India, *Limonia pentagyna* R. Chitreka"; it is a slightly hairy male form of *P. serratum* Engl. with entire leaflets and a wholly rudimentary ovary, and corresponds with Wallich 8492 A, marked "*Ailanthus lanceolata* John Roxb., ex H. B. Calc." These two specimens may be considered to be collected from the tree in the Bot. Gard. at Calcutta mentioned by Roxburg.

*Schleichera*? sp. Beddome l.c., based on Beddome 214 (Golconda-hills, Vizagapatam-district) was referred to *Protium serratum* Engl. forma *pallidula* Radlk. l.c. Because I did not find this specimen in the Herbarium at Kew and I only saw a single-leaf specimen in Herb. C., marked "*Schleichera*?" annotated by Wallich and by Radlkofer and as this leaf turned out to be a quite normal leaf of *P. serratum* Engl. I could not retain the forma *pallidula* Radlk. Besides the structures of the ovary of the male flowers mentioned above I found in some specimens, amongst others in Wallich "100" A in Herb. BM., male flowers with a rudimentary ovary containing in the few weakly developed cells only one ovule-rudiment.

The vegetative characters of the abundant material show much

variability. The possibilities in this regard are exhibited by Wallich 8492 F, second sheet, in Herb. K. which bears on the same branchlet normal leaves with nearly entire margins and other ones showing considerable deviation: leaf about 30 cm long, petiolules up to 12.5 mm long, leaflets up to 14 cm long and 6 cm wide and margin distinctly serrate from the base till the apex, acumen about 5 mm long and 5 mm wide.

Hamilton l.c. states that "Ben Kalesjam" in Rheede, Hort, Malab. IV, p.71, t.34 (1673) probably belongs to his *Schinus Saheria*, referred to *P. serratum* Engl., but the drawing is so lacking in detail that it seems to me to be taking too great a risk to support this identification.

**A n a t o m y :** Solereder, Syst. Anat. Dic. p.216, 218 (1899); Guill. in Ann. Sc. nat., S.9, X, p.208, f.2-2 (1909).

**U s e :** The close-grained and hard wood is much esteemed and is used for furniture.

3. ***Protium connarifolium* (PERK.) MERR.** in Phil. Journ. Sc. X, 1, p.30 (1915); id., Enum. Phil. Fl. Pl. II, p.348 (1923); Engl. in E.-Pr. Nat. Pfl.fam. ed. 2, XIXa, p.412 (1931); Lam in Ann. Jard. bot. Buitenz. XLII, p.201, t.12, f.94 (1932); id. in Bull. Jard. bot. Buitenz. S.3, XII, p.320 (1932).

*Canarium connarifolium* Perk., Frag. Fl. Phil. Isl. II, p.92 (1904).

*Protium philippinensis* Elm. in Leaf. Phil. Bot. VII, p.2571 (1915).

*Santiria Schlechterii* Lauterb. in Engl. Bot. Jahrb. LVI, p.333 (1921).

Large or rather large tree. Branches drooping (Merrill); branchlets slender, terete, striate, glabrous, smooth, castaneous to fuscous, dotted with elliptic ferruginous lenticels. Leaves mostly 1- or 2-jugate, sometimes 3-jugate, 13—19 cm long; petioles terete, striate, above slightly flattened, at the base incrassate, 3—4 cm long; interjuga terete, striate, 3 (2.5—3.5) cm long, like the petioles and the petiolules minutely puberulous, when adult sometimes glabrescent and transversely rimose; petiolules semiterete, striate, narrowly canaliculate, 10—12 (8—15) mm long, the terminal ones 20—25 mm long; leaflets oblong to elliptic-oblong, usually narrowed to both ends, 7.5—9.5 cm long and 3—3.5 cm wide, but the terminal ones larger; apex gradually narrowed in a tapering, acute, mucronate, 10—15 mm long and 3—4 mm wide acumen; base cuneate slightly decurrent; margin entire; subcoriaceous, glabrous, above nitidulous, beneath dull; with 8—10 pairs of sec. nerves; prim. nerves above grooved on each side, beneath prominent, sec. nerves above pro-



minulous, beneath prominent, tert. nerves prominulous to hardly visible. Inflorescences axillary, mixed, 3.5—4.5 (2.5—6) cm long; peduncle  $\frac{1}{2}$  to  $\frac{1}{3}$  the length of the inflorescence; sec. branchlets 5—8 mm long; the axes angulose, sparsely ferrugineous puberulous. Pedicels short, at most 1 mm long, terete, like the triangular, acute, 0.75 mm long bracts and bractlets, the calyx and the outside of the petals rather densely to sparsely and minutely ferrugineous puberulous. Flowers 4-merous, rarely 5-merous, 2.5—3 mm long, white. Calyx cupuliform, 1 mm high; its lobes triangular, subacuminate, longer than the tube. Petals lanceolate-oblong, carnose. inside glabrous; apex acute with incrassate-inflexed apiculum. Stamens in male fl. 1.75—2.5 mm long, the episepalous ones sometimes longer than the epipetalous ones, in fem. fl. 1.25 mm long; filaments subulate, at the base dilated; anthers oblong, 0.5 mm long. Disc urceolate to annular, sub-8-lobed, glabrous, 0.5 mm high. Pistil at the base surrounded by the disc, in the masc. fl. rudimentary, 0.8 mm high, in the fem. fl. 1.35 mm high, consisting of a globose 4-lobed, 4-celled, appressedly sericeous, 0.8 mm high ovary tapering in a glabrous, terete, 0.5 mm long style, ending in a 4-lobed stigma. Drupe oblique-ellipsoid and monopyrenous or globose, 2- to 4-lobed and 2- to 4-pyrenous, smooth, sparsely ferrugineous puberulous to glabrescent, 8 mm long and 5—13 mm in diam.; mesocarp thin; endocarp rather thick, woody.

Type: Merrill 787 in h. Bur. of Sc. Manilla.

Distribution: Philippine Isl. (Palawan) and N.E. New Guinea.

PHILIPPINE ISL.: Palawan, Ewiig River, Merrill 787 (1903) fl. masc. Febr. (B, K, NY) (type); id., prov. Palawan, Puerto Princesa, Mt. Pulgar, on banks of the Iwahig-river, Elmer 12760 (1911) alt. 250 m, fl. masc. March and 13225 (1911) alt. 250 m, fl. fem. and fr. May (B, BM, BZ, G, GR, L, LE, NY, U, W) (type of *P. philippinensis* Elm.); id., Mt. Kabangaan, Bur. of Sc. 77713 (Endano 1688) (1929) in forest slopes, alt. 600 m, fl. masc. and fem. and fr. Apr. (NY); id., without locality, Bur. of Sc. (Foxworthy) 548 (1906) fl. masc. Mar.-Apr. (B, BZ, K, NY); id., id. 737 (1906) fl. fem. Mar.-Apr. (B, NY); id., id. 754 (1906) fl. fem. Mar.-Apr. (B, NY); id., id. 758 (1906) fl. fem. and fr. Mar.-Apr. (BZ, K, NY); id., id. 866 (1906) fl. fem. and fr. May (B, BZ, K, NY).

?NEW GUINEA: Mandated Territory, Mt. Kani, Schlechter 16755 (1907) alt. 800 m, fr. Nov. (B) (type of *Santira Schlechterii* Laut.).

Vern. name: PALAWAN: marangub (Tagb.) (ex. Merrill).

Because of the Foxworthy specimens Merrill (1915) referred *Canarium connarifolium* Perk. to the genus *Protium* and in 1923, he added *Protium philippinensis* Elm. to *Protium connarifolium* Merr.

My investigations confirm the statement of Lam l.c. that *Santiria Schlechterii* Lauterb. most probably is a *Protium* related to *connarifolium* Merr. It is very difficult to state whether in the immature monopyrrenous fruits of Schlechter 16755, the type and single specimen of the former species, the pyrenes are connate or separated by the mesocarp, but I obtained the impression that the maturing pyrene and the two rudimental ones are not connate; the other vegetative and generative characters of this specimen however agree well with *Protium connarifolium* Merr.

On the contrary *Protium australasicum* (Bailey) Sprague, mentioned by Lam in regard to the disjunct area of *P. connarifolium* Merr. had, because of its connate pyrenes, to be referred to *Santiria*.

#### Sectio *Marignia* (COMM. ex KUNTH) HOOK.F.

Hook.f. in Benth. et Hook. Gen. Pl. I, 1, p.324 (1862); Engl. in DC. Mon. Phan. IV, p.91 (1883); id. in E.-Pr. Nat. Pfl. fam. III, 4, p.237 (1897) et ed.2, XIXa, p.414 (1931).

*Marignia* Comm. ex Kunth in Ann. Sc. nat. S.I, II, p.351 (1824).

Shrubs or trees with imparipinnate glabrous leaves. Petiolules never incrassate at the apical end, at most slightly incrassate at the basal end. Leaflets with decurrent base and rounded to emarginate apex, rarely obtusely subacuminate. Species from Madagascar and the Mascarenes.

4. *Protium obtusifolium* (LAM.) MARCH. in Adansonia VIII, p.17, t.3 (1867—1868); Engl. in DC. Mon. Phan. IV, p.91 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237, f.134c (1897) et ed.2, XIXa, p.414, f.191c (1931); Cordemoy in Ann. Inst. Col. Marseille VI, p.205 (1899); Guill. in Bull. Soc. Bot. Fr. LVI, p.145 (1909).

*Bursera obtusifolia* Lam., Enc. méth. Bot. II, p.768 (1786); Baillon, Hist. d. Pl. V, p.260, 296, f.265—268 (1874); id., Dict. Bot. I, p.528 fig. (1876); id., Tr. Bot. méd. phan. p.950 (1884); Baker, Fl. Mauritius and Seych. p.44 (1877).

*Marignia obtusifolia* De Cand., Prodr. II, p.79 (1825); Don, Gen. Hist. Dich. Pl. II, p.84 (1832); Bojer, Hort. Maur. p.82 (1837); Delessert, Ic. Sel. Pl. III, t.55 (1837); Dietr., Syn. Pl. II, p.1408 (1840); Lindley, Veg. Kingd. ed.3, p.459, t.320 (1853).

*Tingulonga obtusifolia* OK., Rev. Gen. Pl. I, p.108 (1891).

*Dammara graveolens* Gaertn., Fr. et Sem. II, p.100, t.103, f.1 (1802).

*Marignia acutifolia* DC. in errore Bojer, Hort. Maur. p.82 (1837).

Shrub or small tree, up to 10 m high. Branchlets stout, angulose and glabrous, when young smooth, greyish-datebrown, when adult scabrous, cinerascens and dotted with ferruginous lenticels. Leaves usually 2- or 3-jugate, sometimes 1- or 4-jugate, 15—20 (10—25) cm long, glabrous; petioles near the base incrassate and flattened, 4—5 (2.5—7.5) cm long, like the rhachis terete, striate and when adult transversely rimose; interjuga 3.5 (2—4.5) cm long, in the nodes hardly incrassate; petiolules semiterete, striate, canaliculate, alate, apical end not articulate, 5—15 mm long, the terminal ones 15—22 (10—30) mm long; leaflets usually oblong-elliptic to elliptic-orbicular, 4.5—7 (4—11) cm long and 2.75—4 (2—5.5) cm wide, but the terminal ones obovate, the lateral ones hardly oblique, slightly narrowed to the apex and the basal ones shorter; apex obtuse to truncate; base broadly cuneate, decurrent; margin entire, usually incurved; coriaceous, smooth, above nitidous, beneath hardly nitidulous; with 8—9 (7—10) pairs of sec. nerves; prim. nerves broad and prominent, sec. nerves prominulous, tert. nerves hardly prominent on both sides. Inflorescences axillary, subterminal, mixed, 6—8 (4.5—13) cm long. Peduncle half the length of the inflorescence, like the few, up to 1 cm long branchlets terete, striate, rather densely puberulous when young, glabrescent when adult. Pedicels rather stout, about 2 mm long, terete, striate, like the triangular, subacuminate, 0.75—1 mm long bracts and bractlets, the calyx and the outside of the corolla sparsely and minutely puberulous. Flowers 5-merous, rarely 4-merous, 3.5 mm long. Calyx broadly cupuliform, 1 mm high; its limb irregularly split; its lobes triangular-ovate, subacuminate, as long as to twice as long as the tube. Petals triangular-ovate, subcarnose; apex acute, slightly incrassate-incurved; margins papillose. Stamens in the masc. fl. 2.5 mm, in the fem. ones 1.5 mm long; filaments subulate, at the base slightly dilated; anthers oblong, about 0.75 mm long. Disc annular, 10-lobed, glabrous, 0.5 mm high. Pistil rather densely appressed-puberulous, consisting of a globose, 4- to 5-lobed, 4- to 5-celled ovary and a sessile 4- to 5-lobed stigma, in the masc. fl. embedded in the disc, 0.75 mm high, in the fem. fl. at the base surrounded by the disc, 1.5 mm high. Drupe either oblique-ovoid and monopyrenous or subglobose, 2- to 4-lobed and 2- to 4-pyrenous, 15 mm long and 8—13 mm in diam.; apex acute, crowned by the stigma, when ripe dehiscent, puberulous when young;

mesocarp thin, carnose; endocarp rather thick, brittle, woody.

Type: Commerson 596 in h.P.

Distribution: Mauritius.

MAURITIUS: Le Pouce, Boivin 1561 (1847) fl. fem. and fr. (P, W); Montagne longue, Bouton (1839) fl. fem. and fr. (BR, K); without locality, Ayres (no date) fl. fem. and fr. (GH); id., Barclay (no date) fl. (K); id., Bélanger (no date) fl. fem. and fr. (W); id., Bojer (no date) fl. masc. (GH, M); id., Commerson 596 (no date) fr. (L, LE) (type); id., Hardwicke 232 (no date) fl. (G); id., Néraud (no date) fr. (G); id., Perrottet (1834) fr. (G, M); id., Sieber 199 (no date) fl. and fr. (B, M, W); id., Sieber II 68 (1830) fl. fem. and fr. (B, BM, BR, BRESL, K, L, LE, W); id., Sieber II 326 (no date) fl. masc. (L, P); id., Sieber (no date) fr. (C); id., Sieber (no date) fl. masc. (W); Vaughan 288 (1920) fr. Mar. (K); Webb (1838) fl. (G); id., ded. Lamarck (no date) fl. masc. (C); id., id. (no date) fr. (C); id., Herb. Blackburn (no date) fl. masc. (K); ex. herb. Paris (no date) fl. masc. (B).

Vern. names: bois de colophane, bois de colophane bâtard, bois de marigni, gommart.

The type-specimen, inscribed by Commerson "Marignia . . . etc.", induced Lamarck l.c. (1786) to the creation of *Bursera obtusifolia* Lam. and Kunth, in *Ann. Sc. nat. S.1, II, p.351* (1824), to the founding of the genus *Marignia*, to which he referred *Dammara* Gaertn. Gaertner l.c. (1802) considered *Dammara graveolens* Gaertn., from Mauritius, as probably identical with *Dammara Itam* s. *nigra* Rumph. These facts caused De Candolle l.c. to distinguish a *Marignia obtusifolia* DC. (*Bursera obtusifolia* Lam., *Dammara graveolens* Gaertn.) from Mauritius, and a *Marignia acutifolia* DC. (*Dammara nigra* Rumph.) from the Moluccas. The latter species however has since been referred to *Canarium acutifolium* Merr., but Bojer l.c. records from Mauritius, apart from *M. obtusifolia* DC., erroneously *M. acutifolia* DC. According to Baker l.c. the specimen meant in this enumeration belongs to *M. obtusifolia* DC. I only found the name *Marignia acutifolia* DC. on the label of a single specimen, Herb. Blackburn in h.K., collected before 1863, and this turned out to be *Protium obtusifolium* March., though with tetramerous flowers.

Use: The resin extracted from the bark and from the fruits, called "colophane bâtard", is used as tar and the wood is said to be valuable for carpenting. (cf.: Marchand l.c.; Baillon l.c.; Cordemoy l.c.; Guill. in *Agr. Pays chauds IX, 1, p. 360 et 2, p. 142* (1909)).

5. *Protium Chapelierii* GUILL. in *Bull. Soc. bot. Fr. LVI, p.138* (1909); Engl. in *E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.414* (1931).

*Protium madagascariense* Engl. var. *ellipticum* Engl. in DC. Mon. Phan. IV, p.91 (1883).

Tree. Branchlets rather stout, when young rather densely but minutely canescent puberulous, when adult glabrous, scabridulous, ferruginous to fuscous. Leaves 3-jugate, 20—25 cm long, glabrous; petioles terete, striate, near the base slightly flattened, 4 (2.5—4.5) cm long; interjuga terete, striate 3.5 (3—5) cm long; petiolules semiterete, canaliculate, 7.5 (5—10) mm long, the terminal ones 20—25 mm; leaflets lanceolate-oblong to oblong-elliptic, slightly narrowed to the acute, decurrent base, usually 8—9 (7—10) cm long and 3—3.5 (2.5—3.75) cm wide, but the terminal ones obovate and wider and the basal ones shorter; apex rounded but provided with an obtuse, 2 mm long and 5 mm wide acumen; margin entire, subcoriaceous, smooth, above nitidous and glaucous, beneath nitidulous and rufescent; with 11—13 pairs of sec. nerves; nerves prominent. Inflorescences axillary, 8—10 cm long, few-branched. Peduncles and axes angulose, like the rather stout, 3 mm long pedicels of the fruits glabrous. Flowers 4- to 5-merous. Calyx cupuliform, sparsely and minutely pilose; its lobes broadly triangular, half the length of the tube. Petals ovate; apex acute, incurvate-incurved. Stamens with subulate filaments, shorter than the calyx. Disc annular, glabrous. Ovary as long as the filaments. Drupe ellipsoid, sub-2-lobed, smooth and glabrous, 12.5 mm long and 7.5 mm in diam., not crowned by a rudiment of style or stigma; mesocarp thin; endocarp woody; monopyrenous.

Type: Chapelier in h.P. (ex. Guill.).

Distribution: Madagascar.

MADAGASCAR: Côte Est, Chapelier in h. P. (ex Guill.); Saint Marie, Boivin 1890 (1848) fr. (G, L, W) (type of *P. madagascariense* Engl. var. *ellipticum* Engl.); without locality, Perrottet (no date) fr. (L).

Vern. names: voiré matata, anba-fanguchanba (ex Guill.).

In regard to its morphological characters this species is nearly related to *P. obtusifolium* March. but the latter differs by the truncate, not-acuminate apex, the 8—9 pairs of sec. nerves and the indistinct tert. nerves of its leaflets and the oblique-ellipsoid or subglobose form of its fruits which are crowned by a stigma-rudiment.

As the war made it impossible to visit the Herbarium at Paris I could not study the type-specimen and so I had to rely on the diagnosis of Guillaumin. Because the latter does not mention the

elongate-cuneate base of the leaflets, which reduces the petiolule to nearly nothing, as in *P. Beandou* Engl. and in *P. madagascariense* Engl., but instead indicates the presence of distinct petiolules, *P. Chapelierii* Guill. seems much nearer related to *P. obtusifolium* March. than to the former Madagascarspecies.

Boivin 1890, type of *P. madagascariense* Engl. var. *ellipticum* Engl., corresponds with the diagnosis of *P. Chapelierii* Guill. and so does a Perrottet-specimen, named by Engler "*Protium madagascariense* Engl."; neither of these two specimens agrees with the diagnosis of the latter species.

Though *P. Chapelierii* Guill. shows much resemblance with *P. obtusifolium* March., the differential specific characters excepted, yet the peculiar, always monopyrenous, one-celled and one-seeded fruits make one septical with regard to its true position; it might even belong to another genus.

Use: The resin of this species is said to be called ditindramy and to be used in several ways. (Cf. Guill. in *Agr. Pays chauds* IX, 2, p. 142 (1909)).

**6. *Protium madagascariense* ENGL.** in DC. Mon. Phan. IV, p.91 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.414 (1931); Cordemoy in Ann. Inst. col. Marseille VI, p.207 (1899); Guill. in Bull. Soc. bot. Fr. LVI, p.144 (1909).

*Tingulonga madagascariense* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree. Branchlets cinereous. Leaves 2- or 3-jugate, about 15 cm long, glabrous; petioles slightly semiterete, 4—6 cm long; interjuga on the sides marginate, in the nodes incrassate, 2.5—3 cm long; petiolules short, at the base incrassate, 2.5 mm long, the terminal ones 15 mm; leaflets obovate-oblong to obovate-lanceolate, usually 6—7.5 cm long and 1.75—2.25 cm wide, but the basal ones shorter; apex obtuse, sometimes shortly and broadly obtusely subacuminate, base cuneate-elongate, narrowed in the petiolule; margin entire; subcoriaceous, smooth, above nitidous, beneath nitidulous; with 9—12 pairs of sec. nerves; prim. nerves above grooved on each side, beneath prominent, sec. and tert. nerves prominent. Inflorescences nearly as long as the leaves. Peduncles and branchlets terete, striate, sparsely puberulous. Pedicels of the fruits terete, striate, glabrous, 5 mm long, bracts and bractlets triangular-ovate, obtuse, 1 mm long, like the calyx sparsely and minutely puberulous. Flowers 5-merous. Calyx broadly cupuliform, 0.75 mm high; its lobes triangular, half the length of the tube. Filaments subulate, dilated, about 1 mm long. Disc annular, glabrous, 0.3 mm high. Drupe ovoid, obliquely compressed to trigonous,

sparsely fulvous puberulous, 12—15 mm long and 8—10 mm in diam.; apex acute, crowned by a sessile, 5-lobed stigma; mesocarp thin; endocarp rather thick, woody; pyrenes 1 or 2.

Type: Richard 118 in h.P. (ex Engl.).

Distribution: Madagascar.

MADAGASCAR: Vohémar, Richard 118 (P) (ex Engl.); without locality, Bernier 214 (no date) fr. (B).

Vern. name: probably tsiramiramy (ex Cordemoy and Guill.).

As the typespecimen in the Herbarium at Paris could not be examined because of the war, the diagnosis is traced from that of Engler with which some of the leaves and the fruits on a sheet in herb. B., a mixture of Bernier 214 and Richard 391, correspond quite well.

This species is related to *P. Beandou* March. which differs from *P. madagascariense* by its smaller leaves, the less numerous sec. nerves and the retuse apex of its leaflets and its inflorescences of about one third the length of the leaves.

The similarity of its fruits and of its leaflets to those of *P. Beandou* Engl. makes it probable that *P. madagascariense* Engl. belongs to the genus *Protium*.

Use: The resin of this species is said to be called ditindramy and to be used in several ways. (Cf. Cordemoy l.c.; Guill. l.c., id. in Agr. Pays chauds IX, 2, p.142 (1909)).

7. *Protium Beandou* MARCH. ex ENGL. in DC. Mon. Phan. IV, p:92 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.414 (1931); Guill. in Bull. Soc. bot. Fr. LVI, p.138 (1909)

*Tingulonga Beandu* OK., Rev. Gen. Pl. I, p.108 (1891).

Shrub. Branchlets slender, terete, striate, when young sparsely appressedly puberulous, when adult glabrous, scabridulous and ferruginous to fuscous. Leaves 2-, rarely 1-jugate, 6.5 cm long, glabrous; petioles 15 (10—17) mm long, like the rhachis and the petiolules semiterete, alate; interjuga 15 (7.5—17.5) mm long, nodes slightly incrassate; petiolules indistinct, about 2 mm long, the terminal ones 10 (7.5—17.5) mm; leaflets obovate-oblong to spatulate, usually 2—2.25 (1.5—2.75) cm long and 1—1.25 (0.8—1.5) cm wide, but the terminal ones larger and the lateral ones slightly oblique; apex truncate to retuse; base cuneate-elongate, distinctly decurrent, margin entire, slightly repandous, undulate;

subcoriaceous, smooth, above nitidous, beneath nitidulous; with 6—7 pairs of sec. nerves; nerves prominent. Inflorescences axillary, nearly 2 cm long; axes few and short, angular, glabrous. Pedicels of the fruits rather stout, 2.5 mm long, angulose, nearly glabrous or sparsely appressed-puberulous; bracts and bractlets triangular-oblong, acute, hardly 0.5 mm long. Flowers 5-merous, 3 mm long. Calyx cupuliform, glabrous or nearly so, 0.8 mm long; its lobes triangular, subacuminate, as long as the tube. Petals oblong, acute with a small inflexed apiculum, subcarnose, outside provided with some short appressed hairs near the midrib. Stamens 1.5 mm; filaments subulate, 1.2 mm; anthers oblong 0.3 mm long. Disc annular, 10-lobed, glabrous. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 3-lobed and 2- to 3-pyrenous, 8—10 mm long and 7—8 mm in diam., glabrous when ripe; apex acute, crowned by a sessile 5-lobed stigma; mesocarp thin; endocarp rather thick, woody.

**Type:** Bernier 238 in h.P. (ex Engl.).

**Distribution:** Madagascar.

**MADAGASCAR:** Sainte Marie, Bernier 238 (no date) fr. (B); id., Boivin (1846—1852) fr. (L); without locality, Goudot (no date) fr. (G.).

**Vern. name:** bé-andou.

The nearest relation of *P. Beandou* March. is probably *P. madagascariense* Engl. but the latter differs by its larger leaves, its narrowly winged petiolules, its leaflets with 10—12 pairs of sec. nerves and its inflorescences which are as long as its leaves. Both are probably related to *P. obtusifolium* March. but differ from the latter by the smaller size of their vegetative organs and their inflorescences, the obovate leaflets with their cuneate-elongate base decurrent in the winged petiolule.

### Sectio *Eu-Icica* SWART

*Icica* Aubl., Hist. Pl. Gui. fr. I, p.337 (1775).

Trees or shrubs with imparipinnate or unifoliolate leaves. Petiolules at both ends incrassate-articulate. Inflorescences thyrsoid. Flowers pedicellate. Disc glabrous, in the masc. fl. not connate with the more or less rudimentary ovary.

8. ***Protium brasiliense*** (SPRENG.) ENGL. in Mart. Fl. Bras. XII, 2, p.268, t.54 (1874); id. in DC, Mon. Phan. IV, p.70, t.2,



f.1—3 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237, f.134, A-B (1897) et ed.2, XIXa, p.412, f.191, A-B (1931); Glaziou in Bull. Soc. bot. Fr. LII, Mém.3, p.91 (1905).

*Amyris brasiliensis* Spreng., Linn. Syst. Veg. ed.16, II, p.217 (1825); Don, Gen. Hist. Dichl. Pl. II, p.87 (1832); Dietr., Syn. Pl. II, p.1271 (1840).

*Tingulunga brasiliensis* OK., Rev. Gen. Pl. I, p.108 (1891).

Large shrub or small tree. Branchlets slender to rather stout, 2.5—4 mm in diam., terete, striate, smooth, glabrous, caesious to castaneous, dotted with oblong, ferruginous lenticels. Leaves 1- or 2-jugate, 10 (6.5—15) cm long; petioles semiterete, above slightly dilated, in 2-jugate leaves at most as long as the interjugum but usually shorter, 12.5—22.5 mm long, or in 1-jugate leaves at most as long as the petiolule of the terminal leaflet but usually shorter, 12.5 (4—17.5) mm long, like the rhachis and the petiolules glabrous or provided with some scattered, minute, patent hairs; interjuga above bisulcate, 20—35 mm long; petiolules semiterete, canaliculate, subulate, 4 (2—5) mm long, the terminal ones in the 1-jugate leaves 17.5 (5—20) mm, in the 2-jugate ones 10 (7.5—12.5) mm long; leaflets oblong to elliptic 7 (3.5—9) cm long and 3.5 (1.25—4.5) cm wide, the terminal ones slightly narrowed to the base and

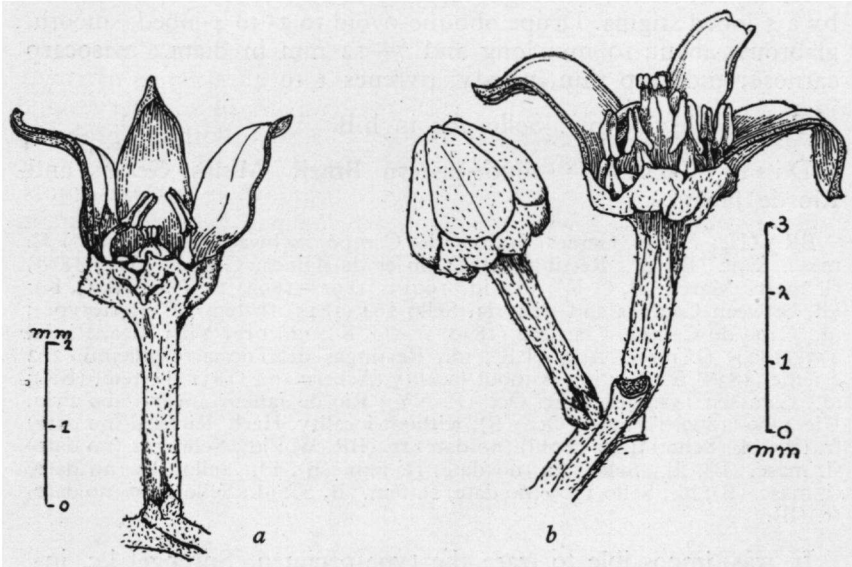


Fig. 1. *Protium brasiliense* (Spreng.) Engl. — a. male flower; b. female flower.

larger than the nearly symmetrical lateral ones; apex tapering, ending obtusely, rarely indistinctly subacuminate; base cuneate; margin entire, usually incurved; subcoriaceous to coriaceous, smooth, glabrous, above nitidous, beneath nitidulous; with 8—10 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. nerves branched near the margin, above prominulous, beneath prominent, tert. nerves indistinct. Inflorescences axillary, branched from the base, 2.5 (1.5—6) cm long, many-flowered. Branchlets terete, striate, slender, like the 1.5—2 mm long, terete, striate pedicels, the ovate, subacuminate, 0.5 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely and minutely puberulous or subglabrous. Flowers 5-merous, 2—3 mm long, greenish to reddish. Calyx cupuliform, 0.8 mm high; its lobes broad-triangular, subacuminate, acute, as long as the tube. Petals oblong-ovate, subcarnose with acute, incassate-inflexed apex and minutely fimbriate margins. Stamens nearly 1.5 mm long; filaments subulate, dilated, 0.9 mm long; anthers oblong, basifixed. Disc annular, 10-lobed, glabrous, 0.3 mm high. Pistil glabrous, in the masc. fl. 0.4—0.7 mm high, embedded in the disc, in the fem. fl. surpassing the stamens, at the base surrounded by the disc.; ovary globose-conical, 5-lobed, 5-celled, about 1.25 mm high, tapering in a short style and crowned by a 5-lobed stigma. Drupe oblique-ovoid to 2- to 4-lobed, smooth, glabrous, about 10 mm long and 7—12 mm in diam.; mesocarp carnose; endocarp thin, woody; pyrenes 1 to 4.

**Type** (lecto-type): Sello 264 in h.B.

**Distribution**: south-eastern Brazil (Minas Geraes and Rio de Janeiro).

**BRAZIL**: Minas Geraes, Itabira do Campo, Schwacke 5823 (1887) fl. masc. Sept. (B); id., Restinga de Taipu et de Tijuca, Glaziou 6114 (1873) fl. masc. March (B, C, K); id., id. 19013 (1891—1892) fl. fem. (B, C, K); id., between Campos and Victoria, Sello 264 (1815) fl. fem. (B) (lectotype); id., Capo do Campe, Claussen (1840) fr. (G, K); id., near Villa Rica, Riedel 473 (1824) fl. masc. Aug. (LE); id., Restingas de Tocaia, Guillemin 222 2-ième (1838) fr. (G); id., without locality, Ackermann (1831) fl. fem. (BR); id., Claussen 1529 (1841) fr. Oct. (P, NY); Rio de Janeiro, near Cabo Frio, Ule 4709 (1899) fl. masc. Oct. (B); without locality, Herb. Richard (no date) fr. (P); id., Schott 4406 (Pohl) (no date) fr. (BR, W); id., Sello 251 (no date) fl. masc. (B); id., Sello 334 (no date) fl. fem. (B); id., Sello 429 (no date) fl. masc. (B); id., Sello 1109 (no date) fl. fem. (B, S); id., Sello 1207 (no date) fr. (B).

It was impossible to trace the typespecimen. Sprengel l.c. included *Amyris brasiliensis* Spr. in his "*Amyris foliis ternatis*"

and indeed several of Sello's specimens are trifoliolate. There is, however, but one specimen, Sello 1109, that is is labelled "Amyris brasiliensis", and as the leaves of this one are for the greater part bijugate, it is not likely that it has served as a base for Sprengel's description. Moreover, the name on the label is not in Sprengel's handwriting. Sello 264, my lecto-type, on the other hand agrees completely with Sprengel's diagnosis.

**Anatomy:** Guill. in Ann. Sc. nat., S.9, X, p.210 (1909).

**var. subacuminatum** ENGL. in Mart. Fl. Bras. XII, 2, p.268 (1874); id. in DC. Mon. Phan. IV, p.70 (1883).

*Protium venosum* Engl. in Mart. Fl. Bras. XII, 2, p.264 (1874); id. in DC. Mon. Phan. IV, p.65 (1883); id. in E.-Pr. Nat. Pfl. fam. III, 4, p.237 (1897) et ed. 2. XIXa, p.412 (1931).

*Tingulunga venosa* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium venosum* Engl. var. *racemosum* Engl. in Mart. Fl. Bras. XII, 2, p.265 (1874); id., in DC. Mon. Phan. IV, p.65 (1883).

*Icica maritima* Casaretto mss. ex Engl. l.c. (1874, 1883).

Leaves 1- or 2-jugate; leaflets distinctly acuminate; acumen 2—3 mm long and 4 mm wide, obtuse. Pedicels short, 0.75—1.5 mm long. Flowers 5-merous, rarely 4-merous.

**Type:** Riedel in h.M.

**Distribution:** south-eastern Brazil (Minas Geraes and Rio de Janeiro).

BRAZIL: Minas Geraes, Restinga de Taipu et de Tijuca, Glaziou 1317 (1867) fl. fem. June (BR, C); id., id. 19012 (1891—1892) fl. fem. (B, C, K, LE); id., Cachoeira do Campo, Schwacke 8871 (1892) fr. Nov. (B); id., Barbacena, Schwacke 8772 (1892) fl. fem. Oct. (B); id., near Minas, Schwacke 13481 (1878) fl. fem. Sept. (B); id., Gardner 4496 (1842) fl. fem. (B, BM, K, P, W) (type of *P. venosum* Engl. var. *racemosum* Engl.); id., Riedel 492 (1844) fl. fem. Sept. (B, K, LE, M) (type of *P. venosum* Engl.); id., Riedel (1824) fl. masc. Sept. (B, LE, M) (type); Rio de Janeiro, Taypée, Casaretto 1798 (no date).

This variety strongly remembers *Protium ovatum* Engl., but the latter differs from this variety by its slender petiole which is longer than the interjugum, its ovate leaflets with sec. nerves branched halfway the blade and its inflorescences with glomerate, 4-merous flowers.

**var. subserratum** SWART in Rec. Trav. bot. néerl. XXXIX, p.189 (1942).

Leaves usually 2-jugate, sometimes 1-jugate; leaflets obtusely subacuminate; margin subserrate, Flowers 3—4.5 mm long.

Type: Glaziou 12545 in h.P.

Distribution: south-eastern Brazil.

BRAZIL: Minas Geraes, between Ouro Preto and Casa Branca, Schwacke 9451 (1893) fl. masc. Sept. (B); Rio de Janeiro, Serra dos Orgãos, Glaziou 8331 (1876) fl. fem. (B, BR, C, G, K, LE, S); id., id. 12545 (no date) fl. masc. (B, BR, C, K, LE, NY, P); id., id. 19015 (1891—1892) fl. masc. (B, BR, C, K, LE, US).

var. *obtusifolium* SWART in Rec. Trav. bot. néerl. XXXIX, p.189 (1942).

Leaves usually 1-jugate, rarely 2-jugate; leaflets elliptic, apex obtuse to emarginate. Pedicels  $\frac{1}{3}$  the length of the flowers, 1 mm long, like the flowers glabrous.

Type: Glaziou 16751 in h.P.

Distribution: south-eastern Brazil.

BRAZIL: Minas Geraes, Itabira do Campo, Glaziou 16751 (1887) fl. masc. Febr. (B, G, K, LE, P).

9. *Protium Icariba* (DC.) MARCH. in Adans. VIII, p.52 (1867—1868); Engl. in Mart. Fl. Bras. XII, 2, p.267, t.53 (1874); id. in DC. Mon. Phan. IV, p.69 (1883); id. in E.-Pr. Nat. Pfl. fam. II, 4, p.237 (1897) et ed.2, XIXa, p.412, 414 (1931); Corde-moy in Ann. Inst. col. Mars. VI, p.200 (1899); Beille, Préc. Bot. pharm. II, p.620, f.420 (1909); Pittier in Trab. Mus. com. Venez. VIII, p.366 (1931) excl. spec. Venez. Non apud March. in Vid. Medd. Kjb. 1873, p.54 (1873) quod ad *P. heptaphyllum* March. var. *brasiliense* Engl. pertinet, nec apud Standl. in Trop. Woods XXXIII, p.15 (1933) quod ad *P. giganteum* Engl. pertinet.

*Icica Icariba* DeCand., Prodr. II, p.77 (1825) syn. *Amyris ambrosiaca* L.f. excl.; Don, Gen. Hist. Dichl. Pl. II, p.83 (1832); Mart., Spec. Mat. Med. Bras. p.118 (1824); Berg und Schmidt, Off. Gew. IV, t.31c (1863); Köhler, Med. Pfl. I, t.33 (1887).

*Elaphrium Icariba* Spr. ex Dietr., Syn. Pl. II, p.1271 (1840). *Bursera Icariba* Baill., Hist. d. Pl. V, p.296 (1874); id., Tr. Bot. méd. phan. p.951 (1884).

*Tingulunga Icariba* OK., Rev. Gen. Pl. I, p.108 (1891).

*Amyris ambrosiaca* L.f., Suppl. Pl. p.216 (1781) quoad syn. Marcgr. et Piso tantum; eadum modo: Persoon, Linn. Syst. Veg.

ed. 15, p. 386 (1797); id., Syn. Pl. I, p. 414 (1805); Willd., Linn. Sp. Pl. II, p. 335 (1799).

*Protium ambrosiacum* Druce in Rep. Bot. Soc. and Exc. Cl. VII, Suppl. 2, p. 642 (1917), "vice *P. Icariba* March."

*Bursera (Icica) Sellowii* Turcz. in Bull. Soc. Imp. Nat. Mosc. XXXVI, 1, p. 613 (1863).

*Icariba* Piso, Hist. Nat. Bras. IV, p. 59 (1648) et Marcgr., ibidem VIII, p. 98 (1648).

Shrub. Branchlets stout, fragile, terete, striate, smooth, glabrous, grey to fuscous. Leaves mostly 2-jugate, sometimes 1-jugate, 15—21 cm long, in all parts glabrous; petioles terete, near the slightly incrassate base semiterete, 5 (3—6.5) cm long; interjuga angulose, 2—3 cm long; petiolules semiterete, at both ends slightly incrassate, 10 (7—13) mm long, terminal ones 15—20 mm; leaflets mostly elliptic, but the smaller ones sometimes oblong, usually 7.5—9.5 (6—10) cm long and 3.5—4.5 (3—5) cm wide, the terminal ones larger, narrowed to the base, the lateral ones oblique, apex abruptly acuminate; acumen tapering, 4 mm long and equally wide, obtuse; base cuneate; margin entire; subcoriaceous, rigid, smooth and nitidulous; with 11 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones prominulous on both sides. Inflorescences axillary, branched from the base, many-flowered, 2—4 cm long. Peduncles and branchlets stout, terete, like the terete, striate, rather stout, 0.75—1.5 mm long pedicels, the ovate-triangular, obtuse, 0.6 mm long bracts and bractlets and the outside of the calyx and corolla rather densely and shortly sericeous. Flowers 5-merous, 2.25—2.5 mm long. Calyx cupuliform, 0.75 mm high; its lobes broad-triangular, acute, as long as the tube. Petals oblong-ovate, carnose, inside glabrous; margins fimbriate; apex acute, incrassate-inflexed. Stamens nearly 1.5 mm long, filaments subulate, slightly dilated at the base, 0.5 mm long; anthers oblong-lanceolate, 1 mm long. Disc annular, sub-10-lobed, glabrous, 0.2 mm high. Pistil surrounded by the disc, glabrous, consisting of a globose-ovoid, 5-lobed, 5-celled ovary and a subsessile 5-lobed stigma, in the masc. fl. rudimentary, as high as the filaments, in the fem. fl. as high as the stamens. Drupe oblique-ellipsoid, acute at both ends, smooth, glabrous, 10 mm long and 7.5 mm in diam., mostly monopyrenous.

Type: Sello in h.G.(?)

Distribution: south-eastern Brazil.

**BRAZIL:** Rio de Janeiro, Gomes (1836) fl. masc. (K, L, M); id., Weddel 696 (1858) fl. fem. (B); id., Richard (no date) fl. fem. Oct. (G, P); id., Cabo Frio, Schenk 3881 (1887) fr. May (B, C, LE); id., Restinga near Cabo Frio, Ule 4710 (1899) fl. fem. Oct. (B); Restingas de Tocaia, Guillemín 222 (1838) (*Icica Guillemíniana* March. mss.) fl. fem. and fr. (P, NY); between Rio de Janeiro and Bahia, Sello (no date) (B); between Campos and Victoria, Sello 307 (no date) fl. masc. (B); between Victoria and Bahia, Sello 83 (no date) fl. fem. (B, K, S); id., id. 169 (no date) fl. (B); without locality, Hoffmannsegg (no date) fl. (B); id., Kalkmann (no date) fl. (LE); id., Pohl (no date) fl. (W); id., Schott (no date) fr. (W); id., Sello 230 (no date) fl. (B); id., id. 1057 (no date) fl. fem. (B).

**Vern. names:** *icicariba* (Piso et Marcgr. l.c., DeCand. l.c. and Baill., Dict. Bot. III, p.115) (1891)); *breu jauaricica*, *almecegueira* (Engl. l.c. (1874); VillaFranca in Bull. Thér. méd. et chir. p. 9 (1880) and LeCointe, Arv. e Pl. ut. a Amaz. Bras. III, p. 64 (1934)).

Although this species and the preceding one cover nearly the same limited area, they show quite different characters.

As all specimens I met with, are restricted to the coastal region between Rio de Janeiro and Bahia, Pittier's record of *P. Icariba* March. from Venezuela (l.c.) is rather astonishing and wants confirmation. For the time being I am inclined to regard it as a wrong identification. The vern. names quoted by Pittier belong to *P. macrophyllum* (H.B.K.) Engl.

The diagnosis of *Amyris ambrosiaca* Linn.f. l.c. obviously refers to *Protium heptaphyllum* (Aubl.) March. and the synonym "*Icica* Marcgr. bras. p. 98; Piso. bras. p. 59" has been added erroneously. Probably for this reason De Candolle added a "?" when he quoted *Amyris ambrosiaca* L.f. as a synonym of *Icica Icariba* DC. and for the same reason *Protium ambrosiacum* Druce l.c. should be regarded as a *nomen confusum*.

The brief diagnosis of *Bursera (Icica) Sellowii* Turcz. agrees with that of *P. Icariba* DC., but as I could not trace any of Sello's specimens signed with the name of Turczaninow I rely for the identification of these two species on Engler's authority.

**Anatomy:** Berg und Schmidt l.c.; Guill. in Ann. Sc. nat., S.9, X, p.210 (1909).

**Uses:** The fruits are said to be edible and the bark of the roots is said to be used as a medicine. The resin from the bark of this tree is mentioned as *Resina Icica*, *Brasilianisches Elemi*, *Elémi d'Amérique*, *Elémi de Brésil*, *Elemiharz*, *Elemi occidentale*, *Elemi von Rio*. Some of these names are also applied to the resins of other *Protium* species. Cf. Marcgr. et Piso l.c.; Berg und Schmidt l.c.; Köhler l.c.; Baill. l.c. (1874); Engl. l.c. (1897, 1931); Cordemoy l.c.; Wiesn. und Bamb. in Wiesn. Rohst. ed. 2, I, p. 175 (1900); Guill. in Agr. Pays chauds IX, 1, p. 358, 494 et 2, p. 144 (1909); Tschirch, Handb. Pharmak. III, 2, p.1135 (1925); Wolff in Wiesn. Rohst. ed.4, I, p.1045 (1927); LeCointe l.c.

10. *Protium macrophyllum* (H.B.K.) ENGL. in Mart. Fl. Bras. XII, 2, p.275 (1874); id. in DC. Mon. Phan. IV, p.75 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Icica macrophylla* H.B.K., Nov. Gen. et Sp. Pl. VII, p.26 (1825); Kunth, Syn. Pl. IV, p.162 (1825); De Cand., Prodr. II, p.77 (1825); Spreng., Linn. Syst. Veg. ed.16, IV, 2, p.148 (1827); Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.299 (1872).

*Elaphrium macrophyllum* Spr. ex Dietr., Syn. Pl. II, p.1271 (1840).

*Tingulonga macrophylla* OK., Rev. Gen. Pl. I, p.108 (1891).

? *Protium Icariba* (DC.) March. in errore Pittier in Trab. Mus. com. Venez. VIII, p.366 (1931) quoad spec. Venez.

Large tree, up to over 25 m high. Branchlets stout, 5—10 mm in diam., terete, striate, glabrous, fuscous, dotted with large cicatrices and small, elliptic, brownish lenticels. Leaves 3-jugate, rarely 2-jugate, 55 (up to 63) cm long, in all parts glabrous; petioles semiterete, subalate, 15—17.5 cm long, at the base dilated and incrassate, up to 15 mm wide; interjuga terete, striate, carinate, 6 cm long; petiolules semiterete, subalate, at both ends slightly incrassate, 10 (7.5—15) mm long, the terminal ones 4—6 cm; leaflets elliptic-oblong to elliptic, usually 20 (19—24) cm long and 10 (7—11) cm wide, the terminal ones larger, sometimes narrowed to the base, the lateral ones nearly symmetrical, the basal ones much shorter, 15—18 cm long; apex rather abruptly acuminate; acumen tapering, 6—8 mm long and 5—6 mm wide, obtuse; base cuneate to nearly rounded; margin entire, undulate; coriaceous, smooth, above nitidous to nitidulous, beneath dull; with 13—15 pairs of sec. nerves; prim. and sec. nerves above broad and flat, grooved on each side, beneath distinctly prominent, pale green, tert. nerves prominulous. Inflorescences axillary, branched from the base, few-flowered, in all parts glabrous, 3—5 cm long. Peduncles and branchlets stout, angulose. Pedicels stout, terete, striate, 1.5—2 mm long; bracts and bractlets ovate, acute, 0.75 mm long. Flowers 5-merous, 2.5 mm long. Calyx cupuliform, 1 mm high; its lobes semi-orbicular, subacuminate, as long as the tube. Petals ovate-oblong, acute, inflexed-apiculate. Stamens about 1 mm long; filaments subulate about as long as the oblong anthers. Disc annular, glabrous. Pistil at the base surrounded by the disc, about as high as the stamens, consisting of a globose-ovoid, 5-gonous, glabrous ovary and a sessile 5-lobed stigma. Drupe broadly globose, 3- to 5-lobed, glabrous, 12.5—15 mm long and 12.5—15 mm in diam.; apex acute crowned by a rudiment

of the stigma; mesocarp rather thick; endocarp thin, woody; pyrenes 3—5.

Type: Humboldt in h.P.

Distribution: Andes of Colombia.

COLOMBIA: near Mariquita, Humboldt in Herb. Willd. 7296 (no date) alt. 500 m, fl. June (B) (sub *Amyris altissima*); prov. Mariquita, Magdalena-valley, near Cundai, Triana 3700 (1855) alt. 700 m, fr. Sept. (B, BM, K, US, W); Chaparral, Goudot (ex Tr. et Pl.).

Vern. names: guacharaco (ex H.B.K.), guacamayo.

As it was impossible for me to visit the Herbarium at Paris I did not see the type. Engler based his diagnosis partly on Triana 3700 and partly on the description given by Kunth; the co-type in Herb. Willd. 7296 he referred to *P. Copal* (S. et C.) Engl.

**11. *Protium attenuatum* (ROSE) URB., Symb. Ant. VII, p.240 (1912); Fawcett and Rendle, Fl. Jam. IV, 2, p.208, f.69 (1920); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.412, 414 (1931).**

*Icica attenuata* Rose in N.Am. Fl. XXV, 3, p.261 (1911).

*Amyris heterophylla* Willd. in errore Wikst. in Kon. Vet. Ak. Handl. 1827, p.63 (1828) (fide Urb. l.c.).

*Icica heptaphylla* Aubl. in errore Gris., Fl. Br. W. Ind. Isl. p. 173 (1864) quoad spec. e St. Lucia et St. Vincent provenientia; Duss in Ann. Inst. col. Mars. IV, 3, p.182 (1897).

*Protium guianense* March. in errore Engl. in Mart. Fl. Bras. XII, 2, p.271 (1874) et in DC. Mon. Phan. IV, p.72 (1883) quoad spec. e St. Lucia, St. Vincent et Guadeloupe provenientia.

*Protium guianense* March. var. Oliver in Hook. Ic. Pl. XVI, t.1571 (1887).

*Icica guianensis* Aubl. in errore Rose l.c. quoad specimina a Griseb. sub nom. *I. heptaphylla* Aubl. citata.

Moderate-sized or large tree with pendent branches. Branchlets slender, 2.5 mm in diam., glabrous, fuscous, dotted with small elliptic, ferruginous lenticels and like the petioles, the rhachis and the petiolules transversely rimose when adult. Leaves 2- or 3-, rarely 1-, jugate, 14—20 (10.5—23) cm long, in all parts glabrous; petioles semiterete, at the base slightly incrassate, 3—5.5 (2.5—6) cm long; interjuga angulose, slightly incrassate at the ends, half the length of the petiole, 1.5—3 cm long; petiolules semiterete, above sulcate, at both ends incrassate, 7.5—10 mm long, the terminal ones 12.5—22.5 mm; leaflets lanceolate-oblong-ovate, 6.5—10 cm long



and 2.75—4 cm wide, the terminal ones slightly narrowed to the base and the lateral ones slightly asymmetrical; apex gradually narrowed in a nearly linear, 5—8 mm long and 2.5—4 mm wide, obtuse acumen; base broadly cuneate to rounded; margin entire; chartaceous to subcoriaceous, smooth, above nitidulous, dark green, beneath dull, pale green; with 10—14 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. and tert. nerves prominent. Inflorescences axillary, subterminal, branched from the base, many-flowered, 3.5—6 cm long; sec. branchlets up to 3 cm long, angulose, like the terete, striate, 2—2.5 mm long pedicels and the triangular, acute, 0.5 mm long bracts and 0.25 mm long bractlets sparsely and minutely puberulous. Flowers 5-merous or rarely 4-merous, 2.5—3 mm long, green. Calyx broadly cupuliform, 1 mm high, outside like the petals glabrous or nearly so; its lobes triangular, acute, nearly as long as the tube. Petals oblong-ovate, acute, carnose; margins papillose. Stamens about 1.5—1.8 mm long; in the masc. fl. filaments subulate, twice the length of the elliptic, 0.6 mm long anthers; in the fem. fl. filaments subulate, dilated, about as long as the oblong, 0.75 mm long anthers. Disc annular, 10-lobed, glabrous, 0.3—0.5 mm high. Pistil glabrous, in the masc. fl. embedded in the disc, 0.5 mm high, in the fem. fl. at the base surrounded by the disc, 1.5 mm high; ovary ovoid, 5-lobed, 5-celled, 1.25 mm high; stigma subsessile, 5-lobed. Drupe ovoid, oblique to 4-lobed, glabrous, scabrous; 2—2.75 cm long and 1.25—2.25 cm in diam.; apex acute, attenuate, mesocarp rather thick, carnose; endocarp rather thick, woody; pyrenes 1—4.

**Type:** Duss 3273 in h.US. 846786.

**Distribution:** Lesser Antilles.

**GUADELOUPE:** Bois de Deshaies, Duss 3273 (1893) alt. 355 m, fl. masc. and fem. and fr. (B, C, LE, NY, US) (type); Duchassaing (no date) fr. (B) (*P. caribaeum* Urb. mss.).

**DOMINICA:** Duss 16 (no date) in shady woods by the sea-side, fl. masc. and fr. (B); Ramage (1888) fl. fem. Aug. (B, K, S); Ramage (1888) fr. July (BM, K).

**MARTINIQUE:** Bois du Lorrain, Duss 1054 (1885) alt. 400—600 m, fl. masc. (B, NY); Duss 142 (1882) fl. fem. and fr. (B, F, NY); Duss (no date) fl. masc. and fr. (B).

**ST. LUCIA:** Anderson (no date) fr. (K); Hooper (1886) fl. and fr. Oct. (cf. Hook, *Ic. Pl. l.c.*) (K); Forets St. Jacques, Ramage (1888) alt. 600 m, fl. masc. Oct. (B, BM, K).

**ST. VINCENT:** fide Urban l.c.

Without locality: Herb. Bishop Goodenough (no date) fr. (K).

**Vern. names:** GUADELOUPE and MARTINIQUE: gommier blanc,

bois d'encens; DOMINICA: gommier blanc, gommier jaune; ST. LUCIA: gommier l'incens.

*P. attenuatum* Urb. bears a striking resemblance to *P. cubense* Urb., but the latter differs by a petiole one and a half time the length of the interjugum, longer petiolules, coriaceous, apically not-narrowed leaflets provided with a narrowed acumen 1 to  $1\frac{1}{2}$  times as long as broad, and 4-merous flowers with triangular petals.

At first view it seemed possible to me to separate the specimens in two groups, viz. one consisting of plants with large leaves, whose proportions correspond with the larger ones of the diagnosis, and with chartaceous leaflets provided with 14 pairs of sec. nerves, and another group consisting of plants with small leaves, whose proportions correspond with the smaller ones of the diagnosis, and with sub-coriaceous leaflets provided with 10—12 pairs of sec. nerves. Some specimens however show an intermediate appearance (Duss 16) and moreover under the same number specimens have been collected of which part belongs to the first, part to the second group. For example the flowering branches of a collection may be of the large-leaved form and the fruiting branches of the small-leaved one.

**U s e s :** The rapidly drying, fragrant gum, extracted from all parts of this tree, is said to be used as incense and as an ointment for dressing wounds, and also for perfuming rooms in order to drive off the mosquitos. Cf. Duss l.c.

12. ***Protium puncticulatum*** MACBR. in Candollea V, p.377 (1934); L. Williams in Field Mus. N.H., Bot. Ser. XV, p. 235 (1936).

Small or medium-sized tree, at times attaining a height of 15 m; bark reddish brown or purplish brown, with broad, low ridges (Williams). Branchlets terete, striate, glabrous, fuscous and dotted with oblong, pale brown lenticels. Leaves 2- to 4-jugate, 20—24 cm long, in all parts glabrous; petioles terete, striate, near the base flattened above, at least twice the length of the interjuga, 5.5—10 cm long; interjuga terete, striate and smooth, at both ends incrassate, 2.5—4.5 cm long; petiolules semiterete, at both ends incrassate, 5—10 mm long, the terminal ones 20—30 mm; leaflets lanceolate to lanceolate-oblong, mostly narrowed near the apex, rarely subovate, usually 10—14 cm long and 3.25—5 cm wide, the terminal ones narrowed near the base, the lateral ones slightly asymmetrical and the basal ones much shorter; apex gradually narrowed in a rather long and nearly linear, 5—7.5 mm long and 2.5—3.5 mm wide, obtuse acumen; base cuneate; margin entire, undulate; chartaceous, smooth, above nitidous and glaucescent, beneath dull; with 10—13 pairs of sec. nerves; prim. nerves prominent on both sides, sec. and

tert. ones above prominulous, beneath prominent, pale green and slightly punctate. Inflorescences axillary, glomeruliform, few-flowered, 10—15 mm in diam., branched from the base. Branchlets terete, striate, sparsely fulvous puberulous, 5—7.5 mm long. Pedicels slender, 4 mm long, like the ovate-elliptic, acute, 0.5 mm long bracts and bractlets and the outside of the calyx provided with some minute, fulvous hairs. Flowers 5-merous, 3—4.5 mm long, Calyx broadly cupuliform, 0.75 mm high and 2 mm in diam., minutely 5-toothed. Petals oblong-ovate, subcarnose, glabrous with acute apiculate-inflexed apex. Stamens 1.5—2 mm long; filaments subulate, slightly dilated, as long as the elliptic anthers. Disc annular, 10-lobed, glabrous, 0.3 mm high. Pistil at the base surrounded by the disc, glabrous, 0.75—1 mm high; ovary conical, sub 5-lobed, base narrowed, apex acute; stigma subsessile, 5-lobed. Drupe globose, 3- or 4-lobed, glabrous, acute at the apex; mesocarp thin, car-nose; endocarp thin, brittle, woody; pyrenes 3 or 4.

Type: Llewelyn Williams 4861 in h.F. 626397.

Distribution: Andes of northern Peru.

PERU: dept. Amazonas, Maranon, Pongo de Manseriche, Tessmann 3456 (1924) fl. masc. (B, G, S); dept. Loreto, Jurimaguas, lower R. Huallaga, Parana Pura, L. Williams 4625 (1929) alt. 155—210 m, fr. Nov. (F, G, US); id., Santa Rosa, L. Williams 4861 (1929) alt. 155—210 m, fl. masc. and fem. and fr. Nov. (F, G, K, US) (type); dept. S. Martin, upper R. Huallaga, Juan-Jui, Klug 4217 (1936) alt. 400—800 m, fl. fem. Jan. (U).

This species is marked by its long petioles, its glomeruliform inflorescences, its long pedicels and its minutely 5-toothed calyx.

13. *Protium Aracouchini* (sphalm. *Aracouchili*) (AUBL.) MARCH. in Adans. VIII, p.51 (1867—1868); Engl. in Mart. Fl. Bras. XII, 2, p.274 (1874) et id. in DC. Mon. Phan. IV, p.74 (1883) excl. syn. *Icica parvifolia* Spruce; id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412, 414 (1931); Radlk. in Sitz. Ber. K. Bay. Ak. Wiss., Mat.-phys. Cl. VII, p.312, 382 (1878) excl. syn. *I. parviflora* Benth.; id. in Engl. Pflanzenreich XCVIII, p.826, 1410 (1933-1934); Cordemoy in Ann. Inst. col. Mars. VI, p.201 (1899); Pittier in Trab. Mus. com. Venez. VIII, p.365 (1931).

*Icica Aracouchini* Aubl., Hist. Pl. Guian. fr. I, p.343, t.133 (1775); Tr. et Pl. in Ann. Sc. nat., S.5, XIV, p.298 (1872); Villa-Franca in Bull. Thé. méd. et chir. 1880, p.4, 9 (1880); Sagot in Ann. Sc. nat., S.6, XIII, p.291 (1882).

*Amyris heterophylla* Willd., Linn. Sp. Pl. ed.4, II, p.335 (1799) nom. nov. illeg.; Pers., Syn. Pl. I, p.414 (1805); Spreng., Linn. Syst. Veg. ed.16, II, p.218 (1825).

*Icica heterophylla* DC., Prodr. II, p.77 (1825); Don, Gen. Hist. Dichl. Pl. II, p.82 (1832).

*Elaphrium heterophyllum* Spr. ex Dietr., Syn. Pl. II, p.1271 (1840).

*Bursera Aracouchili* Baill. (sphalm.), Hist. d. Pl. V, p. 296 (1874); id., Tr. Bot. méd. phan., p.951 (1884).

*Tingulonga Aracuchini* OK., Rev. Gen. Pl. I, p.108 (1891).

*Melicocca geniculata* Spreng., Linn. Syst.Veg. ed.16, II, p.220 (1825).

*Hypelate geniculata* Don, Gen. Hist. Dichl. Pl. I, p.672 (1831).

*Icica Trianensis* March. mss. ex Tr. et Pl. in Ann. Sc. nat., S.5, XIV, p.298 (1872).

*Protium heptaphyllum* March. in errore Standl. in Trop. Woods XXXIII, p.15 (1933) quoad spec. "breu almacega" nom.

Small to medium-sized, rarely large tree, 3.5—10 (20) m high. Branchlets slender, 2 mm in diam., terete, striate, smooth, glabrous, cinereous to fuscous, when adult sometimes scabrous. Leaves 1- to 3-jugate, rarely unifoliate or 4-jugate, 15—20 (10—29) cm long, in all parts glabrous; petioles semiterete, generally longer than the interjuga, 3.5—4.5 (2.5—6) cm long; interjuga angular, above near the incrassate nodes carinate or bisulcate, 2.25—4 cm long; petiioles slender, angulose, canaliculate, at both ends slightly incrassate, 5—7.5 mm long, the terminal ones 15—35 mm; leaflets oblong-lanceolate to oblong-elliptic, sometimes slightly narrowed to the apex, usually 8—10.5 (7.5—13) cm long and 3—4 (2.5—4.5) cm wide, the terminal ones larger, mostly narrowed to the base, the lateral ones slightly asymmetrical, the basal ones smaller; apex abruptly acuminate acumen linear, 8—15 mm long and 2—2.5 mm wide, obtuse; base cuneate to rounder; margin entire, undulate; chartaceous, smooth, nitidulous; with 10—12 (10—15) pairs of sec. nerves; prim. nerves distinctly prominent, sec. nerves prominent, tert. ones above prominulous, beneath prominent. Inflorescences axillary, branched from the base, lax, rather few-flowered, 5—10 cm, rarely 20 cm, long, in all parts glabrous; sec. branchlets patent, 3—5 cm long. Peduncles and branchlets terete, slender. Pedicels terete, 1—2 mm long; bracts and bractlets ovate, acute, 0.3 mm long. Flowers 4-merous, 2—2.5 mm long, luteous to sulfureous. Calyx cupuliform, 0.5 mm high; its lobes triangular to semiorbicular, acuminate, as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, subcarinose. Stamens in the masc. fl. 1.25 mm, in the fem. ones 1 mm long; filaments subulate, dilated at the base; anthers elliptic, 0.3 mm long. Disc annular, 8-sulcate, glabrous, 0.25 mm

high. Pistil glabrous, in the masc. fl. embedded in the disc, in the fem. fl. at the base surrounded by the disc and 1.25 mm high, consisting of an ovoid, 4-lobed, 4-celled, about 1 mm high ovary narrowed in a subsessile 4-lobed stigma. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 4-lobed and 2- to 4-pyrenous, glabrous, smooth, with acute apex and rounded base; mesocarp thin, carnosae; endocarp thin, woody.

**Type:** Aublet in h.BM.

**Distribution:** northern South America.

**COLOMBIA:** prov. Bogota, Llano de S. Martin, Apiai, Triana 3697 (1851—1857) alt. 300 m, fr. (B, BM, K, P, W); id., Villavicencio, Karsten (no date) fr. (B, LE, W).

**VENEZUELA:** Rio Negro, near San Carlos, Spruce 3679 (1854) fl. masc. Oct. (B, BM, BR, C, K, NY, P, W).

**SURINAME:** Saramacca R., Sectie O, Boschbeheer 16bis (no date) fl. masc. (U); id., tree n. 816, BW. 1900 (1916) (U), BW 2320 (1916) fl. masc. Aug. (U), BW. 3388 (1917) fl. masc. Nov. (U), BW. 4394 (1919) fl. masc. Sept. (U).

**FR. GUIANA:** near source of Courou R., Aublet (no date) fr. June (BM) (type).

**BRAZIL:** Amazonas, Rio Negro, near San Gabriel do Cachoeira, Spruce 2179 (1852) fr. Mar. (B, BM, G, K, LE, M, NY, P, W); id., Camañaos, Luetzelburg 22152 and 22730 (1913) fl. fem. Sept. (M); id., basin Rio Madeira, Humayta, Krukoff 6637 (1934) fl. fem. Oct. (K, NY, U); id., near Livramento, Krukoff 7027 (1934) fr. Nov. (K, NY, U); Para, basin R. Tapajoz, Boa Vista, Capucho 401 (1932) fl. masc. Aug. (F); Almada, Riedel 692 (1822) in sandy forest, fl. masc. Apr. (B, LE); between Victoria and Bahia, Sello 604 (no date) fl. masc. (B); without locality, Sello I (no date) fl. masc. (B); id., Sello 108 (no date) fl. masc. (B, K) (type of *Melicocca geniculata* Spr.); id., Sello 224 (no date) fl. masc. (B).

**Vern. names:** SURINAME: tingi-monnier (N.E.); BRAZIL: almesca (ex Krukoff), breu almecha (ex Capucho).

*Protium Aracouchini* Marc. is recognizable by its most graceful appearance. Its nearest relation is *P. plagiocarpium* Ben., which differs by the indistinct sec. and tert. nerves on the upperside of the leaflets of its nearly ever 1-jugate leaves, by the narrowed base of its long-acuminate drupes and by its sparsely pilose ovary. *P. elegans* Engl. also resembles *P. Aracouchini* March. but the former differs by the sparse to rather dense, very short indumentum of its petioles, rhachis, petiolules, peduncles, bracts and calyx, by the indistinct sec. and tert. nerves, by the shorter acumen and the acute-cuneate base of its narrower leaflets and by its shorter inflorescences.

That *Melicocca geniculata* Spr. (*Hypelate geniculata* Don), of

which Sello 108 ex Herb. Sprengel in the herbarium at Berlin is the type, is identic with *P. Aracouchini* March, a statement first made by Radlkofer l.c. (1878), could be confirmed, but *Icica parviflora* Benth. mss., which was also quoted by Radlk. as a synonym, had to be referred to *P. plagiocarpium* Ben.

**Anatomy:** Stone and Freeman, Timb. Br. Gui. p.32 (1914).

**Uses:** The yellow, aromatic resin of this species, which retains its fluidity for a long time, is called "aracouchini", "acouchi" or "alouchi" and is said to be used for dressing wounds and as a cosmetic. Cf. Aublet l.c.; Engl. l.c. (1897, 1931); Wiesn., Rohst., ed.2, I, p.175 (1900); Guill. in Agr. Pays chauds IX, 1, p.358 et 2, p.145 (1909); Tschirch, Handb. Pharmak. III, 2, p.1137 (1925); Wolff in Wiesn. Rohst., ed.4, I, p.1040 (1927).

The wood should be useful for drawers and wardrobe-shelves. Cf. Stone and Freeman l.c.

14. **Protium ovatum** ENGL. in Mart. Fl. Bras. XII, 2, p.264, t.52 (1874); id. in DC. Mon. Phan. IV, p.65 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulonga ovata* OK., Rev. Gen. Pl. I, p.108 (1891).

Shrub or small tree, 0.6—10 m high. Branchlets slender, 3—4 mm in diam., terete, glabrous, smooth, castaneous to fuscous. Leaves 2- or 3-jugate, rarely 1-jugate, 13 (10—17) cm long, petioles semiterete, dilated, with incrassate base, 3 (2.5—4) cm long, like the rhachis, the petiolules and the prim. nerves glabrous or provided with some scattered, minute, patent hairs; interjuga angulose, above flat and bisulcate, with incrassate nodes, 2 (1.5—3) cm long; petiolules semiterete, subalate, when adult at times transversely rimose, 3—5 mm long, the terminal ones 8—15 mm; leaflets elliptic-ovate, narrowed from below the middle to the apex, usually 6 (4.5—7.5) cm long and 3 (2—3.5) cm wide, the terminal ones larger, the lateral ones asymmetrical, the basal ones shorter; apex gradually narrowed in a tapering, 3 mm long and 4 mm wide, obtuse acumen; base broadly cuneate to slightly cordate; margin mostly entire, rarely subserrate, undulate; subcoriaceous, rigid, glabrous, smooth, nitidulous, above dark green, beneath pale green; with 8—10 pairs of sec. nerves branched halfway the blade; prim. nerves distinctly prominent, sec. ones prominent, tert. ones hardly prominent. Inflorescences axillary, glomeruliform, generally many-flowered, 10 (5—15) mm in diam.; peduncles and branchlets like the terete, 1.5 mm long pedicels and the ovate, acute, 0.5 mm long bracts and bractlets rather densely to sparsely and minutely sericeous. Flowers 4-merous, 2.5—3 mm long, reddish. Calyx broadly cupuliform,  $\frac{1}{4}$  the length of the flower, outside like the petals papillose; its lobes

broadly triangular, subacuminate, longer than the tube. Petals oblong-ovate, acute, inflexed-apiculate. Stamens 1.5 mm long; filaments subulate, nearly 1 mm long; anthers elliptic-oblong, 0.7 mm long. Disc annular, 8-lobed, flat, glabrous, 0.25 mm high. Pistil glabrous, in the masc. fl. 0.6 mm high and ovary embedded in the disc; in the fem. fl. 2 mm high and ovary at the base surrounded by the disc, globose, 4-ribbed, 4-celled, nearly 1 mm high; style slender, 4-sulcate, 1 mm long; stigma 4-lobed. Drupe oblique-ovoid, glabrous, smooth, 12 mm long and 8 mm in diam.; mesocarp thick, carnose; endocarp thick, brittle, woody.

Type: Riedel 442 in h.B.

Distribution: eastern Bolivia and southern Brazil.

BOLIVIA: dept. Santa Cruz, prov. Del Sara, Buenavista Mt., Steinbach 2383 (1916) alt. 450 m, fl. fem. July (B).

BRAZIL: Matto Grosso, Burity, Collenate 112 (1927) alt. 750 m, fl. fem. June (K, NY) id., near Cuyabe, Dorrien Smith 327 (1927) alt. 750 m (K, NY); Minas Geraes, Rio Pardo, Riedel 442 (1826) on dry fields, fl. masc. and fem. Aug. (B, LE) (type); id., Lagoa Santa, near S. Anna, Lund in Herb. Warming 2409 (1834) fl. Aug. (C); id., without locality, Riedel (1834) fl. masc. Oct. (LE); id., Riedel (1834) fr. Oct. (LE); id., Claussen 693A (1840) fl. masc. (B, K); Sao Paulo, near S. Paulo, Herb. Richard (no date) (P); without locality, Burchell 5244 (no date) fr. (K); id., Lund in Herb. Warming 2406 (no date) fl. fem. and fr. (C, US).

*Protium ovatum* Engl. is closely related to *P. brasiliense* Engl. var. *subacuminatum* Engl., but the latter differs by its short petioles, its non-ovate leaflets with sec. nerves branching near the margin of the blade and its non-glomeruliform inflorescences with usually 5-merous, rarely 4-merous flowers.

In other respects *P. ovatum* Engl. resembles *P. heptaphyllum* March. which differs from the former by its glabrous and longer petioles and rhachis, by its usually oblong, not ovate leaflets, that are narrowed near the apex, and provided with an acute-cuneate base and with 10—14 pairs of sec. nerves branched along the margin of the blade, and by its linear acumen, that is twice as long as broad.

15. *Protium Widgrenii* ENGL. in Mart. Fl. Bras. XII, 2, p.272 (1874); id. in DC. Mon. Phan. IV, p.73 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIX, p.412 (1931); Glaziou in Bull. Soc. bot. Fr. LII, Mém.3, p.92 (1905).

*Tingulonga Widgrenii* OK., Rev. Gen. Pl. I, p.108 (1891).

Small to large tree. Branchlets terete, striate, when young rather densely tomentellous, soon glabrescent, ferrugineous, dotted with

elliptic pale brown lenticels, when adult scabrous, cinereous. Leaves 1- to 3-jugate, mostly 2-jugate, rarely unifoliolate or 4-jugate, 18—20 cm long, variable in size and shape, in all parts glabrous; petioles semiterete, above flat, at the base hardly incrassate, 3.5—4 (3—5.5) cm long; interjuga angulose, above flattened and bisulcate, at the nodes slightly incrassate, 3 (2.25—4) cm long; petiolules semiterete, canaliculate, at both ends slightly incrassate, 7.5—10 mm long, the terminal ones 15—20 (10—30) mm, leaflets lanceolate to oblong, narrowed at both ends, usually 7.5—9 (5—14) cm long and 2.5—3 (1.5—4.5) cm wide, the terminal ones larger, the lateral ones asymmetrical, at times distinctly oblique and curved; apex gradually narrowed in a tapering, 5—10 mm long and 2.5—5 mm wide, obtuse acumen, but at times subacuminate; base acute-cuneate; margin entire, repandous, undulate; subcoriaceous, smooth, above dark green and nitidulous, beneath pale green and dull; with 12 (10—14) pairs of sec. nerves; prim. nerves prominent, sec. ones above prominulous, beneath, like the tert. ones, hardly prominulous to hardly visible. Inflorescences axillary, irregular and laxly branched from the base, many-flowered, usually 7.5 (6—12) cm long, but sometimes shorter; sec. branchlets up to 4 cm long. Peduncles and branchlets slender, angulose, like all parts of the flowers glabrous. Pedicels rather stout, mostly obconical, half the length of the flower, 1.5 mm long, terete, striate; bracts and bractlets triangular, acute, 0.5 mm long. Flowers 5-merous, rarely 4- or 6-merous, nearly 3 mm long. Calyx cupuliform, about 1 mm high; its lobes broadly triangular, acute, about as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, papillose on the margins. Stamens 1—1.5 mm long; filaments subulate, flat, more or less dilated at the base; anthers oblong-elliptic, 0.75 mm long. Disc annular, 10-lobed, glabrous, 0.25 mm high. Pistil glabrous, in the masc. fl. embedded in the disc, 0.3—0.6 mm high, in the fem. fl. at the base surrounded by the disc, 1.5 mm high, consisting of a globose-ovoid, 5-lobed, 5-celled ovary narrowed in a sessile, 5-lobed stigma. Drupe depressed globose, 3- to 5-lobed, 10 mm long and 8—12 mm in diam., with an acute top; exocarp black, mesocarp thick, carnose; endocarp thin, crustaceous; pyrenes 1—5.

**Type:** Widgren s.n. (*Icica Widgrenii* Engl. mss.) in h.BR.

**Distribution:** south-eastern Brazil.

**BRAZIL:** Minas Geraes, Serra do Lenheiro, near Saõ João d'El Rei, Schwacke 10138 (1873) fr. Dec. (B); id., Serra de Saõ José, near Tiradentes, Schwacke 10182 (1876) fr. Dec. (B); id., near Conceição de Ibitipoca, Schwacke 12374 (1896) fl. masc. Aug. (B); id., id. 12397 (1896) fl. Aug. (B); id.,



Serra de Caracol, Mosén 4067 (1875) in forest, fr. Dec. (S); id., Serra de Caldas, Regnell II 55a (1856) fr. Dec. (B, C, S); id., id. II 55a (1867) fl. fem. Sept. (C); id., id. II 55b (1864) fr. Dec. (S); id., id. II 55c (1846) fr. Nov. (S); id., id. II 55d (1846) fl. fem. and fr. Dec. (S); id., id. II 55e (1845) fl. masc. (B, S); id., id. II 55f (1843) fl. fem. (LE, S); id., id. II 55g (1871) fr. Nov. (S); id., id. II 55h (1869) fl. masc. and fem. Aug. (S); id., id. II 55i (1869) fl. fem. Sept. (S); id., Mosén 452 (1873) fl. Oct. (S); id., id. 453 (1873) fr. Oct. (S); id., id. 4486 (1876) fr. Febr. (S); id., without locality, Widgren (1845) fr. (B, BR, GH, S, W); id., id. (1845) fl. masc. (B, BR, C, LE, M, S) (type); Rio de Janeiro, Alto Macahé de Nova Friburgo, Glaziou 19014b (1891) fl. fem. Oct. (P); Parana, Itararé, Dusén 9696 (1910) (S); id., id. 17400 (1915) alt. 760 m, fr. Dec. (GH, S); Sao Paulo, Itapetininga, Löfgren 138 (1887) fl. Sept. (B); id., S. José do Rio Preto, Löfgren 1389 (1889) fl. fem. Sept. (B); id., Ypanema, Sello 2014/2062 (no date) fr. (B); id., Atibaia, Campos Novas 589 (no date) fl. fem. (B); id., Yparanga, Usteri (1906) fr. Dec. (M); id., Butantan, Hoehne 657 (1917) fl. masc. Oct. (B, US); id., between S. Paulo and Mugi das Cruzes, Lund 953 in Herb. Warming 2401 (no date) fr. (L, LE); Serra de Carauma, Rio Branco, Ule 7729 (1908) fl. masc. Nov. (B, G, K, L); without locality, Burchell 4619 (no date) fr. (L, LE); id. Sello 7 (no date) fl. masc. (B); id., id. 170 (no date) fl. masc. (B).

Vern. name: almecegueira.

This species is marked by the long petiolules of the lateral leaflets, even of the apical jugum and by the variable and irregular shape of its leaflets.

In view of the limited area of this species it is questionable whether Steinbach 7644 (1924) (B,F,S) from Bolivia, dept. Santa Cruz, prov. Sara, Buena Vista, although not unlike *P. Widgrenii* Engl., really belongs to this species.

**var. puberulum** SWART in Rec. Trav. bot. néerl. XXXIX, p.189 (1942).

Leaflets oblong. Pedicels, bracts, bractlets and the outside of the calyx and corolla sparsely and minutely puberulous. Style more or less distinct.

Type: Hoehne 28320 in h.U.

Distribution: south-eastern Brazil.

BRAZIL: Minas Geraes, Widgren (1845) fl. fem. (S, U); Sao Paulo, Ipanema, Sello 2015/2063 (no date) fr. (B); Parana, Itarari, Dusen 10396 (1910) fl. masc. Nov. (B, GH, S, US); without loc., Hoehne 28320 (1931) fl. masc. Oct. (U) (type); id., Glaziou 1389 (no date) fl. fem. (P).

16. **Protium angustifolium** SWART in Rec. Trav. bot. néerl. XXXIX, p.190 (1942).

Small tree. Branchlets terete, smooth, when young densely and

minutely puberulous, soon glabrescent and dark brown. Leaves 2-jugate, about 25 cm long, in all parts glabrous; petioles semiterete, at the base slightly incrassate, 5—6 (3.5—8) cm long; interjuga angulose, above flattened and bisulcate, at the nodes incrassate, 4 (3—5.5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, all about equal in length, 10 (5—15) mm long, the terminal ones 25—30 mm long excepted; leaflets linear-lanceolate, narrowed from the middle to the apex, usually 12.5—16 cm long and 3.5 cm wide, but the terminal ones larger, narrowed to the base, the lateral ones suboblique and the basal ones slightly shorter; apex gradually to rather abruptly acuminate; acumen nearly linear, 10 mm long and 5 mm wide, obtuse; base acutely cuneate; margin entire, repandous, undulate; chartaceous, smooth, nitidulous, with 14 (12—16) pairs of sec. nerves; prim. and sec. nerves prominent and pale green, tert. ones hardly prominulous to inconspicuous. Inflorescences axillary, laxly branched from the base, 3.5 (2—7.5) cm long; peduncles and branchlets angulose, like the terete, 3.5 mm long pedicels, the oblong, 0.75 mm long bracts and bractlets and the outside of the calyx sparsely and patently puberulous. Flowers 4-merous, 4 mm long, white (Curran). Calyx cupuliform, 0.75 mm high; its lobes broadly triangular, obtusely subacuminate, 0.35—0.25 mm long. Petals lanceolate, acute, inflexed-apiculate, glabrous with papillose margins, 3.5 mm long and 1 mm wide. Stamens about 2 mm long; filaments subulate, about as long as the oblong anthers. Disc annular, 8-sulcate, glabrous, 0.3—0.5 mm high. Pistil in the masc. fl. 1 mm high, in the fem. ones about 2 mm high, at the base surrounded by the disc, glabrous, consisting of a globose, 4-lobed, 4-celled ovary and a cylindrical 4-sulcate style of about the same length and ending in a 4-lobed stigma. Drupe oblique-ovoid, 12.5 mm long and 12.5 mm in diam, crowned by a rudiment of the style.

Type: Curran 15 in h.US 537180.

Distribution: twice collected.

COLOMBIA: dept. Bolivar, San Martin de Loba, Curran 15 (1916) fl. masc. Apr.-May (F, US).

BRAZIL: Matto Grosso, S. Anna da Chapada, Malme 2142 (1902) fl. fem. and fr. July (S).

This species belongs to the nearer relations of *P. heptaphyllum* (Aubl.) March., and comes particularly near to the latter's var. *brasiliense* Engl., but differs from it chiefly by its long petiolules and by its linear-lanceolate leaflets provided with pale green prim. and sec. nerves. From *P. Widgrenii* Engl. var. *puberulum* Swart,

with which it agrees in the indumentum of the generative parts, it differs by its narrowed leaflets and its larger, 4-merous flowers with distinct styles.

17. *Protium macrosepalum* SWART in Rec. Trav. bot. néerl. XXXIX, p.190 (1942).

*Protium guianense* March. in errore Gleason in Bull. Tor. Bot. Cl. LVIII, p.377 (1931) quoad spec. Tate 962 cit.

Shrub. Branchlets terete, striate, smooth, glabrous, cinereous. Leaves 1- or 2-jugate, rarely 3-jugate, about 20 cm long, in all parts glabrous; petioles semiterete, at the base slightly incrassate, 4 (3—5) cm long; interjuga angulose, above flattened and bisulcate, at the nodes incrassate, 3 (2.5—3.5) cm long; petiolules semiterete, above sulcate, at both ends slightly incrassate, 3—8 mm long, the terminal ones 22.5 (15—30) mm; leaflets oblong-lanceolate to lanceolate, narrowed to the apex, 8—12 cm long and 3—4 cm wide, but the terminal ones slightly narrowed near the base and the lateral ones nearly symmetrical; apex gradually to rather abruptly acuminate; acumen tapering, 7.5—10 mm long and 3—4 mm wide, obtuse; base cuneate; margin entire, undulate; subcoriaceous, smooth, above nitidous, beneath nitidulous; with 13—15 pairs of sec. nerves; prim. nerves prominent, sec. ones prominulous, tert. ones above hardly visible, beneath hardly prominulous. Inflorescences axillary, rather laxly glomeruliform, 1.5 cm in diam., branched from the base. Axes, like the 1.5—2 mm long pedicels terete, striate, sparsely and minutely patent-puberulous. Bracts triangular-ovate, acute, glabrous, 0.5 mm long, bractlets elliptic-ovate, acute, glabrous, 0.25 mm long. Flowers 4-merous, 2.25 mm long. Calyx campanulate,  $\frac{2}{3}$  the length of the flower, 1.5 mm high, provided with some minute scattered hairs; its lobes triangular, obtuse, 3 to 4 times as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, carnose, outside near the apical end of the midrib mostly provided with some minute hairs, on the margins papillose. Stamens in the masc. fl. 1.75 mm long; filaments subulate; anthers oblong in the masc. fl. 0.5 mm long. Disc annular, 8-lobed, glabrous, 0.25 mm high. Pistil in the masc. fl. embedded in the disc, glabrous, consisting of a globose, 4-lobed, 0.25 mm high, rudimentary ovary and a sessile, 4-lobed stigma.

Type: Tate 962 in h.NY.

Distribution: once collected.

VENEZUELA: Esmeralda, Fish Creek, Tate 962 (1928—1929) alt. 115 m, fl. masc. (NY, US).

*Protium macrosepalum* Swart differs by the large size of the calyx from all its congeners.

18. *Protium heptaphyllum* (AUBL.) MARCH. in Vid. Medd. Kjbhn. 1873, p.54 (1873); Engl. in Mart. Fl. Bras. XII, 2, p.262 (1874); id. in DC. Mon. Phan. IV, p.63 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237, f.135 (1897) et ed.2, XIXa, p.412, 141, f.192 A—H (1931); Kunth, Handb. Bl.biol. III, 1, p.445 (1904); Pulle, Enum. Vasc. Pl. Surin. p.245 (1906); Hart, Herb. List Bot. Dept. Trinidad p.10 (1908); Huber in Bol. Mus. Goeldi V, p.432 (1908); Benoist in Bull. Soc. bot. Fr. LXXVI, p.358 (1919); id. in Ann. Soc. Linn. Lyon LXXII, p.22, 23 (1925); id. in Bull. Soc. bot. Fr. LXXII, p.1078 (1925); id. in Arch. d. Bot. V, Mém.1, p.151 (1933); Hoehne, Guia da Sec. de Bot. e Agr. Inst. biol. Sao Paulo p.35 (1930); Pittier in Trab. Mus. com. Venez. VIII, p.366 (1931); LeCointe, Arv. e Pl. ut. a. Amaz. Bras. III, p.63 (1934). Non apud Millsp. in Publ. Field Mus., Bot. S.I, p.428 (1900) quod ad *P. cubense* (Rose) Urb. pertinet, nec apud Glaziou in Bull. Soc. bot. Fr. LII, Mém.3, p.91 (1905).

*Icica heptaphylla* Aubl., Hist. Pl. Guian. fr. I, p.337, t.130 (1775); Lam., Enc. méth. Bot. III, p.225 (1789); De Cand., Prodr. II, p.77 (1825); Don, Gen. Hist. dichl. Pl. II, p.83 (1832); Sagot in Ann. Sc. nat. S.6, XIII, p.291 (1882). Non apud Grisebach, Fl. Br. W. Ind. Isl. p.173 (1864) nec apud Duss in Ann. Inst. col. Mars. IV, 3, p.182 (1897) quae ad *P. attenuatum* (Rose) Urb. pertinent, nec apud Griseb., Cat. Pl. Cub. p.66 (1866) quod ad *P. cubense* (Rose) Urb. pertinet, nec apud Hart, Herb. List. Bot. Dept. Trinidad p.10 (1908) quod quoad spec. no. 3032 ad *P. neglectum* Swart var. *tenuifolium* Swart pertinet.

*Elaphrium heptaphyllum* Spr. ex Dietr., Syn. Pl. II, p.1272 (1840).

*Tingulonga heptaphylla* OK., Rev. Gen. Pl. I, p.107 (1892).

*Amyris ambrosiaca* L.f., Suppl. Pl. p.216 (1781) excl. syn. Piso et Marcgr.; Persoon, Linn. Syst. Veg. ed.15, p.386 (1797); Willd., Linn. Sp. Pl. ed. 4, II, p. 335 (1799); Meyer, Prim. Fl. Esseq. p.155 (1818); Sprengel, Linn. Syst. Veg. ed.16, II, p.218 (1825) excl. syn. I. guian. et ibidem IV, 2, p.148 (1827).

*Protium ambrosiacum* Druce in Rep. Bot. Soc. and Exc. Cl. VII, Suppl.2, p.642 (1917) excl. syn. *P. Icariba* March.

*Icica Tacamahaca* H.B.K., Nov. Gen. et Sp. VII, p.25 (1825); Kunth, Syn. IV, p.162 (1825); De Cand., Prodr. II, p.77 (1825); Don, Gen. Hist. dichl. Pl. II, p.83 (1832); Berg., Atl. pharm. Bot. II, p.90, t.75 (1861).

*Elaphrium Tacamahaca* Spr. ex Dietr. Syn. Pl. II, p.1272 (1840).

*Protium Tacamahaca* March. in Adans. VIII, p.52 (1867—1868).

*Bursera Tacamahaca* Baill., Hist. d. Pl. V, p.296 (1874); id., Tr. Bot. méd. phan. p.950 (1884).

*Protium guianense* March. in Adans. VII, p.52 (1867—1868) quoad syn. *Icica heptaphylla* Aubl.; Cordemoy in Ann. Inst. col. Mars. VI, 2, p.202, f.34 (1899); in errore Marshall, Trees of Trinidad and Tobago p.25 (1934).

*Icica guyanensis* Aubl. in errore Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.297 (1872); Sagot in Ann. Sc. nat. S. 6, XIII, p.291 (1882); Freeman and Williams in Mem. Dept. Agric. Trin. and Tob. IV, p.91 (1928).

Small to large tree, 2—20 m high. Branchlets slender, 3—4 mm in diam., terete, smooth, when young lurid to castaneous, provided with some minute hairs, when adult cinereous to fuscous, glabrous. Leaves mostly 2- or 3-jugate, at times 1- or 4-jugate, 17—20 (14—25) cm long, in all parts glabrous; petioles semiterete, at the base slightly incrassate, 4—5 (3—7) cm long; interjuga angular, above flattened and bisulcate, at the nodes incrassate, 3—4 (2—5) cm long; petiolules semiterete, canaliculate, subulate, at both ends incrassate, 2.5—6 mm long, those of the apical jugum much shorter than those of the basal one; leaflets oblong-lanceolate to oblong-elliptic, narrowed to the apex, usually 8—10 (7—12) cm long and 3—4 (2.75—5) cm wide, but the terminal ones wider and the lateral ones slightly asymmetric, the basal ones smaller; apex rather abruptly acuminate; acumen linear, 10 (8—12) mm long and 5 (4—6) mm wide, obtuse; base oblique-cuneate; margin entire, undulate; subcoriaceous to chartaceous, smooth, dull to nitidulous; with 12 (10—14) pairs of sec. nerves; prim. nerves above distinctly prominent or grooved on each side, beneath prominent, sec. ones above prominulous, beneath prominent, tert. ones hardly prominulous. Inflorescences axillary, glomeruliform, much-branched, 1—1.5 cm in diam. Branchlets terete, striate, sparsely puberulous. Pedicels terete, shorter than the flowers, 1.5—2.5 mm long, like the ovate-triangular, acute, 0.25 mm long bracts and bractlets and the outside of the calyx sparsely puberulous to nearly glabrous. Flowers 4-merous, rarely 5-merous, 2.5—3 mm long, yellowish green to green to reddish. Calyx cupuliform; its lobes broadly triangular, acute, nearly as long as the tube or shorter. Petals oblong, acute, inflexed-apiculate, outside mostly glabrous, but sometimes provided with some short appressed hairs, papillose on the margins, carnosae. Stamens 1.75 mm long; filaments subulate, 1 mm; anthers oblong-lanceolate, 0.75 mm long. Disc annular, 8-lobed, glabrous, 0.25 mm high. Pistil glabrous,

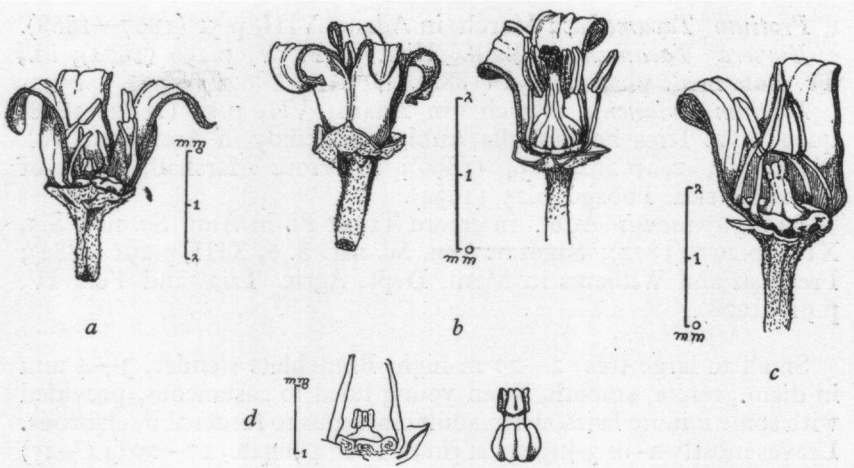


Fig. 2. *Protium heptaphyllum* (Aubl.) March. — a. typical male flower; b. female flower; c. male flower, showing a rather reduced pistil; d. pistils of male flowers with a shortened style.

embedded in the disc or at the base surrounded by the disc; in the masc. fl. 1 mm or less in height, style always distinct, as long as the ovary or shorter; in the fem. fl. surpassing the stamens, 2—2.5 mm high and consisting of a globose, 4-lobed, 4-ribbed, 4-celled, 0.75—1 mm high ovary and a 4-sulcate, 1 mm long style crowned by a 4-lobed stigma. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 3-lobed and 2- to 3 pyrenous, apex acute crowned by a distinct rudiment of the style, glabrous, 12.5—15 mm long and 7.5—15 mm in diam.; pericarp red; mesocarp thick, carnosous white; endocarp thin, woody.

Type: Aublet in h.BM.

Distribution: northern South America.

ST. VINCENT: Anderson (no date) fl. (NY).

TRINIDAD: Caroni North Bank Road, Britton and Mendelson 826 (1920) fr. Mar. (GH, NY, US); Valencia, Britton, Britton and Hazen 1002 (1920) fr. Mar. (GH, K, NY, US); Cedros, near Point Coco, Broadway 9412 (1915) fr. May (NY); Babadia, Broadway (1920) fr. June (G, K, NY, US); Guanapo, McLean (1904) fr. May (NY); Cunupia, Hart 5392 (1895) fr. (G, L, S); without loc., Hart 3671 (no date) fr. fem. (B, G, L, S); Kunze 7994 (1874) fl. masc. Apr. (NY).

COLOMBIA: Bolivar, Savanilla, Kunze (1874) fl. masc. (NY, US).

VENEZUELA: Zulia, near Maracaibo, Perya, Karsten (no date) fr. (W); id., Tejera 254 (no date) fl. fem. (US); id., id. 259 (no date) fl. masc. (US);

Zamora, Guanare, Karsten (no date) fl. masc. (W); id., R. Portuguesa, between Aparicion and Ospino, Pittier 12015 (1925) on banks of a dry river, fl. masc. Dec. (B, G, LE, M, NY, US); Miranda, Llano de Calabozo, Karsten (no date) fl. masc. (W); id., Humboldt 778 in Herb. Willd. 7275 (no date) fl. fem. Mar. (B) (type of *Icica Tacamahaca* H.B.K.); Carabolo, Barbula, on the way between Valencia and Puerto Cabello, Pittier 8945 (1920) fr. July (B, US); Bermudez, Barcelona, Karsten (no date) fl. fem. (LE, W); id., near Maturin, Otto 940 (1840) fl. fem. Oct. (B); Bolivar, Ciudad Bolivar, Rusby and Squires (no date) fr. (B); id., R. Mariquita, Bailey and Bailey 1370 (1921) alt. 65 m, fl. masc. Febr. (GH); without loc., Plée 143 (no date) (P).

BR. GUIANA: N.W. distr., Waini R., DelaCruz 1249 (1922) fl. masc. Febr. (NY, US); Pomeroun-distr., Pomeroun R., DelaCruz 3016 (1923) fr. Jan. (NY, US); Penal Settlement, Hitchcock 17110 (1919) fl. fem. and fr. Dec. (GH, NY, S, US); Bartica, Jenman 4668 (1888) fr. Nov. (K); Essequebo R., Rodschied 41 (no date) fl. masc. (GOET); id., Jenman 1171 (1881) fl. fem. Oct. (K); id., Twasinki Falls, A. C. Smith 2144 (1937) dense forest (U); Purini R., Caburi Falls, Jenman 7634 (1889) fl. masc. Oct. (B, K, US); Potaro R., Kaieteur Falls, DelaCruz 4386 (1923) fl. masc. (F, K, NY); id., id. 4487 (1923) fl. and fr. (F, K, NY, US); Tacutu R., Schomburgk 504 (1842) fl. masc. Apr. (B, BRSL); Berbice, Canje R., Lake Ikuruna, For. Dept. Br. G. 462B (1915) fr. Jan. (K); Corentyn R., Oreala, Jenman 255 (1879) fl. masc. Oct. (K, NY); without loc., Parkin (no date) fr. (K).

SURINAME: Coppename R., Boon 1111 (1901) fr. Sept. (U); Sara-macca R., Watramiri, BW. 4218 (1919) fr. Jan. (U); Oranjewoud, Focke 111 (no date) fl. masc. Oct. (L); near Paramaribo, Wullschlaegel 803 (1854) fl. fem. (BR, GOET, W); id., Beekhuizen, Wullschlaegel 1407 (1854) fr. (BR); Para R., Zandery I, Gongryp 7930 (1909) fl. masc. Nov. (B, U); id., tree n. 209, BW. 1245 (1915) fr. Nov. (U), BW. 4071 (1918) fr. Nov. (U), BW. 4471 (1919) fr. Dec. (U), BW. 5480 (1921) fl. fem. and fr. Nov. (U); Marowyne R., near Langaman Kondre, Lanjouw 556 (1933) strand-forest, fl. fem. Aug. (U); id., Kappler 2013 (no date) fl. masc. and fem. and fr. Aug. (S, U); without loc., Desmarest in Herb. Sloane II, 291 (no date) (BM); id., Hostmann 332 (1842) fl. fem. (B, BM, G, K, U, W); id., Hostmann and Kappler 332 (1842) fl. fem. (M, W); id., Kappler 332 (1842) fl. fem. (S); id., Hostmann (no date) (B); id., Tulleken 521 (1900) fl. fem. Oct. (L); id., Wullschlaegel 2038 (no date) fr. (GOET); id., Wullschlaegel (1852) fr. (BR, M).

FR. GUIANA: Maroni R., Sagot 797 (1857) fl. fem. (BM, K, P, S, W); id., Mélinon 34 (1861) fr. (B); id., Ile Portal, Sagot (no date, fl. masc. (US); id., Pierre Kondre, Wullschlaegel 1405 (1853) fr. Oct. (BR, W); id., Tollinche, Benoist 70 (ex Benoist l.c. 1919); Mana R., Mélinon 86 (1864) fl. fem. and fr. (B, BM, F, P, NY, US); Kourou, Benoist 1693 (ex Benoist l.c.); near Cayenne, Benoist 5 and 6 (ex Benoist l.c.); Gourdonville, Benoist 1610 and 1632 (ex Benoist l.c.); Crique Jacques, Wachenheim 32 (1924) fl. fem. Sept. (P); without locality, Aublet (no date) fl. fem. and fr. Sept. (BM) (type); id., Gabriel (1802) fl. fem. and fr. (G); id., Martin (no date) fr. (BM); id., Mélinon (no date) (BZ); id., Perrottet (1820—1821) fl. fem. and fr. (B, G, P); id., Poiteau (1824) fr. July (K, LE); id., Rohr (no date) fl. masc. (BM, LE); id., collector unknown (no date) fl. masc. and fr. (W).

BRAZIL: Amazonas, R. Mapuere, Cachoeira do Carana, Ducke 9059 (ex Huber l.c.); R. Negro, near Yapura et Ega, Martius (no date) fl. fem. and fr. Dec. (M); id., R. Jurua, Ule 786 (1900) fl. masc. Nov. (B); id., R. Madeira, Falls of Madeira, Rusby 1335 (1886) fr. (F); Para, near Faro,

Ducke 8699 (ex Huber l.c.); id., R. Cumina, Ducke 7981 (ex Huber l.c.); id., Obidos, Ducke 4860 (ex Huber l.c.); id., Alemquer, Ducke 4902 (ex Huber l.c.); id., Almeirim, Ducke 3067 (ex Huber l.c.); id., near Para, Burchell 9639 (no date) (GH, K, L); Maranhao, basin R. Maracassimé, Mata da Cachocira, Krukoff 1902 (1932) fl. masc. and fem. Sept. (B, BM, F, K, NY, U); id., Mosés 44 (1932) (BM); Goyaz, R. Araguaya, Weddel (1884) fl. masc. June-July (P); Pernambuco, Olinda, Pickel 2269 (1930) littoral forest, fl. fem. Febr. (US); id., id. 923 (1926) fr. Jan. (B); Bahia, near Bahia, Martius 2144 (no date) fr. (M) (*Amyris elemifera* ex Mart. Obs. 2144); Minas Geraes, Netto 207 (1862) fl. masc. (S); Espirito Santo, near Ilheos, Riedel 60 (1821) on seacoast, fl. masc. Mar. (LE); id., between Victoria and Bahia, Sello (no date) fl. masc. (BR); id., Saint Hilaire 385 (1816—1821) fl. masc. (P); id., near Barra, Riedel 1589 (1828) fl. fem. Oct. (B, BZ, K, L, LE, M); id., between Campos and Victoria, Sello 167 (no date) fl. masc. (B, US); without locality, Raben 793 (1834) fl. masc. (BR); id., Riedel (no date) fl. (W); id., Schott 4397 (Pohl 4392) (comm. Herb. W. sub no. 992) (no date) fl. masc. (F, K, NY, W); id., Sello 229 (no date) (B); id., Sello (no date) (K, S); id., Wallis (1861) fr. Dec. (B); id., Herb. Zuccarinii (no date) fr. (M).

Without locality: Herb. Aubletii (1816) fl. masc. Mar. (LE).

Apart from the varieties to be described below, the following forms may be distinguished:

**f. brevistylum SWART**

Style in the fem. fl. about half as long as the ovary.

Type: Goudot A 1 in h.P.

COLOMBIA: Bogota, S. Martin, Llanos da Meta, Goudot A 1 (1844) fl. cm. and fr. (P).

**f. pedunculatum SWART**

Pedicels about as long as the flowers, 3 mm long.

Type: Triana 3696 in h.B.

COLOMBIA: Bogota, S. Martin, Apiai, Triana 3696 (1851—1857) alt. 300 m, fl. masc. (B, BM, K, W).

VENEZUELA: Amazonas, Puerto Ayacucho, Holt and Gehriger 401 (1903) alt. 100 m, fl. fem. Febr. (NY, US).

SURINAME: upper Suriname R., Wulschlaegel 826 (1854) fl. fem. and fr. (B, BR, GOET, W).

**f. trifoliolatum SWART**

The majority of the leaves trifoliolate.

Type: Tulleken 395 in h.U.

SURINAME: Nickerie R., Tulleken 395 (1900) fl. fem. Sept. (L, U); Marowyne R., Albina, Wulschlaegel 1406 (1854) fl. fem. and fr. Oct. (BR, GOET, W).



**f. pentamerum SWART**

The majority of the flowers pentamerous.

Type: Usteri 1 in h.M.

BRAZIL: Minas Geraes, Caldas, Widgren 1127 (1845) fl. masc. (S); Sao Paulo, near Sao Paulo, Mundagi, Usteri 1 (1906) fr. Nov. (M).

Vern. names: (incl. those of the varieties); TRINIDAD: incense tree; COLOMBIA: anime, tacamahaca (ex Engl.), anime blanco (ex Record and Mell); VENEZUELA: curucaí, tacamahaca, tacamahaco (ex Pittier); BR. GUIANA: haiowa (Arow.), siepoo (Car.), hayana, hiawa (ex Record and Mell); SURINAME: tiengi-monné (N.E.), ajawa, siewa-arna (Car.), olo (Arow.); FR. GUIANA: bois d'encens, bois à l'encens, arou-aou (ex Aublet); BRAZIL: Amazonas: almecega, almecegueira (ex Pittier), breu branco (ex Huber, Record and Mell), breu branco verdadeiro (ex LeCointe); Ceara: almiscar; Maranhao: almesca; Pernambuco: almecega; Bahia: almeixegueiro; Minas Geraes: almecega; Sao Paulo: almecega, almececa vermelha, almecegueira (ex Hoehne); BOLIVIA: isigo; PARAGUAY: hisi.

This widely spread and frequent, polymorphous species represents a type from which many other species in this genus may be derived.

The nearest relation of *P. heptaphyllum* March. is certainly *P. guianense* March. The resemblance is so great that they have often been combined: by Sprengel l.c. (1825) as *Amyris ambrosiaca* L.f., by Marchand l.c. (1867) as *P. guianense* March., by Triana and Planchon l.c. (1872) as *Icica guianensis* Aubl. and by Benoist l.c. (1919, 1933) as *P. heptaphyllum* March.; but by Marchand l.c. (1873) and others they were kept apart. In Aublet's diagnoses and figures the difference between these two species is indeed but slight: *Icica guianensis* is said to possess a "stylus brevissimus" and is figured with bijugate leaves, whereas *I. heptaphylla* is figured with trijugate leaves. According to Engler's monograph *P. heptaphyllum* possesses 2- to 4-, mostly 3-jugate leaves and an ovary but partly embedded in the disc and a style that is longer than the ovary, whereas in *P. guianense* the leaves are 1- or 2-jugate and provided with slightly smaller leaflets, the ovary is entirely embedded in the disc and the style is shorter than the ovary. As I have already set forth (see p. 221), the degree to which the ovary is embedded in the disc is inconstant in these species and in the masc. fl. the length of the style proved to be variable even in the same specimen; for although the style is mostly as long as the rudimentary ovary, but not unfrequently this equality is obtained only by adding the length of the lobes of the stigma to that of the style, which, though distinct, may be short. However a certain number of specimens which have generally been referred to "*Protium guianense*", show a sessile to subsessile stigma in the fem. fl. and in the masc. ones a sessile

stigma, and the length of the stigma too never attains that of the ovary. These specimens, moreover, have 1- or 2-jugate leaves, whilst the leaflets do not agree in shape or size with those of the 3- or 5-foliolate varieties of *P. heptaphyllum* March.; the latter possess either larger or narrower or much smaller leaflets. It are these specimens which I consider as identical with *Icica guianensis* Aubl., now referred to *P. guianense* March., of which, however, I could not trace the type specimen in the Herb. of the Brit. Museum; probably it is no longer in existence. Nevertheless the differences between *P. heptaphyllum* March. and *P. guianense* March. are slight and they are smaller than those usually found between the species of this genus, and *P. guianense* March. too might perhaps be regarded as a variety of the former.

*P. heptaphyllum* March. may be confused with *P. ovatum* Engl., but the latter differs by its ovate leaflets with short and tapering acumen and broadly cuneate or subcordate base and sec. nerves branched about halfway the blade.

Though *Icica Tacamahaca* H.B.K. is referred by Engler to *P. heptaphyllum* March., its type-specimen, Humboldt 778 in Herb. Willdenow 7275 in the Herb. at Berlin, which is accompanied by a written diagnosis of *I. Tacamahaca* and bears on its cover the name "Amyris lateriflora Willd." in the author's own handwriting, has been labelled by Engler "*P. Icariba* (DC.) March."

**A n a t o m y :** Guill. in Ann. Sc. nat., S.9, X, p.208 (1909); Record and Mell, Timb. trop. Am. p.334 (1924); Benoist l.c. (1933).

**U s e s :** The whole tree is sweet-scented and pours out from the wounded bole or branches an aromatic clear balsam, which soon becomes a solid whitish resin. It is cited as *Tacamahaca*, *Tacamaque*, *Tacamahaque*, *Tacamaque jaune terreuse*, *Hyawa-gummi*, *Conimaharz*, *Weihrauch von Cayenne*, *Olibanum americanarum* and is said to be used as incense and also as a medicine in dysentery.

The pinkish-white wood seems to be of little use and is said to be employed for light carpentry only.

Cf.: Aublet l.c.; Baillon l.c. (1874) and Dict. Bot. IV, p. 146 (1892); Villa Franca in Bull. Thér. méd. et chir. p. 9 (1880); Engl. l.c. (1897, 1931); Cordemoy l.c.; Wiesn., Rohst. ed. 2, I, p. 242, 289 (1900); Chodat et Hassler in Bull. Boiss. S. 2, III, p. 800 (1903); Beille, Préc. Bot. pharm. II, p. 620 (1909); Huber in Bol. Mus. Goeldi VI, p. 91 (1909); Guillaumin in Agr. Pays chauds IX, 1, p. 358 and 2, p. 143 (1909); Benoist l.c. (1919, 1933); Record and Mell l.c.; Tschirch, Handb. Pharmak. III, 2, p. 1135 (1925); Wolff in Wiesn. Rohst. ed. 4, I, p. 1040, 1047 (1927); LeCointe l.c.

Key to the varieties.

- 1a. - inflorescences glomeruliform, many-flowered; pedicels  $\frac{1}{2}$  to  $\frac{3}{4}$  the length of the flowers . . . . . 2  
 1b. - pedicels as long as the flowers; flowers large, 3.5—4 mm long . 6

- 2a. - leaves 2- or 3-, sometimes 4-jugate, small; inflorescences at most 2 cm in diam.; flowers of normal size, 2.5—3 mm long . 3  
 2b. - flowers large, 4 mm or more in length . . . . . 4
- 3a. - petioles and interjuga short, but their length not beyond the limit given in the diagnosis; leaflets lanceolate . . . . .  
 . . . . . I. var. **angustifolium** ENGL.  
 3b. - petioles 2 cm, interjuga 1.5 cm long, their length beyond the limits given in the diagnosis; leaflets oblong-lanceolate . . . . .  
 . . . . . 2. var. **aromaticum** (ENGL.) SWART
- 4a. - leaves mostly unifoliolate, sometimes trifoliolate, about 10 cm long; leaflets small . . . . . 3. var. **unifoliolatum** SWART  
 4b. - leaves mostly 1- or 2-jugate; leaflets large . . . . . 5
- 5a. - branchlets slender, 3—4 mm in diam.; leaflets usually lanceolate; inflorescences at most 2 cm in diam. . . . .  
 . . . . . 4. var. **brasiliense** ENGL.  
 5b. - branchlets rather robust, 5 mm and more in diam.; leaflets oblong-lanceolate; inflorescences 3 cm and more in diam; flowers abundant . . . . . 5. var. **floribundum** SWART
- 6a. - leaves 1- (or 2-) jugate; leaflets lanceolate-oblong to oblong-elliptic, small; inflorescences densely glomeruliform, 1.5—2 cm in diam. . . . . 6. var. **multiflorum** (ENGL.) SWART  
 6b. - leaves 1- to 4-, mostly 2- or 3-jugate; leaflets lanceolate; inflorescences large and lax, but shorter than the petiole of the subtending leaf . 7. var. **surinamensis** (MIQ.) SWART

I. var. **angustifolium** ENGL. in Mart. Fl. Bras. XII, 2, p.263 (1874); id. in DC. Mon. Phan. IV, p.64 (1883) excl. syn.; Chodat et Hassler in Bull. Boiss. S.2, III, p.800 (1903).

Leaves 2- to 4-jugate, usually small; petioles 3 cm, interjuga 2 cm long; leaflets lanceolate, usually small, 8.5 (5.5—13.5) cm long and 2.5 (1.5—3.5) cm wide.

Type (lecto-type): Martius in h.M.

Distribution: northern and eastern South America.

ST. VINCENT: Guilding (1822) fl. fem. (K) (P. Vincentinum Domin mss.).

TRINIDAD: St. Margareto, Broadway 2639 (1908) fr. June (B, BM, F, K, L, M, U); St. Annas, Broadway 5848 (1925) fr. June (BM, S).

VENEZUELA: Zulia, near Mene Grande, Pittier 10637 (1922) fr. Nov. (B, G, GH, NY).

BR. GUIANA: Pomeroon-distr., Moruka R., DelaCruz 4558 (1927) fl.

masc. and fem. (F); Demerara, Parkin (no date) (K); Hianari Creek, Persaud 122 (1922) fr. Aug. (F, NY).

**SURINAME:** Coppename R., Boon 1208 (1901) fl. fem. Oct. (U).

**BRAZIL:** Para, Santarem, Spruce 373 (1849) fl. masc. Nov. (BM, K, LE, M, NY, P, W); Bahia, Blanchet 1661 (1834) fl. fem. (BM, G, K, W); id., Martius 2154 (no date) (M) (*Amyris elemifera* ex Mart. Obs. 2154); between Campos and Victoria, Sello 1007 (1815) fl. masc. (B.); Sao Paulo, at Morro de Ypanema, Martius (no date) fl. fem. and fr. Jan. (M) (*Icica angustifolia* Benth. mss.) (type); without locality, Sello 7a (no date) fl. masc. (B); id., id. 428 (no date) fl. (B, BZ).

**PARAGUAY:** Concepcion, near Paso Laguna, Hassler 703 (ex Chodat et Hassler).

But one specimen collected by Salzmann could be found, and this, though determined by Engler as "*Protium heptaphyllum* March. var. *angustifolium* Engl." had to be referred to the var. *brasiliense* Engl. It is probable that *Icica Salzmannii* Turcz. was based on the same specimen, and this name is here therefore referred as a synonym to the latter variety.

**2. var. aromaticum (ENGL.) SWART n. comb.**

*Protium aromaticum* Engl. in Mart. Fl. Bras. XII, 2, p.273 (1874).

Leaves 2- to 4-, mostly 3-jugate, small; petioles 2 cm, interjuga 1.5 cm long; leaflets oblong-lanceolate, small, 5.5—8 cm long and 2—3 cm wide; subcoriaceous.

**Type** (lecto-type): Martius in h.M.

**Distribution:** eastern Brazil.

**BRAZIL:** Para, near Para, Ilha de Mosqueiro, Killip and Smith 30639 (1929) on sandy coast, fr. Nov. (NY, US); Bahia, near Barril, Martius (no date) fl. masc. Jan.-Febr. (M); Espirito Santo, Itapemirim, Neuwied (1829) fl. masc. (BR, M); between Campos and Victoria, Sello 306 (no date) fl. masc. (B, BR, BZ).

The diagnosis of *P. aromaticum* Engl. gives but one reliable difference between this plant and *P. heptaphyllum* March., viz. the length of the petioles and interjuga. In his monograph (1883) Engler reduced *P. aromaticum* Engl. to *P. heptaphyllum* March., but in view of the difference mentioned above it appears better to retain it as a separate variety of the latter.

Whereas the Neuwied specimen is labelled "*Icica aromatica* (Spr.) Engl.", the Martius specimen is indicated on the label "*Icica aromatica* Spreng." and for this reason the latter will have to be regarded as the type of Engler's diagnosis.

**3. var. unifoliolatum SWART in Rec. Trav. bot. néerl. XXXIX, p.191 (1942).**

*Protium unifoliolatum* Engl. in errore Pulle, Enum. Vasc. Pl. Surin. p.245 (1906).

Leaves mostly unifoliolate, sometimes trifoliolate, small, about 10 cm long; petioles 1.5 (1—2) cm long; leaflets lanceolate, 8 (5.5—11.5) cm long and 3 (1.75—3.75) cm wide; acumen 6 mm long and 4 mm wide. Flowers 4 mm long.

Type: Kappler 2112 in h.P.

Distribution: Suriname.

SURINAME: Lawa R., Kappler 2112 (no date) fl. masc. Sept. (B, GOET, P); without locality, Kappler 129 (1862) fl. masc. (L).

This variety, which in some ways is intermediate between the var. *brasiliense* Engl. and the var. *multiflorum* (Engl.) Swart, shows much resemblance to *P. unifoliolatum* Engl., but the latter differs by its always unifoliolate leaves and by its pilose petioles, rhachis, petiolules and nerves.

4. var. *brasiliense* ENGL. in Mart. Fl. Bras. XII, 2, p.263 (1874); Chodat et Hassler in Bull. Boiss. S.2, III, p.800 (1903); Hoehne in Comm. Lin. Tel. Estr. Matto Grosso ao Amazonas, Bot.VI, Ann.V, p.32 (1915).

*Amyris brasiliensis* Willd. mss in Herb. 7286; Engl. in Mart. Fl. Bras. XII, 2, p.263 (1874); id. in DC. Mon. Phan. IV, p.64 (1883).

*Protium heptaphyllum* (Aubl.) March. var. *grandiflorum* Engl. in DC. Mon. Phan. IV, p.64 (1883).

? *Amyris ambrosiaca* L.f. in errore Vell., Fl. Flum. Ic. IV, t.3 (1827).

*Icica Salzmannii* Turcz. in Bull. Soc. Imp. Nat. Mosc. XXXI, 1, p.473 (1858).

*Protium Icariba* March. in errore March. in Vid. Medd. Kjb. 1873, p.54 (1873).

Leaves usually 1- or 2-jugate, sometimes 3-jugate; leaflets mostly lanceolate, large, 11 (9—15) cm long and 3.5 (3—5) cm wide. Flowers large, 4—5 mm long. Drupe large, 1.75 cm long.

Type (lecto-type): Hoffmannsegg in Herb. Willd. 7286 in h.B.

Distribution: northern and eastern South America.

VENEZUELA: Agua Santa, Trujillo, Pittier 13308 (1929) in savannah-bushes, fl. masc. and fem. Jan.-Febr. (B, F, G, K, M, NY, US); Orinoco, Mariquita, Chaffangon 74 (no date) fl. masc. (P) (*P. mariquitense* Drake mss.); Cumana, Humboldt in Herb. Willd. 7287 (no date) fr. (B).

- BR. GUIANA: Schomburk 41 (1836) fl. masc. (B, BM, BR, K, P, W).  
 SURINAME: Gonini R., BW. 3790 (1918) fr. Febr. (U).  
 FR. GUIANA: near Cayenne, Broadway 363 (1921) savannah, fr. May (NY, US); id., Matabu, Broadway 754 (1921) fr. July (GH, NY, US); without loc., Mélinon (no date) fl. masc. (K, P).  
 BRAZIL: Amazonas, R. Negro, Yapura, Martius (no date) fl. masc. Jan. (M); id., between Barra and Coary, Martius (no date) fl. masc. Febr. (M); Para, Alto Paru, Cumina, Sampaio 5618 (1928) fl. masc. Nov. (B); id., Hoffmannsegg in Herb. Willd. 7286 (no date) fl. fem. (B) (*Amyris brasiliensis* Willd. mss.) (type); Matto Grosso, near S. Anna da Chapado, Malme 1730 (1894) fl. June (S); id., Cuyaba, Malme 1862 (1902) fl. fem. June (B, S); id., Villa Maria, Kunze 17 (1892) fl. masc. July (F, M, NY, US); id., S. Luiz de Cacaes, Hoehne 403, 4998—5001 (ex Hoehne l.c.); Pernambuco, Gardner 1147 (1837) fl. masc. Oct. (BM, K, W); Bahia, Piauby, Coatinga, Luetzelburg 271 (1913) fl. masc. (B, M); id., St. Luzia, Riedel 656 (1824) fl. masc. Oct. (B, LE, NY, US); id., Ilheos, near Curumatahy, Luschnath (no date) fl. masc. (BR) (*Icica schinoides* Mart. mss); id., Cruz de Casma, Luschnath 155 (1835) fl. masc. Nov. (B, LE); id., without loc., Blanchet 1060 (1833) fl. masc. (G); id., id. 1661 (no date) fl. fem. (G); id., id. 2060 (no date) fl. fem. (G); id., Salzmänn (no date) fl. masc. and fr. (BRESL, G, LE, K, P) (type of *Icica Salzmannii* Turcz.); id., Tavares 267 (1913) fr. (M); Minas Geraes, Catalao, Riedel 2479 (1834) fl. masc. Aug. (B, LE, S); id., Lagoa Santa, Warming 2404 and 2405 (1863) fl. fem. Oct. (C); id., id. 2407 (1865) fl. masc. Sept. (C); id., Warming (1863) fl. masc. and fem. Sept. (C, GH); id., without locality, Claussen 318 (1840) fl. masc. (BM, BR); id., id. 470 (no date) fr. (G, P, S); id., Riedel (1824) fl. Aug. (B, LE); Rio de Janeiro, Glaziou 10495 (no date) fl. masc. Aug.-Sept. (B, C, K); Sao Paulo, Ypanema, Sello 2062 (no date) fr. (B, K, S); id., Capoeira, Araraquara, Löfgren 1014 (1888) fr. Nov. (C).  
 BOLIVIA: Santa Cruz, Sara, Buenavista, Steinbach 6504 (1925) fl. masc. Sept. (B, F, G, K); Yaguari, Herzog 477 (1907) (L).  
 PARAGUAY: Cordifère de Péribebuy, Balansa 2529 (1874—1877) fl. masc. and fr. (K, LE, S); upper Yaca R., Chobolo, Hassler 6903 (no date) fl. masc. and fem. Jan. (B, BM, K, W); Cerro Pelado, Hassler (1929) fr. Febr. (ex Chodat et Hassler).

### f. *breviacuminatum* SWART

Acumen of the leaflets short, 5 mm long and 5 mm wide.

BRAZIL: Matto Grosso, Cuyaba, Malme 2270 (1902) fl. fem. Aug. (S).

In 1883 Engler l.c. reduced all the specimens which in 1874 he had referred to the var. *brasiliense* Engl., to *P. heptaphyllum* March., but the diagnosis given in 1883 by Engler of the var. *grandiflorum* Engl. is literally the same as that of the var. *brasiliense* Engl.. "*Amyris brasiliensis* Willd. h.n. 7286" was quoted by Engler as a synonym under both varieties, but the specimen Hoffmannsegg in Herb. Willd. 7286 itself, which Engler marked on the label "*Icica heptaphylla* Aubl. var. *brasiliensis* Engl." and which bears on its cover the name "*Amyris brasiliensis*" accompanied by a unpublished diagnosis, is not mentioned by Engler, neither under the former, nor

under the latter variety. Yet it is clear that this specimen has served as the type of both varieties and therefore I conserved the older name, though none of the specimens actually enumerated by Engler under the var. *brasiliense* Engl. retained there.

*Icica Salzmannii* Turcz. l.c. was based on a Salzmann specimen: "in collibus Bahiae, sub Guarea" and was referred by Engler l.c. (1874, 1883) to *P. heptaphyllum* March. var. *angustifolium* Engl. Though I did not see any specimen marked "*Icica Salzmannii*", the Salzmann specimens marked "Bahia in collibus, Guarea" are evidently representative of the type of *Icica Salzmannii* Turcz. and these specimens are marked by Engler "var. *angustifolium* Engl.". They belong however to the var. *brasiliense* Engl.

5. var. *floribundum* SWART in Rec. Trav. bot. néerl. XXXIX, p.191 (1942).

Leaves 1- or 2-jugate, sometimes 3-jugate; leaflets large, 12 cm long and 4.5 cm wide; acumen 7.5 mm long and 5 mm wide. Inflorescences 3 cm in diam. Flowers abundant, densely glomerate, large, 4—5 mm long.

Type: Manso 127 in Herb. Martius 1277 in h.BR 1204a.

Distribution: Brazil (Ceara and Matto Grosso) and Paraguay.

BRAZIL: Ceara, Villa do Crato, Gardner 1531 (1838) fl. Sept. (BM, K); Matto Grosso, near Cuyaba, Manso 127 in Herb. Fl. Bras. Martius 1277 (1833) fl. masc. and fem. June (B, BM, BR, G, K, L, LE, M, NY, S); without locality, Pohl 2287 (comm. Herb. W. sub no. 1965) (no date) fl. fem. (BR, F, K, M, W).

PARAGUAY: Sierra de Amambahy, Hassler 10596 (1907) fl. masc. Sept. (B, G, K, W).

This variety is nearly related to the var. *brasiliense* Engl., and Engler referred most of the specimens enumerated above to the latter. It differs, however, by the abundance of its flowers which are densely clustered in large inflorescences and by its more robust branchlets.

6. var. *multiflorum* (ENGL.) SWART n. comb.

*Protium multiflorum* Engl. in Mart. Fl. Bras. XII, 2, p.273 (1874); id. in DC. Mon. Phan. IV, p.73 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) and ed.2, XIXa, p.412 (1931); Pittier in Trab. Mus. com. Venez. VIII, p.365 (1931); ? Glaziou in Bull. Soc. bot. Fr. LII, Mém.3, p.92 (1905).

*Tingulunga multiflora* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium heptaphyllum* (Aubl.) March. ex Standley in Trop.

Woods XXXIII, p. 15 (1933) quoad nom. vern. "Breu branco do campo".

Leaves 1- or 2-jugate, usually 1-jugate; petioles 2—2.5 cm long; leaflets small, 6 cm long and 2.25 cm wide; tert. nerves visible. Pedicels as long as the flowers, like the outside of the calyx and corolla sparsely and minutely puberulous. Flowers large, 3.5—4 mm long.

Type (lecto-type): Spruce 994 in h.P.

Distribution: southern Venezuela and northern Brazil.

VENEZUELA: R. Negro, near San Carlos, Spruce 3787 (1854) fl. masc. Dec. (BM, BR, K, P, W).

BRAZIL: Amazonas, R. Negro, Riedel 1588 (1828) fl. masc. Oct. (B, K, LE, M); Para, Tapajoz, Itaituba, Monteiro da Costa 230 (1932) fr. Jan. (F, U); id., near Santarem, Spruce 608A (1850) fr. Jan. (B, GH, K, LE M, P, W); id., id. 608B (1850) fl. masc. July (C, G, GH, S, W); id., id. 994 (1850) fl. masc. July (B, K, LE, P) (type).

Though the diagnosis of *P. multiflorum* Engl., as well as the specimens referred by Engler to this species differ distinctly from the diagnosis and type of *P. heptaphyllum* March., these differences are not sufficiently important to be regarded as specific. They are of the same order as those on account of which the other varieties of *P. heptaphyllum* are distinguished.

I have separated the specimens belonging to Spruce 608 into two groups; those marked A, all fruiting and collected Jan. 1850, which mostly are mixed on the same sheet with Spruce 373 (*P. heptaphyllum* March. var. *angustifolium* Engl.), and those marked B, all flowering male and collected July 1850, which probably are identical with Spruce 994.

The record of *P. multiflorum* Engl. by Glaziou l.c. is dubious, as well on account of its locality (Rio de Janeiro), as on account of the fact that the same collector number, Glaziou 13674, is also quoted under *P. trifoliolatum* Engl.

7. var. *surinamense* (MIQ.) SWART n. comb.

*Icica surinamensis* Miq., Stirp. Sur. Sel. p.65 (1853); Walp., Ann. Bot. Syst. II, p.289 (1851—1852).

Leaflets lanceolate, 9 (7—12.5) cm long and 2.75 (2.25—3.25) cm wide. Inflorescence lax and rather long, but shorter than the petiole of the subtending leaf, 2.5—3 cm long. Pedicels as long as the lowers, 3.5—4 mm.



Type: Hostmann 1242 in h.U.

Distribution: north-eastern South America.

TRINIDAD: Arena Government forests, Broadway 5079 (1923) fl. masc. Oct. (BM, F, G, K); Point Galera, Anderson (no date) fl. fem. (G).

VENEZUELA: Bolivar, Ciudad Bolivar, Holt and Gehriger 189 (1929), alt. 35 m, fl. fem. and fr. Nov. (BM, GH, NY, S, US).

BR. GUIANA: Essequibo R., Jenman 1086 (1881) fl. masc. Sept.-Oct. (K).

SURINAME: Hostmann 1242 (no date) fl. masc. (C, L, P, U) (type); Hostmann and Kappler 1242 (no date) fl. masc. (W); Kappler 1242 (no date) fl. masc. (S).

FR. GUIANA: Jelski (no date) fl. fem. (B).

BRAZIL: Para, R. Cumina, Sampaio 5222 (1928) fl. fem. Oct. (B); id., near Santarem, Spruce (1849) fl. masc. Nov. (K, M, NY, W); Bahia, Blanchet 3204 (1840) fl. masc. (G, P, W); without loc., Herb. Swartzii (no date) fl. masc. (S).

As appears from the autographic notes on the label of the type specimen, Hostmann 1242 is in Miquel's diagnosis erroneously cited under the number 1212.

This variety tends towards *P. laxiflorum* Engl., but the latter differs by its 3- to 5-jugate leaves, its longer petiolules, by its lax and long inflorescences, which are always longer than the petioles and by its pedicels, which are twice as long as the pentamerous, glabrous flowers.

19. *Protium guianense* (AUBL.) MARCH. in Adans. VIII, p.52 (1867—1868) excl. syn. *Icica heptaphylla* Aubl.; Engl. in Mart. Fl. Bras. XII, 2, p.271 (1874); id. in DC. Mon. Phan. IV, p.72 (1883) excl. spec. Antill.; id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, p.412, 414 (1931); Cordemoy in Ann. Inst. col. Mars. VI, p.201 (1899) excl. fig.34 et syn. *Icica heptaphylla* Aubl.; Pittier in Trab. Mus. com. Venez. VIII, p.365 (1931); Gleason in Bull. Tor. Bot. Cl. LVIII, p.377 (1931) quoad spec. Tate 329 cit. tantum. Non apud Oliver in Hook. Ic. Pl. XVI, t.1571 (1887) quod ad *P. attenuatum* (Rose) Urb. pertinet, nec apud Britton in Bull. Tor. Bot. Cl. XVI, p.189 (1889) quod ad *Protium* sp. pertinet, nec apud Marshall, Trees of Trin. and Tob. p.25 (1934) quod ad *P. heptaphyllum* (Aubl.) March. pertinet.

*Icica guianensis* Aubl., Hist. Pl. Gui. fr. I, p.340, t.131 (1775); DeCand., Prodr. II, p.77 (1825); Don, Gen. Hist. dichl. Pl. II, p.83 (1832). Non apud Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.297 (1872) et Sagot in Ann. Sc. nat. S.6, XIII, p.291 (1882) et Freeman and Williams in Mem. Dept. Agr. Trin. and Tob. IV, p.91 (1928) quod ad *P. heptaphyllum* (Aubl.) March. pertinet.

*Icica viridiflora* Lam., Enc. méth. Bot. III, p.225 (1789) nom. nov. ill.

*Amyris guyanensis* Willd., Linn. Sp. Pl. II, p.335 (1799); Pers., Syn. Pl. I, p.414 (1805).

*Elaphrium gujanense* Spr. ex Dietr., Syn. Pl. II, p.1271 (1840).

*Bursera guianensis* Baill., Hist. d. Pl. V, p. 296 (1874); id., Tr. Bot. méd. phan. p.951 (1884).

*Tingulunga guianensis* OK., Rev. Gen. Pl. I, p.107 (1891).

*Amyris ambrosiaca* Spr., Linn. Syst. Veg. ed. 16, II, p.218 (1825) quoad syn. *Icica guianensis* Aubl.

Small tree. Branchlets slender, 3—4 mm in diam., subterete, striate, glabrous, when young brunnescent to fuscous, when adult grey to fuscous, scabrous, dotted with small, elliptic lenticels. Leaves 1- or 2-jugate, rarely unifoliolate or 3-jugate, 14—20 cm long, in all parts glabrous; petioles semiterete, at the base slightly incrassate, 3—4 (1.5—7) cm long; interjuga angulose, above flattened and bisulcate, in the nodes incrassate, 2—3.5 (1—4.5) cm long; petioles semiterete, canaliculate, at both ends incrassate, those of the apical jugum much shorter than those of the basal jugum, 3—7 mm long, but the terminal ones 15—20 mm; leaflets lanceolate-oblong to oblong-elliptic, usually 7—9 (6.5—14.5) cm long and 2.5—3.5 (2.25—5.5) cm wide, but the terminal ones larger, narrowed to the base and the lateral ones asymmetric, mostly slightly narrowed to the apex; apex gradually to rather abruptly acuminate; acumen nearly linear, 6—10 mm long and 3—5 mm wide, obtuse; base broadly cuneate; margin entire, undulate; chartaceous to subcoriaceous, smooth, nitidulous; with 10—14 pairs of sec. nerves; prim. nerves prominent, sec. ones above hardly prominulous, beneath prominulous, tert. ones above invisible, beneath hardly prominulous. Inflorescences axillary, glomeruliform, many-flowered, 1—2 cm in diam.; branchlets terete, striate, like the terete, striate, 1—2 mm long pedicels, the ovate-triangular, obtusely acuminate, about 0.5 mm long bracts and bractlets and the outside of the calyx sparsely to densely patent-puberulous. Flowers 4-merous, rarely 5-merous, 3 (2.5—4) mm long, pale green to white. Calyx cupuliform, 0.5 mm high; its lobes broadly triangular, obtuse, half the length of the tube or less. Petals ovate to oblong, subobtusely, inflexed-apiculate, subcarnose, outside near the midrib provided with a few short hairs or glabrous, inside with some rather long hairs, margins pale, papillose. Stamens in the masc. fl. 1.75—2.25 mm, in the fem. fl. 1.25—1.5 mm long; filaments subulate, at the base dilated; anthers lanceolate-oblong, 0.75—0.5 mm long. Disc annular, 8-lobed, glabrous, 0.25 mm high. Pistil glabrous, in the masc. fl. at most 0.5 mm high and embedded in the disc, in the fem. fl. 0.75—1 mm

high and at the base surrounded by the disc; ovary globose, 4-lobed, 4-ribbed, 4-celled; stigma 4-lobed sessile to subsessile. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 4-lobed and 2- to 4-pyrenous, acute, crowned by a rudiment of the sessile stigma, 7.5—12.5 mm long and 7.5—12.5 mm in diam.; exocarp glabrous, smooth; mesocarp thick, carnose; endocarp thin, woody.

Type: Aublet, Hist. Pl. Gui. fr. I, t. 131(?)

Distribution: northern South America.

COLOMBIA: R. Meta, Llano de S. Martin, Karsten (no date) fl. masc. (W).

VENEZUELA: Zulia, near Mene Grande, Pittier 10630a (1922) fr. Nov. (US); Bolivar, near Ciudad Bolivar, Bailey and Bailey 1681 (1921) alt. 65 m, fl. fem. Mar. (US); id., Holt and Gehriger 70 (1929) alt 35 m, fl. fem. and fr. Nov. (GH, NY, US); Amazonas, Esmeralda, Tate 329 (1928) savannah, alt. 100 m, fl. masc. Nov. (NY, US).

BR. GUIANA: N.W.-distr., Waima R., DelaCruz 4044 (1923) fl. fem. May (F, GH, NY, US); Cuyuni R., Bartlett 8257 (1904) fl. fem. Oct. (K); between Mazaruni R. and Cuyuni R., Graham 244 (1924) fr. July (US); Mt. Roraima, Schomburgk 574 (1842—1843) fl. fem. (P); id., id. 583 (1842—1843) fl. masc. (G, K, W); Essequibo R., near Bartica, DelaCruz 1950 (1922) fl. masc. Sept. (F, NY, US); Demerara R., Jenman 4926 (1888) fl. masc. Nov. (B, K, NY); upper Demerara R., Jenman 4274 (1889) fl. masc. Sept. (K, NY); without loc., Jenman 4546 (1888) fl. masc. Oct. (NY); id., Schomburgk 894 (1842) fl. fem. Oct. (B, BR, BRSL, K); id., id. (no date) fl. masc. (L, U).

SURINAME: Corantyne R., Kaboeri, tree n.538, BW.4740 (1920) fl. fem. Sept. (U); Lucie R., Hulk 417 (1910) fr. Dec. (U); Coppename R., Wullschlaegel 2037 (no date) fr. (GOET); id., near Raleigh Falls, Lanjouw 820 (1933) fl. masc. Sept. (U); Oranjewoud, Focke 684 (1862) fl. fem. Oct. (K, U); Joden-savanne, Kegel 1150 (no date) on sandy soil, fl. fem. and fr. (GOET, U); Suriname R., near Kabelstation, Lanjouw 1147 (1933) fl. masc. Nov. (U); Marowynne R., Albina, Wullschlaegel 2039 (no date) fl. fem. (GOET).

FR. GUIANA: Maroni R., Mélinon 315 (1876) fl. fem. (BR, BZ, P); near Cayenne, Martin (no date) (B, BR); id., Soubiron (no date) fr. (P); without loc., Perrottet (1821) fl. fem. and fr. (G, P).

BRAZIL: Para, Ilha do Mosqueiro, Killip and Smith 30457 (1929), on sandy coast, fr. Nov. (NY); without loc., Hornemann (no date) fl. masc. (W).

Vern. names: VENEZUELA: tacamahaca; BR. GUIANA: arracosary; FR. GUIANA: bois d'encens (ex Aublet).

As I pointed out in my discussion of *P. heptaphyllum* March. *P. guianense* differs from the former merely by its usually 1-or 2-jugate leaves and by the sessile or subsessile stigma.

I did not find the type specimen in the Herbarium of the British Museum; it may be that this specimen is no longer in existence and for that reason the figure given by Aublet will have to be regarded as the type.

**Uses:** The resin of this species is frequently mentioned in one breath with that of *P. heptaphyllum* (Aubl.) March. and is called sometimes Tacamaque jaune, Tacamaque huileuse incolore or Weihrauch von Cayenne.

20. **Protium cubense** (ROSE) URB., Symb. Ant. VII, p.239 (1912); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.412 (1931).

*Icica Copal* Rich. (non Sch. et Ch.), Ess. Fl. Cub. p.386 (1845); id. in Ramon de la Sagra, Hist. Cub. X, p.160 (1845) et XII, t.37 (1855).

*Icica cubensis* Rose in N. Am. Fl. XXV, 3, p.260 (1911).

*Tetragastris cubensis* Urb. in Fedde Rep. XVIII, p.114 (1922).

*Icica heptaphylla* Aubl. in errore Griseb., Cat. Pl. Cub. p.66 (1866).

*Protium guianense* (Aubl.) March. in errore Engl. in DC. Mon. Phan. IV, p.72 (1883) quoad syn. *Icica Copal* Rich. et spec. Cub.

*Protium heptaphyllum* (Aubl.) March. in errore Millsp. in Publ. Field. Mus., Bot.S. I, p.428 (1900).

Shrub or small tree, 2.5—8 m high. Branchlets 3 mm in diam., glabrous, when young smooth, castaneous, when adult rimose, fuscous and dotted with oblong, ferruginous lenticels. Leaves 2- or 3-jugate, rarely 1-jugate or unifoliolate, 18 (12—20) cm long, in all parts glabrous; petioles semiterete, 3.5—4.5 (2.5—5) cm long, transversely rimose; interjuga terete, above slightly carinate, at the nodes subincrassate, 2.5—3 (2—4) cm long; petiolules canaliculate, transversely rimose, 15 (10—18) mm long, the terminal ones 15—30 mm; leaflets oblong to oblong-elliptic, sometimes slightly narrowed to the apex, usually 6.5—10 cm long and 3—5 cm wide, but the terminal ones larger, sometimes narrowed to the base and the lateral ones asymmetric; apex rather abruptly to gradually acuminate; acumen tapering, 5—10 mm long and 5—7.5 mm wide, obtuse; base broadly cuneate to round; margin entire, repandous, undulate; coriaceous, smooth, above nitidous, beneath nitidulous; with 10—14 pairs of sec. nerves; prim. and sec. nerves above immersed, beneath distinctly prominent, tert. ones above hardly visible, beneath prominent. Inflorescences axillary, subterminal, branched from the base, 2.5—5.5 cm long; branchlets terete, striate, rather stout, up to 1.5 cm long, like the stout, angulose, 1.5 mm long pedicels, the ovate-triangular, acute, 0.5 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely and minutely patent-puberulous to subglabrous. Flowers 4-merous, 2.5—3 mm long. Calyx cupuliform, 1 mm high; its lobes semiorbicular, subacuminate, shorter than the tube. Petals triangular, acute, inflexed-apiculate, carnos. Stamens in the masc. fl. 2 mm, in the fem. fl. 1.5 mm long;

filaments flattened; anthers oblong-elliptic, 0.5—0.75 mm long. Disc annular, crenate, glabrous, 0.5—0.7 mm high. Pistil glabrous, in the masc. fl. 0.8 mm, in the fem. fl. 1.25 mm high; ovary globose-ovoid, sub-4-lobed, acute, in the masc. fl. embedded in the disc, in the fem. fl. at the base surrounded by the disc; stigma subsessile, 4-lobed. Drupe either oblique-ovoid and monopyrrenous or globose, 2- to 3-lobed and 1- to 3-pyrrenous.

**Type:** Ramon de la Sagra ex Herb. Rich in h.P.

**Distribution:** Cuba and the Isle of Pines.

**CUBA:** Vuelta Abajo, Ramon de la Sagra (no date) fl. fem. and fr. (B, K, P, W) (type); Pinar del Rio, Loma Pelada de Buenavista, Léon and Roig 13560 (1928) alt. 420 m, fl. fem. Aug. (NY); prov. Oriente, R. Yamanigüey, Schafer 4206 (1910) fr. Febr.-Mar. (B, K, NY, US); id., R. Yamuri, Schafer 7828 (1910) fr. Dec. (GH, K, NY, US); id., near Monte Verde, Wright 1156 (1859) fl. masc. May (B, BM, BR, G, GH, K, LE, NY, P, S); id., id. 1157 (1859) fr. May (BM, BR, GH, K, LE, NY); id., id. 1158 (1859) fr. Apr. (B, BM, GH, K); id., Jacallou, Wright 1603 (1859) fl. fem. Sept. (B, BR, GH, K, LE, NY); id., Bayate, ad Arroyo Piedra, Ekman 4663 (1915) fr. Febr. (S); id., near Baracoa, Ekman 4213 (1915) fl. masc. Jan. (B, NY, S) (type of *Tetragastris cubensis* Urb.).

**ISLE OF PINES (ISOLA DE PINOS):** near Nueva Gerona, Curtiss 421 (1904) fr. Mar. (B, G, L, NY, US); La Cunaga, Britton, Britton and Wilson 14566 (1916) fr. Febr. (F, GH, NY, US); without loc., Blain 7 (no date) fr. (F); id., id. 35 (no date) (F); id., id. 161 (no date) fr. (F).

**Vern. name:** copal.

This species, which is endemic in Cuba and the neighbouring Isle of Pines, is marked among the other relatives of *P. heptaphyllum* (Aubl.) March. by its long petiolules and by its coriaceous leaflets. With *P. fragans* (Rose) Urb., another endemic species of Cuba, *P. cubense* (Rose) Urb. agrees in appearance, but the former differs by its nearly rhomboid and acutely acuminate leaflets provided with 6—7 pairs of sec. nerves, by its longer petioles and petiolules and by the structure of its flowers, according to which it had to be referred to the sectio *Icicopsis*.

21. ***Protium panamense*** (ROSE) JOHNSTON in Contr. Gray Herb., New S. LXX, p.72 (1924); Record and Mell, Timb. trop. Am. p.336 (1924); Standl. in Contr. U.S.N.H. XXVII, p.224 (1928); Kenoyer and Standley in Publ. Field Mus., Bot.S. IV, 6, p.151 (1929); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.414 (1931). Non apud Standl. in Trop. Woods XVII, p.23 (1929) quod ad *P. nicaraguense* Swart pertinet.

*Icica panamensis* Rose in N. Am. Fl. XXV, 3, p.260 (1911).

Small tree, 4—10 m high. Branchlets rather stout, 5 mm in diam., terete, striate, glabrous, smooth, cinereous to fuscous, dotted with elliptic, pale brown lenticels. Leaves 3-jugate, rarely 2- or 1-jugate, 40—45 (27.5—55) cm long, in all parts glabrous; petioles semiterete, at the base incrassate, 10 (5.5—12) cm long; interjuga terete, stout, above slightly carinate, 5.5 (3.5—7) cm long; petiolules semiterete, stout, canaliculate, 1.5—2 (1—3) cm long, the terminal ones 3.5—4 (3—5) cm; leaflets oblong-lanceolate to oblong-elliptic, usually 18—20 (15—25) cm long and 7—8 (6—10) cm wide, but the terminal ones slightly wider, narrowed to the base and the lateral ones narrowed from below the middle to the apex, the basal ones shorter; apex subacuminate or gradually narrowed in a tapering, at most 7.5 mm long and wide, obtuse acumen; base cuneate to nearly round; margin entire, repandous; subcoriaceous to coriaceous, smooth, nitidulous; with 10—14 pairs of sec. nerves; prim. nerves distinctly prominent on both sides, sec. ones above grooved on each side, beneath prominent, tert. ones above visible, beneath prominulous. Inflorescences axillary, laxly branched from the base, 3.5 cm long, the masc. ones sometimes up to 10 cm, rather many-flowered, in all parts glabrous. Branchlets terete, striate, up to 2 cm long. Pedicels terete, striate, about half the length of the flowers; bracts and bractlets triangular, acute, 0.5 mm long. Flowers 4-merous, 4—4.5 mm long, yellow. Calyx cupuliform, 1 mm high; its lobes semiorbicular, obtusely subacuminate, about as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, carnose. Stamens in the masc. fl. 2.5 mm, in the fem. fl. 2 mm long; filaments subulate, at the base dilated; anthers oblong, 1 mm long. Disc annular, 8-lobed, 0.4 mm high. Pistil in the masc. fl. 1 mm high, in the fem. fl. 2 mm; ovary globose-conical, 4-lobed, tapering in a sessile, 4-lobed stigma. Drupe ellipsoid, subangular; apex acute; base mostly narrowed; 2—2.5 cm long and 1.25 cm in diam.; exocarp red; mesocarp rather thick, carnose; endocarp thick, woody; pyrenes 1 to 4.

Type: Sutton Hayes 462 in h.US 371899.

Distribution: Panama.

PANAMA: Bocas del Toro, Almirante, Cooper 433 (1928) fr. Jan.-Mar. (BM, F, K, NY, US); id., id. 517 (1928) fr. Febr. (F, K, NY, US); Gatun, Sutton Hayes 462 (= 1?) (1860) fl. fem. and fr. Febr. (F, NY, US) (type); Canal Zone, Agua Clara Reservoir, Stevens 583 (1924) (US); id., Barro Colorado Island, Bailey and Bailey 319 (1931) fr. Apr. (F); id., Bangham 405 (1929) (US); id., id. 424 (1929) (F); id., Kenoyer 677 (1927) fr. July (US); id., Salvoza 858 (1928) (S); id., id. 884 (1929) fr. Aug. (S); id., Shattuck 1172 (1934) fl. masc. Aug. (F); id., Wilson 125 (1931) fr. Mar. (F);

id., Woodworth and Vestal 425 (1932) fr. Febr. (F); id., id. 462 (1932) fl. Febr. (F), id., id. 490 (1932) fr. Febr. (F); id., id. 559 (1932) fl. fem. Febr. (F); id., Zetex 3467 (1935) fr. May (F); id., Fryoles, Stevens 1269 (1924) fr. Oct. (US); Colon, Loma de la Gloria, near Fati, Pittier 4082 (1911) fr. Aug. (BM, C, F, NY, US).

This species is nearly related to *P. tovariense* Pitt., but the latter differs by its smaller leaves, by the invisible tert. nerves of its leaflets, which are not narrowed to the apex, and by its pentamerous flowers with a minutely 5-dentate calyx.

*P. panamense* (Rose) Johnston also resembles *P. Copal* (S. et C.) Engl., which is recorded from the same regions, but the latter differs by its pilose generative parts, by its pilose ovary and by its longer inflorescences.

22. ***Protium multiramiflorum* LUNDELL** in Field and Lab. VI, 1, p. 11 (1937).

Tree, 10—13 m high. Branchlets terete, striate, 3—4 mm in diam., glabrous, when young ferruginous, when adult grey, dotted with elliptic, ferruginous lenticels. Leaves 1- to 3-jugate, mostly 3-jugate, 16—27 cm long, in all parts glabrous; petioles near the incrassate base semiterete, 6—7 (4—7.5) cm long; interjuga terete, above carinate, at the nodes slightly incrassate, 4 cm long; petiolules canaliculate, at both ends slightly incrassate, 7.5—10 mm long, the terminal ones 20 mm; leaflets oblong to oblong-elliptic, usually 10 cm long and 4 cm wide, but the terminal ones longer, distinctly narrowed to the base, obovate, the lateral ones nearly symmetric and the basal ones shorter, slightly narrowed near the apex; apex rather abruptly acuminate; acumen linear to slightly tapering, 4 mm long and 2.5 mm wide, obtuse; base cuneate; margin entire, undulate; pergamentaceous, smooth, nitidulous; with 13—14 pairs of sec. nerves; prim. nerves above grooved on each side, beneath prominent, sec. and tert. nerves prominulous. Inflorescences axillary, richly branched from the base, many-flowered, about as long as the petioles of the subtending leaves, in all parts glabrous. Branchlets angulose, slender, up to 3 cm long. Pedicels terete, striate, shorter than the flowers, 2 mm long; bracts and bractlets triangular, 0.5—0.7 mm long. Flowers 4-merous, 3 mm long, flavescent. Calyx cupuliform, 1.25 mm high; its lobes triangular, acute, somewhat longer than the tube. Petals ovate-triangular, acute, inflexed-apiculate, subcarinose. Stamens 1.5—2 mm long; filaments flattened at the base, 0.75—1.25 mm long; anthers oblong. Disc annular, 0.2 mm high. Pistil in the masc. fl. at the base surrounded by the disc, 0.6 mm high; ovary globose, 4-lobed; stigma subsessile.

**Type:** Lundell 6212 in h. Univ. Michigan.

**Distribution:** British Honduras.

BR. HONDURAS: El Cayo-distr., Valentin, Lundell 6212 (1936) in valley-forest (ex Lundell l.c.); Toledo-distr., Westmoreland, Schipp 1021 (1932) alt. 75 m, fl. masc. Sept. (BM, F, G, K, NY).

**Vern. name:** copal colorado (ex Lundell l.c.).

23. **Protium cuneatum** SWART in Rec. Trav. bot. néerl. XXXIX, p.191 (1942).

Tree, 18 m high. Branchlets stout, 5 mm in diam., glabrous, fuliginose. Leaves 3-jugate, 40 cm long, in all parts glabrous; petioles near the incrassate base semiterete, 9 cm long; interjuga terete, striate, above slightly carinate, at the nodes incrassate, 5 cm long; petiolules semiterete, above sulcate and dilated, at both ends incrassate, 1—1.5 cm long, the terminal ones 4 cm; leaflets oblong-lanceolate to oblong, distinctly narrowed to the acutely cuneate base, usually 16 cm long and 5 cm wide, but the terminal ones wider, the lateral ones asymmetric and the basal ones shorter; apex abruptly to rather abruptly acuminate; acumen sublinear, 5—6 mm long and 3—4 mm wide, obtuse; margin entire, undulate; subcoriaceous, smooth, above nitidous, beneath nitidulous; with 12—13 pairs of sec. nerves; prim. nerves prominent, sec. and tert. nerves on both sides prominulous. Inflorescences fasciculate in the axils, few-flowered, at most 5 cm long, in all parts glabrous. Branchlets few, angulose, up to 5 mm long. Pedicels terete, striate, slender, longer than the flowers, 3—4 mm; bracts and bractlets oblong-triangular, obtuse, about 0.5 mm long. Flowers 5-merous, 2.5 mm long. Calyx cupuliform, 1 mm high, carnose; its lobes triangular, obtusely subacuminate, longer than the tube. Petals elliptic-ovate, acute, inflexed-apiculate, carnose; margins papillose, pale. Stamens in the fem. fl. 1.25 mm long; filaments subulate, dilated, about as long as the oblong anthers. Disc annular, crenate, 0.5 mm high. Pistil in the fem. fl. 1.5 mm high; ovary depressed globose, slightly 5-lobed, 1.2 mm high; stigma sessile, 5-lobed.

**Type:** Krukoff 8186 in h.NY.

**Distribution:** once collected.

BRAZIL: Amazonas, basin R. Solimoes, Sao Paulo de Olivença, near Palmares, Krukoff 8186 (1936) fl. fem. Sept.-Oct. (NY).

**Vern. name:** breu.



This species differs from its nearest relatives, *P. panamense* (Rose) Johnston and *P. multiramiflorum* Lundell, chiefly by the acutely cuneate base of its leaflets and by its pentamerous flowers.

24. ***Protium tovariense*** PITT. in Trab. Mus. com. Venez. V, p.282 (1929) et ibidem VIII, p.366 (1931).

*Protium Icariba* (DC.) March. var. *glabrescens* Engl. in Mart. Fl. Bras. XII, 2, p.268 (1874); id., in DC. Mon. Phan. IV, p.69 (1883).

*Protium laxiflorum* Engl. var. *Fendleri* Engl. in DC. Mon. Phan. IV, p.66 (1883).

*Protium avilense* Pitt. in Trab. Mus. com. Venez. V, p.281 (1929) et ibidem VIII, p.364 (1931).

Tree, 3—25 m high. Branchlets rather stout, sulcate, when young minutely ferruginous sericeous, when adult glabrescent, lurid to fuscous and dotted with oblong pale brown lenticels. Leaves 1- or 2-jugate, rarely unifoliolate or 3-jugate, 12—21 cm long, rarely up to 35 cm; petioles near the base semiterete, dotted with lenticels, 3—4 (2.5—6.5) cm long, like the rhachis when young at times sparsely and minutely puberulous, but soon glabrescent; interjuga terete, striate, above slightly carinate, 2.5—3.5 (1.5—5) cm long; petiolules stout, semiterete, canaliculate, dilated, 10—15 (7.5—20) mm long, the terminal ones 20—30 (17.5—50) mm long, glabrous, when adult like the petiole and the rhachis rimose; leaflets elliptic, usually 9—10 (7—15) cm long and 4.5—5 (3.5—7.5) cm wide, but the terminal ones larger, mostly narrowed to the base, the lateral ones subsymmetric, usually slightly narrowed to the apex; apex abruptly acuminate or, rarely, subacuminate; acumen linear 2.5—5 mm long and 2.5—5 mm wide, obtuse; base cuneate to round; margin entire, repandous; coriaceous, smooth, nitidulous; with 10—14 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones hardly visible. Inflorescences axillary, branched from the base, rather lax, 4—5 (up to 7) cm long. Branchlets numerous, angulose, up to 2.5 cm long, like the stout, 2.25—3 mm long pedicels, the oblong-triangular, 1 mm long bracts and the ovate, 0.5 mm long bractlets sparsely and minutely puberulous to glabrous. Flowers 5-merous, rarely 4-merous, 2.5—3.5 mm long, greenish, glabrous in all parts. Calyx cupuliform, 0.5—0.75 mm high, minutely 5-dentate. Petals elliptic-triangular, acute, inflexed-apiculate, carinose. Stamens in the masc. fl. about 2 mm, in the fem. fl. 1—1.5 mm long; filaments subulate, at the base dilated; anthers oblong, in the masc. fl. 0.75 mm, in the fem. fl. 0.5 mm long. Disc annular, crenate,

0.3—0.4 mm high. Pistil at the base surrounded by the disc, in the masc. fl. as long as the filaments, in the fem. fl. surpassing the stamens; ovary depressed globose, 5-lobed, 0.8—1.5 mm high; style short, 5-sulcate, stigma 5-lobed. Drupe ovoid, sub-5-lobed, apex acute, base narrowed, 2.25 cm long and 1.75 cm in diam.; mesocarp thin, carnose; endocarp rather thick, woody; pyrenes 1 to 4.

**Type:** Pittier 10053 in h.US 1232576.

**Distribution:** north-eastern Venezuela.

**VENEZUELA:** Carabobo, upper Guaremales, on the road from Puerto Cabello to San Felipe, Pittier 8986 (1920) alt. 100—500 m, fr. July (B, G, GH, M, NY, US); Caracas, Karsten 64? (no date) fl. masc. (B, BRSL, LE, W) (type of *P. Icariba* (DC). March. var. *glabrescens* Engl.); id., Galipan, Pittier 123 (1921) fr. Oct. (NY, US); id., Altos de Galipan, Cerros del Avila, Pittier 8300 (1918) alt. 1850 m, fl. masc. Dec. (GH, US) (type of *P. avilense* Pitt.); Aragua, Colonia Tovar, Karsten (1848) fl. masc. Nov. (B, BRSL); id., Moritz 899 (no date) fl. fem. (B, P, W); id., Fendler 177 (1854—1855) fl. fem. and fr. (B, G, GH, K, P) (type of *P. laxiflorum* Engl. var. *Fendlerii* Engl.); id., Pittier 10053 (1921) alt. 1700—2300 m, in damp forest, fl. masc. and fr. Dec. (G, GH, NY, US) (type); id., id. 10064 (1921) alt. 1700—2300 m, in forest, fl. fem. Dec. (B, GH, NY, US).

**Vern. names:** VENEZUELA: tacamahaca, tacamahaca macho, a camahaco.

This species, which covers a limited area near the Caraibic coast of Venezuela, is recognizable in herbarium material by its dark brown to fuscous, elliptic, coriaceous leaves with incurved margin and pale nerves.

The fact that Pittier 8300 shows tetramerous flowers is insufficient to retain *P. avilense* Pitt. as a separate species.

**Uses:** The resin exuded from the bark, is said to be used as a vulnerary balsam and the wood is said to be used for shingles.

25. ***Protium laxiflorum* ENGL.** in Mart. Fl. Bras. XII, 2, p.275 (1874); id. in DC. Mon. Phan. IV, p.66 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, p.412 (1931); Pitt. in Trab. Mus. com. Venez. VIII, p.367 (1931).

*Tingulonga laxiflora* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree, 15 m high. Branchlets slender, terete, striate, when young densely and shortly ferruginous pilose, when adult glabrescent, castaneous, dotted with elliptic, pale brown lenticels. Leaves 2- to 5-jugate, mostly 3- or 4-jugate, 22—25 cm long; petioles semiterete, dilated, at the base incrassate, 3.5 cm long, like the rhachis, the petiolules and the prim. nerves provided with a few appressed hairs;

interjuga terete, striate, above slightly carinate, in the nodes incrassate, 3 cm long; petiolules canaliculate, at both ends incrassate, 7.5 mm long, the terminal ones 17.5 mm; leaflets oblong to elliptic-oblong, narrowed to the apex, usually 10.5 cm long and 4 cm wide, but the terminal ones wider, narrowed near the base and the lateral ones suboblique, the basal ones shorter and slightly narrower; apex rather abruptly acuminate; acumen linear, 12.5 mm long and 5 mm wide, obtuse; base broadly cuneate; margin entire; subcoriaceous, rigid, glabrous, dull; with 11—12 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. ones hardly prominulous above, prominent beneath, tert. ones above invisible, beneath prominulous. Inflorescences axillary, laxly branched from the base, with a fairly large number of flowers, longer than the petioles of the subtending leaves, 4—6 cm. Branchlets numerous, terete, striate, provided with a few short hairs, up to 4 cm long. Pedicels slender, terete, striate, twice as long as the flowers, like the flowers glabrous; bracts and bractlets oblong, acute, 0.75 mm long. Flowers 5-merous, 3 mm long, greenish yellow. Calyx cupuliform, 0.75 mm high; its lobes minute, broadly triangular, obtusely acuminate. Petals oblong-triangular, acute, inflexed-apiculate, subcarnose. Stamens in the fem. fl. 1.5 mm long; filaments subulate, 1 mm long; anthers elliptic-ovate. Disc annular, crenate, 0.25 mm high. Pistil in the fem. fl. as high as the stamens; ovary globose, 5-lobed, 0.7 mm high, tapering in a 5-sulcate style, as long as the ovary; stigma 5-lobed.

Type: Spruce 1889 in h.G.

Distribution: Brazil (Amazonas).

BRAZIL: Amazonas, basin R. Negro, between Barra and Barcellos, near Airas, Spruce 1889 (1851), on rocky mountains, fl. fem. Nov. (B, BM, C, G, K, LE, M, NY, P, W); id., Manaus, Spruce 1453 (ex Engl. l.c.).

This species resembles *P. heptaphyllum* (Aubl.) March. var. *surinamensis* (Miq.) Swart, but the latter differs by its mostly 2- or 3-jugate leaves, by its shorter petiolules and by its shorter inflorescences with shortly pedicellate tetramerous flowers.

26. *Protium trifoliolatum* ENGL. in Mart. Fl. Bras. XII, 2, p.266 (1874); id. in DC. Mon. Phan. IV, p.68 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulonga trifoliolata* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium Martianum* Engl. in Mart. Fl. Bras. XII, 2, p.266 (1874); id. in DC. Mon. Phan. IV, p.67 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulonga Martiana* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium titubans* Macbr. in Candollea V, p.379 (1934).

Shrub or small tree, 4.5—12 m high. Branchlets slender, subterete to subangulose, fuscous, when young like the petioles, the rhachis, the petiolules and the prim. nerves provided with a sparse, rarely rather dense, patent, ferruginous, villose indumentum, usually densely intermixed with minute to short fuscous hairs, when adult glabrescent, cinereous, smooth to scabridulous and dotted with elliptic, castaneous lenticels. Leaves 1- or 2-jugate, rarely unifoliolate or 3-jugate, 15—20 (13—22) cm long; petioles semiterete, above dilated, incrassate at the base, 2 (1.5—3) cm long; interjuga terete, striate, at the nodes incrassate, 3 (2—4.5) cm long; petiolules semiterete, canaliculate, subulate, at both ends incrassate, 7.5 (5—10) mm long, the terminal ones 30 (15—35) mm; leaflets oblong to oblong-elliptic, usually 8—10 (7—12) cm long and 3—4 (2—5) cm wide, but the terminal ones distinctly larger and slightly narrowed to the base, the lateral ones suboblique, mostly slightly narrowed to the apex; apex rather abruptly acuminate; acumen linear 5—10 mm long and 2—4 mm wide, obtuse; base cuneate; margin entire, repandous; chartaceous, glabrous, smooth, above nitidulous, beneath dull; with 9—10 (8—12) pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. nerves above depressed, beneath prominent, tert. ones above hardly visible, beneath prominent, sec. and tert. nerves scarcely pilose to glabrous. Inflorescences axillary, glomeruliform, 7.5—15 mm in diam. Branchlets terete, striate, sparsely ferruginous pubescent. Pedicels terete, striate, 1.5—2.5 mm long, like the triangular to ovate, 0.75 mm long bracts and bractlets and the outside of the calyx glabrous or provided with a few scattered ferruginous hairs. Flowers 4-merous, 3 mm long. Calyx cupuliform, 0.5—0.75 mm high; its lobes triangular, acute, as long as the tube. Petals elliptic-ovate, acute, inflexed-apiculate, glabrous, carnose. Stamens in the masc. fl. 2 mm, in the fem. fl. 1 mm long; filaments subulate, dilate; anthers oblong to lanceolate, 0.5—0.75 mm long. Disc annular, crenate, glabrous, in the masc. fl. 0.5 mm, in the fem. fl. 0.2 mm high. Pistil glabrous, in the masc. fl. 0.6 mm, in the fem. fl. 1.25 mm high; ovary globose, narrowed to both ends; stigma sessile to subsessile, 4-lobed. Drupe either oblique-ovoid and monopyrenous or ellipsoid, 2- to 4-lobed and 2- to 4-pyrenous, acute at both ends, 15—17.5 mm long and 10—20 mm in diam.; mesocarp rather thick, carnose; endocarp thin, brittle, woody.

Type: Spruce 2845 in h.P.

**Distribution:** equatorial South America, east of the Andes.

PERU: Loreto, near Iquitos, L. Williams 1521 (1929) fl. masc. July (F) (type of *P. titubans* Macbr.).

BRAZIL: Amazonas, R. Uaupès, near Panurè, Spruce 2845 (1852—1853) fr. Oct.-Jan. (B, BM, BR, C, G, K, LE, NY, P, W) (type); id., near Yapura, Martius (no date) fr. Dec. (B, M) (type of *P. Martianum* Engl.); id., basin R. Solimoes, Sao Paulo de Olivença, near Palmares, Krukoff 8288 (1936) fl. masc. Sept.-Oct. (NY); id., id. 8317 (1936) fl. Sept.-Oct. (NY); id., basin of Creek Belem, Krukoff 8870 (1936) fr. Oct.-Dec. (NY); Matto Grosso, basin R. Madeira, upper R. Machado, near Tabajara, Krukoff 1328 (1931) fl. fem. Nov.-Dec. (B, BM, F, G, K, NY, S, U).

FR. GUIANA: Mana R., Leschenault (1823—1824) fl. fem. (P); without loc., Mélinon (1864) (B).

**Vern. name:** PERU: bejuco.

Though the type specimens of *P. trifoliolatum* Engl. and *P. Martianum* Engl. differ in the nature of their indumentum, in the average number of their leaflets and in the relative size of their terminal and lateral leaflets, the other specimens referred to these species show a complete range of intermediate forms.

The differences between *P. titubans* Macbr. and *P. trifoliolatum* Engl. turned out to be so slight that the former species could not be retained.

*P. trifoliolatum* Engl. has been recorded by Glaziou in Bull. Soc. bot. Fr. LII, Mém.3, p.91 (1905) from Rio de Janeiro, but the same number, Glaz. 13674, has also been cited under *P. multiflorum* Engl. The specimen itself was not available to me.

27. **Protium unifoliolatum** ENGL. in Mart. Fl. Bras. XII, 2, p.262 (1874); id. in DC. Mon. Phan. IV, p.62 (1883); id. in E.-Pr; Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931); Britton in Bull. Tor. bot. Cl. XVI, p.189 (1889); LeCointe, Arv. e Pl. ut. Am. bras. III, p.64 (1934); Sampaio in Bol. Mus. nac. X, p.13 (1934). Non apud Pulle, Enum. Vasc. Pl. Surin. p.245 (1906) quod ad *P. heptaphyllum* (Aubl.) March. var. *unifoliolatum* Swart pertinet.

*Icica unifoliolata* Spr. Exs. 1960 mss. ex Engl. l.c.

*Icica simplicifolia* Mart. Obs. 2918 mss. ex Engl. l.c.

*Tingulonga simplicifolia* OK., Rev. Gen. Pl. I, p.107 (1891).

*Protium unifoliolatum* Engl. var. *subserratum* Engl. l.c.; Huber in Bol. Mus. Goeldi V, p.432 (1908).

Small tree. Branchlets slender, terete, striate, smooth, when young castaneous, like the petioles and the prim. nerves rather densely to sparsely puberulous, when adult glabrescent, greyish and dotted

with small, pale brown lenticels. Leaves unifoliolate, 9—14 cm long; petioles terete, at both ends incrassate, 1 cm long; leaflets oblong-lanceolate, sometimes slightly narrowed to the apex, 8—12 (7.5—16) cm long and 3—4 (2.75—6) cm wide; apex gradually narrowed in a tapering, 7.5—10 mm long and 5 mm wide, obtuse acumen; base acutely cuneate; margin entire or remotely but distinctly subserrate; pergamentaceous, glabrous, smooth, nitidulous; with 12—13 (11—14) pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. ones above prominulous, beneath prominent, tert. ones above hardly visible, beneath prominulous, sec. and tert. ones glabrous. Inflorescences axillary, glomeruliform, 1 cm in diam, in all parts glabrous. Pedicels terete, striate, about 1 mm long; bracts and bractlets ovate-triangular, 0.25 mm long. Flowers 4-merous, 4—4.5 mm long, white to greenish yellow. Calyx cupuliform, 1 mm high; its lobes triangular, acutely acuminate, as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate. Stamens in the masc. fl. 2.5 mm, in the fem. fl. 1.75 mm long; filaments subulate; anthers lanceolate, 0.75 mm long. Disc annular, crenate, glabrous, 0.25 mm high. Pistil glabrous, in the masc. fl. 1 mm, in the fem. fl. 2.5 mm high; ovary globose, 4-lobed, 4-celled; style 4-sulcate, once to twice the length of the ovary; stigma 4-lobed. Drupe globose, 2- or 3-lobed, 1 cm long and 1 cm in diam.; mesocarp rather thick, carnose; endocarp thin, brittle, woody; pyrenes 1 to 3.

**Type:** Martius (Obs.n.) 2918 in h.M.

**Distribution:** Brazil (Amazonas and Para).

**BRAZIL:** Amazonas, R. Negro, between Barcellos and San Isabel, Spruce 1960 (1851) fl. masc. Dec. (B, BM, C, G, K, L, LE, M, NY, P, W) (type of *P. unifoliolatum* Engl. var. *subserratum* Engl.; *I. unifoliolata* Spr. mss.); id., Barcellos, Ducke 7091 and 7106 (1905) (ex Huber l.c.); id., near Ega, Martius, Obs. 2918 (no date) fl. fem. and fr. Dec. (B, BR, LE, M, W) (*Icica simplicifolia* Mart. mss.) (type); id., Poeppig 2888 (1831) fl. Dec. (BRSL, G, K, W); id., Falls of R. Madeira, Rusby 2578 (1886) fl. masc. Oct. (B, F, K, NY, US, W); Para, Serra de Santarem, Schwacke 773 (1878) fl. Jan. (B).

**Vern. names:** BRAZIL: breu branco da varzea, breu branco comum (ex LeCointe l.c.; Sampaio l.c.).

As the leaflets of Rusby 2578 show an entire margin as well as a subserrate one it was impossible to retain Engler's var. *subserratum*.

This species is nearly related to *P. heptaphyllum* (Aubl.) March. var. *unifoliolatum* Swart, but the latter differs by its entirely glabrous and, sometimes, trifoliolate leaves.

**var. macrophyllum** HUBER in Bol. Mus. Goeldi V, p.432 (1908).

Leaves always unifoliolate, 15—20 cm long; margin slightly repandous.

Type: Ducke 4898.

Distribution: once collected.

BRAZIL: Para, Alemquer, Ducke 4898 (1903) (ex Huber).

As I did not see this specimen I could not study this variety, but I doubt whether it is sufficiently distinct.

**var. puberulum** HOEHNE in Comm. Lin. Tel. Estr. Matto Grosso ao Amazonas, Bot. VI, Annexe 5, p.31 (1915); id., Res. hist. Comm. Anniv. Sec. bot. a agr. Inst. Biol. Sao Paulo p.118 (1937).

Leaves larger than in the type; petioles, rhachis and prim. nerves densely pubescent.

Type: Kuhlmann 507—511.

Distribution: once collected.

BRAZIL: Matto Grosso, R. Arinos, Kuhlmann 507—511 (1914) fl. Dec. (ex Hoehne).

In the density of the indumentum this specimen, which I did not see, may differ distinctly from the species.

28. **Protium glaucum** MACBR. in Candollea V, p.379 (1934); L. Williams in Field Mus. N.H., Bot. S. XV, p.233 (1936).

Tree, 9—12 m high; bole pale grey or dark purplish brown. Branchlets rather stout, terete, striate, when young cinereous tomentellous, when adult glabrescent, fuscous. Leaves 2- or 3-jugate, 31—35 cm long; petioles semiterete, at the base hardly incrassate, 7—9.5 cm long, like the rhachis and the petiolules sparsely and minutely pilose; interjuga angulose, striate, above near the apex slightly bisulcate, 4—4.5 cm long; petiolules semiterete, above flattened and bisulcate, at both ends slightly incrassate, 7.5—10 mm long, the terminal ones 25—30 mm; leaflets lanceolate to oblong, usually 12.5—15 cm long and 4.75—5.75 cm wide, but the terminal ones larger and slightly narrowed to both ends, the lateral ones suboblique and the basal ones shorter; apex abruptly acuminate; acumen sublinear, 4 mm long and 4 mm wide, obtuse; base broadly cuneate; margin entire, undulate; subcoriaceous, glabrous, smooth, above nitidulous, glaucous, beneath dull and green; with 15—16 pairs of sec. nerves; prim. nerves above prominulous, beneath distinctly

prominent, sec. ones prominent, tert. ones prominulous, all glabrous. Inflorescences axillary, branched from the base, many-flowered, 2—5 cm long. Branchlets many, up to 1 cm long, terete, striate, sparsely puberulous. Pedicels robust, terete, striate, 2.5 mm long, glabrous; bracts and bractlets triangular, obtusely acuminate, 0.4 mm long, minutely pubescent. Flowers 5-merous, 4 mm long, in all parts glabrous, greenish. Calyx cupuliform, 1 mm high; its lobes broadly triangular, obtusely subacuminate, 0.25—0.15 mm long. Petals oblong-triangular, acute, inflexed-apiculate, carnose. Stamens 2 mm long; filaments flattened; anthers oblong-lanceolate, 1 mm long. Disc annular, crenate, 0.25 mm high. Pistil in the masc. fl. 0.75 mm, in the fem. fl. 1.25 mm high; ovary depressed globose, surrounded by the disc; stigma sessile, 5-lobed.

**Type:** L. Williams 4772 in h.F. 626549.

**Distribution:** Andes of northern Peru.

PERU: Loreto, lower R. Huallaga, Yurimaguas, Santa Rosa, L. Williams 4772 (1929) alt. 150 m, in forest, fl. fem. Nov. (F, G, K, US); San Martin, upper R. Huallaga, Juan Jui, Klug 3821 (1934) alt. 400 m, forest, fl. masc. Sept. (B, BM, F).

This species resembles *P. Almecega* March., but the latter differs by its smaller leaves, by its nearly ovate leaflets, which are gradually narrowed in a longer acumen, and by its pilose pedicels and calyx, the latter provided with lobes as long as the tube.

**Anatomy:** L. Williams l.c.

**Use:** The wood is said to be used for fuel.

29. ***Protium glaucescens*** URB., Symb. Ant. VII, p.239 (1912); id., ibidem VIII, p.328 (1920); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.412 (1931).

Tree. Branchlets slender, 2.5 mm in diam., terete, glabrous, smooth, cinereous to castaneous and dotted with small, elliptic lenticels. Leaves 2- (1- to 3-) jugate, 13—15 cm long; petioles near the incrassate base semiterete, 2 cm long, like the rhachis and the petiolules when young rather densely but minutely pilose, when adult glabrescent and scabrous; interjuga terete, striate, at the nodes incrassate, 2.25 cm long; petiolules semiterete, above sulcate, at both ends incrassate, 5 mm long, the terminal ones 15 mm; leaflets lanceolate to oblong-elliptic, usually 6.5 cm long and 2.75 cm wide, but the terminal ones wider and sometimes narrowed to the base and the basal ones shorter; apex 3 mm long and 5 mm wide, ob-



tusely acuminate; base acute; margin entire; subcoriaceous, smooth, glabrous, above nitidous, glaucous, beneath nitidulous glaucescent; with 9—10 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. and tert. ones prominulous, all glabrous. Inflorescences axillary, branched from the base, rather lax, many-flowered, 1.5—2.5 cm long. Branchlets terete, striate, glabrous or provided with some short hairs. Pedicels slender, terete, 2 mm long, glabrous; bracts and bractlets oblong-triangular, acute, fimbriate, 0.75—0.5 mm long. Flowers 4-merous, 3 mm long, white, in all parts glabrous. Calyx cupuliform, 1 mm high; its lobes triangular, obtusely subacuminate, as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, subcarinose; margins papillose. Stamens in the masc. fl. 1.5 mm long; filaments subulate, at the base dilated, 1 mm long; anthers oblong. Disc annular, crenate, 0.5 mm high. Pistil in the masc. fl. 0.8 mm high; ovary embedded in the disc, globose, 4-lobed, 4-celled, 0.5 mm high; stigma 4-lobed, subsessile.

Type: Fuertes 946 in h.B.

Distribution: Santo Domingo.

HAITI: Santo Domingo, Barahona, between Maniel and Paradis, Fuertes 946 (1911) alt. 200 m, fl. masc. July (B, BM, G, GH, L, NY, S, U, US, W).

This species resembles *P. Almecega* March., but the latter differs by its angular and robust rhachis, by the distinct acumen, the 14—16 pairs of sec. nerves and the indumentum at the base of the prim. nerves of its leaflets and by its pilose pedicels.

30. *Protium subacuminatum* SWART in Rec. Trav. bot. néerl. XXXIX, p.192 (1942).

Small tree. Branchlets rather stout, 5 mm in diam., terete, striate, like the petioles, the rhachis and the petiolules when young rather densely but minutely brunnescent pilose and when adult mostly glabrescent, scabrous, cinereous and dotted with small, elliptic, ferrugineous lenticels. Leaves 2- or 3- (1- to 4-) jugate, 15—20 (12—22.5) cm long; petioles semiterete, 4 (3—6) cm long; interjuga angulose, at the nodes slightly incrassate, 2.5—3 cm long; petiolules terete, striate, above sulcate, 7.5—10 mm long, the terminal ones 15—20 mm; leaflets oblong to elliptic, usually 7 (5.5—8) cm long and 3.5 (2.5—4) cm wide, but the terminal ones wider and mostly slightly narrowed to the base, the lateral ones suboblique and the basal ones smaller; apex subacute, up to 2.5 mm long and 5 mm

wide, obtusely acuminate; base broadly cuneate; margin entire, often incurved; coriaceous, glabrous, smooth, nitidulous; with 10—12 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath distinctly prominent, tert. ones prominulous, all glabrous. Inflorescences axillary, hardly branched, many-flowered, 15—20 mm long. Branchlets terete, like the terete, striate stout, 1.5 mm long pedicels, the oblong, acute, 1 mm long bracts, the oblong-triangular, acute, 0.75 mm long bractlets and the outside of the calyx and the corolla rather densely to sparsely patent-puberulous. Flowers 4-merous, 2.5 mm long. Calyx cupuliform, 0.75 mm high; its lobes broadly triangular, acute, 0.25 mm long. Petals ovate-triangular, acute, inflexed-apiculate, carnosae; margins papillose. Stamens in the masc. fl. 2 mm, in the fem. fl. 1.5 mm long; filaments subulate, dilated; anthers oblong, 0.75 mm long. Disc annular, glabrous, 0.5 mm high. Pistil glabrous, in the masc. fl. 0.8 mm high and the ovary embedded in the disc; in the fem. fl. as high as the stamens, the ovary at the base surrounded by the disc and depressed globose, 4-lobed, 4-celled, about 1 mm high, tapering in a subsessile, 4-lobed stigma. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 3-lobed and 2- to 3-pyrenous, about 1 cm long and 1 cm in diam.

**Type:** Ekman 2005 in h.B.

**Distribution:** eastern Cuba.

CUBA: Oriente, Bayate, near R. Piedra, Ekman 2005 (1914) fl. fem. July (B, S) (type); id., Sierra de Nipe, R. Piloto, Ekman 2547 (1914) fl. Aug. (S); id., Arroyo to Piedra Gorda, Shafer 3528 (1910) alt. 150 m, thicket, fr. Jan. (GH, K, NY, US); id., Arroyo Blanco, Leriza, Roig 158 (1917) fr. Sept. (NY); id., Baracoa, Moa, Roig 35 (1917) fl. masc. Aug. (NY).

This species is related to *P. cubense* (Rose) Urb., but the latter differs by its glabrous leaves and by its distinctly acuminate leaflets with hardly visible tert. nerves above.

31. **Protium Krukoffii** SWART in Rec. Trav. bot. néerl. XXXIX, p.193 (1942).

Small tree, 7.5 m high. Leaves 3- to 4-jugate, 23—27 cm long; petioles semiterete, at the base slightly incrassate, 3—4 cm long, like the rhachis and the petiolules rather densely but minutely pilose, when adult glabrescent; interjuga terete, striate, near the apex slightly bisulcate, 2.5—4 cm long; petiolules semiterete, above bisulcate, at both ends incrassate, about 1 cm long, the terminal ones 2.25 (1.5—3) cm; leaflets oblong to oblong-elliptic, usually

10—11 cm long and 4—5 cm wide, but the terminal ones wider and narrowed to the base, the lateral ones oblique and the basal ones smaller; apex rather abruptly acuminate; acumen linear, 12.5 mm long and 2.5 mm wide, obtuse; base broadly cuneate; margin entire, undulate; pergamentaceous, glabrous, smooth, nitidulous; with about 11 pairs of sec. nerves; prim. nerves prominent, above rather densely but minutely pilose, beneath glabrous, sec. ones prominent, tert. ones above prominulous, beneath prominent, sec. and tert. ones glabrous. Inflorescences fasciculate in the axils, branched from the base, 5—6 cm long. Branchlets angulose, sparsely puberulous, up to 3 cm long. Pedicels angulose, 1.5 mm long, glabrous; bracts and bractlets oblong-triangular, obtuse, 0.3 mm long. Flowers 4-merous, 2.5 mm long, in all parts glabrous. Calyx cupuliform, 0.5 mm high, minutely 4-dentate. Petals elliptic-ovate, acute, indexed-apiculate, carnose. Stamens in the fem. fl. 1 mm long; filaments subulate, 0.7 mm long; anthers oblong. Disc annular, 8-lobed, 0.3 mm high. Pistil in the fem. fl. 1.25 mm high; ovary at the base surrounded by the disc, ovoid, 4-lobed, 4-celled, 0.8 mm high, tapering in a short style, crowned by a 4-lobed stigma.

Type: Krukoff 8108 in h.NY.

Distribution: Once collected.

BRAZIL: Amazonas, basin R. Solimoes, Sao Paulo de Olivença, near Pa mares, Krukoff 8108 (1936) in old clearing, fl. fem. Sept.-Oct. (NY).

This species is related to *P. Aracouchini* (Aubl.) March., but the latter differs by its mostly 2-jugate and entirely glabrous leaves, by its slender inflorescences, by its smaller flowers and by its long styles.

32. *Protium elegans* ENGL. in Mart. Fl. Bras. XII, 2, p.273 (1874); id. in DC. Mon. Phan. IV, p.74 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulona elegans* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium Spruceanum* Engl. in errore Glaz. in Bull. Soc. bot. Fr. LII, Mém.3, p.92 (1905).

Small to large tree. Branchlets slender, 2—2.5 mm in diam. terete, castaneous to fuscous, when young densely but minutely pilose, when adult glabrescent and dotted with small, elliptic lenticels. Leaves 1- or 2-jugate, rarely 3-jugate, 10—15 (8—17.5) cm long; petioles semiterete, dilated, 1—2 cm long, like the rhachis and the petiolules rather densely to sparsely and minutely pilose; interjuga

semiterete, above flattened and bisulcate, at the nodes hardly in-crassate, longer than the petioles, 1.5—2.25 cm long; petiolules semiterete, above sulcate and subalate, 3—4 mm long, the terminal ones 10—15 mm; leaflets lanceolate to lanceolate-oblong, narrowed to both ends, usually 8 (6—9) cm long and 2.25 (2—2.75) cm wide, but the terminal ones longer, the lateral ones suboblique and the basal ones smaller; apex gradually to rather abruptly acuminate; acumen linear, 5—10 mm long and 2.5—3 mm wide, obtuse; base acutely cuneate; margin entire or near the apex subserrate, undulate; pergamentaceous, glabrous, smooth, nitidulous; with 12—13 pairs of sec. nerves; prim. nerves above distinctly prominent and pilose like the petiolules, beneath prominent and glabrous, sec. and tert. ones glabrous, above hardly prominulous, beneath prominulous. Inflorescences axillary, slender, hardly branched, few-flowered, 3.5 (2—5) cm long; its axes angulose, like the terete, striate, 2 mm long pedicels, the oblong-triangular, obtuse, 1.5 mm long bracts and bractlets and the outside of the calyx sparsely and minutely pilose. Flowers 4-merous, 3 mm long, brunnescent. Calyx cupuliform, 1 mm high; its lobes semiorbicular, subacuminate, as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, subcarnose, glabrous. Stamens in the masc. fl. 1.5 mm long; filaments subulate, 1 mm long; anthers elliptic. Disc annular, glabrous. Pistil glabrous; ovary in the masc. fl. embedded in the disc, globose 4-lobed; stigma sessile, 4-lobed. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 4-lobed and 2- to 4-pyrenous, with acute apex, 10—15 mm long and 7.5—10 mm in diam.; exocarp reddish; mesocarp thin, carnos; endocarp thin, brittle, woody.

Type: Spruce 2824 in h.P.

Distribution: Brazil and Fr. Guiana.

FR. GUIANA: Leblond, Gabriel and Poiteau (no date) fr. (G).

BRAZIL: Amazonas, R. Uaupès, near Panuré, Spruce 2824 (1852—1853) fr. Oct.-Jan. (B, BM, BR, C, F, G, K, LE, NY, P, W); Rio de Janeiro, Serra de Jerecino, near Campo Grande, Glaziou 9710 (no date) fl. masc. Aug.-Sept. (C).

This species is related to *P. Aracouchini* (Aubl.) March., but the latter differs by its entirely glabrous leaves, by the subrotundate base and the abruptly and also longer acuminate apex of its leaflets and by its larger and wholly glabrous inflorescences.

*P. Spruceanum* Engl. differs from *P. elegans* Engl. by the stronger developed indumentum of its more robust, wider and not-narrowed leaflets and by its pentamerous flowers.

**A n a t o m y :** Guill. in Ann. Sc. nat., S.9, X, p.208 (1909).

33. **Protium Melinonis** ENGL. in DC. Mon. Phan. IV, p.68 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulonga Melinonis* OK., Rev. Gen. Pl. I, p.108 (1891).

Branchlets slender, 2.5 mm in diam., terete, striate, glabrous, when young fuscous, when adult pale brown. Leaves 3-jugate, rarely 2-jugate, 16.5 cm long; petioles semiterete, at the base incrassate, 3.5 cm long, like the rhachis and the petiolules sparsely and patently puberulous; interjuga angulose, above flattened and bisulcate, 2.5 cm long; petiolules semiterete, above sulcate and dilated, 2.5 mm long, the terminal ones 15 mm; leaflets lanceolate to oblong-lanceolate, mostly narrowed to both ends, usually 6.5 cm long and 2 cm wide, but the terminal ones slightly larger, the lateral ones suboblique and the basal ones smaller; apex rather abruptly acuminate; acumen 4 mm long and 3 mm wide, obtuse; base acutely cuneate; margin entire, undulate; pergamentaceous, glabrous, smooth, nitidulous; with 10—13 pairs of sec. nerves; prim. nerves above grooved on each side, pilose like the petiolules, beneath prominent, glabrous, sec. ones above prominulous, beneath prominent, tert. ones above hardly visible, beneath prominulous, sec. and tert. ones glabrous. Inflorescences axillary, subterminal, lax, few-flowered, 12 cm long, at the base provided with some sec. branchlets, up to 1 cm long. Axes terete, striate, slender, like the terete, striate 3 mm long pedicels, the ovate-triangular, 0.5 mm long bracts and bractlets and the outside of the calyx provided with some, scattered, patent hairs. Flowers 5-merous, 3.5 mm long. Calyx cupuliform, 1 mm high; its lobes broadly triangular, obtusely subacuminate, as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, sub-carnose. Disc annular, crenate, glabrous. Pistil glabrous; ovary in the fem. fl. at the base surrounded by the disc, globose, 5-lobed, 5-celled; stigma subsessile, 5-lobed. Drupe ovoid, acute, 11 mm long and 8 mm in diam.; mesocarp thin, carnose; endocarp rather thick, woody.

**Type:** Mélinon 250 in h.P.

**Distribution:** Fr. Guiana.

FR. GUIANA: Mélinon 250 (1842) fl. fem. and fr. (B, L, P).

34. **Protium pilosellum** SWART in Rec. Trav. bot. néerl. XXXIX, p.193 (1942).

Tree, about 10 m high. Branchlets rather slender, terete to subterete, glabrous, smooth, cinereous. Leaves 5- or 6-jugate, 30 cm long; petioles semiterete, 3 cm long, like the rhachis, the petiolules and the prim. nerves rather densely and shortly pilose, when adult sometimes glabrescent; interjuga terete, near the apex bisulcate and dilated, at the nodes incrassate, 3 cm long; petiolules semiterete, canaliculate, at both ends incrassate, 5 (2—10) mm long, the terminal ones 25 mm; leaflets lanceolate to oblong, narrowed to the apex, usually 11 cm long and 3 cm wide, but the terminal ones slightly shorter and wider and narrowed to the base, the lateral ones oblique and the basal ones shorter; apex gradually narrowed in a linear, 20 mm long and 7.5 mm wide, obtuse acumen; base cuneate; margin entire, undulate; pergamentaceous, glabrous, smooth, above glaucescent and dull, beneath nitidous; with 10 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones above inconspicuous, beneath hardly visible, sec. and tert. nerves glabrous or subglabrous. Inflorescences axillary, glomeruliform. Pedicels terete, 2—3 mm long, like the triangular, acute, 1.5 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely puberulous. Flowers 4-merous. Calyx cupuliform; its lobes broadly triangular, as long as the tube. Petals oblong-triangular, acute. Disc annular, glabrous. Drupe oblique-globose, 2- to 3-lobed, glabrous, smooth, 10 mm long and 8 mm in diam., provided with a 1 mm long rudiment of a 4-sulcate style; mesocarp rather thick, carnos; endocarp thin, woody; pyrenes 2 to 3.

Type: Krukoff 1433 in h.U 7922A.

Distribution: Brazil (Matto Grosso).

BRAZIL: Matto Grosso, basin R. Madeira, upper R. Machado, near Tabajara, Krukoff 1433 (1931) on varzea land, fr. Nov. (B, BM, F, G, K, NY, U); id., id. 1460 (1931) fr. Nov.-Dec. (BM).

This species is related to *P. heptaphyllum* (Aubl.) March.

35. *Protium glabrescens* SWART in Rec. Trav. bot. néerl. XXXIX, p.194 (1942).

Large tree, 20—30 m high. Branchlets stout, 4—8 mm in diam., when young like the petioles, the rhachis and the petiolules rather densely but minutely ferruginous pilose, when adult glabrescent, cinereous and scabrous, and dotted with oblong ferruginous lenticeles. Leaves 4- or 5-jugate, rarely 2- or 3-jugate, 35—40 cm long; petioles semiterete, subulate, at the base incrassate, 8 (6—12) cm long, when adult like the rhachis and the petiolules glabrescent and

scabrous; interjuga stout, terete, striate, near the apex mostly bisulcate and subulate, at the nodes slightly incrassate, 3 (2.5—5) cm long; petiolules stout, terete, striate, at both ends slightly incrassate, 10 (7.5—15) mm long, the terminal ones 25 (12.5—40) mm; leaflets lanceolate-oblong, irregular in shape, mostly slightly narrowed to the apex, usually 17.5 (10.5—25) cm long and 5.5 (4.25—8) cm wide, but the terminal ones slightly narrowed to the base, the lateral ones oblique and the basal ones shorter; apex gradually narrowed in a tapering, 7.5—12.5 mm long and 2.5—5 mm wide, obtuse acumen; base broadly cuneate; margin entire, undulate; coriaceous, glabrous, above smooth and nitidous, beneath scabridulous and dull; with 15 (14—17) pairs of sec. nerves; prim. nerves above grooved on each side and glabrous, beneath distinctly prominent and pilose like the rhachis, sec. nerves above depressed, beneath prominent, tert. ones above conspicuous, beneath prominulous, sec. and tert. ones glabrous. Inflorescences axillary, laxly branched from the base, many-flowered, 5.5—7.5 cm long. Branchlets angulose, rather stout, up to 3.5 cm long, like the terete, 2 mm long pedicels, the triangular-ovate, obtuse, about 1 mm long bracts and bractlets and the outside of the calyx and corolla rather densely to sparsely ferruginous puberulous. Flowers 4-merous, nearly 4 mm long. Calyx cupuliform, about 1 mm high; its lobes broadly triangular, subobtuse, as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, carnose. Stamens in the fem. fl. 1.75 mm long; filaments subulate, 1 mm long; anthers lanceolate. Disc annular, 8-lobed, glabrous, 0.5 mm high. Pistil in the fem. fl. nearly 2 mm high, glabrous; ovary at the base surrounded by the disc, ovoid, 4-lobed, 4-celled, 1.25 mm high, tapering in a 0.3 mm long style and crowned by a 4-lobed stigma. Drupe ovoid, oblique or 2- to 3-lobed, acute, 17.5 mm long and 10—12.5 mm in diam.; mesocarp carnose; endocarp thin, woody; pyrenes 1 to 3.

Type: Krukoff 5486 in h.NY.

Distribution: Brazil (southern Amazonas).

BRAZIL: Terr. de Acre, basin R. Purus, near mouth R. Macauhan, Krukoff 5468 (1933) fl. fem. Aug. (B, F, K, NY); Amazonas, basin R. Madeira, Humayta, near Tres Casas, Krukoff 6083 (1934) on varzea land, fr. Sept. (K, NY, U).

Vern. name: almesca.

This species is related to *P. Almecega* March., but the latter differs by its much smaller leaves, by its petioles being but slightly longer than the interjuga, by its subcoriaceous leaflets and by its smaller inflorescences with smaller, usually pentamerous, flowers.

36. **Protium pedicellatum** SWART in Rec. Trav. bot. néerl. XXXIX, p.195 (1942).

Tree, 10—22 m high. Branchlets stout, 5 mm in diam., terete, striate, when young densely ferrugineous puberulous, when adult glabrous, scabridulous and cinereous. Leaves 4- to 5- (2- to 6-) jugate, 25—45 cm long; petioles semiterete, mostly twice as long as the interjuga, 7—10 (4.5—12) cm, like the rhachis and the petiolules sparsely, patent-puberulous, when adult glabrescent; interjuga terete, towards the apex slightly bisulcate and subalate, at the nodes incrassate, 3.5—4 (3—6) cm long; petiolules semiterete, canaliculate, incrassate at both ends, 10—15 (7.5—17.5) mm long, the terminal ones 35—40 (25—45) mm; leaflets oblong-lanceolate to oblong, mostly narrowed to the base, usually 11—12 (9.5—16) cm long and 3.75—4.25 (3—5.25) cm wide, but the terminal ones and the basal ones shorter, the lateral ones suboblique; apex abruptly acuminate; acumen linear, 10—25 mm long and 1.5—2 mm wide, obtuse; base cuneate; margin entire, undulate; subcoriaceous to coriaceous, glabrous and smooth, above nitidous, beneath nitidulous; with 10—12 (9—13) pairs of sec. nerves; prim. nerves above grooved on each side, near the base rather densely but minutely pilose, beneath distinctly prominent, near the base pilose like the petiolules, sec. ones above grooved on each side, beneath prominent, tert. ones above visible, beneath prominulous, sec. and tert. ones glabrous. Inflorescences axillary, slender, laxly branched, many-flowered, 13—25 cm long; the branchlets angular, glabrous or subglabrous, up to 5 cm long. Pedicels terete, striate, slender, 3.5 mm long, like the triangular, acute 0.5 mm long bracts and the triangular, 0.25 mm long bractlets glabrous. Flowers 4-merous, 2.25 mm long, glabrous in all parts. Calyx shallowly cupuliform, 0.25 mm high; its lobes broadly triangular, obtuse, minute. Petals ovate-triangular, acute, inflexed-apiculate, subcarinose. Stamens in the masc. fl. 1 mm long; filaments conical, 0.5 mm long; anthers elliptic. Disc annular, 8-lobed, 0.4 mm high. Pistil glabrous, in the masc. fl. 0.5 mm high; ovary embedded in the disc, globose, 4-lobed; stigma sessile, 4-lobed. Drupe ellipsoid, 25—30 mm long and 12.5—20 mm in diam.; mesocarp thin, carinose; endocarp woody; pyrenes 1 to 3.

Type: Krukoff 7226 in h.U 23099A.

Distribution: Brazil (southern Amazonas and northern Matto Grosso).

BRAZIL: Amazonas, basin R. Solimoes, São Paulo de Olivença, near Palmares, Krukoff 8195 (1936) fl. masc. Sept.-Oct. (NY); id., basin R. Madeira, Humayta, between R. Livramento and R. Ipixuna, Krukoff 7069



(1934) on campinarana, fr. Nov. (K, NY, U); id., id. 7226 (1934) fr. Nov. (K, NY, U) (type); Matto Grosso, basin R. Madeira, upper R. Machado, near Tabajara, Krukoff 1378 (1931) fr. Nov. (B, BM, F, G, K, NY, U).

This species resembles *P. Aracouchini* (Aubl.) March., but the latter differs chiefly by its glabrous, mostly 2-jugate and smaller leaves and by its shorter inflorescences and pedicels.

37. ***Protium Spruceanum*** (BENTH.) ENGL. in Mart. Fl. Bras. XII, 2, p.276 (1874); id. in DC. Mon. Phan. IV, p.76 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.137 (1897) et ed.2, XIXa, p.412 (1931). Non apud Glaz. in Bull. Soc. bot. Fr. LII, Mém.3, p.92 (1905) quod ad *P. elegans* Engl. pertinet.

*Icica Spruceana* Benth. in Hook. Journ. of Bot. IV, p.16 (1852); Mueller in Walp. Ann. Bot. Syst. IV, p.449 (1857).

*Tingulonga Spruceana* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree, 12—15 m high. Branchlets rather stout, 3 mm in diam., terete, striate, smooth, when young densely but minutely ferruginous pilose, when adult glabrescent, greyish black, dotted with oblong ferruginous lenticels. Leaves 2- to 4-jugate, 20—25 cm long; petioles semiterete, at the base incrassate, 4 (3—5.5) cm long, like the rachis and the petiolules rather densely cinereous puberulous; interjuga terete, above near the apex slightly bisulcate and subalate, 2—3 cm long; petiolules terete, subcanaliculate, at both ends incrassate, 3—5 mm long, the terminal ones 17.5 mm; leaflets oblong-lanceolate, usually 8.5—10 cm long and 2.75—3.5 cm wide, but the terminal ones shorter and distinctly narrowed to the base, the lateral ones subsymmetric, sometimes slightly narrowed to the base or to the apex and the basal ones shorter; apex rather abruptly acuminate; acumen linear, 10 mm long and 2 mm wide, obtuse; base acutely cuneate; margin entire, undulate; pergamentaceous, above glabrous and nitidulous, beneath glabrous or subglabrous and dull; with about 16 pairs of sec. nerves; prim. nerves above grooved on each side, sparsely and minutely pilose, beneath distinctly prominent and rather densely ferruginous pubescent, sec. nerves above prominulous and glabrous, beneath prominent and sparsely puberulous or glabrous, tert. ones hardly prominulous and glabrous. Inflorescences axillary, branched from the base, 2 (1—3) cm long; the axes terete, striate, sparsely pubescent. Pedicels terete, striate, about as long as the flowers, near the base sparsely puberulous; bracts and bractlets ovate, obtuse, puberulous, 0.35 mm long. Flowers 5-merous, 3 mm long, virescent, in all parts glabrous. Calyx cupuliform, 0.75 mm high; its lobes broadly triangular, acutely sub-

acuminate, as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, subcarnose, on the margins papillose. Stamens in the masc. fl. 1.75 mm long; filaments subulate, as long as the oblong anthers. Disc annular, crenate, 0.25—0.35 mm high. Pistil in the masc. fl. nearly 1 mm high, in the fem. fl. about as high as the stamens; ovary at the base surrounded by the disc, depressed globose, 5-lobed, 5-celled, tapering in a sessile, 5-lobed stigma. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 3-lobed and 2- to 3-pyrenous, 1 cm long and 1—1.25 cm in diam.; exocarp red and white; mesocarp rather thin, carnose; endocarp thick, woody.

Type: Spruce 1319 in h.K.

Distribution: Brazil (Amazonas).

BRAZIL: Amazonas, R. Uaupès, near Panuré, Spruce 2692 (1852) in forest on rocky ground, fl. masc. Dec. (B, BM, BR, C, G, K, LE, NY, P, W) and probably the same under number 2699 (B, W); id., R. Negro, Barra, Spruce 1123 (1850—1851) fr. Dec.-Mar. (B, BM, C, G, K, LE, M, NY, W); id., id. 1319 (1851) fr. Febr. (K, P) (type); id., basin R. Negro, Manaus, near Aleixo, Krukoff 8031 (1936) in high forest, fl. fem. Aug.-Sept. (NY).

Vern. name: breu.

Anatomy: Solereder, Syst. Anat. Dic. p.216, 217 (1899).

### 38. *Protium Benthamii* SWART nom. nov.

*Icica pubescens* Benth. in Hook. Journ. of Bot. IV, p.16 (1852); Mueller in Walp. Ann. Bot. Syst. IV, p.449 (1857).

*Protium pubescens* Engl. (non W. et A.) in Mart. Fl. Bras. XII, 2, p.265 (1874); id. in DC. Mon. Phan. IV, p.67 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931); ?Britton in Bull. Tor. bot. Cl. XVI, p.189 (1889).

*Tingulonga pubescens* OK., Rev. Gen. Pl. I, p.108 (1891).

Small tree, 7.5 m high. Branchlets slender, 2 mm in diam., terete, when young like the petioles and the petiolules rather densely cinereous puberulous, when adult glabrescent and caesious. Leaves trifoliolate, rarely unifoliolate, about 17.5 cm long; petioles semiterete, 1.75 cm long; petiolules semiterete, at both ends incrassate, 6 mm long, the terminal ones 30 mm; leaflets lanceolate to lanceolate-oblong, the terminal ones 12.5 cm long and 4.5 cm wide, mostly narrowed to the base, the lateral ones 8.5 cm long and 3.25 cm wide, nearly symmetric and usually narrowed to the apex; apex gradually narrowed in a linear, 10 mm long and 5 mm wide, obtuse acumen; base cuneate; margin entire or remotely and obtusely serrate;

pergamentaceous glabrous, smooth and dull; with 8—10 pairs of sec. nerves; prim. nerves above grooved on each side and rather densely but minutely pilose, beneath distinctly prominent and sparsely puberulous, sec. ones above prominulous and minutely pilose, beneath prominent and glabrous, tert. ones glabrous, above hardly visible, beneath prominent. Inflorescences axillary, glomeruliform, less than 1 cm in diam., many-flowered. Pedicels terete, striate, slender, glabrous, 2 mm long; bracts and bractlets triangular, acute, on the margins fimbriate, 0.5 mm long. Flowers 4-merous, 4.5 mm long, white, in all parts glabrous. Calyx cupuliform, 1 mm high; its lobes semiorbicular, acutely acuminate, as long as the tube. Petals lanceolate-triangular, acute, inflexed-apiculate, subcarinose, on the margins papillose. Stamens in the fem. fl. 1.5 mm long; filaments subulate, dilated, about as long as the lanceolate-linear anthers. Disc annular, 8-lobed, 0.35 mm high. Pistil in the fem. fl. 2.5 mm high; ovary at the base surrounded by the disc, ovoid, sub-4-lobed, 4-celled, 1 mm high; style 4-sulcate, 1.5 mm long; stigma 4-lobed. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 4-lobed and 2- to 4-pyrenous, 1.25 cm long and 1 cm in diam.; mesocarp thin, carinose; endocarp thin, crustaceous.

Type: Spruce 1142 in h.K.

Distribution: once collected.

BRAZIL: Amazonas, R. Negro, Barra, Spruce 1122, = 1142, (1850) forest on sandy soil, fl. fem. and fr. Dec. (B, BM, C, G, K, LE, M, NY, P, W).

As *Protium pubescens* W. et A., Prodr. Fl. Pen. Ind. Or. I, p. 176 (1834) (now referred to *Commiphora pubescens* Engl.) has priority over *Protium pubescens* (Benth.) Engl. (1874) a new specific name had to be given to the latter species.

39. ***Protium pauciflorum*** SWART in Rec. Trav. bot. néerl. XXXIX, p.196 (1942).

Shrub. Leaves 2- or 3-jugate, 19—24 cm long; petioles semiterete, above flattened, 2 (1.5—2.5) cm long, like the rhachis, the petiolules and the prim. nerves rather densely but minutely pilose; interjuga terete, striate, at the nodes incrassate, 4 (3.5—4.5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 1—1.5 cm long, the terminal ones 3.5 (2.5—4) cm; leaflets lanceolate-oblong to oblong, usually 10.5 (8.5—11.5) cm long and 3.75 (3—4) cm wide, but the terminal ones slightly wider and narrowed to the base, the lateral ones subsymmetric and mostly slightly narrowed to both

ends and the basal ones smaller; apex rather gradually narrowed in a linear, 5—10 mm long and 2—3 mm wide, obtuse acumen; base cuneate; margin entire, undulate; pergamentaceous, on both sides glabrous, smooth and dull; with 10 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent; sec. and tert. ones glabrous, above prominulous, beneath prominent. Inflorescences axillary, 5 mm long, few-flowered; the axes terete, striate, like the terete, striate, 1.5 mm long pedicels and the broadly triangular, acute, about 0.5 mm long bracts and bractlets glabrous. Flowers 4-merous, 3 mm long, in all parts glabrous. Calyx cupuliform, 1 mm high; its lobes triangular, acute, as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, subcarinose, on the margins papillose. Stamens in the fem. fl. 2 mm long; filaments subulate, 3 times as long as the oblong anthers. Disc annular, 8-lobed, 0.4 mm high. Pistil about as high as the filaments; ovary at the base surrounded by the disc, globose, 4-lobed, 4-celled, 0.6 mm high, tapering in a stout, 4-sulcate, about 1 mm long style, crowned by a 4-lobed stigma.

Type: Krukoff 8212 in h.NY.

Distribution: once collected.

BRAZIL: Amazonas, basin R. Solimoes, Sao Paulo de Olivença, near Palmares, Krukoff 8212 (1936) fl. fem. Sept.-Oct. (NY).

40. **Protium Almecega** MARCH. in Vid. Medd. Kjbhn. 1873, p.56 (1873); Engl. in Mart. Fl. Bras. XII, 2, p.269 (1874); id. in DC. Mon. Phan. IV, p.71 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931). Non apud Glaz. in Bull. Soc. bot. Fr. LII, Mém.3, p.92 (1905).

*Tingulonga Almacega* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium heptaphyllum* (Aubl.) March. in errore Glaz. l.c. p.91 quoad spec. sub n.14611 cit.

Small to large tree. Branchlets rather stout, 4 mm in diam., terete, striate, when young densely ferruginous puberulous, when adult glabrous and cinereous. Leaves 2- or 3- (1- to 5-) jugate, 15—20 (10—25) cm long; petioles stout, semiterete, at the base incrassate, 3—4 (2.5—5.5) cm long, like the rhachis and the petiolules rather densely but minutely pilose, sometimes glabrescent; interjuga angular, above mostly bisulcate and subalate, at the nodes incrassate 2—2.5 (1.5—3.5) cm long; petiolules semiterete, subalate, at both ends incrassate, 5 (2—7) mm long, the terminal ones 15 (10—20) mm; leaflets lanceolate-oblong to oblong-elliptic, usually 10 (5—13) cm

long and 3.5 (2—4.5) cm wide, but the terminal ones wider and mostly narrowed to the base, the lateral ones subsymmetric and sometimes narrowed to the apex and the basal ones smaller; apex gradually to rather abruptly acuminate; acumen tapering, 5—7 mm long and 2.5—4 mm wide, obtuse; base cuneate to round; margin entire, undulate; subcoriaceous, glabrous and smooth, above nitidulous, beneath dull; with 14—16 (12—18) pairs of sec. nerves; prim. nerves above grooved on each side and glabrous or nearly so, beneath distinctly prominent and patently pubescent on their sides, especially near the base, sec. nerves above prominulous, beneath prominent, tert. ones above hardly visible, beneath prominulous, sec. and tert. ones glabrous. Inflorescences axillary, branched from the base, more or less glomeruliform, 2 (2—3) cm long; the axes terete, striate, like the terete, striate, 2.5 mm long pedicels and the oblong-triangular, obtuse, 0.5—0.75 mm long bracts and bractlets rather densely to sparsely appressed puberulous. Flowers 5-merous, 3 mm long, yellowish-green to reddish. Calyx cupuliform, 1 mm high, sparsely puberulous or nearly glabrous; its lobes triangular, acutely subacuminate, as long as the tube. Petals triangular-ovate, acute, inflexed-apiculate, outside glabrous, inside provided with some short hairs, on the margins papillose. Stamens in the masc. fl. 2 mm, in the fem. fl. 1.25 mm long; filaments subulate, dilated; anthers oblong to elliptic, 0.5 mm long. Disc annular, 10-lobed, glabrous, 0.35 mm high. Pistil glabrous, at the base surrounded by the disc, in the masc. fl. 0.6—0.9 mm, in the fem. fl. 1.5 mm high; ovary globose-ovoid, 5-lobed, 5-celled, tapering in a sessile, 5-lobed stigma. Drupe either oblique-ovoid and monopyrenous or globose, 2- or 3-lobed and 2- to 3-pyrenous, 12.5 mm long and 8—12 mm in diam.

**Type:** Warming (19-VII-1864) in h.C.

**Distribution:** south-eastern Brazil.

**BRAZIL:** Matto Grosso, Serra da Chapada, Burity, Malme (1894) in damp forest (S); id., Santa Anna da Chapada, Malme 2043 (1902) fl. masc. July (S); id., id. 2429 (1902) in swampy forest, fl. fem. Oct. (S); Goyaz, Duro, Gardner 3090 (1839) fl. fem. and fr. Oct. (B, BM, G, K, NY, P, W) (cotype of *P. venosum* Engl.); id., without loc., SaintHilaire 890 (1816—1821) fr. (P); Minas Geraes, near Parana, Martius 1782 (no date) (M) (in Mart. Obs. 1782 sub *Hedwigia balsamifera* Sw.); id., Lagoa Santa, Warming 2403 (25-IX-1863) fl. (B); id., id. 2403/1 (28-IX-1863) in copse, fl. masc. (C); id., id. 2403/2 (30-IX-1863) fl. masc. (C); id., Warming (20-XI-1863) fl. masc. (W); id., Warming (16-III-1864) fl. fem. (C); id., Warming (19-VII-1864) fl. fem. (C) (type); id., Warming (23-VIII-1864) fl. fem. (US); id., Warming 2402/1 (2-XI-1864) fl. fem. (C); id., id. 2402/2 (no date) fl. fem. (C); id., Warming (1865) fl. masc. Jan. (LE); id., id. (no date) fr. Sept. (C);

id., id. (no date) fl. fem. (S); id., id. (no date) fl. masc. (W); id., Serra do Lenheiro, near Sao Joao d'El Rei, Schwacke 12115 (1895) fr. Dec. (B); id., Ouro Preto, Glaziou 14611 (1885) fl. fem. (B, BR, G, K, LE); id., without loc., Claussen (1839) fl. masc. (G); Sao Paulo, near S. Carlos, Lund (1834) fr. Jan. (C); id., Ipanema, Sello 2013/2061 (no date) fr. (B); id., Campinas, Mosén 3854 (1875) (S); id., Heiner 162 (1904) fl. masc. Sept. (S); id., Santa Rita do Passa Quatro, Hemmendorff 246 (1899) fl. masc. Oct. (S); id., Rib. da Lagoa, Edwall 182 (1905) fl. masc. Nov. (B); without loc., Sello 348 (no date) (B); id., id. 987 (no date) fl. masc. (B); id., id. 2012/2060 (no date) (B); id., id. 2060 (no date) fl. fem. and fr. (B, S).

**Vern. names:** almecega, almecega do Brazil, almeceiga, almecegueira, almeceica.

This species, which resembles *P. heptaphyllum* (Aubl.) March. in general appearance, is recognizable by the indumentum at the underside of the midrib. The material shows a rather wide range of variability in regard to the size of the leaves, to the number of leaflets and to the development of the indumentum; in Glaziou 14611 and Hemmendorff 246 the underside of the midrib is only sparsely pilose.

**Anatomy:** Guill. in Ann. Sc. nat., S.9, X, p.208 (1909).

**var. Ulei** SWART in Rec. Trav. bot. néerl. XXXIX, p.197 (1942).

Midrib of the leaflets above glabrous, beneath near the base provided with some scattered, short hairs. Flowers tetramerous.

**Type:** Ule 8891 in h.B.

**Distribution:** twice collected.

**BRAZIL:** Amazonas, R. Negro, near Manaos, Pensador, Ule 8891 (1910) fl. masc. Aug. (B, G, K, L); without locality, Helmreichen 93 (no date) fr. (W).

**41. *Protium ecuadorensis* BENOIST** in Bull. Soc. bot. Fr. LXXXI, p.324 (1934).

Large tree. Branchlets dotted with many lenticels. Leaves 1- or 2-jugate, 20—35 cm long; petioles semiterete, like the rhachis, the petiolules and the prim. nerves minutely puberulous; petiolules 8—16 mm long, the terminal ones 26—34 mm; leaflets lanceolate, 8—17 cm long and 3—6 cm wide, the lateral ones oblique; apex shortly and obtusely acuminate; base obtuse; glabrous; with 14—16 pairs of sec. nerves; prim. nerves beneath prominent, sec. nerves above depressed and glabrous, beneath prominent and pilose. Inflorescences axillary, narrowly paniculate, half the length of the petiole and the rhachis together; the axes like the 3 mm long pedicels and

the ovate, 0.5—1 mm long bracts and bractlets puberulous. Flowers 4-merous, in all parts glabrous, green. Calyx cupuliform; its lobes triangular. Petals oblong, 3 mm long. Stamens 8; filaments longer than the anthers. Disc annular, 8-lobed; ovary embedded in the disc; stigma subseßile, 4-lobed.

Type: Benoist 3016.

Distribution: once collected.

ECUADOR: Santo Domingo de los Colorados, Benoist 3016 (1930) fl. masc. Sept. (ex Benoist).

As I could not study the type specimen I had to rely on the diagnosis and by this *P. ecuadorensis* Benoist is nearly related to *P. Almecega* March., but differs from the latter by its 1- or 2-jugate and larger leaves, its long petiolules and its tetramerous flowers.

42. *Protium cordatum* HUB. in Bol. Mus. Goeldi V, p.433 (1908); LeCointe, Arv. e Pl. ut. a Amaz. bras. III, p.64 (1934); Sampaio in Bol. Mus. nac. X, p.13 (1934).

Shrub. Branchlets slender, terete, striate, glabrous, when young smooth and fuscous, when adult scabrous and grey. Leaves unifoliolate to 2-jugate, mostly 2-jugate, 14—16 cm long, in all parts glabrous; petioles semiterete, 3 (2—4) cm long; interjuga terete, striate, at the nodes slightly incrassate, 1—2 cm long; petiolules terete, striate, canaliculate, at both ends incrassate, 2.5 mm long, the terminal ones 5 mm; leaflets ovate to subcordate, 7—8 (5.75—12) cm long and 3.5 (3—5) cm wide; apex rather gradually narrowed in a tapering, 6—7.5 mm long and 4—5 mm wide, obtuse acumen; base round to subcordate; margin entire, slightly repandous; subcoriaceous, smooth, above nitidous, beneath dull; with 9—12 pairs of sec. nerves; prim. and sec. nerves above prominulous, beneath prominent, tert. ones above inconspicuous, beneath visible. Inflorescences axillary, glomeruliform, few-flowered, about 5 mm in diam.; the axes terete, striate, like the terete, 0.5 mm long pedicels, the broadly triangular, acute, 0.25 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely and minutely fulvous pilose. Flowers 4-merous, 4 mm long, greenish. Calyx broadly cupuliform, about 1 mm high; its lobes broadly triangular, acute, about half as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, subcarnose, inside glabrous, on the margins papillose. Stamens in the masc. fl. 2 mm long; filaments subulate, 1.5 mm long; anthers elliptic. Disc annular, 8-lobed, glabrous, 0.5 mm high. Pistil 0.75 mm high; ovary conical, 4-sulcate, at the

base surrounded by the disc, sparsely and appressedly pubescent; stigma sessile, 4-lobed. Drupe globose to ovoid, when young pilose, when mature glabrescent, 1 cm long and 1 cm in diam.; exocarp red.

**Type:** Ducke 8463.

**Distribution:** Brazil (Para).

**BRAZIL:** Para, Faro, Campos do Tigre, Ducke 8463 (1907) on sandy soil, fl. masc. Aug. (B); id., id. 10497 (1910) fr. Jan. (B).

**Vern. name:** breu branco (Cf. LeCointe l.c.; Sampaio l.c.).

43. **Protium Copal** (S. et C.) ENGL. in DC. Mon. Phan. IV, p.83 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed. 2, XIXa, p.413 (1931); Fawcett and Rendle, Fl. Jam. IV, 2, p.208 (1920); Standl. in Field. Mus. N.H., Bot. S. III, 3, p.314 (1930); Lundell in Publ. Carn. Inst. CCCCXXXVI, p.280 (1934). Non apud Standl. in Trop. Woods XVII, p.23 (1929) quod ad *P. nicaraguense* Swart pertinet.

*Icica Copal* Schldt. et Cham. in Linnaea V, p.716 (1830); Schlechtd., Hort. Halensis III, p.23, t.12, f. 1—10 (1853) (non vidi); Mueller in Walp. Ann. Bot. Syst. IV, p.450 (1857); Rose in N. Am. Fl. XXV, 3, p.259 (1911).

*Elaphrium Copal* Schiede ex Mueller l.c. (1857) nomen.

*Tingulonga Copal* OK., Rev. Gen. Pl. I, p.108 (1891).

*Elaphrium macrocarpum* Schiede ex Mueller l.c. (1857) nomen.

? *Icica obovata* Turcz. in Bull. Soc. imp. Nat. Mosc. XXXVI, 1, p.913 (1863) ex Engl. l.c. (1883).

*Icica Palmerii* Rose in N. Am. Fl. XXV, 3, p.260 (1911).

*Protium Palmerii* Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.414 (1931).

Tree, usually of large size. Branchlets rather slender, 2.5—4 mm in diam., when young densely tomentellous but soon glabrescent, cinereous and dotted with elliptic, ferruginous lenticels. Leaves 2- or 3- (1- to 4-) jugate, 20—30 (16—35) cm long, in all parts glabrous; petioles semiterete, near the incrassate base transversely rimose when adult, 5.5—7 (4—10) cm long; interjuga terete, striate, slightly sulcate above, at the nodes incrassate, 4—4.5 (3—5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 1—1.5 (0.5—2) cm long, the terminal ones 2.5 (2—4) cm; leaflets oblong to oblong-elliptic, usually 11—15 (9—20) cm long and 4—5 (3.5—6) cm wide, but the terminal ones obovate, distinctly narrowed to the base and mostly wider, the lateral ones oblique, ovate and narrowed from below the middle to the apex, and the basal ones shorter; apex



more or less gradually narrowed in a tapering, 3—6 mm long and 2.5—5 mm wide obtuse acumen or obtusely subacuminate; base cuneate; margin entire, undulate; pergamentaceous to subcoriaceous, smooth, above nitidous, beneath nitidulous; with 13—14 (11—15) pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. ones above prominulous, beneath prominent, tert. ones above visible, beneath prominulous. Inflorescences fasciculate in the axils, 7.5—15 (—20) cm long; the axes terete, striate and sparsely to rather densely ferruginous puberulous. Sec. branchlets up to 5 cm long. Pedicels terete, 2 mm long, like the triangular, acute, 0.5—0.25 mm long bracts and bractlets and the outside of the calyx and the corolla rather densely appressed-puberulous. Flowers 4-merous, rarely 5-merous, 3—4 mm long., yellow. Calyx cupuliform, 1 mm high; its lobes triangular, acute, nearly as long as the tube. Petals elliptic-triangular, acute, inflexed-apiculate, carnose, inside minutely pilose, on the margins papillose. Stamens in the masc. fl. 1.8 mm, in the fem. fl. 1.4 mm long; filaments in the masc. fl. flattened and 0.75 mm long, in the fem. fl. subulate and 1 mm long; anthers oblong. Disc annular, 8-lobed, glabrous, 0.5 mm high. Pistil about 1 mm high; ovary at the base surrounded by the disc, ovoid, 4-lobed, 4-celled, densely and appressedly pubescent, tapering in a sessile, 4-lobed stigma. Drupe ellipsoid, at the base narrowed, at the apex acute, 2.25—2.5 cm long and 1.25—1.75 cm in diam.; exocarp sparsely pilose; mesocarp carnose; endocarp woody; pyrenes 1 to 4.

Type (lecto-type): Schiede et Deppe 147, sub n. 716, in h.B.

Distribution: Central America (Mexico to Panama).

MEXICO: San Luis Potosi, San Dieguito, Palmer 84 1/2 (1904) fr. June (F, NY, US); id., id. 634 (1905) fr. June (F, NY, US) (type of *Icica Palmerii* Rose); id., Tancanhui, near Tariquian, Seler 172 (1888) fl. fem. March (B); Hidalgo, Zacualtipan, Barranca de Irnampa, Purpus 7127 (1912) fl. masc. Febr. (F, GH, NY, US); id., id. 7719 (no date) fl. (B); Puebla, Huauchinango, Tepexic, Fröderström and Hulten 1043 (1932) alt. 600 m, fl. Febr. (B); Vera Cruz, Huasteca, near Tantoyuca, Ervendberg 165 (1858) fl. masc. (LE); id., Papantla, Schiede et Deppe 147 (1829) fl. masc. Febr. (B sub n. 716, BM, LE, W) (type (*Elaphrium Copal* Schiede mss.); id., Karwinsky 1276 (1841) fr. (LE); id., Liebmann 12315 (1841) fr. June (C, F, US); id., id. 12334 (1841) fr. May (C); id., id. 12337 (1841) fr. June (C, F, US); id., Misantla, Schiede et Deppe 716 (1831) fl. masc. Febr. (B, BM, BRSL, K, LE, US, W); id., valley of Cordoba, at the Piñuela, Bourgeau 2058 (1866) fl. masc. March (K, LE, P); id., Cordillera, Galeotti 3813 (1840) alt. 900 m, fl. masc. (G, K, P, W); Yucatan, Tabasco, Campeche, Tuxpeña, Lundell 1283 (1932) fl. fem. Febr. (F, GH, NY, US); Acusonica, Barrancas de los Llaños, Linden 732 (1839) alt. 150 m, fl. masc. Jan. (G, K, LE); near Hac. de la Laguna, Schiede 6 (1829) (B, BM, LE) (*Elaphrium macrocarpum*

Schiede mss.); Colipa, Liebmann 12335 (1841) fl. masc. March (C, F, P, US); Mirador, Liebmann 12336 (1842) fl. masc. March (C); without loc., Herb. Henschelianum (no date) (BRSL).

BR. HONDURAS: Maskall Pine Ridge, Gentle 1135 (1934) fl. March (F, K, NY, S); near Honey Camp, Meyer 52 (1930) fr. (F); Columbia, Toledo, Donald and Stevenson 5 (1924) fr. (F, K); without loc., Heyder 28 (1927) fr. fem. March (US).

PANAMA: Colon, along R. Fato, Pittier 3949 (1911) fr. July-Aug. (US).  
WITHOUT LOCALITY: Herb. Miller (no date) fl. fem. and fr. (BM).

Vern. names: MEXICO: copal; BR. HONDURAS: copal, carbon.

This species, which occupies a more northern area than any other *Protium*, shows a large variability but is always recognizable by its glabrous leaves with shortly acuminate, obovate terminal leaflets and ovate lateral ones and by its pilose inflorescences, calyx and corolla. It is related to several other Central American species of *Protium*.

In view of the distribution of the other localities it is highly improbable that the specimen in Herb. Miller in Herb. Brit. Mus. quoted by Fawcett and Rendle l.c. has been collected in Jamaica.

Anatomy: Guill. in Ann. Sc. nat., S.9, X, p.208 (1909).

Use: Cf. Wiesn., Rohst. ed.2, I, p.176, 289 (1900).

var. *glabrum* (ROSE) SWART nov. comb.

*Icica glabra* Rose in N. Am. Fl. XXV, 3, p.259 (1911).

*Protium glabrum* Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413 (1931); Standley in Field. Mus. N.H., Bot.S. XVIII, 2, p.576 (1937).

Leaflets as a rule distinctly acuminate and provided with 10—12 pairs of sec. nerves; acumen one and half times as long as wide. Pedicels and the outside of the calyx and the corolla provided with some scattered hairs. Drupe subglabrous, not always narrowed at the base.

Type: Tonduz 6682 in h.US 1380505.

Distribution: Central America.

GUATEMALA: Peten, La Libertad, Sabana San Francisco, Lundell 2481 (1933) fr. Apr. (F,K); id., Uaxactum, Bartlett 12143 (1931) fr. March (F, K, NY).

BR. HONDURAS: Maskall, Gentle 1333 (1934) fr. May (NY); Toledo, Peck 670 (1907) fr. Febr. (B, K); Rio Grande, Schipp 1167 (1929) in forest on riverbank, alt. 100 m, fr. Apr. (BM, F, K, NY).

COSTA RICA: Forêts de Buenos Aires, Tonduz 6682 (1892) alt. 300 m, fl. masc. Febr. (BR, F, M, NY, P, US) (type).

**var. ternatum** (PITTIER) SWART nov. comb.

*Protium ternatum* Pitt. in Contr. U.S.N.H. XX, 12, p.478 (1922); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.414 (1931).

Leaves trifoliolate; petioles short, about  $\frac{1}{6}$  the length of the leaflets and shorter than the petiolules of the terminal leaflets, 2.5 cm long; leaflets distinctly acuminate; acumen about twice as long as wide; with 11 pairs of sec. nerves. Pedicels rather long, like the calyx and the corolla glabrous.

Type: Pittier 4190 in h.US 679294.

Distribution: Panama.

PANAMA: Colon, along Rio Fato, Pittier 4190 (1911) alt. 10—100 m, fl. Aug. (GH, NY, US); id., id. 4191 (1911) fl. Aug. (US).

This variety, which in certain characters resembles *P. decandrum* (Aubl.) March., is united with *P. Copal* (S. et C.) Engl. by the intermediary of the var. *glabrum* (Rose) Swart.

**var. inconforme** (PITTIER) SWART nov. comb.

*Protium inconforme* Pitt. in Contr. U.S.N.H. XX, 12, p.478 (1922); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.414 (1931).

Leaves 1-jugate, or rarely 2-jugate, small, 11.5 (8—15) cm long; petioles  $\frac{1}{5}$  the length of the leaflets, 1.5 (1.25—2) cm long; petiolules  $\frac{3}{20}$  the length of the leaflets, 4 (2—5) mm long, but the terminal ones longer, 15 (8—25) mm; leaflets small, usually 7 (4.5—9.5) cm long and 3 (2—3.75) cm wide; with 11 pairs of sec. nerves. Inflorescences usually 1.5—2 cm, sometimes up to 6 cm long. Pedicels and calyx glabrous.

Type: Pittier 3350 in h.US 677733.

Distribution: once collected.

PANAMA: Chiriqui, near Caldera, Pittier 3350 (1911) alt. 200—300 m, fl. fem. and fr. March (BM, C, F, GH, NY, US).

Vern. name: chutra.

Though *P. inconforme* Pitt. differs from *P. Copal* (S. et C.) Engl. so much that it has been treated as a separate species, the differences are of a similar nature as those shown by the var. *glabrum* (Rose) Swart and especially by the var. *ternatum* (Pitt.) Swart.

44. *Protium giganteum* ENGL. in Mart. Fl. Bras. XII, 2, p.277 (1874); id. in DC. Mon. Phan. IV, p.82 (1883); id. in E.-Pr. Nat.

Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931); Sampaio in Bol. Mus. nac. X, p.13 (1934).

*Tingulonga gigantea* OK., Rev. Gen. Pl. I, p.108 (1891).

*Icica altissima* Aubl. in errore Blume, Mus. Bot. Lugd. Bat. I, p.207 (1849—1851) quoad descr.

*Protium Duckei* Hub. in Bol. Mus. Goeldi V, p.432 (1908).

*Protium Icariba* (DC.) March. in errore Standley in Trop. Woods XXXIII, p.15 (1933).

Small to rather large tree, up to 16 m high. Branchlets rather stout, terete, striate, when young densely but minutely ferruginous pilose, soon glabrescent, fuscous and dotted with small, elliptic lenticels. Leaves 2- to 4-jugate, 25—40 cm long, in all parts glabrous; petioles semiterete, dilated, at the base incrassate, 7.5 (5—9) cm long; interjuga terete, striate, above carinate, at the nodes incrassate, 4—4.5 (2.5—5) cm long; petiolules stout, semiterete, striate, canaliculate, at both ends incrassate, 10 (7.5—15) mm long, the terminal ones 20 (15—25) mm; leaflets oblong, usually 15—17.5 (12.5—20) cm long and 6—7 (4.5—8) cm wide, the terminal ones sometimes narrowed to the base and the basal ones shorter; apex abruptly to rather abruptly acuminate; acumen linear, as long as wide to twice as long as wide, obtuse; base broadly cuneate; margin entire, undulate; coriaceous, smooth and nitidous; with 16 (14—18) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones above hardly conspicuous, beneath prominulous. Inflorescences mostly fasciculate in the axils, many-flowered, 2.5—11 cm long. Branchlets divaricate, stout, subangulose, up to 5 cm long, like the stout, terete, 1—1.5 mm long pedicels, the triangular, acute, 0.35 mm long bracts and bractlets and the outside of the calyx and the corolla rather densely to sparsely and minutely puberulous. Flowers 4-merous, 2.5—3 mm long, yellowish-green. Calyx cupuliform, 0.5—1 mm high; its lobes broadly triangular, acutely subacuminate, about as long as the tube. Petals oblong-ovate to elliptic-ovate, acute, inflexed-apiculate, subcarinose. Stamens in the masc. fl. 1.75 mm, in the fem. fl. 1 mm long; filaments subulate, at the base dilated; anthers elliptic, 0.5—0.75 mm long. Disc annular, 8-lobed, glabrous, 0.4 mm high. Pistil at the base surrounded by the disc, in the masc. fl. 0.75 mm, in the fem. fl. 1 mm high; ovary globose, sub-4-lobed, rather densely and appressedly puberulous, tapering in a sessile, 4-lobed, 0.25 mm high stigma.

Type: Riedel 1561 in h.B.

Distribution: the Guianas and northern Brazil.

BR. GUIANA: basin Essequibo R., near mouth Onoro Creek, A. C. Smith 2728 (1937) on high land, fl. fem. Dec. (U).

FR. GUIANA: Cayenne, Martin (no date) fl. fem. (B, L, P) (*Icica altissima* Aubl. apud Blume l.c.).

BRAZIL: Para, basin R. Trombetas, on R. Mapuera, Ducke 9016 (1907) fl. masc. Dec. (B) (type of *P. Duckei* Hub.); id., basin R. Tapajoz, Boa Vista region, Capucho 375 (1932) fl. fem. Aug. (F) (*P. Icariba* (DC.) March. apud Standley l.c.); id., Santarem, Riedel 1561 (1828) fl. fem. Dec. (B, K, LE) (type).

Vern. name: BRAZIL: breu branco (Capucho).

This species which is marked by its rigid leaflets and by its robust and stiffly branched inflorescences, resembles *P. crassifolium* Engl., but the latter differs by its smaller leaflets, which are distinctly narrowed, viz. the lateral ones to the apex and the terminal ones to the base, and which are gradually narrowed in a tapering acumen, about 4 times as long as wide, and by its glomerate and larger flowers.

The type and only specimen of *Protium Duckei* Hub. differs from the other specimens of *P. giganteum* Engl. merely by the acumen of its leaflets being twice as long as wide; in my opinion this difference is too slight to justify its retention as a separate species.

45. ***Protium nodulosum* SWART** in Rec. Trav. bot. néerl. XXXIX, p.197 (1942).

Large tree, 20—30 m high. Branchlets stout, 7.5 mm in diam. angular and glabrous, when adult cinereous, scabrous and dotted with ferruginous lenticels. Leaves 2- or 3-jugate, at times 1-jugate, 35—45 (27—65) cm long, in all parts glabrous; petioles semiterete, above dilated, 8 (6—10) cm long, like the rhachis when adult transversely rimose; interjuga angulose, at the nodes incrassate, 6—6.5 (5.5—8) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 1.25 (1—2) cm long, the terminal ones 4.5 (4—5.5) cm; leaflets lanceolate to lanceolate-oblong, usually 18 (17—30) cm long and 6 (5—11) cm wide, but the terminal ones larger and narrowed from the middle to the base, the lateral ones hardly narrowed to the base and the basal ones shorter; apex more or less abruptly acuminate; acumen linear, 5—10 mm long and 2.5—5 mm wide, obtuse; base cuneate; margin entire, repandous, undulate; subcoriaceous, smooth, above nitidous, beneath dull; with 14 (12—16) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones above visible, beneath prominent. Inflorescences axillary, branched from the base, 10—17 cm long. Branchlets angulose, up to 7 cm long, like the terete, striate,

about 2 mm long pedicels and the outside of the calyx and the corolla sparsely puberulous. Bracts and bractlets deciduous. Flowers 5-merous, 2.5 mm long. Calyx cupuliform, 0.6 mm high; its lobes triangular, acute, slightly longer than the tube. Petals oblong-ovate, acute, inflexed-apiculate, subcarinose. Stamens with subulate, 0.75 mm long filaments. Disc annular, 10-lobed, glabrous, 0.35 mm high. Pistil at the base surrounded by the disc, in the fem. fl. 1.25 mm high; ovary globose, 5-lobed, rather densely puberulous, tapering in a sessile, 5-lobed stigma. Drupe globose-conical, narrowed at the base and acute at the apex, up to 2.5 cm long and 2 cm in diam.; exocarp sparsely pilose, glabrescent; mesocarp thick, carinose; endocarp woody; pyrenes 2 to 4.

Type: Krukoff 6395 in h.U 22074A.

Distribution: Brazil (Amazonas).

BRAZIL: Amazonas, basin R. Solimoes, Sao Paulo de Olivença, near Palmares, Krukoff 8071 and 8154 (1936) high land, fr. Sept.-Oct. (NY); id., basin R. Madeira, Humayta, near Tres Casas, Krukoff 6395 (1934) on low terra firma, fl. fem. and fr. Oct. (K, NY, U) (type); id., Humayta, near Livramento, Krukoff 6686 (1934) fr. Oct. (NY, U).

Vern. names: breu, almesca.

This species resembles *P. giganteum* Engl. and *P. paniculatum* Engl. em. Swart. The latter differs chiefly by its shorter interjuga, by its much shorter petiolules and by the acumen of its leaflets which is 5 times as long as wide.

46. *Protium crenatum* SANDW. in Kew Bull. 1933, VII, p.327 (1933).

Large tree, about 30 m high. Leaves 1- to 4-jugate, mostly 3-jugate, 21 (11-32) cm long, in all parts glabrous; petioles semiterete, at the base incrassate, 4.5 (2.5-8) cm long, when adult like the petiolules transversely rimose; interjuga angulose, at the nodes slightly incrassate, 2.5-3 (2-5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 4-6 mm long, the terminal ones 15 (12-27) mm; leaflets oblong-lanceolate, usually 7.5 (6.5-11) cm long and 2.5 (2-4) cm wide, but the terminal ones slightly larger and narrowed to both ends, the lateral ones suboblique, at times slightly narrowed to the apex, and the basal ones shorter; apex gradually narrowed in a tapering, 3-5 mm long and 2.5-4 mm wide, obtuse acumen; base cuneate; margin remotely subserrate; pergamentaceous to subcoriaceous, nitidulous; with 11-14 pairs of sec. nerves. Inflorescences mostly fasciculate in the axils, branched

from the base, many-flowered, up to 18 cm long; the branchlets up to 5 cm; the axes slender, terete, striate, like the 0.75 mm long pedicels, the triangular-ovate, obtuse, 0.5 mm long bracts and bractlets and the outside of the calyx sparsely and minutely puberulous. Flowers 4-merous, rarely 5-merous, 2.25 mm long, viridulous. Calyx broadly cupuliform, 0.6 mm high; its broadly triangular, 0.1—0.15 mm long. Petals triangular-ovate acute, inflexed-apiculate, on both sides especially near the apex provided with some minute hairs, subcarnose. Stamens in the masc. fl. 1.75 mm long; filaments subulate, at the base dilated, about as long as the oblong anthers. Disc annular, crenate, 0.35 mm high, glabrous. Pistil in the masc. fl. embedded in the disc, 0.4 mm high; ovary depressed-globose, 0.2 mm high, sparsely pubescent; style 0.05 mm long; stigma 4- (or 5-)lobed.

Type: For. Dept. Br.G. 2195 in h.K.

Distribution: once collected.

BR. GUIANA: N.-side of Kanaku Mts., east of Takutu R., For.Dept. Br. G. 2195 (1931) alt. 150 m, fl. masc. Sept. (K).

Vern. name: kurokai (Arow.).

In its general appearance and particularly in its subserrate leaflets this species resembles *Hemicrepidosperrum rhoifolium* (Benth.) Swart, but it is certainly not identic with this species. The latter is the only representative of a genus which is sharply characterized by the structure of its embryo. As the specimen cited above bears no fruits it is impossible to decide whether it belongs to *Hemicrepidosperrum* or not, but as it agrees, to its most conspicuous characters, with other *Protium*-species I have provisionally retained it in this genus.

47. *Protium octandrum* SWART in Rec. Trav. bot. néerl. XXXIX, p.198 (1942).

Tree. Branchlets slender, 3—4 mm in diam., glabrous, when young terete, striate, lurid, when adult terete, scabrous and fulvous. Leaves 1- or 2-jugate, rarely 3-jugate, 16—20 (—25) cm long; petioles semiterete, at the base incrassate, 3 (2—4.5) cm long, like the rhachis glabrous or provided with some minute scattered hairs; interjuga angulose, at the nodes slightly incrassate, 2—3 cm long; petiolule semiterete, subcanaliculate, at both ends subincrassate, 4—9 mm long, but those of the apical jugum shorter than those of the basal jugum and the terminal ones 15 (7.5—20) mm long; leaflets lanceo-

late-oblong to oblong-elliptic, usually 8.5—10.5 cm long and 3.5 cm wide, but the terminal ones larger and slightly narrowed to the base, the lateral ones asymmetric and sometimes slightly narrowed to the apex; apex rather abruptly acuminate; acumen tapering, 8—10 mm long and 4—5 mm wide, obtuse; base broadly cuneate to nearly round; margin entire; subcoriaceous, glabrous and smooth, above nitidulous, beneath dull with 12 (9—14) pairs of sec. nerves; prim. nerves distinctly prominent, sec. ones above hardly visible, beneath prominulous, tert. ones hardly visible. Inflorescences axillary, glomeruliform, many-flowered, up to 2.5 cm in diam. the axes terete, striate, like the terete, striate, 1—2 mm long pedicels, the triangular-ovate, obtuse, 0.5 mm long bracts and bractlets and the calyx rather densely puberulous. Flowers 4-merous, 3 mm long,

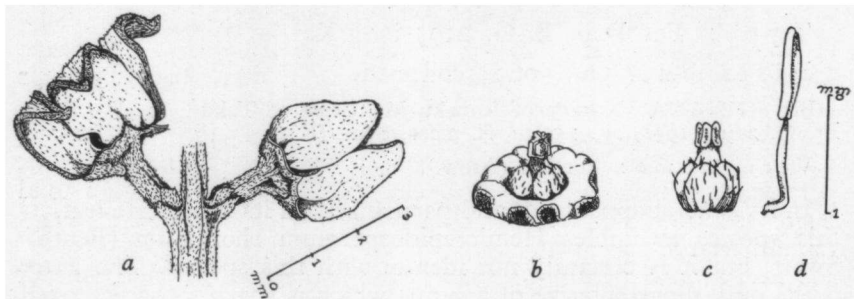


Fig. 3. *Protium octandrum* Swart — a. flowers; b. disc and pistil; c. pistil; d. stamen.

yellowish white. Calyx shallowly cupuliform, 0.5 mm high; its lobes minute, broadly triangular, subobtruse. Petals oblong-ovate, subacute, inflexed-apiculate, subcarnose, sparsely puberulous outside, with papillose margins. Stamens 1.5 mm long; filaments subulate with dilated base, about as long as the basifixed, lanceolate anthers. Disc annular, 8-lobed, glabrous, 0.25 mm high. Pistil as high as the filaments, 0.75 mm; ovary at the base surrounded by the disc, globose, 4-lobed, 4-celled, 0.5 mm high, provided with long scattered hairs; style terete, short; stigma 4-lobed.

Type: BW. (Suriname) 4404 in h.U.

Distribution: northern South America.

COLOMBIA: Magdalena, Chiriguana, Valle de Upas, Karsten (no date) fl. (LE, W).

VENEZUELA: Los Andes, Trujillo, near Dividivi, Pittier 10800 (1922) savannah-woods, fl. Nov. (G, GH, NY, US).



**SURINAME:** Saramacca R., Watramiri, tree n. 1666, BW. 1949 (1916) (U), BW. 2959 (1917) fl. June (U); id., Sectie O, tree n. 556, BW. 1235 (1915) fl. Nov. (U), BW. 3958 (1918) fl. Aug. (U), BW. 4404 (1919) fl. Sept. (U) (type), BW. 4823 (1920) fl. Oct. (U).

**Vern. names:** VENEZUELA: anime, tacamahaca; SURINAME: tiengi-monnier (N.E.), ibajawa (Arow.), tapoekjan ajaawa, siepio (Car.).

The flowers are probably all masculine as the relative length of the stamens and the pistil, which is similar in all flowers, agrees with that in the masculine flowers of *P. decandrum* March. and other related species.

This species differs from *P. guianense* (Aubl.) March., to which it is nearly related, by its pilose ovary and by its sessile stigma.

**48. *Protium decandrum* MARCH.** in Adans. VIII, p.51 (1867—1868); Engl. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931); Cordemoy in Ann. Inst. col. Mars. VI, p.200 (1899). Non apud Engl. in DC. Mon. Phan. IV, p.82 (1883) quod ad *P. Schomburgkianum* Engl. pertinet.

*Icica decandra* Aubl., Hist. Pl. Guian. fr. I, p.346, t. 135 (1775); Lam., Enc. méth., Bot. III, p.226 (1789); De Cand., Prodr. II, p.77 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832). Non apud Sagot in Ann. Sc. nat., S.6, XIII, p.291 (1882) quod ad *P. Sago-tianum* March. pertinet.

*Icica pentandra* Aubl. in errore, Hist. Pl. Guian. fr., sub tab. 135 (1775).

*Amyris decandra* Willd., Linn. Sp. Pl. ed.4, II, p.336 (1799); Persoon, Syn. Pl. I, p.415 (1805); Sprengel, Linn. Syst. Veg. ed. 16, II, p.218 (1825).

*Elaphrium decandrum* Spr. ex Dietr., Syn. Pl. II, p.1272 (1840).

*Bursera decandra* Baill., Hist. d. Pl. V, p.296, f. 275—276 (1874); id., Dict. Bot. I, p.528 fig. (1876); id., Tr. d. Bot. méd. phan. p.951, f. 2699—2700 (1884).

*Icica enneandra* Aubl., Hist. d. Pl. Guian. fr. I, p.345, t.134 (1775); Lam., Enc. méth., Bot. III, p.226 (1789); De Cand., Prodr. II, p.77 (1825); Don, Gen. Hist. Dichl. Pl. II, p.82 (1832); Sagot in Ann. Sc. nat., S.6, XIII, p.292 (1882).

*Amyris enneandra* Willd., Linn. Sp. Pl. ed.4, II, p.335 (1799); Persoon, Syn. Pl. I, p.414 (1805); Spreng., Linn. Syst. Veg. ed. XVI, p.218 (1825).

*Elaphrium enneandrum* Spr. ex Dietr., Syn. Pl. II, p.1271 (1840).

*Tingulonga enneandra* OK., Rev. Gen. Pl. I, p.107 (1891).

*Protium orinocense* Rusby, Descr. new sp. S. Am. plants p.35 (1920); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413 (1931).

Tree, up to 20 m high. Branchlets rather stout, terete, striate, glabrous, smooth, cinereous to ferruginous. Leaves 1- or 2-jugate, 19 (17.5—25) cm long, in all parts glabrous; petioles semiterete, above flat and dilated, at the base slightly incrassate, 2.5—3 (1.5—5) cm long, when adult like the rhachis and the petiolules transversely rimose; interjuga terete, striate, above carinate, at the nodes incrassate 3.5 (3—4) cm long; petiolules stout, canaliculate and subulate, at both ends incrassate, 7.5—10 (5—12.5) mm long, the terminal ones 25 (15—30) mm; leaflets oblong to elliptic, usually 10—12 (8.5—15) cm long and 4—5 (3.5—5.5) cm wide, but the terminal ones slightly larger and mostly narrowed to the base and the lateral ones suboblique, sometimes hardly narrowed to the base or to the apex; apex more or less gradually narrowed in a tapering, 8—10 (5—12.5) mm long and 4—5 (2.5—5) mm wide, obtuse acuminate; base cuneate; margin entire; subcoriaceous, on both sides smooth and dull; with 12—14 (10—16) pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. ones above prominulous, beneath prominent, tert. ones above hardly prominent, beneath prominulous. Inflorescences axillary, sometimes fasciculate in the axils or pseudoterminal, laxly branched, 5—10 cm long, the pseudoterminal ones 10—15 cm; the axes rather slender, angulose, like the terete, 1—1.5 mm long pedicels and the triangular, acute, 0.5 mm long bracts and bractlets sparsely and minutely ferruginous pilose. Flowers 5-merous, 3—4 mm long, whitish to greenish. Calyx cupuliform, about 1 mm high, glabrous; its lobes broadly triangular, acutely subacuminate, about as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, subcarinose, glabrous or outside near the apex sparsely and minutely pilose, on the margins papillose. Stamens 2 mm long; filaments subulate, at the base dilated, about twice as long as the oblong anthers. Disc annular, 10-lobed, glabrous, 0.5 mm high. Pistil in the masc. fl. 0.8 mm high and embedded in the disc; in the fem. fl. 2 mm high and at the base surrounded by the disc; ovary globose-conical, sub-5-lobed, 5-celled, rather densely and appressedly puberulous, tapering in a short, 5-sulcate style, crowned by a 5-lobed stigma.

**Type:** Aublet in h.BM.

**Distribution:** eastern Venezuela and the Guianas.

**VENEZUELA:** lower Orinoco, Eleanor Creek, Rusby and Squires 133 (1896) fl. masc. May (B, F, K, M, NY) (type of *P. orinocence* Rusby).

**BR. GUIANA:** Pomeroon-distr., Pomeroon R., Delacruz 3032 (1923) fl. masc. Jan. (F, GH, NY, US); Cuyuni R., Kauri Creek, Tutin 113 (1933) fl. fem. May (BM, K, U); Essequibo R., Bartica, Jenman 4732 (1888) fl. masc. Nov. (B, K, NY).

FR. GUIANA: without loc., Aublet (no date) fl. fem. (BM) (type); id., Aublet (no date) fl. masc. (BM) (type of *I. enneandra* Aubl.).

Vern. names: BR. GUIANA: krokai; FR. GUIANA: arouaou.

This species is nearly related to *P. Schomburgkianum* Engl., but the latter differs by the rather dense but minute indumentum of its petioles, rhachis and petiolules and by the longer acumen of its leaflets. As Aublet's diagnosis is in regard to these characters incomplete, it is comprehensible that these two species were mixed up by Engler, who did not study the type specimens.

*Icica decandra* Aubl. and *I. enneandra* Aubl. have been treated separately till Marchand referred both to *Protium decandrum* March.

Uses: When the bark of this tree is wounded a nearly white, citriodorous balsam flows out, which dries quickly changing in a yellow resin, which is called "chipa" by the Galibis of Cayenne and which is used as incense in churches and also as a medicine. (Cf. Aublet l.c.; Baill. l.c.; Cordemoy l.c.; Guill. in Agr. Pays ch. IX, 2, p. 146 (1909)).

49. *Protium crassifolium* ENGL. in Mart. Fl. Bras. XII, 2, p.270 (1874); id. in DC. Mon. Phan. IV, p.81 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931); Benoist in Bull. Soc. bot. Fr. LXVI, p.359 (1919); id. in Arch. d. Bot. V, Mém.1, p.153 (1933). Non apud L. Williams in Field Mus.N.H., Bot.S. XV, p.233 (1936) quod ad *Tetragastris panamensis* (Engl.) OK. var. *hirtella* Swart pertinet.

*Icica crassifolia* Rich. in sched. ex Engl. l.c. (1874).

*Tingulonga crassifolia* OK., Rev. Gen. Pl. I, p.108 (1891).

*Connarus confertiflorus* Baker in errore Sagot in Ann. Sc. nat., S.6, XIII, p.296 (1882).

Tree. Branchlets rather stout, 4 mm in diam., terete, when young densely but minutely ferrugineous pilose, but soon glabrescent, smooth and dotted with small, elliptic lenticels. Leaves 4-jugate, 25—35 cm long, in all parts glabrous; petioles stout, semiterete, above flat and subalate, at the base slightly incrassate, 5—6 (3.5—7.5) cm long; interjuga stout, terete, carinate above, at the nodes incrassate, 3—4 (2—4.5) cm long; petiolules semiterete, subalate and canaliculate, at both ends incrassate, 5—10 mm long, the terminal ones 20 mm; leaflets lanceolate-oblong to oblong-elliptic, usually 15 (13—17.5) cm long and 5 (4.5—6.25) cm wide, but the terminal ones wider and slightly narrowed to the base, the lateral ones subsymmetric and mostly somewhat narrowed to the apex and the basal ones shorter; apex gradually narrowed in a tapering, 10 (7.5—12.5) mm long and 2.5 (2—3) mm wide, obtuse acumen; base broadly cuneate; margin entire, undulate; firmly coriaceous, smooth and

nitidulous; with 14—16 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath distinctly prominent, tert. ones above hardly conspicuous, beneath prominulous. Inflorescences subterminal, solitary or fasciculate in the axils, many-flowered, 15 (14—18) cm long. Sec. branchlets few, up to 6.5 cm long. The axes stout, angular, like the stout, terete, 2 mm long pedicels, the triangular, acute, 0.5 mm long bracts and bractlets and the outside of the calyx and the corolla rather densely but minutely ferruginous puberulous. Flowers 4-merous, 4 mm long, glomerate in terminal clusters. Calyx cupuliform, 1.25 mm high; its lobes triangular, acutely acuminate, slightly longer than the tube. Petals lanceolate-triangular, acute, inflexed-apiculate, subcarnose, glabrous inside. Stamens in the fem. fl. 1.5 mm long; filaments subulate, about twice as long as the oblong anthers. Disc annular, 8-lobed, glabrous, 0.4 mm high. Pistil in the fem. fl. 1.5 mm high; ovary at the base surrounded by the disc, globose-conical, 4-lobed, 4-celled, about 1 mm high, rather densely and appressedly puberulous; style 4-sulcate, 0.3 mm long; stigma 4-lobed. Drupe ellipsoid, with narrowed base and acute apex, 1.25 cm long and 1 cm in diam.; exocarp pilose; mesocarp thin, carnosae; endocarp thin, crustaceous; pyrenes 2 to 4.

Type: Richard in h.P(?)

Distribution: French Guiana.

FR. GUIANA: Acarouany, Sagot (1854) fr. Oct. (P); between Chavrein and the Acarouany, Benoist 140 (1913) (ex Ben. l.c. (1919)); Gourdonville, Benoist 1592 (1914) (ex Ben. l.c. (1919)); Kourou R., Richard (no date) fl. fem. (C); without loc., Leprieur 322 (1833) fr. (B, G, L).

This species resembles *P. giganteum* Engl., but the latter differs by its larger, not narrowed but more or less abruptly acuminate leaflets, by its short acumen and by its paniculate and divaricately branched inflorescences with smaller flowers.

Anatomy: Guill. in Ann. Sc. nat., S.9, X, p.210 (1909); Benoist l.c. (1933).

50. *Protium polybotryum* (TURCZ.) ENGL. in Mart. Fl. Bras. XII, 2, p.278 (1874); id. in DC. Mon. Phan. IV, p.85 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931); Pulle, Enum.Vasc.Pl. Surin. p.246 (1906).

*Icica polybotrya* Turcz. in Bull. Soc. imp. Nat. Mosc. XXXI, 1, p.473 (1858).

*Tingulonga polybotrya* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree, up to 30 m high. Branchlets stout, 3.5—5 mm in diam., terete, when young densely but minutely ferruginous tomentellous, but soon glabrescent, fuscous and dotted with elliptic, ferruginous lenticels. Leaves 4- to 5- (3- to 6-) jugate, 30—35 (27—50) cm long; petioles subterete, near the incrassate base flattened above, 7—8 (5.5—10) cm long, like the rhachis and the petiolules slender and glabrous or, when young, provided with some minute hairs; interjuga subterrete, striate, above carinate, at the nodes incrassate, 3—3.5 (1.5—4.5) cm long, but the basal ones shorter than the others; petiolules semiterete, canaliculate, at both ends incrassate, 7.5—10 (5—15) mm long, the terminal ones 20—25 (10—35) mm; leaflets oblong to elliptic, usually 8.5—10 (6.5—12.5) cm long and 2.75—3.75 (2.25—4.5) cm wide, but the terminal ones slightly larger and mostly narrowed to the base, the lateral ones oblique and mostly somewhat narrowed to the apex and the basal ones much shorter; apex rather abruptly to rather gradually acuminate; acumen linear, 10—12.5 mm long and 1.5—3 mm wide, obtuse; base cuneate to nearly round; margin entire; subcoriaceous, glabrous and smooth, above nitidulous, beneath dull; with 10—12 (8—13) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones above invisible, beneath prominent. Inflorescences subterminal, fasciculate in the axils, richly and stiffly branched from the base, many-flowered, 10—15 (7.5—20) cm long. Sec. branchlets up to 7.5 cm long, tert. ones up to 1.5 cm. The axes slender, terete, like the slender, terete, 1.5—2 mm long pedicels, the oblong, subacute, 0.75 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely to rather densely puberulous. Flowers 4-merous, 2—2.5 mm long, pale green. Calyx cupuliform, 0.5—0.75 mm high; its lobes broadly triangular, sub-obtuse, about  $\frac{1}{3}$  the length of the tube, 0.125—0.25 mm long. Petals elliptic-ovate, acute, inflexed-apiculate, carnose. Stamens about 1 mm long; filaments cylindrical, slightly dilated, as long as the elliptic anthers. Disc annular, 8-lobed, glabrous, 0.25—0.35 mm high. Pistil in the masc. fl. 0.5 mm high and embedded in the disc, in the fem. fl. 1—1.25 mm high and at the base surrounded by the disc; ovary ovoid, sub-4-lobed, 4-celled, rather densely and shortly appressed-sericeous, tapering in a sessile, 4-lobed stigma. Drupe ovoid and either oblique and monopyrenous or 2-lobed and 2-pyrenous, 2.25 cm long and 1.5 cm in diam.; exocarp green to brown; mesocarp rather thick, carnose, white; endocarp thin, crustaceous and brittle.

**T y p e** (lecto-type): Hostmann 1268 in h.U.

**Distribution:** Suriname.

**SURINAME:** Coppename R., Raleighfalls, BW. 6176 (1923) fl. masc. July (U); Voltzberg, Lanjouw 905 (1933) fr. Sept. (U); Saramacca R., Watramiri, tree n. 1541, BW. 1859 (1916) (U); id., Sectie O, tree n. 548, BW. 1135 (1915) fl. fem. Oct. (U), BW. 1817 (1916) fr. May (U), BW. 3364 (1917) fr. Oct. (U), BW. 3612 (1918) fr. Jan. (U), BW. 3944 (1918) fl. fem. Aug. (U); Para R., Zandery I, tree n. 67, BW. 1208 (1915) (U); Suriname R., Brownsberg, tree n. 81, BW. 3229 (1917) fl. masc. Sept. (U); id., tree n. 1122, BW. 1697 (1916) (U); without loc., Hostmann 1268 (no date) fl. masc. and fem. (B, BM, K, P, U, W) (type); id., Hostmann and Kappler 1268 (no date) fl. masc. and fem. (F, G, S, W).

**Vern. names:** **SURINAME:** salie, witte salie (N.E.), jorieballi, jorieballi kolero (Arow.), peraka, pakira sipioli (Car.).

This species is recognizable by the most slender appearance of both its vegetative parts and its generative parts.

Though nearly related to *P. crassifolium* Engl., which is restricted to French Guiana, this Suriname-species is distinctly different from the other one.

**51. *Protium carnosum* A. C. SMITH** in *Brittonia* II, 2, p.153 (1936).

Tree or shrub. Branchlets stout, 5—10 mm in diam., when young angulose and densely ferrugineous tomentellous, when adult terete, glabrescent, fuscous and dotted with elliptic, ferrugineous lenticels. Leaves 4-jugate, 47.5—60 cm long, in all parts glabrous; petioles terete, but near the incrassate and transversely rimose base flattened above, 18 (15.5—27) cm long; interjuga terete, striate, above carinate, at the nodes incrassate, 3.5—5 cm long; petiolules semiterete, striate canaliculate, at both ends incrassate, 7.5—10 (—15) mm long, the terminal ones 30 mm; leaflets lanceolate to lanceolate-oblong, more or less obovate, usually 16 (15—25) cm long and 4 (4—7.5) cm wide, but the terminal ones shorter and wider and mostly distinctly obovate, the lateral ones subsymmetric and slightly obovate and the basal ones much shorter; apex abruptly acuminate; acumen linear, 12.5—20 mm long and 2—2.5 mm wide, obtuse; base cuneate; margin entire, repandous; subcoriaceous, smooth, above nitidulous, beneath dull; with 10—11 (9—12) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath distinctly prominent, tert. ones above visible, beneath prominulous. Inflorescences axillary, subterminal, laxly branched, 14 (8—17) cm long. Peduncles half the length of the inflorescences; sec. branchlets few, up to 4.5 cm long, tert. ones 0.5 cm. The axes stout, angulose and rather densely ferrugineous hirsute. Pedicels stout, about 2 mm long, like

the oblong, acute, 1 mm long bracts and bractlets and the outside of calyx rather densely but minutely puberulous. Flowers 4-merous, 4 mm long. Calyx broadly cupuliform, about 1 mm high; its lobes broadly triangular, acutely acuminate, slightly shorter than the tube. Petals oblong-triangular, subobtuse, outside sparsely fulvous puberulous, inside glabrous, on the margins papillose, very thick and carnose. Stamens in the fem. fl. 1.25 mm long; filaments subulate, 1 mm long; anthers elliptic. Disc annular, 8-lobed, 0.5 mm high, glabrous. Pistil in the fem. fl. at the base surrounded by the disc, 1.25 mm high; ovary globose, 4-sulcate, 4-celled, rather densely and appressedly sericeous, tapering in a sessile, 4-lobed stigma. Drupe ellipsoid, glabrescent, 3 cm long and 2 cm in diam.; mesocarp rather thin, carnose; endocarp rather thick, woody; pyrenes 2 or 3.

Type: Krukoff 4624 in h.NY.

Distribution: western Brazil.

BRAZIL: Amazonas, basin R. Jurua, near mouth R. Embira, trib. of R. Tarauaca, Krukoff 4624 (1933) on varzea land, fl. fem. and fr. June (B, F, K, NY, U); id., id. 4968 (1933) on high terra firma, fl. June (NY); Matto Grosso, basin R. Madeira, upper R. Machado, near Tabajara, Krukoff 1336 (ex A. C. Smith l.c.).

This species is particularly remarkable for its petals which are so much thickened that only a small cavity is left for the inner organs.

## 52. *Protium paniculatum* ENGL. em. SWART.

*Protium paniculatum* Engl. in Mart. Fl. Bras. XII, 2, p.270 (1874); id. in DC. Mon. Phan. IV, p.87 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931). Non apud Gleason in Bull. Tor. bot. Cl. LVIII, p.377 (1931) quod ad *P. Llewelynii* Macbr. pertinet.

*Icica paniculata* VillaFranca in Bull. Thér. méd. et chir. 1880, p.4 (1880).

*Tingulonga paniculata* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium nitidum* Engl. in Mart. Fl. Bras. XII, 2, p.271 (1874); id. in DC. Mon. Phan. IV, p.87 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931).

*Tingulonga nitida* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium Riedelianum* Engl. in Mart. Fl. Bras. XII, 2, p.279, t. 56 (1874); id. in DC. Mon. Phan. IV, p.88 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931).

*Tingulonga Riedeliana* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree, up to 18 m high. Branchlets rather stout, 4 mm in diam.,

terete, striate, when young densely but minutely ferrugineous pilose, when adult glabrescent, fuscous, scabriculous and dotted with elliptic, ferrugineous lenticels. Leaves 2- or 3-jugate, 24—45 cm long; petioles semiterete or terete and flattened only near the in-crasate base, 6.5—9 (4.5—11.5) cm long, like the rhachis glabrous or subglabrous; interjuga terete, striate, at the nodes incrasate, 3.5—4.5 (3—5) cm long; petiolules stout, terete, striate, canaliculate, glabrous, when adult at times transversely rimose, 7.5—10 (5—15) mm long, the terminal ones 20—25 (15—35) mm; leaflets lanceolate-oblong to oblong-elliptic, sometimes slightly narrowed to the apex, usually 12—20 (10.5—26) cm long and 5—6.75 (4.5—9) cm wide, but the terminal ones slightly wider and more or less distinctly narrowed to the base, the lateral ones suboblique and the basal ones shorter; apex gradually narrowed in a slightly tapering, 12.5 (10—20) mm long and 2.5 mm wide, obtuse acumen; base cuneate; margin entire, undulate; subcoriaceous to coriaceous, glabrous and smooth, above nitidous, beneath dull or nitidulous; with 13—16 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones hardly prominulous. Inflorescences fasciculate in the axils and subterminal or pseudoterminal, branched from the base, many-flowered, 10—35 (6—45) cm long; sec. branchlets up to 9 cm, tert. ones up to 3 cm long. The axes angulose, like the rather slender, terete, striate, 2 (1.5—2.5) mm long pedicels, the triangular, acute, 0.3—0.75 mm long bracts and bractlets and the outside of the calyx and the corolla rather densely to sparsely and minutely puberulous. Flowers 4-merous, 2.5—3 mm long. Calyx broadly cupuliform, 0.75—1 mm high; its lobes broadly triangular acute, about as long as the tube. Petals oblong-triangular-ovate, acute, inflexed-apiculate, carnosae. Stamens about 1.5 mm long; filaments subulate, in the masc. fl. as long as the oblong anthers, in the fem. fl. twice as long as the oblong anthers. Disc annular, 8-lobed, glabrous, 0.35—0.5 mm high. Pistil in the masc. fl. 1 mm high and embedded in the disc, in the fem. fl. 1.5 mm high and at the base surrounded by the disc; ovary globose-conical, 4-lobed, 4-celled, rather densely but shortly appressed-sericeous, tapering in a 0.3 mm long style, crowned by a 4-lobed stigma. Drupe ovoid, 2- to 4-lobed, acute, 3 cm long and 2—3 cm in diam.; pyrenes 2 to 4.

**Type:** Spruce 2770 in h.P.

**Distribution:** western Brazil.

**BRAZIL:** Amazonas, basin R. Negro, on R. Uaupés, near Panuré, Spruce 2662 (1852—1853) fl. masc. Oct.-Jan. (B, BM, BR, K, P, W) (type of *P. nitidum* Engl.); id., id. 2770 (1852) fl. fem. and fr. Dec. (BM, BR, K, P)



(type of *P. paniculatum* Engl.); id., prov. R. Negro, Riedel 1402 (1828) fl. masc. Sept. (B, K, LE, M) (type of *P. Riedelianum* Engl.); id., basin R. Solimoes, Sao Paulo de Olivença, near Palmares, Krukoff 8389 (1936) fl. fem. and fr. Sept.-Oct. (NY).

Engler l.c. (1874) based *P. paniculatum* Engl. on Spruce 2770, *P. nitidum* Engl. on Spruce 2662 and *P. Riedelianum* Engl. on Riedel 1402, but the differences between each two of these specimens are ever linked by the intermediate character of the third one. It was therefore impossible to keep these three species separate and the differences shown by the limited material at hand seemed to me even insufficient to retain them as subspecies. The differences between the three specimens, mentioned above, chiefly concern the length of the inflorescences versus that of the subtending leaves, the terete or semiterete petioles, the size of the leaflets in general and the shape of the terminal ones and the number of their sec. nerves. Krukoff 8389 agrees with Spruce 2770.

*P. Riedelianum* Engl. is quoted by Glaziou, in Bull. Soc. bot. Fr LII, Mém.3, p.92 (1905), from Rio de Janeiro, but as I did not met with the cited specimen, Glaziou n. 6717, I could not confirm this statement, which, from a geographic point of view, seems to me unlikely.

**var. pentamerum** SWART in Rec. Trav. bot. néerl. XXXIX, p. 198 (1942).

Leaves unifoliolate to 3-jugate; leaflets irregular in shape and size; acumen 10—15 mm long and 2.5—4 mm wide; tert. nerves prominent. Flowers 5-merous, yellowish brown.

Type: Klug 348 in h.F 624070.

Distribution: once collected.

PERU: Loreto, near Iquitos, Mishuyacu, Klug 348 (1929) alt. 100 m, fl. masc. Oct.-Nov. (F, NY, US).

53. **Protium medianum** MACBR. in Candollea V, p.377 (1934); L. Williams in Field Mus.N.H., Bot.S. XV, p.234 (1936).

Tree, up to 17 m high. Branchlets rather slender, terete, striate, when young rather densely but minutely pubescent, when adult glabrous, ferruginous to cinereous and dotted with small, elliptic, ferruginous lenticels. Leaves 2-jugate, 22.5 cm long; petioles semiterete, at the base incrassate, 4 (3.5—5.5) cm long, like the rhachis and the petiolules glabrous or, when young, subglabrous; interjuga terete, above carinate, at the nodes incrassate, 3.5 (3—4.5) cm long;

petiolules semiterete, at both ends incrassate, 10—12.5 mm long, the terminal ones 25 mm; leaflets lanceolate-oblong, usually 11 (9—12) cm long and 4 (3—4.5) cm wide, but the terminal ones slightly larger and obovate, the lateral ones symmetric and mostly somewhat narrowed to the base and the basal ones shorter; apex more or less abruptly acuminate; acumen linear, 8 mm long and 2 mm wide, obtuse; base acutely cuneate; margin entire, undulate; pergamentaceous, glabrous, smooth and dull; with 10 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath distinctly prominent, tert. ones above hardly conspicuous, beneath prominent. Inflorescences either subterminal and solitary or fasciculate in the axils or pseudoterminal, many-flowered, 12.5—20 cm long. Peduncles half the length of the inflorescences. Sec. branchlets up to 4 cm long, like the tert. ones branched only above the middle. The axes angulose, rather densely and patently puberulous. Pedicels terete, 2—2.5 mm long, like the ovate-semiorbicular, acute, 0.5 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely and minutely appressed-pubescent. Flowers 4-merous, 3 mm long, fulvous. Calyx broadly cupuliform, 0.75 mm high, carnos; its lobes broadly triangular, acutely subacuminate, twice as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, on the margins papillose. Stamens in the fem. fl. 1.75 mm long; filaments subulate; anthers oblong, 0.4 mm long. Disc annular, sub-8-lobed, glabrous, 0.4 mm high. Pistil in the fem. fl. as high as the stamens, 1.75 mm high; ovary depressedly globose, 4-lobed, 4-celled, 1 mm high, provided with scattered, rather long hairs, tapering in a 4-sulcate, 0.4 mm long style, crowned by a 4-lobed stigma. Immature drupe ovoid, 1 cm long and 0.75 cm in diam., glabrescent.

**Type:** Klug 270 in h.F 624303.

**Distribution:** north-eastern Peru.

PERU: Loreto, near Iquitos, Mishuyacu, Klug 270 (1929) alt. 100 m, fl. fem. Oct.-Nov. (F, NY, US); id., L. Williams 3792 (1929) alt. 120 m, fl. fem. Oct. (F, US).

This species is nearly related to *P. paniculatum* Engl. em. Swart. Its area is apparently more or less contiguous with that of the latter.

**Anatomy:** Cf. L. Williams l.c.

54. **Protium plagiocarpium** BENOIST in Bull. Soc. bot. Fr. LXVI, p.359 (1919); id. in Bull. Mus. Hist. nat. I, p.1 (1920); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.412 (1931).

*Protium Aracouchini* March. apud Engl. in Mart. Fl. Bras. XII, 2, p.274 (1874) et id. in DC. Mon. Phan. IV, p.74 (1883) quoad syn. *Icica parvifolia* Spruce et spec. cit. tantum.

*Icica parviflora* Benth. mss. in sched. Pl. Spruc. n. 2321; Radlk. in Sitz. Ber. K. Bay. Ak. Wiss., Mat.-phys. Cl. VII, p.383 (1878).

Tall tree, up to 7.5 m high. Branchlets slender, 2.5 mm in diam., terete, striate, glabrous, when young smooth and dark brown, when adult coarse and cinereous. Leaves 1-jugate, but sometimes 2-jugate, 14—18 (10—12) cm long, in all parts glabrous; petioles semiterete, striate, above sulcate, at the base incrassate, 2—4 (1.5—5) cm long; interjuga terete, striate, at the nodes incrassate, 2.5—3.5 cm long; petiolules semiterete, striate, canaliculate, at both ends incrassate, 4—7 (3—9) mm long, the terminal ones 15—25 (12.5—35) mm; leaflets oblong to oblong-elliptic, usually 5.25—7.5 (4—11) cm long and 2.25—3 (1.5—4.5) cm wide, but the terminal ones larger and mostly slightly narrowed to the base; apex abruptly acuminate; acumen linear 8—10 mm long and 1.5—2.5 mm wide, obtuse; base broadly cuneate; margin entire, undulate; pergamentaceous, smooth and nitidulous; with 9—10 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. and tert. ones above hardly prominent, beneath prominulous. Inflorescences axillary, laxly branched, few-flowered, about half the length of the subtending leaves, 5—9 (3—11) cm long. Peduncles most half the length of the inflorescences, rarely minute. The axes very slender, terete, striate, like the rather stout, 1.25—1.5 mm long pedicels, the triangular, acute, 0.25—0.5 mm long bracts and bractlets and the calyx and the corolla glabrous. Flowers 4-merous, 2—2.5 mm long, white or pale green. Calyx shallowly cupuliform, 0.4 mm high; its lobes semiorbicular, subacuminate, slightly longer than the tube. Petals oblong-elliptic-ovate, acute, inflexed-apiculate, subcarinose. Stamens 1.25 mm long; filaments subulate, at the base slightly dilated, 1 mm long; anthers elliptic. Disc annular, 8-lobed, glabrous, 0.3 mm high. Pistil in the masc. fl. 0.25—0.5 mm high and embedded in the disc, in the fem. fl. nearly 2 mm high and at the base surrounded by the disc; ovary ovoid, 4-lobed, 4-celled, scattered with rather long, silky hairs, tapering in a sessile, 4-lobed stigma. Drupe oblong-ovoid with rather long cylindrical narrowed base and long tapering apex, 2.5 cm long and 0.75—1 cm in diam., glabrescent.

Type: Benoist 368 in h.P.

Distribution: the Guianas and western Brazil.

BR. GUIANA: Roraima Mts., Schomburgk 954 (1842) fl. fem. Nov. (B); junction Oronoque R. and New R., Beddington 3 (1937) fl. masc. Sept. (K).

SURINAME: Brownsberg, VanEmden (1931) fl. masc. Sept. (U).

FR. GUIANA: Maroni R., Wachenheim 203 (no date) fl. masc. (P); near Charvein, Benoist 368 (1913) fr. Dec. (P) (type); without loc., Mélinon (1864) fr. (B, BM, F, LE); id., Aubriz leComte (no date) fl. fem. (B).

BRAZIL: Amazonas, R. Negro, near San Gabriel de Cachoeira, Spruce 2321 (1852) fl. masc. May (B, BM, C, G, K, LE, M, NY, P, W) (*Icica parviflora* Benth. mss.).

This species is nearly related to *P. Aracouchini* (Aubl.) March., but the latter differs chiefly by its glabrous ovary and by its drupes being not narrowed.

On the other hand *P. plagiocarpium* Ben. resembles *P. divaricatum* Engl. var. *intermedium* Swart, but the latter differs by its larger leaflets which are narrowed to the base and provided with more sec. nerves.

55. ***Protium divaricatum*** ENGL. in Mart. Fl. Bras. XII, 2, p. 279, t.55 (1874); id. in DC. Mon. Phan. IV, p.86 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931).

*Evodia divaricata* Poepp., Diar. n. 2703 ex Engl. l.c.

*Tingulonga divaricata* OK., Rev. Gen. Pl. I, p.108 (1891).

Small tree. Branchlets slender, 2.5 mm in diam., terete, striate, glabrous, cinereous and dotted with small, inconspicuous lenticels. Leaves trifoliolate, 32 (25—38) cm long, in all parts glabrous; petioles semiterete, 8—10 (5—12) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 1.5 (1—2) cm long, the terminal ones 4.5—5 (2.5—6) cm; leaflets oblong to oblong-elliptic, usually 15—18 (11—21) cm long and 6—7 (4.5—8.5) cm wide, but the terminal ones larger and obovate and the lateral ones symmetric and mostly narrowed to the base; apex abruptly acuminate; acumen linear, 8—12.5 mm long and 2—3 mm wide, obtuse; base acutely cuneate; margin entire, repandous; pergamentaceous, smooth, above nitidous, beneath dull; with 13—15 (12—16) pairs of sec. nerves; prim. nerves prominent, sec. ones above grooved on each side, beneath prominent, tert. ones prominulous. Inflorescences sub-terminal axillary, laxly and divaricately branched, many-flowered, 35 (20—45) cm long. Sec. branchlets up to 10 cm, tert. ones up to 3 cm long. The axes slender, terete, striate, glabrous to sparsely pilose. Pedicels slender, terete, glabrous, 1.75 mm long. Bracts and bractlets triangular-elliptic, acute, sparsely puberulous, 0.4 mm long. Flowers 4-merous, 2.5 mm long, yellow. Calyx cupuliform, glabrous,

0.8 mm high; its lobes semiorbicular, acutely subacuminate, as long as the tube. Petals oblong-ovate, acute, inflexed-apiculate, glabrous, subcarnose. Stamens 1.5 mm long; filaments subulate, 1 mm long; anthers elliptic. Disc annular, 8-lobed, glabrous, 0.4 mm high. Pistil in the masc. fl. embedded in the disc, 0.3 mm high; ovary depressed globose, 4-lobed, rather densely puberulous; stigma sessile, 4-lobed. Drupe ellipsoid, sparsely puberulous, 1.5 cm long and 1 cm in diam.; mesocarp carnose; endocarp thin, crustaceous; pyrenes 1 or 2.

**Type** (lecto-type): Poeppig 2703 in h.LE.

**Distribution**: Brazil (central Amazonas).

BRAZIL: Amazonas, R. Solimoes, Maynas, Poeppig 2703 (1831) fl. masc. Oct. (B, BRSL, F, G, LE, W) (type); id., Ega, Poeppig 2704 (1832) fl. masc. (W) and probably the same under n. 2815 (LE); id., id. 2815 (1831) fr. Nov. (BRSL, F, G, LE, W); id., Coary, Traill 109 (1874) fl. Oct. (K); id., R. Madeira, near Borba, Riedel 1362 (1828) fl. masc. Aug. (B, LE).

This species is recognizable by its large 1-jugate leaves, by its pergamentaceous leaflets which are narrowed to the base, by its long and divaricately branched inflorescences and by its small, glabrous flowers.

I was unable to discover whether Poeppig ever published the name „*Evodia divaricata*”, but as Poeppig 2703 in the Herbarium at Leningrad is the only specimen labelled “*Evodia divaricata*” by Poeppig, and also “(*Icica*) *Protium divaricatum*” by Engler, I consider this specimen as the type.

**var. *Krukoffii*** SWART in Rec. Trav. bot. néerl. XXXIX, p.198 (1942).

Leaves 1- or 2-jugate, 24 (15—28) cm long; leaflets with 11—12 pairs of sec. nerves. Inflorescences about  $\frac{3}{4}$  the length of the subtending leaves, 17.5 (15—20) cm long. Pedicels longer than the flowers.

**Type**: Krukoff 4703 in h.U 15840A.

**Distribution**: once collected.

BRAZIL: Amazonas, basin R. Jurua, near mouth R. Embira, trib. of R. Tarauaca, Krukoff 4703 (1933) fl. masc. June (B, F, NY, U).

**var. *intermedium*** SWART in Rec. Trav. bot. néerl. XXXIX, (p.199 (1942).

Leaves 1- or 2-jugate, 20—25 (16—28.5) cm long; leaflets 11 8—14.5) cm long and 4 (2.5—5) cm wide, with 11—13 pairs of

sec. nerves. Inflorescences about as long as the petioles, up to 5 cm long, few-flowered. Ovary sparsely to rather densely puberulous.

Type: Krukoff 5064 in h.U 16003A.

Distribution: twice collected.

COLOMBIA: Magdalena Valley, between R. Sagamoso and R. Colorado, near Barranca Bermya, Haught 1527 (1935) alt. 100—150 m, fl. masc. Jan. (U).

BRAZIL: Amazonas, basin R. Jurua, near mouth R. Embira, trib. of R. Tarauaca, Krukoff 5064 (1933) fl. fem. June (B, F, K, NY, U).

Both varieties, but especially the latter one, show transitions from *P. divaricatum* Engl. to *P. plagiocarpium* Ben., but they are referred here to the former species because of the size and shape and the number of sec. nerves of their leaflets.

56. *Protium nicaraguense* SWART in Rec. Trav. bot. néerl. XXXIX, p.199 (1942).

*Protium Copal* (S. et C.) Engl. in errore Standl. in Trop. Woods XVII, p.23 (1929).

*Protium panamense* (Rose) Johnston in errore Standl. l.c.

Small tree. Leaves 4-jugate, 37.5—40 cm long; petioles terete, above slightly flattened, 6—6.5 cm long, like the rhachis and the petiolules rather densely but minutely pilose, but glabrescent when adult; interjuga terete, striate at the nodes incrassate, 5.5 (4.5—6) cm long; petiolules semiterete, canaliculate, subalate, at both ends incrassate, 15 (10—17.5) mm long, the terminal ones 4 cm; leaflets lanceolate-oblong to oblong, usually 18 (17—20) cm long and 6.5 (6.25—7.5) cm wide, but the terminal ones narrowed to the base, the lateral ones sometimes slightly narrowed near the apex and the basal ones shorter; apex rather abruptly acuminate; acumen sublinear, 12.5 mm long and 2.5 mm wide, obtuse; base acutely cuneate; margin entire; subcoriaceous, glabrous and smooth, above nitidulous, beneath dull; with 11—12 pairs of sec. nerves; prim. nerves above grooved on each side and pilose like the petioles, beneath prominent and glabrous, sec. ones above depressed, beneath prominent, tert. ones above invisible, beneath prominulous, sec. and tert. ones glabrous. Inflorescences mostly fasciculate in the axils, few-branched, 5 cm, rarely up to 9 cm, long. The axes slender, angulose, like the terete, striate, about 2 mm long pedicels, the triangular, acute, 0.3 mm long bracts and bractlets and the calyx and the corolla sparsely puberulous or subglabrous. Flowers 4-merous, 3 mm long, yellowish white. Calyx cupuliform, 0.75 mm high; its lobes minute,

broadly triangular, acutely subacuminate, 0.15 mm long. Petals elliptic-ovate, acute, inflexed-apiculate, subcarnose, inside puberulous. Stamens 1.75 mm long; filaments subulate; anthers oblong, basifixed, 0.5 mm long. Disc annular, 8-lobed, glabrous, 0.4 mm high. Pistil at the base surrounded by the disc, 0.75 mm high; ovary globose, sub-4-lobed, rather densely appressed-puberulous, 0.6 mm high, tapering in a sessile, 4-lobed stigma. Drupe globose, 1.5 cm in diam.

Type: Englesing 76 in h.F 585314.

Distribution: Nicaragua.

NICARAGUA: region of Braggmann's Bluff, Kukalaya R., Englesing 76 (1927) alt. 65 m, fl. and fr. Dec. (F); id., id. 67 (1927) fl. (F, K, NY).

Vern. name: fosforito.

Probably both specimens are female though the flowers show rather small pistils.

This species is related to *P. Copal* (S. et C.)Engl., but the latter differs by its glabrous vegetative parts and by its ovate leaflets which are provided with a short acumen. *P. nicaraguense* Swart resembles also *P. Pittierii* (Rose)Engl., but the latter differs by its 1- or 2-jugate leaves, by its oblong-elliptic leaflets which are provided with a short acumen, by its much-branched inflorescences and by its calyxlobes being longer than the tube.

57. *Protium Altsonii* SANDWICH in Kew Bull. 1928, 9, p.369 (1928).

Tall tree. Branchlets rather slender, 3 mm in diam., terete and smooth, when young densely brown puberulous, when adult glabrescent, dark brown and dotted with pale brown lenticels. Leaves 4- to 6-jugate, 24—32 cm long; petioles semiterete, at the base incrassate, 3.75—4.75 (3.5—5) cm long, like the rhachis and the petiolules rather densely but minutely pubescent; interjuga subangulose, above slightly bisulcate, at the nodes slightly incrassate, 2.5—3 (2—3.5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 7.5 mm long, the terminal ones 22.5 mm; leaflets lanceolate to lanceolate-oblong, mostly somewhat narrowed to the apex, usually 10.5 cm long and 3 cm wide, but the terminal ones shorter and narrowed to the base, the lateral ones subsymmetric and the basal ones shorter; apex rather abruptly acuminate; acumen linear, 12.5 mm long and 2 mm wide, obtuse; base broadly cuneate; margin entire, undulate; more or less coriaceous, glabrous and

smooth, above nitidulous, beneath dull; with 16—17 pairs of sec. nerves; prim. nerves distinctly prominent, above sparsely and minutely puberulous, beneath glabrous, sec. ones prominent and glabrous, tert. ones prominulous and glabrous. Inflorescences axillary, branched from the base, many-flowered, glomeruliform, 2 (1.5—2.5) cm long; sec. branchlets up to 1 cm. The axes stout, terete, striate, like the stout, terete, striate, 1.5—1.75 mm long pedicels and the oblong-triangular, acute, 0.75—1 mm long bracts and bractlets rather densely to sparsely and minutely puberulous. Flowers 5-merous, 3.25 mm long, greenish. Calyx cupuliform, glabrous, 1 mm high; its lobes broadly triangular, acuminate, about as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, mostly glabrous but in the bud outside slightly pilose, sub-carnose. Stamens 1 mm long; filaments subulate and dilated, twice as long as the elliptic anthers. Disc annular, 10-lobed, glabrous, 0.5 mm high. Pistil in the masc. fl. 0.5 mm high; ovary biconical, 10-sulcate, rather densely but shortly appressed-hirsute, tapering in a sessile, 5-lobed stigma.

Type: Altson 529 in h.K.

Distribution: Br.Guiana.

BR.GUIANA: Ireng-Distr., Paramacutoi savannah, Altson 529 (1926) alt. 700 m, in forest, fl. masc. May (K, NY).

Vern. name: tsepur (Patamona).

This species is related to *P. Hostmannii* (Miq.)Engl., but the latter differs by the short petioles of its 2- or 3-jugate leaves, by the shorter acumen and the less numerous sec. nerves of its wider and pergamentaceous leaflets and by the minutely dentate calyx of its 4-merous flowers.

58. **Protium Poeppigianum** SWART in Rec. Trav. bot. néerl. XXXIX, p.200 (1942).

*Protium Carana* (H.B.K.)March. in errore Engl. in Mart. Fl. Bras. XII, 2, p.277 (1874) et id. in DC. Mon. Phan. IV, p.84 (1883) excl. syn. et spec. Humb. et Bonpl.; Pitt. in Trab. Mus. com. Venez. VIII, p.364 (1931).

Tree. Branchlets rather stout, 5 mm in diam., angulate, sparsely puberulous, fuscous and dotted with small, elliptic, pale brown lenticels. Leaves 3- or 4-jugate, about 55 cm long; petioles terete, above slightly flattened, at the base incrassate, 9—13 cm long, like the rhachis and the petiolules sparsely and minutely pilose; interjuga



terete, striate, at the nodes incrassate, 6—7.5 cm long; petiolules semiterete, canaliculate, at both ends incrassate, 1—1.5 cm long, the terminal ones 5 cm; leaflets lanceolate to lanceolate-oblong, narrowed to the base, usually 22.5 (19—27) cm long and 7 (6.5—8) cm wide, but the basal ones shorter; apex abruptly acuminate; acumen sublinear, 10 (7.5—15) mm long and 2—2.5 mm wide; base acutely cuneate; margin entire, repandous; pergamentaceous, smooth and dull, above glabrous, beneath subglabrous; with 15—17 pairs of sec. nerves; prim. nerves near the base sparsely and minutely pilose, above grooved on each side, beneath distinctly prominent, sec. ones glabrous, above prominulous, beneath prominent, tert. ones glabrous, above inconspicuous, beneath prominulous. Inflorescences fasciculate in the axils, 10 (6.5—12.5) cm long; sec. branchlets few, up to 1 cm long. The axes angulose, like the stout, terete, striate, 5 mm long fruitstalks and the calyx when young sparsely and minutely pilose, when adult glabrescent. Flowers 5-merous, 3 mm long. Calyx cupuliform, about 1 mm long; its lobes semi-orbicular, obtusely acuminate, about as long as the tube. Petals elliptic-ovate, acute, incrassate-apiculate, sparsely and minutely puberulous. Stamens 1.5 mm long; filaments subulate, at the base dilated, as long as the oblong anthers. Disc annular, glabrous. Drupe ellipsoid, with cylindrically narrowed base and acute apex, sparsely pilose, 2.5—3 cm long and 1.5—2.5 cm in diam., crowned by a sessile, 5-lobed stigma.

Type: Poeppig 2830 in h.W.

Distribution: Brazil (central Amazonas).

BRAZIL: Amazonas, R. Solimoes, Ega, Poeppig 2830 (1831) fr. Nov. (W); id., id. 2832 (1832) fr. (W).

This species is related to *P. grandifolium* Engl., but the latter differs by the dense indumentum of its petioles and rhachis and by its nitidous, at the base not narrowed leaflets which at the top are gradually narrowed in a short acumen.

Engler, l.c., referred the type specimen of this species to *P. Carana* (H.B.K.) March. and founded his diagnosis of the latter species on Poeppig 2830, but this specimen differs distinctly from the type specimen of *P. Carana* (H.B.K.) March., viz. Humboldt 960, which had not been studied by Engler. Both species are incompletely known, but the fruits of Poeppig 2830 and 2832 show a distinct Protium-structure.

59. *Protium Llewelynii* MACBR. in *Candollea* V, p.378 (1934); L. Williams in *Field Mus.N.H., Bot.S.* XV, p.234 (1936).

*Protium paniculatum* Engl. in errore Gleason in Bull. Tor. bot. Cl. LVIII, p. 377 (1931).

Tree, up to 20 m high. Branchlets slender, 2.5 mm in diam., terete, striate, when young densely but minutely brown pilose, when adult glabrescent, scabrous and castaneous to fuscous. Leaves 4- (3- to 5-) jugate, 25 (20—30) cm long; petioles semiterete, at the base slightly incrassate, 4.5 (3—7.5) cm long, like the rhachis and the petiolules rather densely but minutely pale brown puberulous and sometimes, when adult, transversely rimose; interjuga angulose, striate, at the nodes more or less incrassate, 2.5—3.5 (2—5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 4 (3—8) mm long, the terminal ones 10—20 mm; leaflets lanceolate-oblong, sometimes slightly narrowed to the apex, usually 10—12 (8—18) cm long and 3.4 (2.75—6) cm wide, but the terminal ones narrowed to the base, the lateral ones oblique and sometimes slightly narrowed to the base, and the basal ones smaller; apex rather abruptly acuminate; acumen linear, 5—10 (3—12) mm long and 2.5—3.5 (2—4) mm wide, obtuse; base acutely cuneate; margin entire, undulate; subcoriaceous, glabrous or subglabrous, smooth and dull to nitidulous; with 14 (12—15) pairs of sec. nerves; prim. nerves pilose like the petioles, above grooved on each side, beneath distinctly prominent, sec. and tert. ones above conspicuous to inconspicuous and glabrous, beneath prominent and provided with some hairs. Inflorescences subterminal, axillary, laxly branched from the base, 7.5—10 cm long; sec. branchlets few, up to 5 cm long, tert. ones up to 1 cm. The axes terete, striate, like the slender, terete, striate, 2—2.5 mm long pedicels, the triangular, obtusely subacuminate, 0.5—0.75 mm long bracts and bractlets and the outside of the calyx and the corolla rather densely to sparsely and minutely puberulous. Flowers 5-merous, 3—3.5 mm long, white or yellowish. Calyx broadly cupuliform, 0.75—1 mm high; its lobes broadly triangular, obtusely subacuminate, nearly as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, inside glabrous, on the margins papillose, carnosae. Stamens about 1.5 mm long; filaments subulate, at the base dilated, about twice as long as the oblong-lanceolate anthers. Disc annular, 10-lobed, glabrous, 0.35 mm high. Pistil at the base surrounded by the disc, in the masc. fl. 0.8 mm, in the fem. fl. 2 mm high; ovary globose, sub-5-lobed, rather densely and appressedly puberulous, tapering in a stout, conical style, half as long as the ovary, crowned by a 5-lobed stigma. Drupe either oblique-ovoid and monopyrenous or globose, 2- to 4-lobed and 2- to 4-pyrenous, minutely ferruginous pilose, 2 cm long and 1.5—2.5

cm in diam.; mesocarp rather thick, carnose; endocarp thin, crustaceous.

Type: L. Williams 3704 in h.F 618015.

Distribution: eastern slopes of the Andes.

VENEZUELA: Amazonas Terr., Esmeralda, Tate 348 (1928) alt. 100 m, fl. masc. Nov. (NY, US); id., id. 957 (1928—1929) alt. 150 m, fl. masc. (NY).

BRAZIL: Amazonas, basin R. Solimoes, Sao Paulo de Olivença, near Palmares, Krukoff 8197 (1936) fl. fem. Sept.-Oct. (NY); id., id. 8419 (1936) high land, fr. Sept.-Oct. (NY); id., basin Creek Belem, Krukoff 8890 (1936) in high forest, fr. Oct.-Dec. (NY).

PERU: Loreto, near Iquitos, L. Williams 3704 (1929) alt. 120 m, fl. fem. Oct. (F, US) (type).

BOLIVIA: region Mapiri San Carlos, Buchtien 1669 (1927) alt. 850 m (B).

Vern. name: breu (ex Krukoff).

Anatomy: cf. L. Williams l.c.

60. *Protium grandifolium* ENGL. in Mart. Fl. Bras. XII, 2, p.269 (1874); id. in DC. Mon. Phan. IV, p.84 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931); Pitt. in Trab. Mus. com. Venez. VIII, p.364 (1931).

*Tingulunga grandifolia* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree. Branchlets slender, 4 mm in diam., terete, striate, densely but minutely pilose. Leaves 4-jugate, rarely 3- or 5-jugate, 40 (26—50) cm long; petioles terete, slightly flattened near the incrassate base, 8 (5.5—9.5) cm long, like the rhachis and the petiolules densely but minutely pilose; interjuga terete, at the nodes incrassate, 4.5 (3—5) cm long; petiolules terete, striate, canaliculate, at both ends incrassate, when adult transversely rimose, 15 (10—17.5) mm long, the terminal ones 35 (20—50) mm; leaflets lanceolate, usually 17 cm long and 4.75 cm wide, but the terminal ones wider and narrowed to both ends, the lateral ones oblique and the basal ones shorter; apex more or less gradually narrowed in a slightly tapering, 7.5—10 mm long and 3 mm wide, obtuse acumen; base acutely cuneate; margin entire; subcoriaceous, glabrous and smooth, nitidulous; with 17 (16—19) pairs of sec. nerves; prim. nerves rather densely but minutely pilose, above grooved on each side, beneath distinctly prominent, sec. and tert. nerves above conspicuous and glabrous, beneath prominent, sparsely and minutely pilose. Inflorescences axillary, laxly branched from the base, many-flowered, 12.5 (7—15) cm long; sec. branchlets up to 4 cm long. The axes slender, like the slender, terete, 4.5 mm long pedicels, the ovate-triangular, obtuse,

0.75—0.5 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely and minutely puberulous. Flowers 5-merous, 4 mm long. Calyx cupuliform, 1 mm high; its lobes broadly triangular, acutely subacuminate, as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate subcarinose. Stamens 1.5—2 mm long; filaments subulate, at the base dilated; anthers oblong, 0.5 mm long. Disc annular, 10-lobed, 0.5 mm high, glabrous. Pistil in the fem.fl. as long as the stamens, 2 mm high, at the base surrounded by the disc, rather densely puberulous; ovary depressedly globose, 5-lobed, 5-celled, as high as the cylindrical, 5-sulcate style, crowned by a 5-lobed stigma.

Type: Spruce 3304 in h.P.

Distribution: once collected.

VENEZUELA: Amazonas Terr., on R. Casiquari, R. Vasiva and R. Pacimoni, Spruce 3304 (1854) fl. fem. Jan. (B, BM, BR, G, K, LE, NY, P, W).

Anatomy: Guill. in Ann. Sc. nat., S.9, X, p.210 (1909).

61. *Protium Pittierii* (ROSE) ENGL. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413 (1931); Standl. in Field Mus.N.H., Bot.S. XVIII, p.576 (1937).

*Icica Pittierii* Rose in N. Am. Fl. XXV, 3, p.260 (1911).

Probably a tree. Branchlets rather stout, 4 mm in diam., when young angulose and densely but minutely ferruginous pilose, when adult terete, glabrescent, pale brown and dotted with oblong lenticels. Leaves 2-jugate or, sometimes, trifoliolate, 25—37 cm long; petioles semiterete, above sulcate and dilated, at the base subincrassate, 10 (5—11.5) cm long, like the rhachis and the petiolules rather densely and minutely to shortly and patently pubescent, when adult glabrescent and scabridulous; interjuga terete, striate, at the nodes incrassate, 8 (4—8.5) cm long; petiolules semiterete, striate, canaliculate, at both ends incrassate, 1.5 (1—2) cm long, the terminal ones 4 (3—5) cm; leaflets oblong-elliptic to elliptic, mostly somewhat narrowed to the apex, usually 15 (12—22) cm long and 7 (5.5—10.5) cm wide, but the terminal ones wider and mostly narrowed to the base, the lateral ones subsymmetric and the basal ones smaller; apex rather abruptly acuminate; acumen tapering, about as long as wide, 5—10 mm long and 5—7.5 mm wide, obtuse; base round; margin entire, repandous, undulate; pergamentaceous, scattered with minute hairs, smooth and dull; with 11 (10—12) pairs of sec. nerves; prim. nerves pilose like the petioles, above

grooved on each side, beneath distinctly prominent, sec. and tert. nerves sparsely and minutely pilose, above prominulous, beneath prominent. Inflorescences axillary, branched from the base, up to 11 cm long; sec. branchlets up to 6 cm, tert. ones up to 7.5 mm long. The axes slender, angulose, like the terete, striate, 1.5—1.75 mm long pedicels, the elliptic-ovate, subobtuse, about 0.5 mm long bracts and bractlets and the outside of the calyx and corolla rather densely hirtellous. Flowers 4-merous, 4 mm long. Calyx cupuliform, 1.5 mm high; its lobes triangular, acute, slightly longer than the tube. Petals oblong-ovate, acute, inflexed-apiculate, inside puberulous, on the margins papillose, carnose. Stamens 1.75 mm long; filaments subulate, about as long as the oblong-elliptic anthers. Disc annular, 8-lobed, glabrous, 0.5 mm high, Pistil in the fem. fl. rather more than 1 mm high, rather densely appressed-puberulous; ovary depressedly globose, 4-lobed, 4-celled, at the base surrounded by the disc, tapering in a short, conical style, crowned by a 4-lobed stigma. Drupe oblong-ovoid, with narrowed base and acute apex, sparsely hirtellous, 2.5—3.5 cm long and 1—2 cm in diam.; mesocarp thick, carnose; endocarp thin, woody, brittle; pyrenes 2 or 3.

Type: Pittier 13426 in h.US 1380510.

Distribution: Central America.

MEXICO: Oaxaca, Jocotepex, Reto 4062 (1919) alt. 300 m, fl. fem. and fr. March (US).

COSTA RICA: R. Blanco, Llanuras de Santa Clara, Pittier 13426 (1899) alt. 300 m, fl. fem. and fr. July (B, US).

This species is related to *P. Copal* (S. et C.) Engl. but the latter differs by its glabrous and smaller leaves and by its narrower and nitidous leaflets which are distinctly tapering and which are provided with more sec. nerves. *P. Pittierii* (Rose) Engl. also resembles *P. costaricense* (Rose) Engl., but the latter differs by the rather long indumentum covering its vegetative parts, by its much shorter petioles, interjuga and petiolules, by its smaller and oblong leaflets and by its much shorter inflorescences.

62. *Protium opacum* SWART in Rec. Trav. bot. néerl. XXXIX, p.200 (1942).

Large tree, 15—30 m high. Branchlets rather stout, terete, striate, when young densely but minutely ferrugineous pilose, when adult glabrescent, cinereous to fuscous and dotted with elliptic, ferrugineous lenticels. Leaves 2- or 3-jugate, rarely 4-jugate, 30—40 (22—42) cm long; petioles semiterete, alate, at the base incrassate,

7—9 (5—11) cm long, like the rhachis and the petiolules densely but minutely and patently pilose; interjuga subterete, striate, at the nodes incrassate, 3.5—4.5 (3—5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 10 (7.5—12.5) mm long, the terminal ones 25 (20—35) mm; leaflets oblong-lanceolate to oblong-elliptic, slightly narrowed to the apex, usually 13—17.5 (11—20) cm long and 4.75—6 (4.5—7) cm wide, but the terminal ones wider and distinctly narrowed to the base, the lateral ones oblique and mostly narrowed to the base, and the basal ones smaller; apex rather abruptly acuminate; acumen sublinear, 15 (10—20) mm long and 2.5—3 mm wide, obtuse; base cuneate; margin entire; subcoriaceous, scabridulous and dull, above glabrous, beneath scattered with minute hairs; with 12—14 (11—15) pairs of sec. nerves; prim. nerves pilose like the petioles, above grooved on each side, beneath distinctly prominent, sec. nerves above depressed and glabrous, beneath prominent and sparsely and minutely pilose, tert. nerves above invisible, beneath prominent and scattered with minute hairs. Inflorescences subterminal, fasciculate in the axils, laxly branched from the base, many-flowered, 20 (15—30) cm long; sec. branchlets up to 11 cm, tert. ones up to 2.5 cm. The axes terete, striate, like the terete, short, about 1 mm long pedicels and the triangular, acute, 0.5—1 mm long bracts and bractlets rather densely puberulous. Flowers 4-merous, 4 mm long, white. Calyx broadly cupuliform, sparsely puberulous, 0.5 mm high; its lobes triangular, acute slightly longer than the tube. Petals elliptic-ovate, acute, inflexed-apiculate, outside sparsely puberulous, inside glabrous, carnose. Stamens in the masc. fl. 2.5 mm long; filaments subulate, 2 mm long; anthers elliptic. Disc annular, 8-lobed, glabrous, 0.5 mm high. Pistil in the masc. fl. 0.75 mm high; ovary embedded in the disc, depressedly globose, 4-lobed, rather densely appressed-puberulous, tapering in a sessile, 4-lobed stigma. Drupe ovoid, unfurrowed to 4-lobed, with acute apex, rather densely ferruginous appressed-puberulous, 2 cm long and 1.5—2 cm in diam.; mesocarp rather thick, carnose; endocarp thin, crustaceous and brittle; pyrenes 1 to 4.

**Type:** Krukoff 4816 in h.U 15954A.

**Distribution:** Brazil (southern Amazonas).

**BRAZIL:** Amazonas, basin R. Jurua, near mouth R. Embira, trib. of R. Tarauaca, Krukoff 4816 (1933) fl. masc. June (F, NY, U); id., id. 4911 (1933) fl. masc. June (F, NY, U); id., basin R. Madeira, Humayta, on plateau between R. Livramento and R. Ipixuna, Krukoff 7131 (1934) fr. Nov. (NY, U); id., id. 7173 (1934) fr. Nov. (NY, U).

This species is recognizable by its scabridulous leaflets, a feature

which rarely occurs in *Protium*, and its related to *P. paniculatum* Engl.em.Swart, but the latter differs by its glabrous vegetative parts, by its smooth and nitidous leaflets which are gradually acuminate, and which are provided with a somewhat larger number of sec. nerves.

63. ***Protium Schomburgkianum*** ENGL. in Mart. Fl. Bras. XII, 2, p.276 (1874) excl. syn.

*Protium decandrum* (Aubl.) March. in errore Engl. in DC. Mon. Phan. IV, p.82 (1883) excl. syn. *Icica enneandra* Aubl. et *Amyris enneandra* Willd. cum mat. Aubl.

Tree, up to 17 m high. Branchlets terete, glabrous, smooth, castaneous and dotted with small, elliptic lenticels, when adult cinereous and scabridulous. Leaves 1-jugate, rarely unifoliolate or 2-jugate, 17.5—25 cm long; petioles semiterete, above dilated, at the base subincrassate, 2.5 (1—4) cm long, like the terete, striate, 4—5 cm long interjuga and the petiolules rather densely but minutely and patently pilose, but when adult sometimes glabrescent; petiolules semiterete, canaliculate, at both ends incrassate, 7.5—10 (5—12.5) mm long, the terminal ones 15—25 mm; leaflets lanceolate-oblong, mostly narrowed to the base, 12—13 (10—15.5) cm long and 4—4.75 (3.5—5.25) cm wide, the lateral ones suboblique; apex gradually narrowed in a slightly tapering, 7.5—10 mm long and 2.5—3 mm wide, obtuse acumen; base acutely cuneate; margin entire, undulate; pergamentaceous, glabrous, smooth and nitidulous; with 12—14 pairs of sec. nerves; prim. and sec. nerves above grooved on each side and glabrous or nearly so, beneath prominent and glabrous, tert. ones glabrous, above hardly visible, beneath prominulous. Inflorescences pseudoterminal and up to 10 cm long or subterminal axillary, sometimes fasciculate in the axils, and 4.5—6 cm long; sec. branchlets few, 5 mm long. The axes terete, striate, sparsely appressed-puberulous. Pedicels rather stout, terete, striate, 1—1.25 mm long, like the outside of the calyx and the corolla sparsely and minutely puberulous to glabrous; bracts and bractlets broadly triangular, 0.5 mm long rather densely puberulous. Flowers 5-merous, 2.5—3 mm long. Calyx broadly cupuliform, 0.8—1 mm high; its lobes semiorbicular, acutely subacuminate, about as long as the tube. Petals elliptic-ovate, acute, inflexed-apiculate, inside puberulous, carnose. Stamens 1.5 mm long; filaments subulate, flattened, about twice as long as the oblong anthers. Disc annular, 10-lobed, glabrous, 0.4 mm high. Pistil in the masc. fl. 0.75 mm high and embedded in the disc, in the fem. fl. 1.5 mm high and at the base surrounded by the disc; ovary depressedly globose, 5-lobed,

5-celled, rather densely appressed-puberulous, tapering in a subsessile 5-lobed stigma. Drupe ellipsoid, 2- or 3-lobed, with acute apex and narrowed base, sparsely puberulous, 2.5 cm long and 1.25—1.75 cm in diam.; pyrenes 2 or 3.

**Type:** Schomburgk 1468 in h.B.

**Distribution:** the Guianas and northern Brazil.

BR.GUIANA: Roraima Mts., Schomburgk 898 (1842—1843) fl. masc. (G, P, W); Sururu R., Schomburgk 1468 (1843) fl. masc. Sept. (B, BRSL) (type).

FR.GUIANA: Cayenne, Richard (no date) fl. fem. (G, L).

BRAZIL: Amazonas, basin R. Solimoes, Sao Paulo de Olivença, near Palmares, Krukoff 8535 (1936) on high lands, fr. Sept.-Oct. (NY).

This species is very similar to *P. decandrum* (Aubl.) March. and might be considered a mere variety of it, differing by the minute but distinct and dense indumentum of its petioles and petiolules and by the slightly longer acuminate apex of the leaflets. Engler, l.c. 1874, founded this species on Schomburgk 1468 and referred to it *Icica enneandra* Aubl. and *Amyris enneandra* Willd. Although he did not doubt that *Icica decandra* Aubl., (*Amyris decandra* Willd.), would belong to the same species he did not definitively express an opinion as to their identity, evidently because he never saw the Aublet-material. In 1883 however he transferred *P. Schomburgkianum* Engl., accompanied by its former diagnosis and synonyms to *P. decandrum* March., again omitting *Icica decandra* Aubl. amongst the synonyms.

64. *Protium Hostmannii* (Miq.) ENGL. in Mart. Fl. Bras. XII, 2, p.266 (1874); id. in DC. Mon. Phan. IV, p.81 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931); Pulle, Enum. Vasc. Pl. Surin. p.245 (1906).

*Icica Hostmannii* Miq., Stirp. Sur. Sel. p.66 (1850); Walp., Ann. Bot. Syst. II, p.289 (1851—1852).

*Tingulunga Hostmannii* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium heptaphyllum* (Aubl.) March. var. *puberulum* Engl. in Mart. Fl. Bras. XII, 2, p.263 (1874); id. in DC. Mon. Phan. IV, p.64 (1883); Pulle, Enum. Vasc. Pl. Surin. p.245 (1906); ?Hoehne in Comm. Lin. Tel. Estr. Matto Grosso ao Amazonas, Bot. VI, Annexe 5, p.32 (1915).

Tree, usually small, up to 17 m high. Branchlets slender, 2—2.5 mm in diam., terete, when young smooth and rather densely ferruginous tomentellous, when adult glabrescent, scabridulous, grey and dotted with elliptic lenticels. Leaves 1- to 3-jugate, mostly



2-jugate, rarely unifoliolate, 15—17.5 (11—22) cm long; petioles semiterete, base hardly incrassate, 1.5—2 (1—3) cm long, like the rhachis and the petiolules rather densely puberulous; interjuga terete, striate, at the nodes incrassate, 2.5—3 (1.5—4) cm long; petiolules semiterete, canaliculate, at both ends slightly incrassate, 5—6 (3—10) mm long, the terminal ones 2—3 cm; leaflets oblong to oblong-elliptic, usually 8—9 (5—10) cm long and 3—3.5 (2—4) cm wide, but the terminal ones wider and slightly narrowed to the base, the lateral ones suboblique and slightly narrowed to the apex, and the basal ones shorter; apex mostly gradually, but sometimes rather abruptly acuminate; acumen sublinear, 7.5 (5—12.5) mm long and 2.5—4 (2—6) mm wide, obtuse; base cuneate; margin entire; subcoriaceous to pergamentaceous, glabrous, smooth and dull; with 10 (8—12) pairs of sec. nerves; prim. and sec. nerves sparsely and minutely pilose, above grooved on each side, beneath prominent, tert. nerves glabrous, above invisible, beneath hardly visible. Inflorescences axillary, richly branched from the base, few-flowered, 1—1.5 (0.75—2.5) cm in diam. The axes slender, angulose, like the terete, 1.75—2 mm long pedicels, the semiorbicular to elliptic, 0.25 mm long bracts and bractlets and the outside of the calyx sparsely and minutely puberulous. Flowers 4-merous, 2 mm long, yellowish white. Calyx cupuliform, 0.5 mm high, minutely 4-lobed to 4-dentate. Petals triangular-ovate, subacute, inflexed-apiculate, outside scattered with minute hairs, inside glabrous, on the margins papillose, subcarinose. Stamens in the masc. fl. 1.75, in the fem. fl. 1.25 mm long; filaments subulate, dilated; anthers oblong-elliptic, about 0.5 mm long. Disc annular, 8-lobed, glabrous, 0.25—0.35 mm high. Pistil at the base surrounded by the disc, in the masc. fl. 0.75 mm high, in the fem. fl. about 1.5 mm high; ovary globose-ovoid, sub-4-lobed, 4-celled, rather densely puberulous, tapering in a 4-sulcate, glabrous style half as long as the ovary, crowned by a 4-lobed stigma. Drupe either oblique-ellipsoid and monopyrenous or globose, 2- or 3-lobed and 2- or 3-pyrenous, 1.25 cm long and 0.75—1.25 cm in diam., glabrescent; exocarp deep red; mesocarp rather thick, carinose; endocarp thin, crustaceous.

**Type** (lecto-type): Hostmann and Kappler 1247 in h.U.

**Distribution**: the Guianas.

BR.GUIANA: Cuyuni R., Oko Creek, For. Dept. Br. G. 2336 (1932) in mora-forest, fl. fem. Nov. (K, U); id., id. 2341 (1933) alt. 100 m, in mora-forest, fr. March (K); without loc., Persaud 86 (1924) fr. Aug. (F).

SURINAME: Wilhelmina Mts., Stahel 423, = BW. 7072 (1926) fl. fem. June (U); Saramacca R., Pulle 133 (1902) fl. masc. Dec. (U); id., Sectie O,

tree n. 566, BW. 785 (1915) (U), BW. 5997 (1922) fl. masc. Nov. (U); Para R., Zandery I, tree n. 76, BW. 434 (1914) fl. fem. Nov. (U), BW. 438 (1915) fr. March (U), BW. 1583 (1916) fl. fem. and fr. Jan. (U); id., tree n. 181, BW. 1418 (1915) (U), BW. 4047 (1918) fl. fem. and fr. Nov. (U), BW. 6043 (1923) fl. fem. and fr. Jan. (U); without loc., Hostmann 1247 (no date) fl. masc. (BM, C, GOET, K, P, U, W); id., Kappler 1247 (no date) fl. masc. (S); Hostmann and Kappler 1247 (no date) fl. masc. (G, U, W) (type); id., Hostmann 1292 (no date) fl. fem. (G, GOET, K, NY, U, W); id., Kappler 1292 (no date) fl. fem. (P) (type of *P. heptaphyllum* (Aubl.) March. var. *puberulum* Engl.).

FR. GUIANA: without loc., Leprieur 279 (1839) fr. (B, P); id., id. 279 (1839) in bud (B, G); id., Mélinon (1863) fl. fem. (B, LE); id., id. (1864) fr. (B).

Vern. names: BR. GUIANA: haiowa (Arow.), mahaica-balli; SURI-NAME: tiengi-monni (N.E.) hajawa balli (Arow.), pakiria sipiolo, miejoelwa, koeséwé iekolju (Car.).

This species resembles *P. heptaphyllum* (Aubl.) March. and *P. guianense* (Aubl.) March., but differs from these species chiefly by the indumentum of its vegetative parts, by its petiole being shorter than the interjuga and by its smaller flowers provided with a pilose ovary.

Hoehne, l.c., quotes this species, viz. *P. heptaphyllum* March. var. *puberulum* Engl., from Matto Grosso, but as the cited specimen, Kuhlmann 512—515, could not be studied I was unable to confirm this statement which seems, from a geographic point of view, dubious.

65. **Protium Schippii** LUNDELL in Field and Lab. VI, p.12 (1937).

Tree, up to 15 m high. Branchlets slender, 2.5 mm in diam., terete, striate, when young rather densely but minutely ferruginous pilose but soon glabrescent, grey, scabridulous and dotted with ferruginous lenticels. Leaves unifoliolate to 3-jugate, mostly trifoliolate, 16—20 (7.5—29) cm long; petioles semiterete, above dilated, at the base subincrassate, 2—3 (1.5—5) cm long, like the rhachis and the petiolules rather densely but minutely pilose; interjuga subterete, above carinate or bisulcate, at the nodes subincrassate, 2.5—3 (2—3.5) cm long; petiolules semiterete, canaliculate, at both ends incrassate, 6—7.5 (4—10) mm long, the terminal ones 15—20 (10—25) mm; leaflets lanceolate-oblong to oblong, usually 9—11 (6.5—13.5) cm long and 3—4.25 (2.5—4.75) cm wide, but the terminal ones larger and obovate, the lateral ones subsymmetric and mostly slightly narrowed to both ends, and the basal ones shorter; apex rather abruptly to rather gradually acuminate; acumen sublinear, 10 (7—15) mm long and 3 (2.5—4) mm wide, obtuse; base acutely cuneate; margin entire, undulate; pergamentaceous, glabrous,

smooth, nitidulous to dull; with 11—13 pairs of sec. nerves; prim. nerves above grooved on each side and rather densely but minutely pilose, beneath distinctly prominent, sparsely and minutely pilose, sec. and tert. nerves above hardly visible and glabrous, beneath prominulous and subglabrous. Inflorescences axillary, laxly brached from the base, few-flowered, mostly as long as the petiole of the subtending leaves, 2—3.5 cm long; sec. branchlets up to 2 cm long. The axes slender, angulose, like the terete, 1—1.5 mm long pedicels, the broadly triangular, obtusely acuminate, 0.3 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely puberulous. Flowers 4-merous, 2.5—3 mm long, yellowish white. Calyx cupuliform, 0.8 mm high; its lobes triangular to semiorbicular, acute, about as long as the tube. Petals elliptic-ovate, acute, inflexed-apiculate, inside puberulous, carnose. Stamens about 1.5 mm long; filaments subulate, dilated; anthers oblong, 0.4 mm long. Disc annular, 8-lobed, glabrous, 0.3 mm high. Pistil in the masc. fl. 0.6 mm high and embedded in the disc, in the fem. fl. 1.5 mm high and at the base surrounded by the disc; ovary ovoid, 4-sulcate, 4-celled, rather densely and appressedly pubescent, tapering in a short style, crowned by a 4-lobed stigma. Drupe ovoid, 2- or 3-lobed, with narrowed base and acute apex, glabrescent, 2 cm long and 1 cm in diam.; exocarp red; mesocarp carnose; endocarp woody.

Type: Schipp 973 in h.Univ. Michigan.

Distribution: Central America.

MEXICO: Yucatan, near Hae Chuca, Schott 757 (1866) fl. fem. March (BM, F).

BR.HONDURAS: Orange Walk Distr., Hillbank, Winzerling VIII-3 (1926) fr. (F, US); Middlesex, Schipp 229 (1929) alt. 60 m, fl. fem. and fr. July (B, F, G, GH, NY, S, US); Stann Creek Distr., Stann Creek R., Schipp 973 (1932) alt. 75 m, in open places, fl. masc. June (BM, F, G, NY, S) (type); Punta Gorda, Schipp 1038 (1932) alt. 60 m, in wet forest, fl. masc. Sept. (F, K, NY).

Vern. names: MEXICO: copal (Yuc.), pom (Maya); BR.HONDURAS: mancho copal.

This species resembles *P. Pittierii* (Rose) Engl. and is therefore also related to *P. Copal* (S. et C.) Engl.

66. *Protium costaricense* (ROSE) ENGL. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413 (1931); Standl. in Field Mus. N.H., Bot.S. XVIII, p.576 (1937).

*Icica costaricensis* Rose in N. Am. Fl. XXV, 3, p.259 (1911).

*Icica confusa* Rose in N. Am. Fl. XXV, 3, p.260 (1911); Standl. in Field Mus. N.H., Bot.S. XVIII, p.575 (1937).

*Protium confusum* Pittier in Contr. U.S.N.H. XX, p.479 (1922); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413 (1931).

*Protium Salvozæ* Standl. in Journ. Arn. Arb. XI, p.122 (1930)

?*Protium Copal* (S. et C.) Engl. in errore Pitt., Ens. Pl. us. de Costa Rica p.83 (1908).

Small tree. Branchlets slender, terete, striate, when young rather densely and patently puberulous, when adult glabrescent. Leaves 2- or 3-jugate, 23—28 cm long; petioles semiterete, at the base subincrassate, 4—5 (2.5—6) cm long, like the rhachis and the petiolules rather densely villose, but when adult sometimes glabrescent; interjuga subterete, above sulcate, at the nodes hardly incrassate, about as long as the petioles, 4—5 (2—5.5) cm; petiolules semiterete, canaliculate, at the ends hardly incrassate, 7.5—10 (5—15) mm long, the terminal ones 25 (17.5—30) mm; leaflets lanceolate-oblong to oblong-elliptic, usually 12 (10—12.5) cm long and 4.75 (3—5) cm wide, but the terminal ones wider and narrowed to the base, the lateral ones slightly narrowed to the apex and the basal ones smaller and subovate; apex more or less gradually narrowed in a sublinear to tapering, 7.5—10 mm long and 2.5—5 mm wide, obtuse acumen; base cuneate; margin entire; pergamentaceous, dull, above sparsely puberulous, beneath glabrous; with 12 (10—14) pairs of sec. nerves; prim. nerves villose like the petioles, above grooved on each side, beneath prominent, sec. nerves subglabrous, above prominulous, beneath prominent, tert. ones above visible, beneath prominulous. Inflorescences axillary, laxly branched from the base, few-flowered, up to 4 cm long; sec. branchlets up to 1 cm. The axes angulose, more or less densely and patently pubescent. Pedicels terete, 2—3 mm long, like the triangular, acute, 0.5 mm long bracts and bractlets and the outside of the calyx and the corolla sparsely puberulous. Flowers 4-merous, 3—4 mm long, yellow. Calyx broadly cupuliform, 1 mm high; its lobes broadly triangular, acutely subacuminate about as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, inside glabrous, on the margins papillose. Stamens 1.75 mm long; filaments subulate, at the base dilated; anthers oblong, 0.5 mm long. Disc annular, 8-lobed, glabrous, 0.5 mm high. Pistil at the base surrounded by the disc, in the masc. fl. 1 mm high, in the fem. fl. 2.5 mm; ovary globose-ovoid, sub-4-lobed, 4-celled, rather densely pubescent, tapering in a short, 4-sulcate, subglabrous style, crowned by a 4-lobed stigma. Drupe ellipsoid, at both ends acute, sparsely puberulous, 1.25—1.5 cm long and 1—1.5 cm in diam.; exocarp red; mesocarp thin, carnose; endocarp thin, crustaceous.

Type: Biolley 10665 in h.US 1380504.

Distribution: Costa Rica and Panama.

COSTA RICA: Santa Clara, Las Delicias, Biolley 10665 (1897) alt. 500 m, fl. fem. Febr. (M, US) (type); between R. Volcan and R. Convento, Diquis Valley, Pittier 12106 (1898) alt. 300 m, fl. masc. March (US) (type of *Icica confusa* Rose).

PANAMA: Canal Zone, Barro Colorado Island, Bangham 513 (1929) fr. Sept. (F, S, US) (type of *P. Salvozae* Standl.); id., Salvoza 948 (1929) fr. Sept. (F) (cotype of *P. Salvozae* Standl.); id., Woodworth and Vestal 605 (1932) fl. fem. Febr. (F).

Vern. name: COSTA RICA: copal.

Like most of the Central American species of *Protium* this species resembles *P. Copal* (S. et C.) Engl., but the latter differs by its glabrous vegetative parts, by its longer petioles and petiolules, by its ovate and nitidous leaflets and by its larger inflorescences.

Pittier, l.c. (1908), evidently refers to Pittier 12106, which is the only one of Pittier's specimens collected in Costa Rica and labelled "*Protium Copal* Engl."

67. *Protium pilosissimum* ENGL. in DC. Mon. Phan. IV, p.80 (1883); id. in E.-Pr. Nat. Pf.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulunga pilosissima* OK., Rev. Gen. Pl. I, p.108 (1891).

Small tree. Branchlets slender, terete, densely ferrugineous villose. Leaves unifoliolate to 4-jugate, mostly 1- or 2-jugate, 12-17 (9-34) cm long; petioles semiterete, at the base subincrassate, 2-4.5 (1.25-6.5) cm long, like the rhachis and the petiolules densely ferrugineous villose; interjuga subangulose, at the nodes slightly incrassate, 2-3.5 (1.75-5) cm long; petiolules semiterete, canaliculate, at both ends hardly incrassate, 5 (3-8) mm long, the terminal ones 17.5-25 (10-30) mm; leaflets lanceolate to oblong-ovate, more or less narrowed to the apex, usually 6-10 (5-13) cm long and 2.5-3.5 (2.5-4.5) cm wide, but the terminal ones larger and distinctly narrowed to the base and the lateral ones oblique and sometimes slightly narrowed to the base; apex more or less gradually narrowed in a tapering, 5 (3-8) mm long and 3 (2-4) mm wide, subobtusely acuminate; base acutely cuneate; margin entire; pergamentaceous, sparsely and minutely pilose or nearly glabrous. smooth, dull or nitidulous; with 10-12 pairs of sec. nerves; prim. nerves villose like the petioles, above depressed, beneath prominent, sec. ones sparsely villose, above prominulous, beneath prominent, tert. ones above invisible and glabrous, beneath hardly prominent.

and sparsely villose. Inflorescences axillary, glomeruliform, few-flowered, 1 cm in diam. Branchlets up to 5 mm long, terete, like the terete, 1.5—2 mm long pedicels, the oblong-triangular, acute, 0.5 mm long bracts and bractlets and the outside of the calyx rather densely and patently ferruginous pubescent or puberulous. Flowers 4-merous, 2.5—3.5 mm long. Calyx broadly cupuliform, about 1 mm high; its lobes broadly triangular, distinctly shorter than the tube. Petals oblong-triangular, acute, inflexed-apiculate, subcarnose, outside sparsely pubescent or puberulous, inside glabrous, on the margins papillose. Stamens in the masc. fl. 2 mm, in the fem. fl. 1.25 mm long; filaments subulate, dilated; anthers oblong, 0.5 mm long. Disc annular 8-lobed glabrous 0.25—0.5 mm high. Pistil in the masc fl. 0.5—0.75 mm high and embedded in the disc, in the fem fl. 1.25—1.75 mm high and at the base surrounded by the disc; ovary globose-conical, densely and appressedly fulvous pubescent, tapering in a distinct, glabrous style of about half the length of the ovary, crowned by a 4-lobed stigma.

Type: Burchell 7890 in h.P.

Distribution: Brazil.

BRAZIL: Para, R. Cumina, Cachoeiro do Mel, Sampaio 5142 (1928) fl. fem. Oct. (B); Matto Grosso, Santa Anna da Chapada, Malme 2364 (1902) fl. masc. Sept. (S); id., id. 2436 (1902) fl. masc. Oct. (S); without loc., Burchell 7890 (no date) fl. fem. (B, GH, K) (type).

This species resembles *P. costaricense* (Rose) Engl., but the latter differs by the less dense and shorter indumentum of its vegetative parts and by its lax and long inflorescences.

Whereas the indumentum of the generative parts is distinctly more developed in the type specimen than in the other ones, they all agree in their more important characters. There is however also a rather large range of variability in regard to the number, the size and the width of their leaflets.

### Sectio *Icicopsis* (ENGL.) SWART

*Icicopsis* Engl. in Mart. Fl. Bras. XII, 2, p.254 (1874).

Trees with imparipinnate leaves. Petiolules at both ends incrassate-articulate. Inflorescences pseudospicate. Flowers usually sessile, but at times pedicellate. Disc and ovary pilose and in the masc. fl. mostly confluent in a globose pilose rudiment.

68. *Protium fragans* (ROSE)URB. in Fedde Repert. XXII,

p.362 (1926); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413 (1931).  
*Icica fragans* Rose in N. Am. Fl. XXV, 3, p.241 (1911).

Shrub or tree, from 3 m up to 13 m high. Branchlets rather stout, 3—4 mm in diam., terete, striate, when young densely but minutely pilose, when adult glabrescent, smooth and fuliginose. Leaves 1-jugate, rarely 2-jugate, 20—25 (20—28) cm long, in all parts glabrous; petioles semiterete, near the subincrassate base when adult transversely rimose, 6—9 (4.5—9.5) cm long; interjuga terete, 4 (2.5—6) cm long; petiolules slender, semiterete and striate, canaliculate, at both ends slightly incrassate, when adult transversely rimose, 2—2.5 (1.5—3) cm long, the terminal ones 3.5 (2.5—4) cm; leaflets rhomboid, usually 9—11.5 (8—14) cm long and 4.5—5.5 (3.5—7) cm wide, but the terminal ones slightly longer, the lateral ones symmetric; apex rather abruptly acuminate; acumen tapering, 10—15 mm long and 4—5 mm wide, acute; base cuneate; margin entire; subcoriaceous, glabrous and smooth, above nitidous, beneath nitidulous; with 6—7 pairs of sec. nerves; prim. and sec. nerves above impressed, beneath distinctly prominent, tert. ones on both sides prominulous. Inflorescences subterminal, axillary, branched from near the base, 6—9 (4—10) cm long, few-flowered. Peduncles short; sec. branchlets few, up to 1.25 cm long. The axes rather slender, terete, striate, like the slender, terete, 1.5 mm long pedicels, the broadly triangular acute 0.5 mm long bracts and bractlets and the outside of the calyx rather densely to sparsely and minutely pilose. Flowers 4-merous, 2 mm long, greenish. Calyx cupuliform, 0.8 mm high, carnose; its lobes triangular to semiorbicular, acutely subacuminate, about as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, distinctly carnose, glabrous, with papillose margins. Stamens about 1.5 mm long; filaments terete, carnose, nearly 1 mm long; anthers oblong. Disc densely ferruginous tomentose, in the masc. fl. confluent with the rudiment of the pistil in an obtuse, 1 mm high cone; in the fem. fl. annular, 8-lobed, 0.2 mm high. Pistil in the fem. fl. at the base surrounded by the disc, about 1 mm high, rather densely ferruginous tomentose; ovary ovoid, sub-4-lobed, tapering in a sessile, 4-lobed stigma. Drupe ovoid with acute apex, rather densely pilose, but when maturing glabrescent, 2 cm long and 1.25 cm in diam.; exocarp scabrous; mesocarp carnose; endocarp thin, brittle, woody; pyrenes 1 to 3.

Type: Shafer 4240 in h.NY.

Distribution: eastern Cuba.

CUBA: prov. Oriente, R. Yamaniquey, Shafer 4240 (1910) on riverbank,

fr. Febr.-March (K, NY, US) (type); id., Sierra de Nipe, near Arroyo del Medio, Ekman 15288 (1922) in forest, fl. masc. Sept. (B, S); id., east of R. Moa, on Moa Bay, Shafer 8344 (1911) fl. fem. Jan. (B, GH, K, NY, US); id., between Moa and Baracoa, Roig 36 (1917) fl. masc. Aug. (NY); id. near Baracoa, Maravi, Ekman 4036 fl. masc. Dec. (B, S).

Vern. names: incensio, incienso.

This species resembles *P. cubense* (Rose) Urb., but the latter has smaller leaves, shorter petioles and petiolules, elliptic and obtusely acuminate leaflets provided with 9—14 pairs of sec. nerves and a glabrous disc and ovary, that are always distinctly separated from each other.

69. *Protium apiculatum* SWART in Rec. Trav. bot. néerl. XXXIX, p.201 (1942).

Tree. Branchlets stout, 7.5 mm in diam., angulose, when young densely ferruginous tomentellous, when adult glabrescent, ferruginous to fuscous and dotted with many elliptic lenticels. Leaves 2- to 5-jugate, mostly 3-jugate, 35—40 (34—43) cm long; petioles semiterete, at the base incrassate, 9—17 (7.5—23) cm long, like the rhachis and the petiolules rather densely but minutely and patently pilose; interjuga angulose, 3.5—4.5 (1.5—6) cm long, the basal one shorter than the other ones; petiolules semiterete, striate, at both ends slightly incrassate, 10 (7.5—15) mm long, the terminal ones 30—35 (25—40) mm; leaflets lanceolate-oblong to oblong-elliptic, usually 15 (13—20) cm long and 5 (4—6.25) cm wide, but the terminal ones wider and narrowed from the middle to the base, nearly obovate, the lateral ones suboblique and at most slightly narrowed to the apex but those of the apical jugum mostly narrowed to the base, and the basal ones much smaller; apex rather abruptly acuminate; acumen sublinear, 6—9 mm long and 2—5 mm wide, obtuse but ending in a 0.25—0.5 mm long apiculus; base cuneate; margin entire, undulate; subcoriaceous, smooth, above glabrous and nitidulous, beneath subglabrous and dull; with 15 (10—17) pairs of sec. nerves; prim. and sec. nerves sparsely and minutely pilose, above prominulous, beneath distinctly prominent, tert. nerves prominulous and glabrous. Inflorescences pseudoterminal, in the axil of deciduous, semiorbicular, 2.5 mm long bracts, stiffly branched from the base, many-flowered, 12.5 (10—20) cm long; sec. branchlets 2 (1—5) cm long. The axes rather stout, angulose, like the stout, terete, 1.6—2.5 mm long pedicels, the elliptic, acutely acuminate, 1 mm long bracts, the semiorbicular acuminate 0.35 mm long bractlets and the outside of the calyx and the corolla densely but minutely ferruginous pubescent. Flowers 5-merous, 2.5—3 mm long, yel-



lowish green. Calyx broadly cupuliform, 0.75 mm high; its lobes broadly triangular, obtusely subacuminate, about one third the length of the tube. Petals oblong-ovate to elliptic-ovate, acute, inflexed-apiculate, carnose, inside glabrous, on the margins papillose. Stamens about 1.5 mm long; filaments slender, subulate; anthers oblong, 0.5 mm long. Disc annular, 10-lobed, 0.5 mm high, rather densely ferruginous tomentellous. Pistil densely and appressedly ferruginous pubescent, in the masc. fl. entirely immersed in the disc and nearly confluent with it, in the fem. fl. at the base surrounded by the disc and 2 mm high; ovary ovoid, sub-5-lobed, 5-celled, tapering in a sessile, 5-lobed stigma.

Type: Stahel 125 in h.U.

Distribution: northern South America.

SURINAME: upper Suriname R., near Goddo, Stahel 125 (1926) fl. fem. Jan. (U) (type); id., id. 60 (1926) fl. fem. Jan. (U).

PERU: upper R. Marañon, near mouth R. Santiago, Tessmann 4158 (1924) fl. masc. Sept. (B).

This species is related to *P. neglectum* Swart, but the latter differs by its glabrous vegetative parts, by the not apiculate acumen of its leaflets and by its sessile flowers.

Though Tessmann 4158 differ slightly from the specimens collected by Stahel, it agrees, in spite of the important geographic difference, on the whole quite well with the latter.

70. **Protium Sagotianum** MARCH. in Adans. VIII, t.1 (1867—1868); Engl. in DC. Mon. Phan. IV, p.78 (1883) p.p.; id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931); Sandwith in Kew Bull. 1933, p.327 (1933). Non apud Pulle, Enum. Vasc. Pl. Surin. p.245 (1906) quod p.p. ad *P. insigne* Engl., p.p. ad *P. neglectum* Swart pertinet, nec apud Standl. in Trop. Woods XXXIII, p.15 (1933) nec apud LeCointe, Arv. e. Pl. ut. a Amaz. bras. III, p.64 quae ad *Protium* sp. diversas pertinent.

*Icicopsis caudata* Engl. in Mart. Fl. Bras. XII, 2, p.257 (1874) p.p.  
*Icica decandra* Aubl. in errore Sagot in Ann. Sc. nat., S.6, XIII, p.291 (1882).

*Icica Sagotiana* Sagot l.c.

*Tingulonga caudata* OK., Rev. Gen. Pl. I, p.107 (1891) quoad syn. *P. Sagotianum* March.

Large tree, 20—30 m high. Branchlets rather stout, 3—5 mm in diam., when young angulose and densely but minutely ferruginous lose but soon terete, glabrescent, scabrous, fuscous and

dotted with elliptic lenticels. Leaves 2- to 5-jugate, usually 4-jugate, 30—37.5 (27—40) cm long, when very young in all parts rather densely but minutely ferruginous pilose but soon glabrescent; petioles semiterete, at the base subincrassate, 9 (7.5—10) cm long, like the petioles when adult transversely rimose; interjuga terete, striate, above slightly carinate, at the nodes subincrassate, 3.5 (2.5—4) cm long; petiolules terete, sometimes sulcate above, at both ends incrassate, 10—15 (6—18) mm long, the terminal ones 20—35 mm; leaflets oblong-lanceolate to oblong-elliptic, more or less narrowed to the base, usually 11—15 (10—17.5) cm long and 3.25—4 (3—4.25) cm wide, but the terminal ones slightly shorter, the lateral ones subsymmetric and the basal ones shorter; apex abruptly acuminate; acumen linear, 15—30 mm long and 1—2 mm wide, obtuse; base acutely cuneate; margin entire, undulate; pergamentaceous, nearly smooth or scabridulous, nitidulous; with 11 (9—13) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath distinctly prominent, tert. ones above hardly visible, beneath prominent. Inflorescences fasciculate in the axils and 3—7.5 cm long with sec. branchlets up to 2 cm long, at times terminal, paniculate and up to 17 cm long with sec. branchlets up to 8 cm and tert. ones up to 3 cm long, laxly branched. The axes slender, angulose, like the broadly triangular subobtuse, 0.75—1 mm long bracts and bractlets and the outside of the calyx rather densely ferruginous tomentellous. Flowers glomerate, sessile or subsessile, 5-merous, 3—4 mm long, white. Calyx cupuliform, 1 mm high; its lobes triangular, acute, once and half the length of the tube. Petals oblong-lanceolate, triangular, narrowed to the acute apex, inflexed-apiculate, subcarnose, glabrous, on the margins papillose. Stamens 1.5—2.25 mm long; filaments subulate, twice as long as the oblong anthers. Disc in the masc. fl. confluent with the rudiment of the pistil in a depressed, 0.75 mm high, densely ferruginous tomentose globe, in the fem. fl. annular and rather densely ferruginous pubescent, 0.5 mm high. Pistil in the fem. fl. rather densely ferruginous pubescent, 3 mm high; ovary at the base surrounded by the disc, globose, 5-lobed, 5-celled, 1.5 mm high, tapering in a long, terete, 5-sulcate style, crowned by a 5-lobed stigma.

**Type:** Sagot 1191 in h.P.

**Distribution:** northern South America.

BR. GUIANA: Rupununi R., Simuni Creek, For. Dept. B.G. 2126 (1931) alt. 130 m, fl. Aug. (K); id., id. 2139 (1931) alt. 120 m, fl. masc. Aug. (K, U).

SURINAME: Coppename R., Raleigh Falls, Pulle 327 (1920) fl. masc. Aug. (U); Saramacca R., Sectie O, tree n. 524, BW.1159 (1915) (U), BW.

3931 (1918) fl. masc. Aug. (U), BW.4671 (1920) in bud May (U).  
FR. GUIANA: Aracouany, Sagot 1191 (1858) fl. fem. Aug. (B, K, P, W)  
(type).

BRAZIL: Amazonas, basin R. Jurua, near mouth of R. Embira, trib. of  
R. Tarauaca, Krukoff 5063 (1935) fl. masc. June (B, F, K, NY, U).

Vern. names: BR.GUIANA: kurokai (Arow.); SURINAME:  
hajawaballi (Arow.), imjawara motapo ajawa (Car.).

This species is recognizable by the extremely long acumen of  
its leaflets and by the slender habit of its inflorescences.

Though *P. Sagotianum* March. was published by its author as  
a figure of the type specimen, this figure is quite clear. Confusion  
arose when Engler, l.c. 1874, referred the type specimen to *Icicopsis*  
*caudata* (Turcz.) Engl. This species was based by Turczaninow, in  
1863, partly on Kappler 2009, now referred to *P. insigne* Engl.,  
and partly on Hostmann and Kappler 1039, now referred to *P.*  
*neglectum* Swart; its name, therefore, must be regarded as a "nomen  
confusum". When Engler, l.c. 1883, reduced the genus *Icicopsis*  
to *Protium*, *I. caudata* could moreover, on account of *P. caudatum*  
W. et A. (1834), now referred to *Commiphora caudata* Engl., not  
retain its specific epithet. As, in Engler's delimitation of the species  
it included *P. Sagotianum* March., this name, which was not men-  
tioned by him in 1874, had to be accepted. Engler's diagnosis,  
however, is based on the specimens named *Icica caudata* by Turc-  
zaninow, and is therefore not applicable to Marchand's species.

Anatomy: Pfeiffer in Med. Kon. kol. Inst. XXII, p. 324  
(1926).

71. *Protium insigne* (Tr. et Pl.) ENGL. in DC. Mon. Phan. IV,  
p.77 (1883); id in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et  
ed.2, XIXa, p.412 (1931). Non apud Marshall, Trees of Trin.  
and Tob. p. 25 (1934) quod ad *P. neglectum* Swart var. *tenuifolium*  
Swart pertinet.

*Icica insignis* Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.299 (1872).

*Icicopsis insignis* Engl. in Mart. Fl. Bras. XII, 2, p.256 (1874).

*Tingulonga insignis* OK., Rev. Gen. Pl. I, p.108 (1891).

*Bursera (Icica) caudata* Turcz. in Bull. Soc. imp. Nat. Mosc.  
XXXVI, 1, p.614 (1863) quoad spec. Kappler 2009.

*Icicopsis caudata* Engl. in Mart. Fl. Bras. XII, 2, p.257 (1874)  
quoad descr. p.p. et spec. Wullschlaegel 1663.

*Tingulonga caudata* OK., Rev. Gen. Pl. I, p.107 (1891) quoad  
syn. *Bursera caudata* Turcz. p.p.

*Protium Sagotianum* March. apud Engl. in DC. Mon. Phan. IV.  
p.78 (1883) quoad descr. p.p. et spec. Wullschlaegel 1663 et Kappler  
2009.

Large tree, 20—25 m high. Branchlets stout, 5—9 mm in diam., terete, when young densely but minutely pilose, when adult glabrous and fuscous, or at times scabrous, dotted with elliptic, ferruginous lenticels. Leaves 5- or 6-jugate, rarely 3- or 4-jugate, 40 (35—50) cm long; petioles semiterete, at the base subincrassate, 9—12 cm long, like the rhachis and the petiolules when young rather densely but minutely pilose, when adult glabrous; interjuga terete, striate, at the nodes slightly incrassate, 3—5 cm long, the basal ones shorter than the other ones; petiolules terete, above sulcate, at both ends incrassate, 15 (7.5—25) mm long, the terminal ones 30 (20—40) mm; leaflets lanceolate to oblong, more or less narrowed to the base, usually 14—17.5 (12.5—20) cm long and 4.5—6 (4—7) cm wide, but the terminal ones slightly shorter and like those of the apical jugum narrowed near the apex, the lateral ones suboblique and the basal ones shorter; apex abruptly acuminate; acumen linear, 15—20 mm long and 1.5—2 mm wide, obtuse; base cuneate; margin entire, undulate; subcoriaceous, glabrous, above smooth and nitidous, beneath nearly smooth, papillose and dull to nitidulous; with 12 (10—14) pairs of sec. nerves; prim. nerves on both sides distinctly prominent, sec. ones above grooved on each side, beneath distinctly prominent, tert. ones prominulous. Inflorescences solitary in the axils, divaricately and stiffly branched, 10—14 cm long, at times only 5—8 cm; sec. branchlets up to 7 cm; tert. ones up to 2 cm long. The axes robust, densely but minutely pilose. Bracts and bractlets broadly triangular, acute, about 0.5 mm long, like the outside of the calyx sparsely and minutely pilose. Flowers 5-merous, 3—4 mm long, yellowish. Calyx cupuliform, 1—1.5 mm high; its lobes triangular, acute, once to twice as long as the tube. Petals lanceolate-triangular to ovate-triangular, acute, inflexed-apiculate, glabrous, or rarely outside subglabrous, subcarinose. Stamens in the masc. fl. 2.5—3 mm, in the fem. fl. 1.5—2 mm long; filaments subulate; anthers elliptic, about 0.5 mm long. Disc in the masc. fl. confluent with the rudiment of the pistil to a depressed, densely ferruginous tomentose, 0.75 mm high globule; in the fem. fl. annular and densely ferruginous villose. Drupe obliquely ovoid to globose, 4- to 5-lobed, with acute apex, sparsely and shortly pilose, 2.5 cm long and 1.5—2.25 cm in diam.; mesocarp rather thick, carinose; endocarp rather thick, brittle, woody; pyrenes 4 to 5.

Type: Triana 5932 in h.BM.

Distribution: equatorial South America.

COLOMBIA: Bogota, Villavicencio, Karsten (no date) alt. 460 m, fr. (B, W); id., Llano de San Martin, Triana 5932 (1856) alt. 450 m, fr. (BM) (type).

TRINIDAD: ?Mount Tamana, Britton, Britton and Hazen 1931 (1920) (GH, NY, US).

SURINAME: Marowynne R., Kappler 2009 (no date) fl. masc. Nov. (S, U); id., Albina, Wullschlaegel 1663 (1853) fl. masc. Oct. (BR, W); Keping Ligtenberg, Boschbeheer 16 (1905) (U).

BRAZIL: Amazonas, basin R. Solimoes, São Paulo de Olivença, near Palmares, Krukoff 8213 (1936) high land, fl. masc. Sept.-Oct. (NY); id., basin Creek Belem, Krukoff 8661 (1936) high forest (U); terr. de Acre, basin R. Purus, near mouth R. Macauhan, trib. of R. Yaco, Krukoff 5558 (1933) fl. masc. Aug. (B, F, K, NY, U) (a 3-jugate form).

BOLIVIA: R. Beni, near Rurrenabaque, Cardenas 1152 (1921) alt. 300 m, fl. fem. and fr. Nov. (B, GH, K, US) (*Icica ornithorhymens* Rusby mss., *I. rhynchophylla* Rusby mss.).

Vern. name: SURINAME: tiengi monnie (N.-E.).

This species resembles *P. Sagotianum* March. and *P. neglectum* Swart, but the latter differs by its usually smaller 3- to 4-jugate leaves and by its oblong to elliptic leaflets provided with an acumen which is at most 4 times as long as wide.

Especially with regard to the long and narrow acumen of the leaflets the Karsten's incomplete material (no date) (W) from Colombia, Santa Marta, Valle de Upas, Tamaraco, which served as the type specimen of *Icicopsis tenuifolia* Engl. var. *multijuga* Engl. in Mart. Fl. Bras. XII, 2, p.256 (1874), now referred to *Protium tenuifolium* Engl. var. *multijugum* Engl., I am inclined to consider this variety as a large-leaved, paucijugate form of *P. insigne* Engl.

Turczaminow, l.c. 1863, indicated as types of *Bursera* (*Icica*) *caudata* "Hostmann 1039, Kappler 2009". I have referred the former collection to *P. neglectum* Swart and the latter one to *P. insigne* Engl., but I did not find any specimen signed "*Bursera* (*Icica*) *caudata*" by the author and the diagnosis is too brief to decide whether it was based on the one or the other of these specimens, and I have therefore assumed that it included both and was to be treated therefore as a confused species.

72. *Protium tenuifolium* ENGL. in DC. Mon. Phan. IV, p.76 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2. XIXa, p.412 (1931); L. Williams in Field Mus. N.H., Bot.S. XV, p.236 (1936).

*Icicopsis tenuifolia* Engl. in Mart. Fl. Bras. XII, 2, p.255 (1874).

*Tingulonga tenuifolia* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium Carana* March. in errore L. Williams l.c. p.233 quoad spec. cit. 5056 et 5356.

Shrub or small tree, but sometimes up to 18 m high. Branchlets stout, 4 mm in diam., terete, striate, when very young sparsely

ferruginous puberulous but soon glabrous, fuscous and dotted with elliptic, ferruginous lenticels. Leaves 3- or 4-jugate, sometimes 2-jugate or rarely trifoliolate to unifoliolate, 30 (25—40) cm long, in all parts glabrous; petioles semiterete, 9 (7.5—15) cm long; interjuga terete, striate, above carinate, at the nodes slightly incrassate, 3.5 (3—5) cm long, the basal one as long as the other ones, rarely slightly shorter but in this case the leaflets lanceolate and provided with an up to 13 mm long acumen and up to 19 pairs of sec. nerves; petiolules semiterete, striate, canaliculate, at both ends incrassate, 10 (6—15) mm long, the terminal ones 25—40 (20—50) mm; leaflets lanceolate-oblong to oblong-elliptic, usually 14 (12—25) cm long and 5 (3.25—8.5) cm wide, but the terminal ones larger and like those of the apical jugum near the base slightly narrowed, the lateral ones oblique and the basal ones shorter; apex abruptly acuminate; acumen linear, 7.5 (5—10) mm long and 2.5 (2—3) mm wide, obtuse; base cuneate; margin entire, repand, undulate; pergammentaceous, nitidulous, above papillose and scabridulous, beneath nearly smooth; with 12—16 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones above visible, beneath prominulous. Inflorescences fasciculate in the axils, 5—9 cm long, pseudospicate or with but few, up to 2.5 cm long sec. branchlets, or pseudoterminal and laxly paniculate and up to 20 cm long. The axes rather slender, angulose, like the triangular acute, 0.25 mm long bracts and bractlets and the outside of the calyx rather densely to sparsely and minutely ferruginous pubescent. Flowers glomerate, sessile, 5-merous, rarely 4-merous, 3—4 mm long, yellowish white. Calyx cupuliform, about 1 mm high; its lobes triangular, acute, as long as the tube. Petals lanceolate-triangular, acute, inflexed-apiculate, outside scattered with minute hairs, inside glabrous, on the margins papillose. Stamens 2—2.5 mm long; filaments subulate, at the base dilated; anthers elliptic-ovoid, 0.4 mm long. Disc in the masc. fl. confluent with the rudimentary pistil in a densely ferruginous tomentellous, about 1 mm high globule. Pistil in the fem. fl. at the base surrounded by the annular, crenate, densely tomentellous, 0.35 mm high disc, 2.5 mm high; ovary globose-ovoid, densely ferruginous puberulous, about 2 mm high; style terete, glabrous; stigma 5-lobed. Drupe oblique-ovoid to globose, with acute apex, sparsely and shortly pilose, 1—1.5 cm long and 0.5—1.5 cm in diam.

Type: Spruce 4194 in h.BR.

Distribution: eastern slopes of the Andes.

COLOMBIA: Santa Marta, Calarasa, H. H. Smith 405 "A" (1898) alt.

160 m, fl. masc. Dec. (B, BM, BR, F, G, GH, K, L, NY, P, S, U, US).  
 PERU: Loreto, lower R. Huallaga, between Yurimaguas and Balsapuerto, Killip and Smith 28227 (1929) alt. 135—150 m, in bud Aug. (F, US); id., below Yurimaguas, Santa Rosa, Killip and Smith 28938 and 28962 (1929) alt. 135 m, in dense forest, fl. fem. Sept. (F, US); id., Puerto Actino, L. Williams 5056 (1929) alt. 155—210 m, fr. Nov. (F, US); id., id. 5356 (1929) alt. 155—210 m, fr. Oct.-Nov. (F, US); San Martin, upper R. Huallaga, near Tarapoto, Lamas, L. Williams 6423 (1929) alt. 840 m, fr. Dec. (F, US); id., near Tarapoto, Spruce 4194 (1855—1856) fl. masc. (B, BM, BR, K) (type); id., Ule 6414 (1902) fl. masc. Sept. (B, G, K, L); id., L. Williams 5458 (1929) alt. 750 m, fr. Dec. (F); id., id. 5578 (1929) alt. 360—900 m, fr. Dec. (F); id., id. 5708 (1929) alt. 360—900 m, fr. Dec. (F, G, U); id., id. 5845 (1929) fr. Dec. (F); id., id. 6138 (1929) alt. 360—900 m, fl. masc. Dec. (F, US); id., id. 6289 (1929) alt. 360—900 m, fr. Dec. (F, US); id., Juan Guerra, L. Williams 6819 (1929) alt. 720 m, fl. masc. Dec. (F, G, US); id., Juan Jui, Klug 3786 (1934) alt. 400 m, fl. masc. Sept. (B, BM, F, K, S); id., R. Ucayali, Chorillos, Tessmann 3085 (1923) fl. masc. Aug. (B, G, S).  
 BOLIVIA: R. Beni, Rurrenabaque, near Reyes, Fleischmann 583 (1930) fl. masc. Oct.-Dec. (S).

The material referred to this species shows all transitions between specimens provided with interjuga of equal length, with oblong leaflets possessing 12—13 pairs of sec. nerves and a 7.5 mm long and 2.5 mm wide acumen and with strictly pseudospicate inflorescences, for example Spruce 4194, and others provided with a basal interjugum being slightly shorter than the other ones, with lanceolate leaflets possessing 15—19 pairs of sec. nerves and a 10 mm long and 2 mm wide acumen and with laxly branched inflorescences, for example Smith 405 "A". The latter form strongly remembers *P. neglectum* Swart var. *tenuifolium* Swart, but it is different by its fasciculate inflorescences.

The material belonging to H. H. Smith 405, all named "*Protium insigne* Engl." is a mixture of three different collections, which I marked A, B and C. H. H. Smith 405 "A", collected 16 Dec. 1898, is marked by its lanceolate leaflets with 15—19 pairs of sec. nerves and by its fasciculate inflorescences; it represents the ultimate variation of *P. tenuifolium* Engl. H. H. Smith 405 "B", collected May 1899, and "C", collected Jan. 1899, are marked by their oblong to elliptic leaflets with 8—11 pairs of sec. nerves and by their solitary inflorescences; in my opinion they belong to *P. neglectum* Swart.

73. *Protium peruvianum* SWART in Rec. Trav. bot. néerl. XXXIX, p.202 (1942).

*Icicopsis tenuifolia* Engl. var. *brevicalyx* Engl. in Mart. Fl. Bras. XII, 2, p.255 (1874).

*Protium tenuifolium* Engl. var. *brevicalyx* Engl. in DC. Mon. Phan. IV, p.76 (1883).

High tree. Branchlets rather stout, 2.5 mm in diam., terete, striate, when young rather densely but shortly pilose and soon glabrescent, cinereous and dotted with elliptic ferruginous lenticels. Leaves 3-jugate, rarely 2-jugate, 24 cm long, in all parts glabrous; petioles semiterete, at the base incrassate, 6 (5—8) cm long, like the rhachis and the petiolules when adult transversely rimose; interjuga terete, striate, above slightly carinate, at the nodes incrassate, 3 (2.5—4.5) cm long; petiolules terete, striate, at both ends incrassate. 1—1.5 cm long, the terminal ones 2.5 (2—4) cm; leaflets oblong, variable in size and shape, usually 9 (8—11) cm long and 3.5 (2.75—4.75) cm wide, but the terminal ones narrowed from the middle to the base, the lateral ones oblique and as a rule distinctly narrowed near the base and the basal ones shorter; apex rather abruptly to rather gradually acuminate; acumen sublinear, 5—7.5 mm long and 2.5 mm wide, obtuse; base cuneate; margin entire, repand, undulate; pergamentaceous, above subpapillose, scabridulous and dull, beneath nearly smooth and nitidulous; with 8—10 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones above visible, beneath prominulous. Inflorescences fasciculate in the axils and pseudospicate, 2 (1.5—4) cm long, or pseudoterminal with pseudospicate sec. branchlets. The axes robust, angulose, like the triangular subobtuse, 0.5—0.75 mm long bracts and bractlets and the calyx and corolla rather densely but minutely ferruginous puberulous. Flowers sessile, 5-merous, 3 mm long. Calyx cupuliform, 1.5—1.75 mm high; its lobes broadly triangular, subobtruse, at most one fourth the length of the calyx. Petals oblong-triangular, acute, inflexed-apiculate, carnose. Stamens in the fem. fl. 1.5—1.75 mm long; filaments subulate; anthers elliptic-oblong, hardly 0.5 mm long. Pistil in the fem. fl. at the base surrounded by the annular, densely ferruginous pubescent, 0.6 mm high disc, 2 mm high; ovary ovoid, 5-celled, rather densely and adpressedly fulvous pubescent, 1.25 mm high, tapering in a terete, 0.4 mm long style, crowned by a 5-lobed stigma.

Type: Spruce 4473 in h.BR.

Distribution: north-eastern Peru.

PERU: San Martin, near Tarapoto, Spruce 4473 (1855) fl. fem. Dec. (B, BM, BR, K, W) (type of *Icicopsis tenuifolia* Engl. var. *brevicalyx* Engl., *Icicopsis peruviana* Engl. mss.); id., between Moyobamba and Tarapoto, Raimondi 227 (1869) in bud Febr. (B).

Though this species is perhaps most nearly related to *P. tenuifolium* Engl. and to *P. Warmingianum* March., the differences



between these specimens are almost as large as they are between other species in the section *Icicopsis*.

74. **Protium Warmingianum** MARCH. in Vid. Medd. Kjbhvn. 1873, p.48 (1873—1874); Engl. in Mart. Fl. Bras. XII, 2, p.278 (1874); id. in DC. Mon. Phan. IV, p.86 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931).

*Tingulonga Warmingiana* OK., Rev. Gen. Pl. I, p.108 (1891).

*Icica brasiliensis* Mart. mss. in sched. ex Engl. in Mart. Fl. Bras. XII, 2, p.257 (1874).

*Icicopsis brasiliensis* Engl. l.c. et tab. 50 (1874).

*Protium Blanchetii* Engl. in DC. Mon. Phan. IV, p.79 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Tingulonga Blanchetii* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree. Branchlets stout, 7.5 mm in diam., when young angulose and densely but minutely ferrugineous pilose, when adult terete, striate, glabrescent and dotted with elliptic ferrugineous lenticels. Leaves 4- or 5-jugate, rarely 6-jugate, 30—35 (25—40) cm long; petioles near the incrassate base semiterete, 7.5—10 (6—12.5) cm long, like the rhachis and the petiolules when young densely but minutely ferrugineous pilose and when adult glabrescent; interjuga stout, terete, striate, above carinate, at the nodes subincrassate, usually 2.5—3 (2—4.5) cm long, but the basal ones about two third the length of the other ones and 1.5—3 cm long; petiolules semiterete, striate, canaliculate, at both ends slightly incrassate, like the petioles when adult transversely rimose, 10 (5—12.5) mm long, the terminal ones 15—30 mm; leaflets lanceolate-oblong to oblong-elliptic, usually 12 (10—15) cm long and 4 (3.25—4.75) cm wide, but the terminal ones and those of the apical jugum shorter and narrowed from the middle to the base, the lateral ones oblique, as a rule slightly narrowed to the apex and the basal ones shorter and subovate; apex more or less gradually narrowed in a slightly tapering, 5—10 mm long and 2.5—3 mm wide, obtuse acumen; base cuneate; margin entire, repand, undulate; subcoriaceous, when young sparsely and minutely pilose but soon glabrescent and subpapillose, nearly smooth, above subopaque, beneath nitidous; with 15—16 (12—18) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. ones above hardly prominent, beneath prominent. Inflorescences fasciculate in the axils, the masc. infl. 5—8 cm, the fem. infl. about 2.5 cm long; sec. branchlets more or less numerous, pseudospicate, 2.5 (1.25—4) cm long. The axes stout, angulose,

like the triangular, acute, 0.5—0.75 mm long bracts and bractlets and the calyx rather densely but minutely ferruginous pilose. Flowers sessile, glomerate, 5-merous, 4 (3—5) mm long. Calyx cupuliform, 1—1.5 mm high; its lobes triangular, acute, as long as the tube. Petals oblong- to lanceolate-triangular, incrassate at the acute apex, carnose, outside subglabrous, inside glabrous, on the margins papillose. Stamens in the masc. fl. 2.75—3.25 mm, in the fem. fl. 1.5—2 mm long; filaments subulate, at the base dilated; anthers elliptic-oblong, 0.5 mm long. Disc in the masc. fl. confluent with the rudimentary pistil in a 1.5 mm high, densely ferruginous pubescent cone. Pistil in the fem. fl. at the base surrounded by the annular, densely ferruginous tomentose, 0.75 mm high disc, 2 mm high; ovary ovoid-conical, 5-celled, rather densely ferruginous pubescent, about 1.25 mm high, tapering in a 5-sulcate glabrous, 0.5 mm long style, crowned by a 5-lobed stigma.

**Type:** Warming in h.C.

**Distribution:** south eastern Brazil (Bahia and Minas Geraes).

**BRAZIL:** Bahia, basin R. Grongogy, Curran 17 (1915) alt. 100—500 m, fl. fem. Oct.-Nov. (US); id., near Ilheos, Blanchet 82j (1835) fl. masc. (BR) (*Icica brasiliensis* Mart. mss., I, bahiensis Mart. mss.) (type of *Icicopsis brasiliensis* Engl.); id., id. 178 (1835) (BM, BR); id., id. 2360 (no date) fl. masc. (B, BR, K, LE, P); Minas Geraes, at Lagoa Santa, Warming (1865) fl. fem. Sept. (C) (*Icica lenticellata* Warming mss.) (type); id., Vicosia, road to São Miguel, Mexia 5139 (1930) alt. 700 m, fl. masc. Oct. (B, BM, F, GH, K, NY).

**Anatomy:** Engl. in Abh. naturf. Ges. Halle XIII, 2, tab. XIII, f. 12—13 (1874).

75. ***Protium neglectum*** SWART in Rec. Trav. bot. néerl. XXXIX, p.203 (1942).

*Bursera (Icica) caudata* Turcz. in Bull. Soc. imp. Nat. Mosc. XXXVI, 1, p.614 (1863) quoad spec. Hostmann 1039.

*Icicopsis caudata* Engl. in Mart. Fl. Bras. XII, 2, p.257 (1874) quoad descr. p.p. et spec. Hostmann et Kappler 1039.

*Tingulonga caudata* OK., Rev. Gen. Pl. I, p.107 (1891) quoad syn. *Bursera candata* Turcz. p.p.

*Protium Sagotianum* March. apud Engl. in DC. Mon. Phan. IV, p.78 (1883) quoad descr. p.p. cum spec. Hostmann et Kappler 1039 et Poiteau.

Shrub or tree, 6—21 m high. Branchlets stout, 5—10 mm in diam., terete, striate, glabrous, or when young minutely ferruginous

pilose, when adult rimose, cinereous to fuscous and dotted with large lenticels. Leaves 3- to 4-jugate, at times 5- or 6-jugate, rarely 1- or 2-jugate, 25—35 (20—40) cm long, in all parts glabrous; petioles near the slightly incrassate base semiterete, 9—10 (5—13) cm long; interjuga terete, striate, at the nodes subincrassate, 2.5—3.5 (2—6) cm long, but the basal ones mostly shorter than the other ones; petiolules terete, striate, above subcanaliculate, at both ends slightly incrassate, when adult transversely rimose, 10—12.5 (5—20) mm long, the terminal ones 20—30 (15—35) mm; leaflets oblong-elliptic to oblong, usually 10—13 (8.5—15.5) cm long and 3.5—4.5

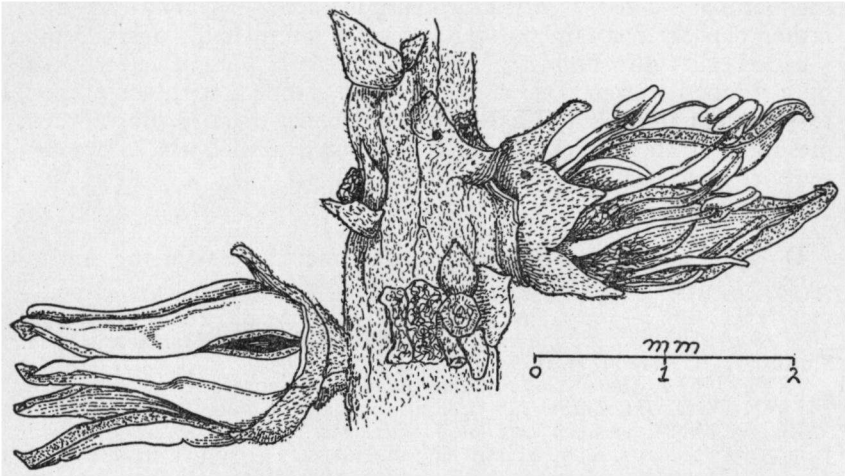


Fig. 4. *Protium neglectum* Swart — male flowers.

(3—6) cm wide, but the terminal ones shorter and like those of the apical jugum narrowed from the middle to the base, the lateral ones oblique and not or hardly narrowed to the base, and the basal ones shorter; apex abruptly acuminate; acumen linear 7.5 (6—12.5) mm long and 2.5 (2—3) mm wide, obtuse; base broadly cuneate to nearly rounded; margin entire, undulate; subcoriaceous, on both sides subpapillose, nearly smooth and nitidulous; with 10—12 (8—13) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath distinctly prominent, tert. ones above conspicuous, beneath prominulous. Inflorescences solitary in the axils, 10—12 (5—18) cm long; peduncles short; sec. branchlets few, divaricate, up to 8 cm long, tert. ones up to 2.5 cm. The axes stout, terete, striate and like the broadly triangular to semiorbicular, acutely subacuminate, 0.3—0.6 mm long bracts and bractlets

rather densely but minutely ferruginous pilose. Flowers 5-merous, 3—4 mm long, greenish white. Calyx cupuliform, sparsely and minutely pilose, 1 mm high; its lobes broadly triangular, acute, as long as the tube. Petals oblong-triangular, acute, inflexed-apiculate, subcarinose, outside scattered with some minute hairs, inside glabrous, on the margins papillose. Stamens in the masc. fl. 2—2.5 mm, in the fem. fl. 1.5 mm long; filaments subulate; anthers elliptic, about 0.5 mm long. Disc in the masc. fl. confluent with the rudimentary pistil in a densely brunnescent-tomentose, 0.75 mm high globule. Pistil in the fem. fl. at the base surrounded by the annular, densely ferruginous pubescent, 0.5 mm high disc, rather densely ferruginous pubescent, 1.5 mm high; ovary ovoid, 5-celled, 0.75 mm high, tapering in a 0.5 mm long style, crowned by a 5-lobed stigma. Drupe ovoid, 2- to 4-lobed, with acute apex, 1.75—2 cm long and 1.25—2 cm in diam.; exocarp subglabrous; mesocarp rather thick, carinose; endocarp rather thick, woody; pyrenes 2 to 4.

Type: BW. (Suriname) 5920 in h.U.

Distribution: tropical South America, east of the Andes.

COLOMBIA: Magdalena, R. Frio, near Ciénaga de Santa Marta, Pittier 1628 (1906) alt. 0—100 m, fr. June (US); Santa Marta, H. H. Smith 405 "B" (1899) alt. 500 m, fl. masc. May (F, NY, U); id., near Mamatoca, H. H. Smith 405 "C" (1899) fl. masc. Jan. (G, U).

VENEZUELA: Barinitas, Karsten (no date) fl. masc. (F, W).

TRINIDAD: ?Hart mis. sub n. 1637 (no date) in bud (B, G, S).

BR. GUIANA: western extr. of Kanuku Mts., Takutu R., A. C. Smith 3108 (1938) alt. 250 m, fr. March (U); id., id. 3223 (1938) fl. masc. March (U); id., Moku-moku Creek, A. C. Smith 3531 (1938) alt. 150—400 m, fr. Apr. (U); basin Rupununi R., Yupukari, A. C. Smith 2271 (1937) in scrub-savannah, fl. masc. Oct. (U).

SURINAME: Corantyne R., Kaboeri, tree n. 539, BW. 5022 (1920) fl. masc. Sept. (U), BW. 5908 (1922) fl. masc. June (U); id., tree n. 601, BW. 5009 (1920) fl. masc. Oct. (U), BW. 5920 (1922) fl. masc. July (U) (type); upper Suriname R., Junker 522 (1926) fl. masc. (Delft); without loc., Hostmann 1039 (no date) fl. masc. (B, G, K, U, W); id., Hostmann and Kappler 1039 (no date) fl. masc. (W).

FR. GUIANA: Poiteau (1819—1821) in bud (B, G).

BRAZIL: terr. de Acre, basin R. Purus, near mouth R. Macauhan, trib. of R. Yaco, Krukoff 5736 (1933) fl. masc. Sept. (B, F, K, NY, U); id., id. 5789 (1933) fl. masc. Sept. (K, NY); Amazonas, basin R. Madeira, Humayta, near Tres Casas, Krukoff 6459 (1934) fl. masc. Oct. (K, NY, U); id., on R. Livramento, near Livramento, Krukoff 6598 (1934) fl. masc. Oct. (K, NY, U); Espirito Santo, between Victoria and Bahia, Sello (no date) fl. masc. (B, US); Rio de Janeiro, near Paineiras, Corcovado, Schwacke 7174 (1891) (B).

Vern. names: VENEZUELA: anime; SURINAME: roode salie.

This species resembles *P. insigne* Engl., but the latter differs

by its usually 5- or 6-jugate and 35—50 cm long leaves and, especially, by the acumen of its lanceolate to oblong-lanceolate leaflets which is 10 times as long as wide.

In regard to the identity of *Bursera* (*Icica*) *caudata* Turcz. I refer to the remarks made under *P. insigne* Engl.

I have distinguished the following varieties:

1. *tenuifolium* Swart: leaflets lanceolate to lanceolate-oblong, provided with 14—15 pairs of sec. nerves.
2. *robustum* Swart: leaves twice as large, 70—100 cm long; leaflets provided with 15—18 pairs of sec. nerves.
3. *panamense* Swart: leaves rather large, 45—50 cm long; leaflets ending in a slightly tapering acumen and provided with 16—17 pairs of sec. nerves.
4. *sessiliflorum* (Rose) Swart: leaves rather large, 40 cm long; leaflets ending in an acumen which is as long as wide and provided with 16—18 pairs of sec. nerves.

**1. var. *tenuifolium* SWART** in Rec. Trav. bot. néerl. XXXIX, p.204 (1942).

*Icica heptaphylla* Aubl. in errore Hart, Herb. List Bot. Dept. Trin. p.10 (1908).

*Protium insigne* Engl. in errore Marshall, Trees of Trin. and Tob. p.25 (1934).

Leaves usually 3- to 4-jugate; but sometimes 5- or 6-jugate, rather large, 40 cm long; leaflets lanceolate to oblong-lanceolate, slightly narrowed to the apex, usually 12 (9.5—17) cm long and 3.5 (2.5—4.5) cm wide; apex rather abruptly to rather gradually acuminate; acumen sublinear; pergamentaceous; with 14—15 (12—16) pairs of sec. nerves. Inflorescences with rather rigid branches; the axes varying between rather robust and rather slender.

**Type:** H. H. Smith 1741 in h.U 74846.

**Distribution:** north-western South America.

**COLOMBIA:** Magdalena, Dugand and Petén 364/812 (1935) fl. masc. May (F); Santa Marta, Maria Theresia Plantation, H. H. Smith 1741 (1899) alt. 1100 m, mountain forest, fl. masc. Jan. (B, BM, BR, F, G, GH, K, L, NY, P, S, U, US) (type); id., R. Sevilla, Record 12 (1930) fl. masc. Jan. (F, GH, NY); without loc., Mutis 4220 (1783—1808) fl. fem. (F, K, S).

**VENEZUELA:** near Cristobal Colon, near Blue Basin, Lamalong, Broadway 779 (1923) fl. masc. Jan.-Febr. (NY, US).

**TRINIDAD:** Chatham, Jackson Trace, Broadway 8577 (1916) fl. fem. and fr. Nov. (NY); Southern Watershed Reserve, Marshall 12158 (1929) fl. masc. May (F, K); without loc., Hart mis. sub. n. 3032 (no date) fr. (B); ?San Fernando Hill, Britton and Hazen 1041 (1910) in bud March (GH, K, NY, US).

BR. GUIANA: basin Kuyuwimi R., trib. of Essequibo R., A. C. Smith 2582 (1937) fl. masc. Nov. (U).

Vern. names: COLOMBIA: vara blanca; TRINIDAD: gommier.

This variety strongly resembles *P. tenuifolium* Engl. and *P. insigne* Engl., but the former differs by its relatively wider and larger leaflets and by its fasciculate inflorescences, and the latter differs by its relatively wider leaflets provided with a long and linear acumen and by the more rigid and robust branches of the inflorescences.

2. **var. robustum** SWART in Rec. Trav. bot. néerl. XXXIX: p.204 (1942).

Branchlets very stout. Leaves 2- to 4-jugate, 70—100 cm long; petioles 20—30 cm long; interjuga 7.5—12.5 cm long; petiolules 17.5—25 mm long, the terminal ones 55—90 mm; leaflets 25—40 cm long and 10—18 cm wide; acumen linear, 10—15 mm long and 2.5—3 mm wide; with 15—18 (14—20) pairs of sec. nerves. Inflorescences richly and rather laxly branched, 12—22 cm long; sec. branchlets up to 12.5 cm, tert. ones up to 3 cm long. The axes very robust. Flowers abundant, yellowish.

Type: Stahel 144 in h.U.

Distribution: north-eastern South America.

SURINAME: Saramacca R., Sectie O, BW. 1A (1906) fl. masc. Nov. (U); id., tree n. 804, BW. 2307 (1916) (U), BW. 3655 (1918) fr. Febr. (U), BW. 4519 (1919) fr. Dec. (U), BW. 6105 (1923) fr. Febr. (U); upper Suriname R., Tresling 397 (1908) in bud Sept. (U); id., near Goddo, Stahel 144 (1926) fl. fem. and fr. Jan. (U) (type); Tapanahoni R., BW. 4131 (1918) fl. masc. Nov. (U).

BRAZIL: Para, R. Tapajoz, Boa Vista, Monteiro da Costa 58 (1931) fl. masc. (F); id., upper R. Cupary, on plateau between R. Xingy and R. Tapajoz, Krukoff 1126 (1921) fl. masc. Sept. (U).

Vern. names: SURINAME: aloe mansingi; BRAZIL: breu branco.

This variety differs from the species itself by the fact that the dimensions of its vegetative parts and of the inflorescences are twice as large and also by the more numerous sec. nerves of its leaflets.

**f. intermedium** SWART.

Vegetative parts smaller. Leaves 40—80 cm long; leaflets 22 (14—37) cm long and 7.5 (5—10) cm wide.

Type: BW. (Suriname) 2597 in h.U.

Distribution: Suriname.

SURINAME: Saramacca R., Sectie O, tree n. 648, BW. 1323 (1915) (U), BW. 2597 (1917) fl. masc. Jan. (U).

Vern. name: joeliballi (N.-E.), fiere bewe banna (Arow.), troesinan (Car.).

3. var. **panamense** SWART in Rec. Trav. bot. néerl. XXXIX, p.205 (1942)

Leaves 4-jugate, rather large, 50 (45—70) cm long; leaflets 17—24 (14—30) cm long and 6.5—8.5 (5—10) cm wide; apex rather gradually narrowed in a slightly tapering, 7.5—12.5 (5—15) mm long and 3—4 (2—5) mm wide acumen; with 16—17 (15—20) pairs of sec. nerves. Inflorescences 10—12 cm long.

Type: Bailey and Bailey 294 in h.F 643071.

Distribution: Panama.

PANAMA: Chiriqui, Progreso, Cooper and Slater 169 (1927) fr. July-Aug. (NY, US); id., id. 259 (1927) fr. July-Aug. (F, NY, US); R. Chagres, above Alhajucla, Pittier 3522 (1911) alt. 30—100 m, on dry limestone, fl. masc. March (NY, US); Canal Zone, Barro Colorado Island, Standley 40984 (1925) (US); id., Kenoyer 422 (1927) fr. Aug. (US); id., Bangham 427 (1929) fr. Aug. (F); id., Bailey and Bailey 294 (1931) fr. June (F) (type).

Vern. names: anime, chutras, comida de mono.

This variety strongly resembles the var. *robustum* Swart, but it is different by its smaller leaves and by its tapering acumen. It also shows a different distribution.

All specimens cited above were formerly named *Protium sessiliflorum* (Rose) Standl.

4. var. **sessiliflorum** (ROSE) SWART nov. comb.

*Icica sessiliflora* Rose in N. Am. Fl. XXV, 3, p.259 (1911).

*Protium sessiliflorum* Standl. in Contr. U.S.N.H. XXVII, p.224 (1928); id. in Field Mus. N.H., Bot.S. X, p.239 (1931); id. in Field Mus. N.H., Bot.S. XVIII, p.576 (1937); Engl. in E.-Pr.Nat. Pfl.fam. ed.2, XIXa, p.413 (1931).

Leaves rather large, 40 (22—58) cm long; petioles 10 (5.5—15) cm long, like the 5 (3.5—7) cm long interjuga sparsely and minutely ferruginous pilose; petiolules of the terminal leaflets 32.5 (20—45) mm long; leaflets 18 (15—24) cm long and 7.5 (5—9.5) cm wide; acumen rather abruptly acuminate; acumen about as long as wide, 4—5 mm long; with 16—18 (15—20) pairs of sec. nerves. Inflorescences rather robust, rarely provided with tert. branchlets.

Type: Tonduz 6989 in h.US 398230.

**Distribution:** once collected.

**COSTA RICA:** Santo Domingo de Golfo Dulce, Tonduz 6989 (in Herb. nat. Costar. 9952) (1896) fl. masc. March (B, F, G, GH, K, M, NY, P, US, W).

This variety, which strongly resembles the var. panamense Swart, is different from the species and its other varieties by the short acumen of its leaflets.

76. **Protium subserratum** ENGL. in DC. Mon. Phan. IV, p.89 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed. 2, XIXa, p.413 (1931); L. Williams in Field. Mus. N.H., Bot.S. XV, p.235 (1936).

*Icicopsis subserrata* Engl. in Mart. Fl. Bras. XII, 2, p.259 (1874).

*Tingulunga subserrata* OK., Rev. Gen. Pl. I, p.108 (1891).

Tree, 6—30 m high. Branchlets very stout, 10—15 mm in diam., terete, striate, when young rather densely ferrugineous puberulous, when adult glabrescent and dotted with lanceolate lenticels. Leaves 8- to 12-jugate, at times 7-jugate, 55 (40—75) cm long; petioles semiterete, at the base subincrassate, 10—13 (7—17) cm long, like the rhachis and the petiolules rather densely to sparsely and minutely ferrugineous tomentose; interjuga semiterete, above subsulcate, at the nodes slightly incrassate, 2.5—3.5 (2—4) cm long; petiolules semiterete, canaliculate, at both ends hardly incrassate, 2.5—5 mm long, the terminal ones 10—15 mm; leaflets lanceolate to lanceolate-oblong, distinctly narrowed from above the middle to the apex, usually 11.5—14 (10—17.5) cm long and 3.25—3.75 (2.5—4) cm wide, but the terminal ones shorter and slightly wider, the lateral ones oblique and the basal ones much shorter; apex gradually narrowed in a sublinear, 10—15 mm long and 2.5 mm wide, obtuse acumen; base broadly cuneate to nearly rounded; margin, especially in the apical part, remotely but distinctly subserrate; pergamentaceous, on both sides glabrous, smooth and dull; with 14—15 pairs of sec. nerves; prim. nerves on both sides distinctly prominent and pilose like the petioles, sec. nerves above grooved on each side and glabrous, beneath similar to the prim. ones, tert. nerves prominulous and glabrous. Inflorescences axillary, pseudospicate, 20 (10—24) cm long, not or sparsely branched; sec. branchlets 1—2 cm, rarely up to 7 cm, long. The axes angulose and rather densely and minutely ferrugineous tomentose. Pedicels very short, hardly 0.5 mm long, like the ovate, 0.5 mm long bracts and bractlets rather densely and adpressedly puberulous. Flowers sessile or subsessile, glomerate, 5-merous, 5 mm long, yellowish



green to white. Calyx cupuliform, 1.25 mm high, outside like the corolla sparsely and adpressedly puberulous; its lobes oblong-triangular, acute, 3 times as long as the tube. Petals linear-lanceolate, acute, inflexed-apiculate, carnose, inside on the upper half, especially on the midrib, densely white villose, on the margins papillose. Stamens 1.5—2 mm long; filaments subulate; anthers oblong, 0.5 mm long. Disc in the masc. fl. confluent with the rudimentary pistil in a depressed, 0.5 mm high, tomentellous globule provided with a central, 0.25 mm long style-remnant. Pistil in the fem. fl. at the base surrounded by the annular, tomentellous, 0.25 mm high disc; ovary globose, 5-celled, densely sericeous, 1 mm high, crowned by a very short glabrous style and a subsessile 5-lobed stigma. Drupe ovoid with acute apex, 1.25 cm long and 1 cm in diam.; exocarp sparsely puberulous, smooth; mesocarp thin, carnose; endocarp rather thick, woody; pyrenes 1 to 3.

Type: Spruce 2620 in h.P.

Distribution: western tropical South America, east of the Andes.

BR. GUIANA: between Bartica and Potaro, Tutin 231 (1933) alt. 130 m, fl. fem. June (K, U).

PERU: Loreto, basin R. Marañon, near mouth R. Santiago, at Pongo de Manseriche, Tessmann 4107 (1924) alt. 160 m, fl. masc. Sept. (B, G); id., id. 4129 (1924) fl. Sept. (B); id., lower R. Huallaga, Yurimaguas, Fortalega, L. Williams 4417 (1929) alt. 155 m, fr. Oct. (F, US).

BRAZIL: Amazonas, basin R. Negro, on R. Uaupés, near Panuré, Spruce 2620 (1852) fl. fem. and fr. Oct. (B, BM, BR, G, K, LE, P, W) (type); id., basin R. Jurua, near mouth R. Embira, trib. of R. Tarauaca, Krukoff 5083 (1933) fl. masc. June (B, F, K, NY, U) (*P. rigidum* A. C. Smith mss.); id., Basin R. Madeira, Humayta, between R. Livramento and R. Ipixuna, Krukoff 7063 (1934) fr. Nov. (K, NY, U).

This species is easily recognizable by its subserrate and apically narrowed leaflets and by the villose indumentum on the inside of its long petals.

77. *Protium ferrugineum* ENGL. in DC. Mon. Phan. IV, p.79 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931); Pittier in Trab. Mus. com. Venez. VIII, p.364 (1931).

*Idicopsis ferruginea* Engl. in Mart. Fl. Bras. XII, 2, p.258 (1874).

*Tingulonga ferruginea* OK., Rev. Gen. Pl. I, p.108 (1891).

Slender tree, 10 m high. Branchlets rather slender, 3—4 mm in diam., angulose, when young densely ferrugineous tomentose, when adult glabrescent and grey. Leaves 3- or 4-jugate, sometimes

2-jugate, 26—30 (17—35) cm long; petioles near the incrassate base semiterete, 7 (4.5—9.5) cm long, like the rhachis and the petiolules when young densely but minutely pilose and when adult glabrescent and transversely rimose; interjuga terete, striate, above carinate, at the nodes subincrassate, 3—3.5 cm long; petiolules semiterete, canaliculate, at both ends incrassate, 7.5—10 mm long, the terminal ones 25 mm; leaflets oblong-elliptic, irregular and oblique, usually 10.5 cm long and 4.25 cm wide, but the terminal ones shorter and slightly wider and the basal ones smaller; apex gradually narrowed in a sublinear, 12.5 mm long and 3 mm wide, obtuse acumen; base obliquely cuneate; margin entire, repand, undulate; subcoriaceous, glabrous and smooth, above nitidulous, beneath dull; with 10 (8—11) pairs of sec. nerves; prim. and sec. nerves above grooved on each side and glabrous, beneath distinctly prominent and near the base sparsely and minutely pilose, tert. ones glabrous, above hardly prominent, beneath prominulous. Inflorescences axillary, pseudospicate, 2—3.5 cm long, not branched or, rarely, with some very short branchlets. The axes angulose and like the stout and short, up to 1 mm long pedicels, the triangular, acute, 1.25—1.5 mm long bracts and bractlets and the outside of the calyx and the corolla rather densely ferruginous tomentose. Flowers subsessile, 5-merous, 5 mm long. Calyx cupuliform, 1.5 mm high; its lobes triangular, acute, about twice the length of the tube. Petals lanceolate-triangular, acute, inflexed-apiculate, carnosae, inside ferruginous puberulous. Stamens in the fem. fl. 1.5—2 mm long; filaments subulate, slightly dilated; anthers oblong, 0.5 mm long. Disc in the fem. fl. annular, ferruginous, tomentellous. Drupe oblong-ovoid, oblique or 2- or 3-lobed, acute at both ends, at the base mostly narrowed, rather densely and shortly ferruginous pilose, when mature glabrescent, 2.5 cm long and 1.25 cm in diam.; mesocarp thin, carnosae; endocarp thin, woody; pyrenes 1 to 3.

**Type:** Spruce 3494 in h.P.

**Distribution:** once collected.

VENEZUELA: Amazonas-terr., R. Negro, near San Carlos, Spruce 3494 (1854) fr. May (B, BM, BR, C, G, K, LE, NY, P, W).

This species is remarkable, amongst those of the section *Icicopsis*, by the strongly developed indumentum on its generative parts and by its large, subsessile flowers.

78. **Protium reticulatum** ENGL. in DC. Mon. Phan. IV, p.79,

t.2, f.4—7 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.412 (1931).

*Icicopsis reticulata* Engl. in Mart. Fl. Bras. XII, 2, p.258, t.51 (1874).

*Tingulunga reticulata* OK., Rev. Gen. Pl. I, p.108 (1891).

Erect tree, 16 m high. Branchlets stout, 3—5 mm in diam., subterete, densely ferrugineous puberulous. Leaves mostly 5-jugate, at times 4-jugate, rarely 3-jugate, 20 (14—23) cm long; petioles semiterete, at the base incrassate, 6 (5—7.5) cm long, like the rhachis and the petiolules densely and minutely canescent pilose; interjuga angulose, at the nodes hardly incrassate, 2 (1.5—2.5) cm long; petiolules angulose, above bisulcate, at both ends subincrassate, 5 (3—6) mm long, the terminal ones 12.5 (7.5—15) mm; leaflets oblong-ovate to elliptic-ovate, mostly narrowed from below the middle to the apex, usually 6 (5—6.5) cm long and 2.5 (1.75—2.75) cm wide, but the terminal ones and those of the apical jugum shorter; apex rather gradually narrowed in a sublinear, 10 (7.5—15) mm long and 2.5 mm wide, obtuse acumen; base broadly cuneate to nearly rounded; margin entire, undulate; subcoriaceous, glabrous, slightly papillose and nearly smooth, above nitidulous, beneath dull; with 7 (6—8) pairs of sec. nerves; prim. nerves above grooved on each side and glabrous, beneath distinctly prominent and subglabrous, sec. ones glabrous, above grooved on each side, beneath prominent, tert. ones glabrous, above hardly prominent, beneath prominent., sec. and tert. ones forming beneath a conspicuously pale green reticulation. Inflorescences axillary, pseudospicate, not branched, 1.5 (1—2) cm long. The peduncles stout, terete, striate, like the semiorbicular, about 1 mm long bracts and bractlets and the outside and inside of the calyx and the corolla densely ferrugineous puberulous. Flowers sessile or subsessile, 5-merous, 4 mm long. Calyx shallowly cupuliform, about 2 mm long; its lobes oblong-triangular, acute, 2 to 3 times as long as the tube. Petals lanceolate-triangular, acute, carnose. Stamens in the fem. fl. about 2 mm long; filaments subulate; anthers oblong, 0.5 mm long. Disc in the fem. fl. annular, densely ferrugineous tomentellous. Drupe either oblique-ovoid and monopyrenous or broadly globose, 2- to 5-lobed and 2- to 5-pyrenous, with subacute apex, crowned by the rudiments of a sessile stigma, densely to sparsely ferrugineous puberulous, 1.25 cm long and 1.25—1.75 cm in diam.; mesocarp rather thick, carnose; endocarp thick, woody.

Type: Spruce 3476 in h.P.

Distribution: once collected.

VENEZUELA: Amazonas-terr., R. Negro, near San Carlos, Spruce 3476 (1854) fr. Apr. (B, BM, BR, G, K, LE, NY, P, W).

Like *P. ferrugineum* Engl., this species is different from the other species of the section *Icicopsis* by the strongly developed indumentum on its generative parts, and also by its small, ovate leaflets.

**A n a t o m y :** Guill. in Ann. Sc. nat., S.9, X, p.209 (1909).

#### Doubtful species

**Protium Carana** MARCH. in Adans. VIII, p.51 (1867—1868); Engl. in E.-Pr. Nat. Pfl.fam. III, 4, p.237 (1897) et ed.2, XIXa, p.413 (1931). Non apud Engl. in Mart. Fl. Bras. XII, 2, p.277 (1874) et id. in DC. Mon. Phan. IV, p.84 (1883) quod quoad descr. et spec. Poeppig 2830 ad *P. Poeppigianum* Swart pertinet, eadum modo Pittier in Trab. Mus. com. Venez. VII, p.364 (1931), nec apud L. Williams in Field Mus. N.H., Bot.S. XV, p.236 (1936) quod ad *P. tenuifolium* Engl. pertinet.

*Amyris Carana* Humb., Voyage Rég. équin. I, Relat. hist. II, p.421, 435 (1819) nomen; Spreng., Linn. Syst. Veg. ed.16, IV, 2, p.148 (1827).

*Icica?* *Carana* H.B.K., Nov. Gen. et Spec. Pl. VII, p.27 (1825); Kunth. Syn. Pl. IV, p.163 (1825); DeCand., Prodr. II, p.78 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832); Tr. et Pl. in Ann. Sc. nat., S.5, XIV, p.299 (1872).

*Elaphrium Carana* Spr. ex Dietr. Syn. Pl. II, p.1271 (1840).

*Bursera Carana* Baill., Hist. d. Pl. V, p.296 (1874); id., Tr. Bot. méd. phan. p.951 (1884).

*Tingulonga Carana* OK., Rev. Gen. Pl. I, p.108 (1891).

*Protium altissimum* March. apud Pitt. in Trab. Mus. com. Venez. VIII, p.367 (1931) p.p.

Large and balsamiferous tree, more than 30 m high (Humb.). Leaves at least trifoliolate, probably 2-jugate or multijugate, in all parts glabrous; interjuga terete, striate, at the nodes slightly incrassate, more than 5 cm long; petiolules terete, striate, at both ends incrassate, 13 mm long; leaflets oblong-ovate, narrowed from below the middle to the apex, slightly asymmetric, 23—24 cm long and 9—11 cm wide; apex rather abruptly acuminate; acumen sublinear, 17.5 mm long and 4 mm wide, obtuse; base cuneate; margin entire, repand, undulate; subcoriaceous, smooth, above nitidous, beneath dull; with 16 pairs of sec. nerves; prim. nerves on both sides distinctly prominent; sec. nerves above immersed

beneath prominent, tert. ones above hardly prominent, beneath prominulous.

Type: Humboldt 960 in h.B.

Distribution: once collected.

VENEZUELA: Amazonas-terr., R. Temi, near Javita, Humboldt 960 (1799—1804) (B).

Vern. names: carana, mararo.

The type collection consists of only three lateral leaflets and a part of an interjugum. Although these fragments agree with *Protium* in general aspect, they do not agree with any other species of the genus, nor with any of the specimens referred to *P. Carana* March. by other authors.

Engler, who did not see the type-specimen, based his diagnosis on Poeppig 2830, which is distinctly different and on which I founded *P. Poeppigianum* Swart.

Pittier's diagnosis of *P. altissimum* (Aubl.) March., l.c. p.367, which I have referred to *Tetragastris altissima* (Aubl.) Swart, is an excerpt of that given by Engler, which does not pertain to this species, but is founded on a Poiteau specimen now referred to *Talisia* (Sapindac.). The vern. names "carana" and "mararo", quoted by Pittier, and the last sentence of his comment, however, are taken from Kunth's description of *Icica Carana*, the vern. name "jacifate" and the last but one sentence of his comment from Kunth's description of *Icica cuspidata* and the distribution is that of the two last-named species combined.

Uses: Humboldt, l.c. p.435, already stated that the name "Carana" is used for various plants and resins, and therefore the scources of "carana"-resin given in the literature are untrustworthy. (Cf.: Humb. l.c.; Tr. et Pl. l.c.; Baill. l.c., Engl. l.c.; Cordemoy in Ann. Inst. col. Mars. VI, p.205 (1899); Wiesn. und Bamb. in Wiesn. Rohst. ed.2, I, p.175 (1900); Guill. in Agr. Pays ch. IX, 1, p.358 and 2, p.145 (1909); Tschirch, Handb. Pharmak. III, 2, p.1136 (1925).

***Protium tonkinense*** ENGL. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413 (1931); Lam in Ann. Jard. bot. Btz. XLII, p.201 (1932); id. in Bull. Jard. bot. Btz., S.3, XII, p.321 (1932).

*Bursera tonkinensis* Guill. in Rev. gén. Bot. XIX, p.161, t.11 (1907); id. in LeComte Fl. gén. Indo-ch. I, p.718 (1911).

Tree, 6—8 m high. Leaves 3- to 5-jugate, about 40 cm long; petioles about 7 cm long; interjuga 2.5—4 cm long; petiolules 2—7 mm long, the terminal ones about 25 mm; leaflets elliptic-ovate,

about 7 cm long, asymmetric; apex gradually narrowed in a 7—8 mm long and 4—5 mm wide, obtuse acumen; base rounded; margin entire; membranaceous, glabrous; with 5—6 pairs of sec. nerves; sec. nerves prominent, tert. ones prominulous. Inflorescences subterminal, axillary, 7—12 cm long, laxly branched. Pedicels slightly longer than the 5-merous, about 1 mm long flowers. Calyx nearly as long as the corolla; its lobes acute, about 3 times as long as the tube. Petals acute, whitish. Stamens 10, the episepalous ones nearly as long as the petals, the epipetalous ones shorter, anthers oblong. Pistil at the base surrounded by the disc, consisting of an ovoid 3-celled ovary, containing 2 collateral, epitropous ovules in each cell, and crowned by a short style and a 3-lobed stigma.

**Type:** Balansa.

**Distribution:** once collected.

INDO-CHINA: Tonkin, Haï Nam, Phu Ly, Ké So, Balansa (1855—1889) fl. fem.(?) May. (ex Guill.).

As I did not see the type specimen, I had to rely on the description given by Guillaumin, which, however, is not sufficiently explicit and I was therefore unable to check the opinion expressed by Engler and by Lam, that this species should be referred to the genus *Protium*.

#### Neglected species

***Protium coriaceum*** ENGL. in Mart. Fl. Bras. XII, 2, p.281 (1874).

This species, based on a fruiting specimen collected by Schomburgk (without number or date) in Br. Guiana, has never again been mentioned, not even in Engler's monograph of 1883 and I have seen no specimen bearing this name.

***Icica acuminata*** DE CAND., Prodr. II, p.78 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832); Klotzsch in Schomb. Reisen in Br. Guiana III, p.1188 (1848).

This species has not been mentioned subsequently in the literature and I did not see any specimen bearing its name.

***Icica ? cuspidata*** H.B.K., Nov. Gen. et Spec. Pl. VII, p.27 (1825); Kunth, Syn. Pl. IV, p.163 (1825); DeCand., Prodr. II, p.78 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832); Engl. in DC. Mon. Phan. IV, p. 90 (1883).

*Elaphrium cuspidatum* Spr. ex Dietr., Syn. Pl. II, p.1271 (1840).

*Protium altissimum* March. in errore Pittier in Trab. Mus. com. Venez. VIII, p.367 (1931) p.p. (Cf. sub P. Carana March.).

The type specimen of this species, which is indicated as "negligenda" by Engler, was collected by Humboldt in Venezuela, near Javita, on the bords of the R. Temi and consisted of leaves only. I neither saw a specimen inscribed with the name "Icica ? cuspidata," nor with the vern. name "jacifate".

*Bursera (Icica) macrostachya* TURCZ. in Bull. Soc. imp. Nat. Mosc. XXXVI, 1, p.613 (1863); Engl. in DC. Mon. Phan. IV, p.60 (1883).

I have not found Schomburgk I, 333, the type specimen of this species, which is mentioned by the author and by Engler, under "Bursera; Species excl.", only. The short diagnosis makes further identification impossible.

*Icica Schomburgkii* KLOTZSCH in Schomb. Reisen in Br. Guiana III, p.1188 (1848) nomen.

I did not see any specimen bearing this name and the brief comment of the author made it impossible to trace the type.

*Icica ? serrata* DECAND., Prodr. II, p.77 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832).

*Amyris ambrosiaca* Moc. et Sessé (non L.), Fl. Mex. Ic. et Descr. ined.

I saw two copies of the original drawing, by Alph. de Candolle inscribed "Amyris serrata DC.", but there is no conformity with any Central American species which I studied.

#### Excluded species

*Protium africanum* Harv. in Harv. et Sond. Fl. Cap. II, p.592 (1861—1862)

= *Commiphora Harveyi* ENGL. in DC. Mon. Phan. IV, p.25 (1883).

*Protium australasicum* (Bailey) Sprague in Kew Bull. 1912, p.370 (1912); Francis, Austr. Rain For. Trees p.175, f. 112—113 (1929); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.413; Lam in Ann. Jard. bot. Btz. XLII, p.201 (1932); id. in Bull. Jard. bot. Btz., S.3, XII, p.321 (1932).

*Bursera australasica* Bailey in Queensl. Dept. Agr. Bull. XVIII, p.8 (1892); id. in Proc. Roy. Soc. Queensl. XI, p.14 (1895); id., Queensl. Fl. I, p.223 (1899); id., Compr. Cat. Queensl. Pl. p.85,

f.71 (1909).

= **Santiria ? sp.**

The type specimen, J. M. Bailey, May 1892, in the herbarium at Kew, possesses a drupe with a thin and fleshy mesocarp and a thick and woody endocarp with 4 cells, two of which are fertile. These cells are firmly united by solid tissue and form a single plurilocular pyrene, instead of the separate pyrenes found in *Protium*. The additional material, Simmonds and Bailey, Nov. 1894, in the herbaria of the British Museum and at Kew shows masculine flowers, which are mostly 3-merous with soft petals provided with a thin and slightly imbricate margin and a minute, rudimentary ovary; such features are never met with in *Protium*. Most probably this material belongs to the genus *Santiria*, though no Australian species of this genus are yet known.

*Protium bolivianum* Britton in Bull. Tor. bot. Cl. XVI, p. 189 (1889); Engl. in E.-Pr. Nat. Pfl. fam. ed. 2, XIXa, p. 412 (1931)  
= **Mauria ferruginea** TUL. (Anacardiaceae).

*Protium caudatum* W. et A., Prodr. Fl. Pen. Ind. Or. I, p.177 (1834)  
= **Commiphora caudata** ENGL. in DC. Mon. Phan. IV, p.27 (1883).

*Protium gileadense* W. et A., Prodr. Fl. Pen. Ind. Or. I, p.177 (1934)  
= **Commiphora Berryi** ENGL. in DC. Mon. Phan. IV, p.17 (1883).

*Protium Klugii* Macbride in Candollea V, p.378 (1934)  
= **Bursera sp.**

*Protium lucidum* (Rose) Engl. in E.-Pr. Nat. Pfl. fam. ed.2, XIXa, p.414 (1931).

*Icica lucida* Rose in N. Am. Fl. XXV, 3, p.260 (1911)  
= **Mauria sp.** (Anacardiaceae.) (Cf. STANDL. in Field Mus. N.H., Bot.S. XVIII, p.576 (1937).

*Protium ? mossambicense* Oliver, Fl. Trop. Afr. I, p.329 (1868)  
= **Commiphora mossambicensis** ENGL. in DC. Mon. Phan. IV, p.26 (1883).

*Protium pubescens* W. et A., Prodr. Fl. Pen. Ind. Or. I, p.176 (1834)  
= **Commiphora pubescens** ENGL. in DC. Mon. Phan. IV, p.21 (1883).

*Protium Roxburghianum* W. et A., Prodr. Fl. Pen. Ind. Or. I, p.176 (1834)



= *Commiphora caudata* ENGL. var. *Roxburghiana* ENGL. in DC. Mon. Phan. IV, p.28 (1883).

*Icica Abilo* Blanco, Fl. Philipp. ed.2, p.256 (1845)

= *Garuga floribunda* DECNE in Nouv. Ann. Mus. Par. III, p. 477 (1834).

*Icica ? dentata* DC., Prodr. II, p.78 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832).

*Amyris dentata* Willd., Linn. Sp. Pl. ed.4, II, p.337 (1799)

= *Clausena dentata* M. ROEM., Syn. I, p.44 (1846).

*Icica ? dentata* DC. was referred by Blume, Mus. Lugd. Bat. I, p.229 (1849—1851), to *Protium javanicum* Burm. and this view was reproduced by Walp., Ann. Bot. Syst. II, p.288 (1851—1852), by Miquel, Fl. Ned. Indië I, 2, p.654 (1859) and by Koorders en Valetón in Med. s'Lands Pltt. XVII, 4, p.22 (1896). Hook., Fl. Br. Ind. I, p.506 (1875) however recognized the identity of *Icica dentata* DC. with *Clausena Willdenowii* W. et A. (1834), and for this species now the correct name *Clausena dentata* Roem. has been reestablished.

*Icica leptostachya* Turcz. in Bull. Soc. imp. Nat. Mosc. XXXI, 1, p.473; Engl. in DC. Mon. Phan. IV, p.90 (1883); Rose in N. Am. Fl. XXV, 3, p.261 (1911).

*Tingulonga leptostachya* OK., Rev. Gen. Pl. I, p.108 (1891).

A duplicate of the type specimen, Galeotti 3493 in the herbarium at Brussels, consists of young inflorescences only, and these certainly do not belong to *Protium*, and probably not even to a *Burseraceous* genus.

*Icica ? timoriensis* DC., Prodr. II, p.78 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832).

A specimen in the herbarium at Geneva, signed with this name, and probably either the type or a duplicate of the type, is provided with young flowers, which do not belong to *Protium* and probably not even to a *Burseraceous* genus.

## II. HEMICREPIDOSPERMUM SWART

*Hemicrepidosperrum* SWART in Rec. Trav. bot. néerl. XXXIX, p.205 (1942).

Trees. Bark balsamiferous. Leaves scattered, imparipinnate; petiolules short; leaflets oblong to elliptic, obtusely acuminate,

serrulate. Inflorescences subterminal, axillary, the main ramifications racemose but the flowers arranged in terminal cymes, rather large, not or but slightly branched. Peduncles and branchlets slender. Flowers polygamous-dioecious, small, 5-merous. Calyx synsepalous. Petals free, subinduplicate-valvate in aestivation, with incrassate inflexed apex. Stamens 10, obdiplostemonous, the episepalous ones somewhat longer. Disc annular, 10-lobed, glabrous. Pistil appressedly puberulous, in the masc. flowers rudimentary, embedded in the disc, in the fem. flowers as high as the stamens, at the base surrounded by the disc; style short; stigmas 5; ovary with 5 epipetalous locules, each with 2 subapical collateral epitropous pendulous ovules. Drupe with pilose exocarp, carnose balsamiferous mesocarp and thin crustaceous endocarp; pyrenes separated by a thin layer of mesocarp, one-seeded. Seed ovoid with brittle testa, exalbuminous; embryo subhippocrepiform, apex of the cotyledons uncinata, the inner cotyledon with a short recurved part,  $\frac{1}{2}$  to  $\frac{1}{3}$  the length of the basal part, the outer one with a very short incurved part, at most  $\frac{1}{4}$  the length of the basal part, overlapping the inner one.

Type-species of the genus: *Hemicrepidosperrum rhoifolium* (Benth.) Swart.

Distribution: 1 species; equatorial South America, east of the Andes.

The genus *Crepidosperrum* has been founded in 1862 by Hooker f. and is based on Spruce 4193 as the type of *C. Sprucei*. This specimen has been identified by Triana and Planchon in 1872, with Goudot A no. 2, on which Tulasne in 1846 had based his *Icica Goudotiana* Tul., and in this way the name *C. Goudotiana* (Tul.) Tr. et Pl. originated. This identification could be confirmed to be right. The principal characters of this genus are its isostemony and its cotyledons, replicate in the midst of their length.

In the same publication Triana and Planchon rightly identified Spruce 1344, the type of *Hedwigia rhoifolia* Benth., with Triana 3699 and with a specimen of Mélinon, named by L. Marchand in manuscript *Crepidosperrum guyanense*. These specimens consist merely of fruiting branches, but already in 1852 Bentham stated "Stamina 10", and that this is true can be seen on the other specimens too. Triana and Planchon pay no attention to this fact, but they stated that the distinctly uncinata inner cotyledon, is provided with a recurved part, which is but  $\frac{1}{2}$  to  $\frac{1}{3}$  the length of the basal part, and that the outer cotyledon has but a very short incurved part. Bentham also says: cotyledones apice inferae pro-

ductae in acumen breve radicaeforme tenue incurvum, in dorsum alterius cotyledonis incumbens. So Triana and Planchon placed these specimens in the genus *Crepidospermum* as *C. rhoifolium* (Benth.) Tr. et Pl. But they suggested that perhaps a separate section of the genus for this species should be formed, for which they proposed the name *Hemicrepidospermum*.

In the ample description of the genus given by Engler in his monograph of the Burseraceae (1883), and in his other publications (1874, 1897, 1931) no attention is paid to the difference in the number of stamens and in the folding of the cotyledons. The difference in the relative length of the folded top of the cotyledons may perhaps, as suggested by Triana and Planchon, be treated as of slight importance, but the difference in the number of stamens is in my opinion of generic value.

**1. *Hemicrepidospermum rhoifolium* (BENTH.) SWART n. comb.**

*Hedwigia rhoifolia* Benth. in Hook. Journ. of Bot. IV, p.17 (1852); Mueller in Walp. Ann. IV, p.450 (1857).

*Crepidospermum rhoifolium* Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.300 (1872); Engl. in Mart. Flor. Bras. XII, 2, p.290, t.61, f.1 (1874); id. in DC. Mon. Phan. IV, p.94, t.2, f.20—24 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.235 (1897) et ed.2, XIXa, p.415 (1931); Sagot in Ann. Sc. nat. S.6, XIII, p.290 (1882); Huber in Bol. Mus. Goeldi V, p.431 (1908); Benoist in Bull. Soc. bot. Fr. LXVI, p.360 (1909); LeCointe, Arv. e. Pl. ut. a. Amaz. Bras. III, p.64 (1934); Sampaio in Bol. Mus. nac. R. d. Jan. X, p.13 (1934).

*Crepidospermum guianense* March. mss. in h.P (Mélinon 1887); Tr. et Pl. l.c.; Sagot l.c.

Tree. Branchlets thick, 0.5 cm in diam., terete, striate, when young ferruginous tomentellous, when adult glabrescent, scabrous and grey. Leaves 2- to 4-, mostly 3-jugate, 30—40 cm long; petioles at the base semiterete, 9—10 cm long, like the rhachis and the petiolules when young densely ferruginous puberulous, when adult glabrescent, greyish and at the base slightly transversely rimose; interjuga terete, striate, 3—4 cm long; petiolules semiterete, above sulcate, 5—7.5 mm long, the terminal ones 3 cm; leaflets elliptic, sometimes narrowed to the apex, usually 11—14 cm long and 5.5—6.5 cm wide, but the terminal ones larger, the lateral ones slightly asymmetric and the basal ones much smaller; apex gradually narrowed in a tapering, 7.5 mm long and 5—7 mm wide, obtuse acumen; base cuneate; margin remotely but distinctly

serrulate; pergamentaceous, on both sides nitidulous, scabriusculous and nearly glabrous; with 8—10 pairs of sec. nerves; prim. nerves densely ferrugineous puberulous, above grooved on each side, beneath prominent, sec. ones similar to the prim. ones but sparsely puberulous, tert. ones above visible and glabrous, beneath prominent provided with some hairs. Inflorescences subterminal axillary, mixed, 9—18 cm long, always shorter than the subtending leaves. Peduncles and the few, on an average 2 cm long, sec. branchlets terete, striate, densely ferrugineous puberulous. Pedicels terete, puberulous, about half as long as the flowers; bracts oblong-lanceo-

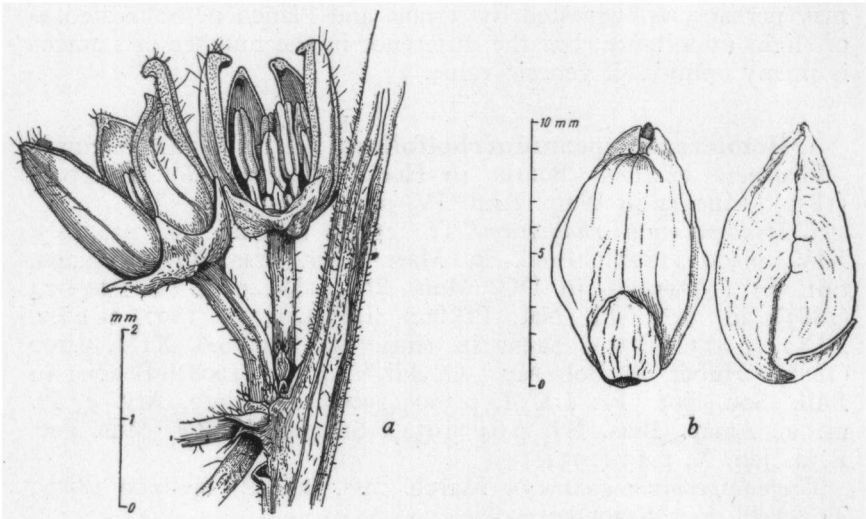


Fig. 5. *Hemicrepidium rhoifolium* (Benth.) Swart — a. male flowers; b. embryo.

late, acute, sparsely puberulous, about 1 mm long; bractlets elliptic, 0.5 mm long. Flowers 5-merous, 2.5 mm long, whitish. Calyx cupuliform to campanulate, half the length of the flower, puberulous; its lobes triangular, acute, once to once and half as long as the tube. Petals free, oblong-elliptic, acute, subcarnose, outside sparsely pubescent to glabrous, and villose on the midrib, inside glabrous, on the margins papillose. Stamens 10, 1.5 mm long; filaments short, 0.35—0.5 mm long, broadly subulate; anthers oblong. Disc annular, glabrous, 0.35 mm high. Pistil in the masc. fl. rudimentary and embedded in the disc, 0.5 mm high, in the fem.fl. about as high as the stamens; ovary ovoid, 5-sulcate, 5-celled, adpressedly

puberulous, tapering in a short 5-sulcate style, crowned by a 5-lobed stigma. Drupe oblique-ovoid to globose and 2- to 5-lobed, with acute apex crowned by the rudiments of the style, densely ferruginous tomentellous, 1.5 cm long and 1.25—2 cm in diam.; pyrenes 1 to 5.

Type: Spruce 1344 in h.BM.

Distribution: equatorial South America, east of the Andes.

COLOMBIA: Bogota, Llanos de San Martin, Triana 3699 (1851—1857) alt. 300 m, fr. (B, BM, K, P, W); without loc., Karsten (no date) fr. (W).

SURINAME: Corantyne R., Kaboeri, Pulle 519 (1920) virgin forest, fl. masc. Sept. (U); Saramacca R., Watramiri, tree n. 1641, BW. 2006 (1916) (U), BW. 2506 (1916) fr. Dec. (U); id., Sectie O, tree n. 507, BW. 344 (1915) fl. fem. and fr. Apr. (U), BW. 1134 (1915) fr. Oct. (U), BW. 1291 (1915) fr. Oct. (U), BW. 2380 (1916) fr. Nov. (U); upper Suriname R., Tresling 457 (1908) fr. Sept. (U).

FR. GUIANA: Maroni R., Mélinon (1864) fr. (B, BM, BR, BZ, G, K, LE, NY, P); id., St. Jean, Benoist 901 (1914) fl. masc. March. (P).

BRAZIL: Para, R. Maloquinha, Mapuere, Ducke 9080 (1907) (ex Huber 1908); Amazonas, R. Negro, near Barra, Spruce 1344 (1851) fr. Febr. (BM, G, K, LE, M, NY, P, W) (type); id., basin R. Solimoes, São Paulo de Olivença, near Palmares, Krukoff 8283 (1936) fr. Sept.-Oct. (NY); id., basin R. Madeira, Humayta, near Tres Casas, Krukoff 6392 (1934) virgin forest, low land, fr. Oct. (K, NY, U); id., id. 6485 (1934) virgin forest, low land, in bud Oct. (K, NY, U).

Vern. names: SURINAME: salie (N.E.), joriballi-béléro (Arow.), pokiria sipioli (Car.); BRAZIL: breu branco (Ducke, ex Huber).

Anatomy: Solereder, Syst. Anat. Dic. p.218, f.43G (1899); Guill. in Ann. Sc. nat., S.9, X, p.206, f.I (1909)

### III. CREPIDOSPERMUM HOOK.F.

*Crepidospermum* HOOK.F. in Benth. et Hook. Gen. Pl. I, 1, p.325 (1862); Marchand in Adans. VIII, p.17, p.65 (1867—1868); Baillon, Hist. d. Pl. V, p.260, p.310 (1874); Engl. in Mart. Fl. Bras. XII, 2, p.290 (1874); idem in DC. Mon. Phan. IV, p.93 (1883); Baillon, Dict. Bot. II, p.266 (1886); Engl. in E.-Pr. Nat. Pfl.fam. III, 4, p.325 (1897) et ed.2, XIXa, p.415 (1931); Guill. in Ann. Sc. nat., S.9, X, p.206 (1909); Lemée, Dict. II, p.368 (1930); Benoist in Arch. d. Bot. V, Mém.I, p.154 (1931).

Shrubs, rarely trees. Branches and branchlets balsamiferous, Leaves scattered, imparipinnate; petiolules short. Leaflets lanceolate to elliptic, acuminate, serrate. Inflorescences subterminal, axillary, the main ramifications racemose but the flowers arranged in ter-

minial cymes, rather large, much-branched, many-flowered; peduncles and branchlets slender. Flowers polygamous-dioecious, small, 5-merous or rarely 4-merous. Calyx synsepalous; its lobes imbricate in bud. Petals free, subinduplicate-valvate in aestivation, carnose, with incrassate and inflexed apex. Stamens episepalous. Disc annular, lobed, glabrous. Pistil glabrous, in the masc. flowers rudimentary, in the fem. flowers at the base surrounded by the disc; ovary with epipetalous locules, each with 2 subapical collateral epitropous pendulous ovules. Drupe with glabrous thin exocarp, rather carnose balsamiferous mesocarp and thin crustaceous endocarp; pyrenes separated by a thin layer of mesocarp, one-seeded. Seed ellipsoid with brittle testa, exalbuminous; embryo hippocrepiform with uncinat cotyledons, the latter both curved to the same side, their upper and lower parts equal in length or nearly so.

Type-species of the genus: *Crepidospermum Sprucei* Hook.f. which is now reduced to *C. Goudotianum* (Tul.) Tr. et Pl.

Distribution: eastern slopes of the Andes, from Colombia to Bolivia.

Though the original description of the genus was published by Hooker f. and the latter is everywhere credited with it the label of the type specimen in the Herbarium at Kew reads *Crepidospermum Sprucei* Bentham and the sheet moreover bears an analysis in Bentham's handwriting.

Key to the species.

- 1a. - leaves 3- to 4-jugate; leaflets with 9—12 pairs of sec. nerves; both pedicel and calyx about half as long as the flower  
 . . . . . 1. *C. Goudotianum* (TUL.) TR. et PL.  
 1b. - leaves 6- to 8-jugate; leaflets with about 15 pairs of sec. nerves; pedicel nearly as long as the flower, calyx one fifth the length of the flower . . . . . 2. *C. multijugum* SWART

1. *Crepidospermum Goudotianum* (TUL.) TR. et PL. in Ann. Sc. nat. S.5, XIV, p.300 (1872); Engl. in Mart. Flor. Bras. XII, 2, p.289, t.61, f.2 (1874); id. in DC. Mon. Phan. IV, p.93, t. 2, f.15—19 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.235 (1897) et ed.2, XIXa, p.415 (1931); Williams in Field Mus. N.H., Bot. S. XV, p.232 (1936).

*Icica Goudotiana* Tul. in Ann. Sc. nat. S.3, VI, p.372 (1846); Walp., Ann. Bot. Syst. I, p.201 (1848—1849).

*Crepidospermum Sprucei* Hook.f. in Benth. et Hook. Gen. Pl. I, 1, p.325 (1882).

Shrub, or, rarely, tree. Branchlets rather stout, polygonous, when young densely ferrugineous pubescent, when adult glabrescent and lurid. Leaves 3- to 4-jugate, 20 (15—30) cm long; petioles near the slightly incrassate base semiterete, 4—6 cm long, like the rhachis and the petiolules when young rather densely brown tomentose but when adult glabrescent and ferrugineous; interjuga terete, striate, 2—3.5 cm long; petiolules semiterete, 2.5—3.5 mm long, the terminal ones 20—25 mm; leaflets oblong to elliptic, usually 7—10 cm long and 3—3.5 cm wide, but the lateral ones oblique and the basal ones much smaller; apex gradually narrowed in a short acumen; base broadly cuneate; margin rather densely serrate; pergamentaceous, above glabrous and nitidulous, beneath puberulous and dull, with 9—12 pairs of sec. nerves; prim. nerves on both sides prominent, above tomentellous, beneath puberulous; sec. ones above slightly immersed and subglabrous, beneath prominent, tert. ones above hardly visible, beneath prominulous. Inflorescences subterminal, axillary, mixed, 8—10 (5—13) cm long, with but few short branchlets, up to 1 (1—3) cm long, ending in many-flowered clusters; bracts lanceolate. Peduncles mostly half as long as the inflorescences and like the branchlets densely puberulous. Pedicels half as long as the flowers, 1—1.5 mm, sparsely puberulous; bracts and bractlets lanceolate. Flowers 5-merous, or rarely 4-merous, 2—3 mm long. Calyx infundibuliform, about 1 mm long, nearly half as long as the corolla; its lobes once to twice as long as the tube, acute. Petals free, oblong, acute, outside near the top with some patent, rather long hairs, inside glabrous, margins papillose. Stamens 5, episepalous, about half the length of the corolla; filaments broadly subulate, about as long as the oblong anthers. Disc 0.3 mm high. Pistil in the masc. fl. 0.3 mm high, sunken in the disc; in the fem. fl. as high as the stamens, 1.2 mm high, and consisting of a globose, slightly 5-lobed, 5-celled, glabrous, 0.7 mm high ovary, and a cylindrical style of 0.5 mm length. Drupe oblique-ovoid to compressed-ellipsoid, glabrous, about 1.5 cm long and 0.75 cm in diam.; pyrenes mostly 1, sometimes 2.

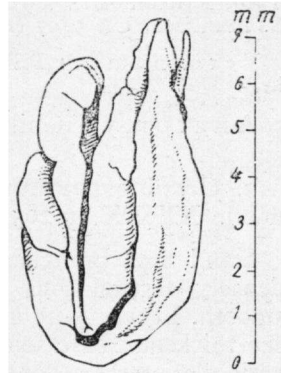


Fig. 6. *Crepidospermum Goudotianum* (Tul.) Tr. et Pl. — embryo.

Type: Goudot A no. 2 in h.P.

**Distribution:** eastern slopes of the Andes, from Colombia to Bolivia.

COLOMBIA: Upper Orinoco, Goudot A no. 2 (1844) fr. (P) (type).

PERU: dept. San Martin, Tarapoto, Spruce 4193 (1855—56) fl. masc. (B, BM, BR, C, F, G, K, LE, P, S, W) (type of *C. Sprucei* Hook. f.); id., L. Williams 5390 (1929) alt. 750 m, on sandy soil, fr. March (F, US); upper Rio Huallaga, L. Williams 5636 (1929), alt. 360—900 m, fr. Dec. (F); id., L. Williams 5869 (1929) alt. 750 m, fr. Dec. (F, U); id., Klug 3771 (1934) alt. 400 m, fl. masc. Oct. (B, BM, F, K); id., San Roque, L. Williams 7193 (1930) alt. 1350—1500 m, fr. Jan. (F, G, US); dept. Loreto, Ule 6413 (1902) fl. masc. Sept. (B, G, K, L); dept. Loreto, prov. Moyobamba, Weberbauer 4502 (1904) alt. 800—900 m, in savannah, fl. fem. Aug. (B, G); id., id., Weberbauer 4579 (no date) alt. 800—900 m, fl. fem. (B, G).

BRAZIL: terr. de Acre, basin R. Purus, near mouth R. Macauhan in R. Yaco, Krukoff 5715 (1933) fl. masc. Aug. (B, K, NY, S, U); Amazonas, S. Fransisco, Ule 9507 (1911) fl. masc. Sept. (B, G, K).

**Vern. names:** PERU: isula micunan, trompetero caspi (ex Williams l.c.).

**Anatomy:** Guill. in Ann. Sc. nat., S.9, X, p.215 (1909).

2. *Crepidospermum multijugum* SWART in Rec. Trav. bot. néerl. XXXIX, p.205 (1942).

Small tree. Branchlets rather stout, terete, sulcate, when young densely ferruginous puberulous, when adult glabrescent and smooth. Leaves 6- to 8-jugate, 25—30 cm long; petioles terete, near the thickened base semiterete, 6 cm long, like the rhachis and the petiolules rather densely tomentellous; interjuga 2.5 cm long; petiolules semiterete, above subalate, 2.5 mm long, the terminal ones 15 mm; leaflets mostly oblong to lanceolate, but the basal ones oblong to elliptic, slightly asymmetrical, 6.5 cm long and 2 cm wide; apex gradually and rather shortly acuminate; acumen 4 mm long and 3 mm wide, acute; base acute; margin rather densely and acutely serrate; pergamentaceous, scabriusculous and dull, above glabrescent, beneath sparsely puberulous; with 15 pairs of sec. nerves; prim. nerves prominent and pubescent, sec. nerves above prominulous and provided with some scattered hairs, beneath prominent and sparsely puberulous, tert. nerves above indistinct, beneath prominulous and provided with some scattered hairs. Inflorescences subterminal, axillary, laxly paniculate, many-flowered, 12 cm long; peduncles and branchlets slender, terete, striate, rather densely pubescent. Pedicels as long as the flowers; 2.5 mm long, like the lanceolate, 0.5 mm long bracts and bractlets sparsely puberulous. Flowers 5-merous, 2.5 mm long. Calyx short, cupuliform, 0.5 mm high; its lobes semiorbicular, acuminate, as long as



the tube. Petals lanceolate-oblong, acute, outside near the top with some rather long patent hairs, glabrous for the rest, margins papillose. Stamens 5, episepalous, half the length of the corolla; filaments broadly subulate, about as long as the oblong anthers. Disc annular, 0.35 mm high, 5-lobed, glabrous. Pistil in the masc. fl. rudimentary, embedded in the disc, 0.5 mm high, provided with a short style.

Type: Klug 2284 in h.F. 668750.

Distribution: eastern Ecuador.

ECUADOR: Loreto, Florida, R. Putumayo at mouth of R. Zubineta, Klug 2284 (1931) alt. 180 m, fl. masc. (BM, F, K); id., id. 2004 (1931) alt. 200 m, fl. masc. (F).

This species resembles *C. Goudotianum* (Tul.) Tr. et Pl. in general appearance, but is distinctly different by its multijugate leaves, its smaller and narrower leaflets, its much longer pedicels and its much shorter calyx.

#### IV. TETRAGASTRIS GAERTN.

*Tetragastris* GAERTN., Fr. et Sem. II, p. 130, t. 109, f. 5 (1802); Kuntze, Rev. Gen. Pl. I, p. 106 (1891); Engl. in E.-Pr. Nat. Pfl. fam. III, 4, p. 238 (1897); et id., ed. 2, XIXa, p. 415 (1931); Guill. in Ann. Sc. nat., S. 9, X, p. 213 (1909); Pulle in Bull. Kol. Mus. Haarl. XLVII, p. 118 (1911); Rose in N. Am. Fl. XXV, 3, p. 241 (1911); Britton and Wilson, Bot. of P. Rico and the Virg. Isl. V, p. 461 (1924); Benoist in Arch. d. Bot. V, Mém. I, p. 154 (1931); Lemée, Dict. VI, p. 505 (1935); Backer, Verkl. Woordenb. p. 578 (1936).

*Hedwigia* Swartz, Prodr. Veg. Ind. Occ. p. 62 (1788); id., Fl. Ind. Occ. II, p. 670 (1800); Willd., Linn. Sp. Pl. ed. 4, II, p. 332 (1799); Persoon, Syn. Pl. I, p. 414 (1805); Kunth in Ann. Sc. nat. S. 1, II, p. 353 (1824); DeCand., Prodr. II, p. 80 (1825); Sprengel, Linn. Syst. Veg. ed. 16, II, p. 170 (1825); id., Linn. Gen. Pl. ed. 9, I, p. 301 (1830); Don, Gen. Hist. Dichl. Pl. II, p. 80 (1832); Meisner, Pl. Vasc. Gen. I, p. 77 et II, p. 56 (1836—1843); Endl., Gen. Pl. p. 1137 (1836—1840); Dietr., Syn. Pl. II, p. 1227 (1840); Blume, Mus. L. B. I, p. 226 (1849—1851); Hook. f. in Benth. et Hook. Gen. Pl. I, 1, p. 326 (1862); Griseb., Fl. Br. W. Ind. Isl. p. 174 (1864); March. in Adans. VIII, p. 65 (1867—1868); Tr. et Pl. in Ann. Sc. nat. S. 5, XIV, p. 301 (1872); Baillon, Hist. d. Pl. V, p. 262, 314 (1874); id., Dict. Bot. III, p. 22 (1891) and IV, p. 165 (1892); Engl. in Mart. Fl. Bras. XII, 2, p. 284 (1874); id., in DC. Mon. Phan. IV, p. 95 (1883).

*Caproxylon* Tussac, Fl. d. Ant. IV, p.87 (1827).

*Schwägrichenia* Reichb., Consp. I, p.147 (1828).

*Knorrea* Moc. et Sessé, Fl. Mex. Icon. ined. ex DeCand., Prodr. l.c.

Trees or shrubs; the bark provided with balsamiferous ducts. Leaves scattered, imparipinnate, 2- to 5-jugate; petioles semiterete; interjuga above carinate, at both ends incrassate; petiolules semiterete, above sulcate and subulate; leaflets elliptic to lanceolate, the terminal ones narrowed to the base, the lateral ones slightly oblique; apex acuminate; base slightly decurrent; margin entire; glabrous. Inflorescences axillary and subterminal or terminal, the main ramifications racemose but the flowers arranged in terminal cymes. Flowers 4- to 5-merous, or rarely 6-merous, dioecious or polygamous. Calyx cupuliform; its lobes imbricate in aestivation. Corolla sympetalous, tubular, carnose; its lobes induplicate-valvate in aestivation, ending in an incrassate inflexed apex. Stamens obdiplostemonous, inserted below the disc; filaments dilated, especially at the base; anthers oblong, apiculate introrse. Disc annular, glabrous, lobed. Pistil in the masc. fl. rudimentary, forming with the disc a cone nearly as high as the stamens; in the fem. fl. at the base surrounded by the disc and consisting of a 4- to 5-celled ovary and a 4- to 5-lobed sessile stigma; each cell with 2 subapical collateral epitropous pendulous ovules. Fruit a drupe with a membranaceous exocarp, a carnose balsamiferous mesocarp and a smooth brittle woody endocarp, when fully ripe sometimes septicial dehiscent; pyrenes up to 5, separated from each other by a distinct layer of mesocarp, 1-seeded. Seed exalbuminous; embryo with plane-convex cotyledons.

Type-species of the genus: *Hedwigia balsamifera* Swartz, now reduced to *Tetragastris balsamifera* (Swartz) OK.

Distribution: tropical America, but chiefly north of the equator.

Persoon (1805) already recognized the identity of *Hedwigia* Swartz and *Tetragastris* Gaertn., and Kunth, DeCandolle, Reichenbach, Endlicher, Dietrich and Hooker f. agreed with him. As *Hedwigia* had priority they all conserved this name, excepted Reichenbach who choose a new generic name. Tussac, in a remark added to his diagnosis of *Caproxylon*, realized that the generic name *Hedwigia* should be conserved for Ehrhart's genus *Hedwigia* (1781).

Baillon l.c. enlarged the genus by including *Trattinickia* Mart.,

but as this genus differs from *Tetragastris* by its 3-merous flowers, its nearly connate, corrugate pyrenes and the presence of vascular bundles in the medulla of its petioles it should be kept apart.

In the herbarium most of the species of this genus are at first view recognizable by their chestnut-brown, usually lustrous leaflets dotted with nearly black spots and slightly decurrent at their base by the absence of an articulation at the top of the petiolules and by their large, usually more or less cracked, fruits whose fleshy mesocarp also separates the pyrenes.

**A n a t o m y :** Solereder, *Syst. Anat. Dic.* p.216 (1899); Pfeiffer in *Med. kon. kol. Inst. Amsterdam* XXII, p.319 (1926).

Key to the species.

- 1a. - inflorescences rather long, many-flowered, branched above the middle only; calyx glabrous . . . . . 2
- b. - inflorescences branched from the base; calyx and corolla pilose . . . . . 4
- 2a. - leaflets subcoriaceous, with 14 pairs of sec. nerves, abruptly acuminate; acumen 3-times as long as wide; limb of the calyx  $\frac{1}{4}$  the length of the tube; corolla pilose; ovary sparsely pilose . . . . . 1. **T. mucronata** (RUSBY) SWART
- b. - leaflets chartaceous, with 9—12 pairs of sec. nerves; ovary glabrous . . . . . 3
- 3a. - leaflets rather abruptly acuminate, with 9—10 pairs of sec. nerves; acumen once or twice as long as wide; the calyx minutely 4- to 5-toothed; corolla glabrous . . . . . 2. **T. Hostmannii** (ENGL.) OK.
- b. - leaflets gradually acuminate, on the average with 11 pairs of sec. nerves; acumen 2 to 3 times as long as wide; limb of the calyx  $\frac{1}{3}$ — $\frac{1}{2}$  the length of the tube; corolla pilose . . . . . 3. **T. balsamifera** (SWARTZ) OK.
- 4a. - leaflets chartaceous, smooth, with 10 pairs of sec. nerves; sec. and tert. nerves on both sides distinctly prominent; acumen at most as long as wide; inflorescences rather short, many-flowered; flowers 4-merous; calyx  $\frac{1}{4}$  the length of the flower, its lobes as long as the tube; lobes of the corolla half the length of the tube; ovary glabrous . . . . . 4. **T. breviacuminata** SWART
- b. - leaflets subcoriaceous to coriaceous; sec. nerves above prominulous; acumen  $1\frac{1}{2}$  to 3 times as long as wide; flowers 5-merous . . . . . 5

- 5a. leaves large, 35—60 cm long; leaflets rather abruptly acuminate, on the average with 15 pairs of sec. nerves, smooth and shining; acumen relatively short; inflorescences nearly twice as long as the petioles, many-flowered; bracts and bractlets large, as long as the calyx; calyx large, half the length of the flower, its lobes as long as the tube; corolla-lobes as long as the tube; ovary pilose . 5. *T. altissima* (AUBL.) SWART
- b. leaves rather small, 20—30 cm long; leaflets rather gradually acuminate, on the average with 10—12 pairs of sec. nerves, generally scabridulous; inflorescences variable in length; bracts and bractlets small, shorter than the calyx; calyx small,  $\frac{1}{4}$ — $\frac{1}{5}$  the length of the flower, with very short lobes; corolla-lobes  $\frac{2}{3}$  the length of the tube; ovary glabrous or, sometimes, hirtellous . . . 6. *T. panamensis* (ENGL.) OK.

**1. *Tetragastris mucronata* (RUSBY) SWART nov. comb.**

*Protium mucronatum* Rusby, Descr. S. Americ. plants p. 34 (1920); Engl. in E.-Pr. Nat. Pfl.fam. ed. 2, XIXa, p. 413 (1931).

Tree, up to 15 m high. Branchlets stout, terete, striate, when young densely ferruginous tomentellous, when adult glabrous and smooth. Leaves mostly 4-, sometimes 2- or 3-jugate, 50 cm long, in all parts glabrous; petioles semiterete, 12 cm long; interjuga angulose, above carinate, 5 cm long; petiolules sulcate, subulate, transversely rimose, 1 cm long, the terminal ones 3.5 cm long; leaflets lanceolate-oblong to oblong-elliptic, usually 19 cm long and 7 cm wide, but the terminal ones larger and narrowed to the base, the lateral ones oblique and sometimes narrowed to the apex, and the basal ones shorter; apex abruptly acuminate; acumen tapering and acute, 15 mm long and 5 mm wide; subcoriaceous, on both sides smooth and nitidulous; with 14 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath distinctly prominent, tert. nerves above just visible, beneath prominulous. Inflorescences subterminal axillary, 20 (9—25) cm long, the sec. branchlets up to 9 cm, the tert. ones up to 2.5 cm long, ending in many-flowered clusters. Peduncle half the length of the inflorescence, like the branchlets and the pedicels terete, striate and sparsely fuscous puberulous. Pedicels 1 mm long; bracts and bractlets triangular, 0.5 mm long. Flowers 4-merous, 4 mm long, whitish. Calyx cupuliform, glabrous, carnose, 1.25 mm high; its lobes short, broadly triangular, acute, 0.25 mm long. Corolla 3 times as long as the calyx, tubular, outside rather densely adpressed-puberu-

lous, inside glabrous, carnose; its lobes longer than the tube, ovate-triangular, acute. Stamens 2 mm long; filaments 1.3 mm long; anthers dorsifixed, 1.3 mm long. Disc glabrous, 0.75 mm high. Pistil rudimentary, forming with the disc a 2 mm high sparsely puberulous cone.

**Type:** H. H. Smith 2743 in h.NY.

**Distribution:** northern Colombia.

COLOMBIA: Santa Marta, Don Diego, H. H. Smith 2743 (1899) damp forest near the coast, fl. masc. May (B, F, G, K, NY, U, US).

This species is nearly related to *Tetragastris balsamifera* OK., but differs from the latter by its larger, usually 4-, instead of 3-jugate leaves, the more numerous sec. nerves of its leaflets, the longer branchlets of its inflorescences, its shorter calyx and its puberulous pistil.

2. *Tetragastris Hostmannii* (ENGL.) OK., Rev. Gen. Pl. I, p.106 (1891); Engl. in E.-Pr. Nat. Pfl.fam. III, 4, p.238 (1897) et ed.2, XIXa, p.415 (1931); Pulle, Enum. Vasc. Pl. Surin. p.246 (1906).

*Hedwigia Hostmannii* Engl. in DC. Mon. Phan. IV, p.97 (1883).

Tree. Branchlets rather stout, terete, striate, when young sparsely and minutely pilose, when adult glabrous, slightly rugose, castaneous and dotted with oblong, fuscous lenticels and marked with large cicatrices. Leaves usually 3- or 4-, rarely 1-, 2- or 5-jugate, 24 (20—35) cm long; petioles semiterete, at the base incrassate, 6—7.5 (5—10) cm long, like the rhachis glabrous or nearly so, castaneous; interjuga terete, striate, above carinate, 3—4 (2.5—5) cm long; petiolules semiterete, subalate, glabrous, sometimes transversely rimose, 5 (3—8) mm long, the terminal ones 15—20 mm long; leaflets oblong-elliptic to elliptic to subovate, usually 8—12 cm long and 3—5 cm wide, but the terminal ones wider and narrowed to the base, the lateral ones mostly narrowed to the apex and the basal ones shorter; apex rather abruptly acuminate; acumen tapering or slightly tapering, acute to subobtuse, 6—10 mm long and 3—6 mm wide; base broadly cuneate; chartaceous, on both sides glabrous and nitidous; with 9—10 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. and tert. nerves above prominent, beneath prominent. Inflorescences subterminal axillary, with a fairly large number of flowers, masc. infl. 10 (6—15) cm, fem. ones 4—7.5 cm long; sec. branchlets up to 3 cm, tert. ones up to 1 cm long. Peduncle half the length of

the inflorescence, like the branchlets and the pedicels slender, terete, striate and glabrous. Pedicels from as long as the calyx to twice as long as the calyx, 1—2 mm; bracts and bractlets triangular-ovate, acute to subobtuse, 0.5 mm long, glabrous but with pubescent margins. Flowers 4- or 5-merous, 5 mm long, whitish to greenish. Calyx broadly cupuliform, 1.25 mm long, glabrous, rather indistinctly 4- or 5-denticulate. Corolla tubular, glabrous, carnose; its lobes oblong-ovate, acute, the margins papillose,  $\frac{2}{3}$  the length of the tube to nearly as long as the tube, 2—2.5 mm. Stamens in masc. fl. about half the length of the corolla, 2 mm; filaments short, 0.5 mm long; stamens in fem. fl. 1.5 mm long. Disc annular, lobed, glabrous, somewhat higher than the filaments. Pistil provided with some scattered hairs or nearly glabrous, in the masc. fl. rudimentary, broadly conical, in the fem. fl. as long as the tube of the corolla and consisting of a conical, basally narrowed, 4- or 5-celled, carnose ovary, a short, terete style and a lobed stigma. Drupe either oblique-ovoid and monopyrenous or subglobose-cordiform, 2- to 4-lobed and 2- to 4-perenous, top acute, 17—20 mm long and 12—20 mm in diam.

**Type:** Hostmann 1161 in h.K.

**Distribution:** Suriname and the adjacent Guianas.

**BR. GUIANA:** Schomburgk (1842) fr. (B); Persaud 91 (1924) forest, on clayey soil, fr. Aug. (F).

**SURINAME:** Coppename R., near Raleigh Falls, Lanjouw 1003 (1933) fl. fem. Sept. (U); Saramacca R., Watramiri, tree n. 1515, BW. 1987 (1916) (U), BW. 3877 (1918) fl. masc. July (U), BW. 5156 (1921) fl. masc. June (U), BW. 5575 (1921) fl. masc. Dec. (U); id., Watermolenkreek, BW. 441 (1913) fr. Oct. (U); id., Sectie O, Boschbeheer 12 (1907) (U); id., tree n. 586, BW. 1156 (1915) (U), BW. 5354 (1921) (U); id., tree n. 761, BW. 2417 (1916) fr. Sept. (U), BW. 3830 (1918) fr. May (U), BW. 4778 (1920) fr. Nov. (U); id., BW. 4332 (1919) (U); id., BW. 6407 (1924) (U); Para R., Zandery I, tree n. 70, BW. 1553 (1915) (U); Beaumontlyn, Junker 583 (1927) (Delft); upper Suriname R., Tresling 453 (1908) fl. masc. Sept. (U); Cottica R., near Moengo, Lanjouw 412 (1933) fl. masc. Aug. (U); Marataba, BW. 3444 (1917) fr. Nov. (U); without locality, Hostmann 1161 (no date) fl. masc. (B, K, U, W) (type); id., Boschbeheer "12" (1905) (U).

**FR. GUIANA:** Poiteau (1819—1821) fr. (G).

**Vern. names:** BR. GUIANA: simiri; SURINAME: salie, witte salie (N.E.), jolliballie, jorieballie tataro (Arow.), poelikoh, apotona pereka (Car.).

3. **Tetragastris balsamifera** (SWARTZ) OK., Rev. Gen. Pl. I, p.106 (1891); Engl. in E.-Pr. Nat. Pfl.fam. III, 4, p.238, f.134 F-J (1897) et ed.2, XIXa, p.415, f.191 F-J (1931); Urb., Symb. Ant. IV, p.323 (1905) et VIII, p.238 (1920); Guillaumin in Agric. Pays chauds IX, 2, p.150 tab. (1909); Rose in N. Am. Fl. XXV,

3, p.257 (1911); Britton and Wilson, Bot. of P.Rico and the Virg. Isl. V, p.461 (1924); Domin in Fl. Photogr. I, p.22 (1929).

*Hedwigia balsamifera* Swartz, Prodr. Veg. Ind. Occ. p.62 (1788); id., Fl. Ind. Occ. II, p.670, t.13(1800); Willd., Linn. Sp. Pl. ed 4, II, p.332 (1799); Pers., Syn. Pl. I, p.414 (1805); DeCand., Prodr. II, p.80 (1825); Sprengel, Linn. Syst. Veg. ed.16, II, p.202 (1825); Descourtilz, Fl. pitt. et méd. d. Ant. III, p.263, t.209 (1827); Don, Gen. Hist. Dichl. Pl. II, p.85 (1832); Dietrich, Syn. Pl. II, p.85 (1840); Bancroft in Hook. Journ. of Bot. IV, p.136 (1842); Blume, Mus. L.B. I, p.227 (1849—1851); Walp., Ann. Bot. Syst. II, p.293 (1851—1852); Griseb., Fl. Br. W. Ind. Isl. p.174 (1864); id., Cat. Pl. Cub. p.66 (1866); Marchand in Adans. VIII, p.54 (1867—1868); Baillon, Hist. d. Pl. V, p.296, f.284—293 (1874); id., Dict. Bot. I, p.181 fig. (1876) et III, p.22 fig. (1891); id., Traité bot. méd. phan. II, p.957, fig. 2709—2718 (1884); Radlkofer in Sitzb. Bayer. Akad. Wiss., Math. phys. Cl. 1878, p.312, 382 (1878) et 1879, p.531, 535, 639 (1879); Engl. in DC. Mon. Phan. IV, p.96, t.2, f.32—34 (1883); Urb. in Jahrb. Bot. Gart. und Mus. IV, p.244 (1886); id., in Engl. Bot. Jahrb. XXI, p.612 (1896). Non apud Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.301 (1872) quod ad *T. panamensis* OK. pertinet, nec apud Glaz. in Bull. Soc. bot. Fr. LII, Mém.3, p.92 (1905) quod ad *Protium* sp. pertinet, nec apud Mart. Obs. 1782 quod ad *P. Almecega* March. pertinet.

*Bursera balsamifera* Pers., Syn. Pl. I, p.414 (1805); Wikstr. in Kon. Vet. Ac. Handl. 1827, p.63 (1828).

*Caproxylon Hedwigii* Tussac, Fl. d. Antilles IV, p.87, t.30 (1827).

*Hedwigia Tussacii* Walp., Rep. Bot. Syst. I, p.559 (1842).

*Icica Edwigia* Rich., Ess. Fl. Cuba. p.388 (1842); id., in Dela Sagra, Hist. Cuba, X, p.161 (1845).

*Amyris toxifera* Willd., Linn. Sp. Pl. ed.4, II, p.336 (1799) (excl. syn.) et herb. n. 7290.

*Tetragastris ossea* Gaertn., Fr. et Sem. II, p.130, t.109, f.5 (1802).

*Matayba guianensis* Aubl. in errore DeCand., Prodr. I, p.609 (1824) quoad sp. Bert. in S.Dom. lect.

*Ephielis fraxinea* Willd. in errore Bertero ex Camb. in Mém. Mus. Hist. nat. XVIII, p.36 (1829); Sprengel, Linn. Syst. Veg. ed.16, II, p.223 (1825) quoad sp. Antill.

*Amyris altissima* Aubl. in errore Wikstr. in Kon. Vet. Ac. Handl. 1827, p.63 (1828).

*Icica altissima* L. in errore Eggers in Vid. Med. Nat. For. 1876, p.110 (1876).

Tree, 6 to 20 m high. Branchlets rather stout, terete, striate,

when young sparsely covered with appressed ferruginous hairs, when adult glabrescent, fuscous, slightly rimose and dotted with elliptic brownish lenticells and marked with large prominent cicatrices. Leaves 2- to 4-, usually 3-jugate, 30 (25—40) cm long, glabrous; petioles semiterete, 8 (5—12) cm long; interjuga above distinctly carinate, 3.5 (2—4) cm long; petiolules above sulcate and subalate, 5 (3—10) mm long, but the terminal ones 1—3 cm; leaflets oblong to elliptic, usually narrowed from below the middle to the apex, mostly 13 (10—15) cm long and 4.5 (3.5—5) cm wide, but the terminal ones larger and sometimes narrowed near the base, the lateral ones slightly oblique and the basal ones much shorter; apex gradually narrowed in a nearly linear, 10 mm long and 3—5 mm wide, subacute acumen; base cuneate; chartaceous, above smooth and nitidous, beneath nitidulous; with 11 (10—12) pairs of sec. nerves; nerves above prominulous, beneath prominent. Inflorescences, subterminal or pseudoterminal, axillary, 15 (7.5—25) cm long. Peduncle half the length of the inflorescence, like the branchlets terete, striate and sparsely to rather densely puberulous; sec. branchlets up to 5 cm long. Pedicels terete, striate and scarcely puberulous, about half the length of the calyx, 1 mm long; bracts and bractlets ovate, acuminate, hardly half the length of the pedicels. Flowers 4-merous, rarely 5-merous (?), about 4 mm long, white. Calyx cupuliform, glabrous,  $\frac{1}{3}$  to  $\frac{1}{2}$  the length of the corolla, 1.5—2 mm long; its lobes triangular, obtusely acuminate,  $\frac{1}{2}$  to  $\frac{1}{3}$  the length of the tube. Corolla tubular, carnose, sparsely puberulous, 4 mm long; its lobes oblong-ovate, acute, inside glabrous, from  $\frac{2}{3}$  the length of the tube to nearly as long as the tube. Stamens 1.75 mm long; filaments 0.5 mm; anthers 1 mm long, basifixed. Disc in the masc.fl. 0.5 mm high, in the fem.fl. 1 mm high. Pistil glabrous, in the masc.fl. rudimentary and nearly as high as the stamens, in the fem.fl. 2.5 mm high; ovary conical but the base narrowed and surrounded by the disc, slightly 8-sulcate, carnose, 4-celled; style 4-ridged, short; stigma 4-lobed. Drupe oblique-ovoid to subglobose, furrowed along the dissepimental lines, with acute top, smooth, glabrous, 2—2.5 cm long and 1—2 cm in diam; pyrenes usually 1 or 2, rarely 3 or 4.

Type (lecto-type): Swartz in h.M.

Distribution: Antilles (isl. of Haiti, Porto Rico and St. Croix).

HAITI; Rep. HAITI: Tortue Isl., La Vallée, Leonard and Leonard 11625 (1929) fl. masc. Jan. (NY, US); Massif du Nord, Port Margot, Ekman H 2919 (1924) fl. fem. Dec. (S, US); dept. du Nord, Bayeux, Ekman H 2697



(1924) (B, S); Massif des Cahos, Hinche, Morne, Ekman H 6130 (1926) fl. masc. May (B, S, US); near Porte au Prince, Gorge de la Marianne, Christ 2074 (1909) fl. Aug. (B); dept. du Sud, Trouin, Ekman H 2390 (1924) alt. 300 m, fl. masc. Nov. (B, S); id., Port à Piment, Ekman H 440 (1917) fr. Aug. (B, S); Pilate, Nash 602 (1903) alt. 500 m, fr. Aug. (NY).

HAITI; Rep. St. DOMINGO: Moncion, Arroyo, Valeur 469 (1930) fr. Oct. (C, F, G, K, S, US); near Altamira, Eggers 2414b (1887) alt. 325 m, fl. June (B); Santiago, Eggers 2400 (1887) alt. 350 m, fl. masc. June (B, BRSL, BM, G, K, L, LE, M, NY, S, US); prov. DelaVega, Cotuy, Abbott 851 (1921) alt. 300 m, fr. Jan.-Febr. (B, US); prov. Pacificador, San Francisco de Macoris, La Bracito, Abbott 2165 (1922) alt. 400—1000 m, fl. masc. Apr. (B, US); prov. Seibo, Higuey, Taylor 416 (1909) edge of savannah, fr. Dec. (B, NY); prov. Barahona, near Barahona, Fuertes 237 (1910) alt. 250 m, fl. masc. May (B, BM, C, F, G, GH, K, L, LE, M, NY, P, S, U, US, W); Jovero, Abbott 2514 (1913) alt. 0 m, fl. masc. Feb. (B, US); Liali, Abbott 2615 (1923) alt. 100—500 m, fr. Feb. (B, US); Las Cañitas, Abbott 2724 (1923) alt. 0 m, fl. masc. Feb. (US); without locality, Bertero 1023 (no date) fl. masc. (B, M); id., Poiteau (no date) fr. (P); id., Poiteau (1802) fr. (B, BM, G); id., Poiteau (1815) fl. masc. (G, LE, P); id., Schomburgk 77 (1852) (B); id., Schomburgk 134 (1852) fl. (B); id., Schomburgk (1853) fl. (K); id., Swartz (no date) fl. masc. (BM, C, M) (type); id., Wright, Parry and Brummel 197 (1871) fr. Jan.-Mar. (K, US).

PORTO RICO: Cabo Rojo, Sintenis 793 (1885) fr. Jan. (B); San Germain, Casa Maria, Velez 820 (1936) fl. masc. May (NY); Utuado, near Jayuga, Gundlach 244 (1876) (B); near Utuado, San André, Sintenis 6312 (1887) fl. fem. and fr. Feb. (B, BR); near Utuado, Paso Palma, Sintenis 6346 (1887) (B); Adjuntas, Mt. Bahaja, Sintenis 4228 (1886) fr. Apr. (B, C, W); Coamo, Sintenis 3287 (1885) fr. Dec. (B, US); Coamo Springs, Britton, Britton and Brown 5811 (1922) fr. Jan. (G, NY); Aibonito, Britton and Britton 9787 (1931) fl. Dec. (NY); Cayey, Sintenis 2072 (1885) (B, NY); Bayamom, Stahl 452 (1886) in forest, fl. fem. Apr. (B, L, S); Sierra de Yabucoa, Mt. Cerro Sardo, Sintenis 2779 (1885) fr. Sept. (B); id., Mt. Guayaca, Sintenis 7017 (1886) fl. Oct. (B); Juncos, Mt. Goyo, Sintenis 1938 (1885) fl. fem. and fr. Aug. (B, G, L, NY, P, US); Carolina, Herb. Willd. 7290 (no date) fl. (B) (type of *Amyris toxicifera* Willd.); Sierra de Luquillo, Mt. Jimenes, Sintenis 1519 (1885) fl. June (B, BRSL, F, K, LE, M, S, US); id., Heller 732 (1899) (B, NY); Algarrobio, Britton and Britton 10038 (1932) fl. Apr. (NY); Casa Maria, Britton and Britton 10097 (1933) (NY); Colonia San Miguel, Britton and Shafer 1616 (1913) fr. Mar. (F, NY, US); without locality, Cowles 308 (1912) fl. (NY); id., Plee 804 (no date) fl. masc. (P); id., Richard (no date) fl. fem. and fr. (P); id., Stahl (1873) fl. (B).

St. CROIX: Ryan (no date) fl. (BM, C).

WITHOUT LOCALITY: Herb. Persoon (no date) fr. (L); id., fl. fem. (L); Herb. Willd. 7269 (no date) fr. (B).

Vern. names: St. DOMINGO: bois cochon, sucrier, sucrier de montagne (Haiti); amacey (St. Domingo); PORTO RICO: masa, masa colorado, palo de masa, palo de aceite.

Though Bancroft l.c., referring to Pouppé-Desportes, *Traité d. Pl. us. de St. Dominique* p. 32, 215 (1770) and to Nicholson, *Essai sur l'Hist. nat. de St. Domingo* p. 176 (1776), states that "Sucrier de montagne" is the only reliable vern. name and that "Bois cochon" is used erroneously, both names have in later years too been regularly recorded.

Tussac l.c. describes and figures his *Caproxylon Hedwigii* (*Hedwigia Tussacii* Walp.) with 5-merous flowers. Though I never saw a 5-merous specimen I am nevertheless convinced that this diagnosis refers to *Tetragastris balsamifera* OK. (cf. Walp. l.c. (1851—1852); Griseb. l.c.; Engl. l.c. (1883) and Rose l.c.).

The record from Guadeloupe, cf. Engl. l.c. (1883), Urban l.c. (1905, 1920) and Bitton and Wilson l.c., is based on a specimen of *Duchassaing* in h.B., but this specimen is not a *Tetragastris*.

**Anatomy:** Guill. in *Ann Sc. nat.*, S.9, X, p.213 (1909); Solereder, *Syst. Anat. Dic.* p.216 (1899).

**Uses:** The resin exuding from the bark of this tree, known as "Baume de cochon", "Baume à cochon" or "Résine de Sucrier de montagne" and classified with the Elémi-resins, is mentioned as an unguent for dressing wounds and as a febrifuge. The wood is said to be used for sugar barrels.

**Lit.:** Descourtilz l.c.; Marchand l.c.; Baillon l.c.; Engler l.c.; Guillaumin l.c. 1, p. 358, 494 et 2, p. 150; Tschirch, *Handb. Pharm.* III, 2, p. 1153 (1925); v. Brehmer in *Wiesn. Rohst. ed.4, II*, p.1239 (1928).

**var. lanceifolia** SWART in *Rec. Trav. bot. néerl.* XXXIX, p.206 (1942).

Leaves 2- to 4-, rarely 1-jugate, 20 (14—21) cm long; petioles 6 (4—6) cm; interjuga 2 (1.5—3) cm long; leaflets lanceolate, usually 8.5 (8—9.5) cm long and 2.5 cm wide, but the terminal ones larger and distinctly narrowed to the base and the basal ones ovate and shorter; firmly chartaceous, on both sides dull. Peduncle  $\frac{1}{3}$  the length of the rather short, 5 cm long, inflorescence. Pedicel about as long as the calyx, 1 mm.

**Type:** Sintenis 4486 in h.B.

**Distribution:** St. Domingo and Porto Rico.

St. DOMINGO: prov. Azua, Sierra de Ocea, Ekman H 11669 (1929) alt. 450 m (B, S).

PORTO RICO: near Utuado, Mt. Pellejas, Sintenis 4486 (1886) fl. masc. June (B, BM, K) (type); Rio Portugues, Britton and Britton 7419 (1923) fr. Febr. (G, NY).

ANTILLES: Riedlé (no date) fr. (P).

**4. *Tetragastris breviacuminata*** SWART in *Rec. Trav. bot. néerl.* XXXIX, p.206 (1942).

Shrub. Branchlets terete, striate, pale brown, sparsely puberulous. Leaves 2- to 4-jugate, 17—27 cm long, glabrous; petioles semiterete, above subalate, 4.5—7.5 cm long; interjuga terete, striate, above carinate, 2.5—3.5 cm long; petiolules above sulcate, 5—7 mm, the terminal ones 10—12 mm long; leaflets oblong, usually 7.5—8.5

cm long and 2.5—3 cm wide but, the terminal ones obovate and the basal ones shorter; acumen 2.5—5 mm long and 5 mm wide, obtuse; base cuneate; chartaceous, on both sides smooth and nitidous; with 10 (9—11) pairs of sec. nerves; prim. and sec. nerves on both sides distinctly prominent, tert. ones above prominulous, beneath prominent. Inflorescences subterminal, axillary, branched from the base, up to 5 cm long, many-flowered; sec. branchlets usually branched above the middle only, up to 4 cm, tert. ones up to 2 cm long, like the pedicels terete, striate and sparsely and minutely puberulous. Pedicels stout, longer than the calyx, 1.25—1.5 mm; bracts and bractlets oblong-triangular, acute, 0.75 mm long. Flowers 4-merous, more than 4 mm long, yellowish. Calyx cupuliform, sparsely and minutely puberulous, hardly  $\frac{1}{4}$  the length of the corolla, 1 mm long; its lobes broadly triangular, subacute, as long as the tube. Corolla tubular, outside sparsely papillose to nearly glabrous, inside glabrous; its lobes ovate-triangular, acute, about half the length of the tube. Stamens in the masc.fl. as long as the corolla-tube, more than 2 mm long; filaments dilated, 0.5 mm long; anthers oblong, nearly 2 mm long. Disc glabrous, 0.5 mm high. Pistil in the masc.fl. rudimentary, conical, 4-ridged, glabrous, 2 mm high.

Type: Riedel 1070 in h.LE.

Distribution: Brazil (Rio de Janeiro).

BRAZIL: near Rio de Janeiro, Riedel 1070 (1832) in mountain forest, fl. masc. Oct. (B, BR, K, L, LE, M, NY, S, US, W); id., Glaziou 8332 (1876) (C, G, LE).

This species, which from a geographic point of view occupies an isolated position differs from the other species by its but slightly acuminate leaflets.

##### 5. *Tetragastris altissima* (AUBL.) SWART nov. comb.

*Icica altissima* Aubl., Hist. d. Pl. Guian. fr. I, p.342, t.132 (1775); Lamarck, Enc. méth., Bot. III, p.225 (1789); DeCand., Prodr. II, p.77 (1825); Don, Gen. Hist. Dichl. Pl. II, p.83 (1832); Villa-Franca in Bull. d. Thérap. méd. et chirurg. 1880, p.4, 9 (1880); Spruce, Not. of a bot. on the Amaz. and the Andes I, p.104, 105 (1908). Non apud Blume, Mus. Bot. Lugd. Bat. I, p.207 (1849—1851) cf. *Protium giganteum* Engl., nec apud Eggers in Vid. Medd. Nat. For. p.110 (1876) cf. *T. balsamifera* OK., nec apud Sagot in Ann. Sc. nat. S.6, XIII, p.291 (1882) quod ad *Talisiam* (Sapind.) pertinet.

*Amyris altissima* Willd., Linn. Sp. Pl. ed. 4, II, p. 336 (1799); Pers., Syn. Pl. I, p. 415 (1805); Sprengel, Linn. Syst. Veg. ed. 16, II, p. 218 (1825) and IV, 2, p. 148 (excl. syn.) (1827). Non apud Wikstr. in Kon. Vet. Ac. Handl. 1827, p. 63 (1828) cf. *T. balsamifera* OK.

*Elaphrium altissimum* Spr. ex Dietr., Syn. Pl. II, p. 1273 (1840).

*Protium altissimum* March. in Adans. VIII, p. 51 (1867—1868); Engl. in E.-Pr. Nat. Pfl. fam. III, 4, p. 237 (1897) et ed. 2, XIXa, p. 413, 414 (1931); Guill. in Agr. Pays ch. IX, 1, p. 358 tab. (1909); Stone and Freeman. The timbers of Br. Guiana p. 70 (1914). Non apud Engl. in Mart. Fl. Bras. XII, 2, p. 280 (1874) et id. in DC. Mon. Phan. IV, p. 90 (1883) quae ad Talisiam (Sapindac.) pertinent, nec apud Pitt. in Trab. Mus. com. Venez. VIII, p. 367 (1931) quod p.p. ad Talisiam (Sapindac.), p.p. ad *Protium Carana* March., p.p. ad *Icica cuspidata* H.B.K. pertinet (Cf. sub *P. Carana* March.).

*Bursera altissima* Baill., Hist. d. Pl. V, p. 296 (1874); id., Traité Bot. méd. phan. p. 951 (1884).

*Tingulonga altissima* OK., Rev. Gen. Pl. I, p. 108 (1891).

*Tetragastris phanerosepala* Sandw. in Kew Bull. 1932, 5, p. 209 (1932); Smith in Brittonia II, 2, p. 154 (1936).

Tree. Branchlets stout, when young densely and minutely ferrugineous pilose, when adult glabrescent and dotted with prominent lenticels. Leaves 2- to 5-, mostly 3- or 4-jugate, 35—55 (—80) cm long; petioles semiterete with incrassate base, 12 (8—14) cm long, like the rhachis glabrous or with some scattered, short hairs; interjuga above carinate, 4—6 (3.5—7.5) cm long, the basal ones shorter than the other ones; petiolules above, sulcate and subalate, glabrous, 3—5 (2—7) mm, the terminal ones 30 (25—50) mm long; leaflets oblong to nearly elliptic, the terminal ones narrowed to the base, the lateral ones oblique, 16 (12—21) cm long and 6.5 (4.5—8) cm wide, but the basal ones much smaller, 10×5 cm; apex rather abruptly acuminate; acumen tapering and acute to subobtuse, 8—11 mm long and 4—5 mm wide; base cuneate to rounded; subcoriaceous, on both sides smooth and nitidulous; with 12—16 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. nerves above prominulous, beneath, prominent, tert. nerves above hardly visible, beneath prominulous. Inflorescences terminal or axillary, stout, up to 20 cm long, richly branched from the base, flowers abundant in terminal cymes. The axes terete, striate and sparsely to densely puberulous. Pedicels stout, terete, striate, 0.2 mm long, like the broadly triangular, acute, 3 mm long bracts and bractlets and the calyx and corolla sparsely and minutely puberulous. Flowers 5-merous, 5—6 mm,

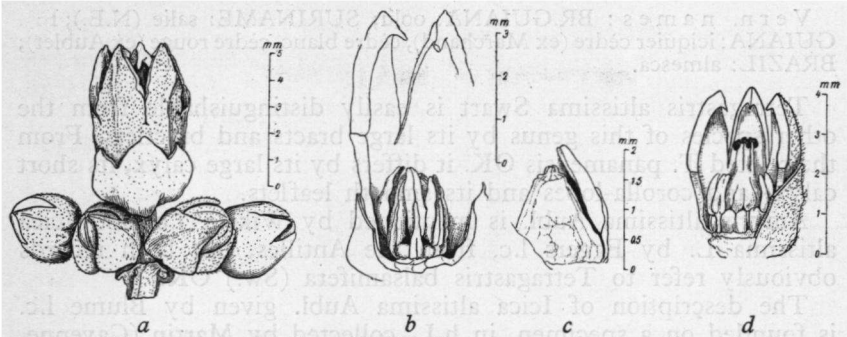


Fig. 7. *Tetragastris altissima* (Aubl.) Swart — a. flowers; b. male flower; c. detail of male flower; d. female flower.

rarely 7 mm, long. Calyx cupuliform, nearly half the length of the flower, carnose; its lobes triangular, nearly as long as the tube. Corolla tubular, carnose; its lobes oblong-triangular, acute, about as long as the tube. Stamens 1.5—2 mm; filaments 0.5 mm; anthers oblong, in the masc. fl. 1.5 mm, in the fem. fl. 1 mm long. Disc annular, glabrous, 0.6—0.8 mm high. Pistil sparsely and rather long puberulous to nearly glabrous, in the masc.fl. rudimentary, conical, 1.5—2 mm high, in the fem.fl. over 2 mm high; ovary subglobose, 5-lobed and 5-celled, at the base surrounded by the disc, about 1.5 mm high; style short, 5-grooved; stigma 5-lobed. Drupe either oblique-ovoid and monopyrenous or subglobose, 2- to 5-lobed and 2- to 5-pyrenous, with acute top, glabrescent, 2—2.5 cm long and 1.5—2.5 cm in diam.

Type: Aublet in h.BM.

Distribution: the Guianas and western Brazil.

BR. GUIANA: N.-W. slopes of Mt. Kanuku, in drainage of Moku-moku creek, A. C. Smith 3429 (1938) alt. 150—400 m, dense forest, fr. Apr. (U); Demerara R., Jenman 4928 (1880) fl. fem. May (K) (type of *T. phanerossepala* Sandw.); basin Essequibo R., Shodikarcreek, A. C. Smith 2844 (1938) on low land, fr. Jan. (U); Winipero, Persaud 59 (1924) clayey soil, forest, fr. July (B, F, K, NY, S).

SURINAME: Saramacca R., Sectie O, tree n. 111, BW. 2412 (1916) (U); basin Suriname R., Casipora R., Junker 518 (1926) (Delft); id., upper Casipora R., BW. 5527 (1921) (U); id., near Goddo, Stahel 80 (1926) fr. Jan. (U); without locality, Junker 486 (1927) (Delft).

FR. GUIANA: Aublet (no date) (fr. ex fig. Aubl.) (BM) (type).

BRAZIL: terr. de Acre, basin R. Purus, near mouth R. Macauhan, Krukoff 5608 (1933) on terra firma, fl. masc. Aug. (F, K, NY); Amazonas, basin R. Madeira, region R. Machado, Krukoff 1563 (1931) on terra firma, fr. Dec. (B, BM, G, K, NY, P, U).

Vern. names: BR.GUIANA: oolu; SURINAME: salie (N.E.); FR. GUIANA: iciquier cèdre (ex Marchand), cèdre blanc, cèdre rouge (ex Aublet); BRAZIL: almesca.

*Tetragastris altissima* Swart is easily distinguishable from the other species of this genus by its large bracts and bractlets. From the related *T. panamensis* OK. it differs by its large calyx, its short calyx- and corolla-lobes and its smooth leaflets.

*Amyris altissima* Aubl. is mentioned by Wikstr. l.c. and *Icica altissima* L. by Eggers l.c. from the Antilles, but both records obviously refer to *Tetragastris balsamifera* (Sw.) OK.

The description of *Icica altissima* Aubl. given by Blume l.c. is founded on a specimen, in h.L., collected by Martin (Cayenne, 1819) which had to be referred to *Protium giganteum* Engl. Engler's description of *Protium altissimum* (Aubl.) March. l.c. (1874) and (1883) is based exclusively on specimens collected by Poiteau (Fr. Guiana, 1819—1821). The latter had to be referred to the genus *Talisia* (Sapindac.); they have been mentioned by Sagot l.c. too.

Uses: The wood of this tree, which sometimes is said to be common, is praised as quite suitable for furniture making and carpentering and for canoes and boats; that of the *Cèdre rouge* is believed by the natives to be more durable than that of the *Cèdre blanc*, but in the herbarium I am unable to see any difference between these "Cèdres". The resin "Carana blanche" and, according to Holmes, the Cayenne Linaloë oil also are thought to be derived from this species.

Lit.: Aublet l.c.; Don l.c.; Marchand l.c.; Baillon l.c.; Cordemoy in Ann. Inst. col. Marseille VI, p. 205 (1899); Tschirch und Saal in Arch. Pharm. CCXLII, p. 366, 395 (1904); Guill. l.c. 1, p. 358 et 2, p. 143; Holmes in Perfum. and Essent. Oil Rec. I, p. 32 (1910); Stone and Freeman l.c.; Record and Mell, Timb. trop. Amer. p. 335 (1924); Wolff in Wiesn. Rohst. ed 4, I, p. 1040 (1927) and Brehmer in id. II, p. 1239, 1470 (1928); Engler l.c. (1931).

6. *Tetragastris panamensis* (ENGL.) OK., Rev. Gen. Pl. I, p.106 (1891); Engl. in E.-Pr. Nat. Pfl.fam. III, 4, p.238 (1897) et ed.2 XIXa, p.415 (1931); Rose in N. Am. Pl. XXV, 3, p.258 (1911); Benoist in Bull. Soc. bot. Fr. LXVI, p.360 (1919); id. in Arch. d. Bot. V, Mém. I, p.154 (1931); Standley in Contr. U.S.N.H. XXVII, p.224 (1928) Sandwith in Kew Bull. 1933, 7, p.327 (1933).

*Hedwigia balsamifera* Swartz in errore Tr. et Pl. in Ann. Sc. nat. S.5, XIV, p.301 (1872) (excl. syn.).

*Hedwigia balsamifera* Swartz in errore Engl. in Mart. Fl. Bras. XII, 2, p.285, t.60 (1874) (excl. syn. et spec. Antill.).

*Hedwigia panamensis* Engl. in Engl. Bot. Jahrb. I, p.42 (1881); id., in DC. Mon. Phan. IV, p.96, t. II, f.30, 31 (1883).

*Tetragastris Stevensonii* Standl. in Field Mus. N. H., Bot.S. IV, 8, p.216 (1929); id. in Trop. Woods XVII, p.23 (1929); id., in

Field Mus. N. H., Bot.S. X, p.239 (1931); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.415 (1931).

Tree, up to 25 m high. Branchlets rather stout, when young densely ferruginous puberulous, when adult scabrous, greyish brown, glabrous and dotted with elliptic, ferruginous lenticels. Leaves 2- to 5-, mostly 3- or 4-jugate, 20—25 (15—35) cm long; petioles semiterete, above flattened, 6—10 cm long, like the rhachis, the petiolules and the prim. nerves glabrous or provided with some scattered, minute hairs; interjuga terete, above carinate, at both ends incrassate, 2—3.5 cm long; petiolules above canaliculate and subulate, transversely rimose, 5 (3—7) mm long, the terminal ones 20 (15—25) mm; leaflets oblong-lanceolate to oblong-elliptic, distinctly to slightly narrowed to the apex, usually 11 (6—14.5) cm long and 4 (2—5) cm wide, but the terminal ones larger, the lateral ones suboblique and the basal ones shorter; apex more or less gradually narrowed in a slightly tapering, acute to subobtuse, mucronulate, 7.5—15 mm long and 3—5 mm wide acumen; base broadly cuneate; coriaceous to subcoriaceous, glabrous, when young scabridulous and dull, when adult nearly smooth and nitidulous; with 10—12 (8—14) pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. nerves above hardly visible, beneath prominulous. Inflorescences subterminal and axillary, usually about as long as the petioles, rarely about as long as the leaves, branched from the base. Branchlets slender terete, striate and sparsely to rather densely ferruginous puberulous. Pedicels angulose, about as long as the calyx, 1—1.5 mm, rather densely puberulous; bracts and bractlets ovate-triangular, acute, 0.5—0.7 mm long. Flowers 5-merous, rarely 6-merous, 5—7 mm long, pale green to reddish brown. Calyx broadly cupuliform,  $\frac{1}{6}$ — $\frac{1}{4}$  the length of the flower, like the corolla carnose and sparsely and minutely ferruginous puberulous; its lobes triangular,  $\frac{1}{3}$ — $\frac{1}{4}$  the length of the tube or smaller, sometimes denticulate. Corolla tubular; its lobes  $\frac{2}{3}$  the length of the tube, oblong-triangular, acute. Stamens half the length of the corolla-tube; filaments short; anthers 2 to 3 times as long as the filaments. Disc annular, 10-lobed, glabrous, as high as the filaments. Pistil glabrous, in the masc. fl. rudimentary, in the fem.fl. reaching above the stamens, at the base surrounded by the disc; ovary ovoid, 5-lobed, 5-celled, as high as the stamens, carnose; style terete, short; stigma 5-lobed. Drupe either ovoid and monopyrenous or subglobose, 2- to 5-lobed and 2- to 5-pyrenous, acute, glabrous, 2 (1.5—2.52) cm long and 1.25—2.5 cm in diam.

Type: Sutton Hayes 342 in h.BR.

Distribution: Central America and the Guianas.

BR. HONDURAS: Punta Gorda, Stevenson I-II (1927) fr. (F); Mullins River Road, Schipp 861 (1931) alt. 30 m fl. Dec. (BM, F, G, GH, K, S); Stan Creek Railway, Schipp 863 (1929) alt. 30 m, fr. Nov. (F, G); without locality, Stevenson 9 (1928) fl. masc. Sept. (F, US) (type of *Stevensonii* Standl.).

HONDURAS: dept. Atlantida, Lancetilla Valley, near Tela, Standley 53542 (1927—1928) (F, US) and 55385 (1927—1928) fr. (F, US).

NICARAGUA: region of Braggman's Bluff, Englesing 265 (1928) fl. Aug. (F, GH, K, NY) and 278 (1928) fl. (F, K); id., id. 272 (ex Standl.).

PANAMA: Penonome, Williams 201 (1908) fr. Febr.-Mar. (NY, US); near City of Panama, Sutton Hayes 342 (1861) in woods, fl. masc. July (B, BM, BR, K, P, W) (type); San Blas-district, Perme, Cooper III 265 (1933) fr. Apr. (F, NY) and III 290 (1933) fr. Apr. (NY); Rio Grande, Sutton Hayes 773 (1859) fr. Dec. (NY); Juan Diez, Standley 30647 (1924) fr. Jan. (US).

BR. GUIANA: N.-side of Kanaku Mt., E. of Takutu R., For. Dept. B.G. 2197 (1931) alt. 150 m, fl. Oct. (K).

SURINAME: Corantyne, R., Kaboeri, tree n. 531, BW. 4944 (1920) fl. fem. Sept. (U); Saramacca R., Sectie O, Karreweg, Boschbeheer 12 (XII) (1905) (U); id., BW. 5840 (1922) (U); Suriname R., Brownsberg, tree n. 1127, BW. 1693 (1916) (U), BW. 4003 (1918) fl. fem. Sept. (U), BW. 6122 (1923) fr. May (U); id., tree n. 1013, BW. 1778 (1916) (U), BW. 3256 (1917) fl. fem. Sept. (U), BW. 3266 (1917) fl. fem. Sept. (U), BW. 3443 (1917) fr. Nov. (U).

FR. GUIANA: Maroni, Mélinon (1864) fl. masc. (P); Gourdonville, Benoist 1636 (1914) fl. Oct. (P).

Vern. names: BR. HONDURAS: carbon, copal(?); BR. GUIANA: haïowaballi (Arow.); SURINAME: salie, witte salie (N.E.).

This species is nearly related to *Tetragastris altissima* (Aubl.) Swart but differs from the latter by its smaller leaves, its gradually and rather long acuminate, scabridulous leaflets with less numerous sec. nerves, its small bracts and bractlets and its short calyces.

According to Standley l.c. (1929) *Tetragastris Stevensonii* Standl. chiefly differs from *T. panamensis* OK. by the larger size of its flowers. In comparing the type specimens I could however not confirm this view. The other differences too are unreliable as the rather abundant material which I could investigate shows an almost unbroken range of variability.

var. *hirtella* SWART in Rec. Trav. bot. néerl. XXXIX, p.207 (1942).

*Protium crassifolium* Engl. in errore L. Williams in Field Mus. N.H., Bot. S. XV, p.233 (1936).

Leaflets coriaceous. Inflorescences short and few-flowered.



Flowers containing a sparsely hirtellous ovary. Drupe sparsely hirtellous.

Type: BW. (Suriname) 4777 in h.U.

Distribution: Suriname, Fr. Guiana and northern Peru.

SURINAME: Coppename R., Boon 1103 (1901) fl. fem. and fr. Sept. (U); id., Boon 1220 (1901) fl. fem. and fr. Oct. (U); Saramacca R., Sectie O, tree n. XIII, BW. 3980 (1918) (U), BW. 4514 (1919) fr. Dec. (U), BW. 4777 (1920) fl. fem. and fr. Nov. (U), BW. 6080 (1923) fr. Mar. (U).

FR. GUIANA: Mélinon (1862) fr. (P); id. (1865) fr. (B, P).

PERU: dept. Loreto, lower R. Huallaga, Jurimaguas, L. Williams 4564 (1929) alt. 150—200 m, fr. Nov. (F, US).

Vern. names: FR. GUIANA: jaoua; PERU: copal caspi.

#### Doubtful species

*Hedwigia mexicana* DC., Prodr. II, p.80 (1825); Rose in N. Am. Fl. XXV, 3, p.258 (1911).

*Knorrea mexicana* Moc. et Sessé, Fl. Mex. Icon. ined. t.204.

No material of this species could be studied, but judging from other authors I cannot believe that it belongs to this genus.

#### V. TRATTINICKIA WILLD.

*Trattinickia* WILLD., Linn. Sp. pl. ed.4, IV, p.887 (1805); DeCand., Prodr. II, p.89 (1825); Sprengel, Linn. Syst. Veg. ed. 16, I, p.504 (1825); id., Linn. Gen. Pl. ed.9, I, p.161 (1830); Mart., Nov. Gen. et Sp. III, p.92 (1829); Don, Gen. Hist. Dichl. Pl. II, p.62, 77 (1832) Endl., Gen. Pl., p.1137 (1836—1840); Meisner, Pl. Vasc. Gen. I, p.75 et II, p.54 (1836—1843); Dietrich, Syn. Pl. I, p.568 (1839); Didrichsen in Vid. Medd. Kjbhn. 1857, p.124 (1857); Hooker in Benth. et Hook. Gen. Pl. I, 1, p.326 (1862); Marchand in Adans. VIII, p.66 (1867—1868); Baillon, Hist. d. Pl. V, p.314, 362 (1874); id., Dict. Bot. IV, p.211 (1892); Engl. in Mart. Fl. Bras. XII, 2, p.282 (1874); id. in DC. Mon. Phan. IV, p.98 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.238 (1897) et ed.2, XIXa, p.415 (1931); Guill. in Ann. Sc. nat., S.9, X, p.215 (1909); Benoist in Arch. d. Bot. V, Mém. 1, p.155 (1931); Pittier in Trab. Mus. com. Venez. VIII, p.361 (1931); Lemée, Dict. VI, p.653 (1935).

Trees. Branches usually stout; the bark provided with balsamiferous ducts. Leaves scattered, imparipinnate, 2- to 10-jugate;

petioles with inverted vascular bundles in the medulla; interjuga, like the petiolules mostly at both ends incrassate; leaflets lanceolate to elliptic, ovate to obovate, lateral ones but slightly oblique; subcoriaceous to coriaceous; margin entire. Inflorescences axillary and subterminal to pseudoterminal or terminal, the main ramifications racemose but the branchlets usually ending in densely clustered cymes. Flowers 3-merous, polygamous-dioecious to monoecious. Calyx irregularly 3-fid; its lobes in the bud imbricate. Petals connate, rarely nearly free, longer than the sepals, carnose; their lobes induplicate-valvate in bud and ending in an incrassate, inflexed apex. Stamens 6, in the masc.fl. inserted on the basal part of the disc, in the fem.fl. inserted on its margin; filaments very short and much dilated; anthers apiculate. Disc annular, 6-sulcate. Pistil in the masc.fl. rudimentary, forming with the disc a hexagonal pyramid, in the fem.fl. at the base surrounded by the disc, longer than the stamens, and consisting of a 2- to 3-celled, carnose ovary and a 2- to 3-lobed, nearly sessile stigma; each cell with 2 subapical collateral epitropous pendulous ovules. Fruit a drupe with membranaceous exocarp; carnose, balsamiferous mesocarp and corrugate, thick woody endocarp; pyrenes either 2 and then nearly connate, separated by a very thin layer of mesocarp only, or 1, 1-seeded. Seed exalbuminous; embryo with contortuplicate cotyledons.

Type-species of the genus: *Trattinickia rhoifolia* Willd.

Distribution: equatorial South America, from Isthmus of Panama to Peru.

Baillon l.c. joins this genus with *Hedwigia* Swartz, but retains the name *Trattinickia* for a separate section; this conception is never shared.

Anatomy: Solereder, [Syst. Anat. Dic., p.217, 218 (1899).

Key to the species.

- 1a. - leaflets lanceolate to oblong-lanceolate to oblong-elliptic, always narrowed to the apex, distinctly acuminate; flowers large (5 mm or more); corolla adpressedly puberulous; fruit globose, at both ends slightly acute, 1 cm or more in length . . . . . Sectio **Rhoifoliae** SWART . . . . . 2
- 1b. - leaflets oblong-elliptic to orbicular-elliptic, never narrowed to the apex, not or hardly acuminate, above smooth and beneath mostly scabridulous . . . . . Sectio **Burserifoliae** SWART. . . . . 7

- 2a. - leaflets with cuneate base, on both sides smooth or nearly so . . . . . 1. **T. demerarae** SANDW.  
 2b. - leaflets on both sides scabrous to scabridulous . . . . . 3  
 3a. - leaflets with rounded to cordate base, distinctly scabrous; petiolules and prim. nerves sparsely and minutely pilose; fruits longer than their stalks. . . . . 2. **T. rhoifolia** WILLD.  
 3b. - leaflets with cuneate base . . . . . 4  
 4a. - leaves very large; leaflets with about 35 pairs of sec. nerves on both sides very scabrous . . . . . 3. **T. aspera** (STANDL.) SWART  
 4b. - leaflets with less than 25 pairs of sec. nerves, scabridulous . . . . . 5  
 5a. - branchlets densely pilose; petioles, rhachis, petiolules and prim. nerves densely but shortly pilose; leaflets on both sides shortly pilose; fruits longer than their stalks. . . . . 4. **T. peruviana** LOES.  
 5b. - branchlets and leaflets glabrous; petioles, rhachis and petiolules glabrous or nearly so . . . . . 6  
 6a. - leaves 6- to 9-jugate; leaflets large (15×5 cm) . . . . . 5. **T. Lawrancei** STANDL.  
 6b. - leaves 4- to 6-jugate; leaflets small (10×3 cm) . . . . . 6. **T. Glaziovii** SWART  
 7a. - inflorescences few-flowered, lax; flowers large (5 mm); sepals connate up to  $\frac{1}{6}$ , petals up to  $\frac{1}{2}$  of their length; corolla very shortly pilose to papillose; fruits ellipsoid, at both ends sub-acute . . . . . 7. **T. laxiflora** SWART  
 7b. - inflorescences many-flowered, flowers more or less densely clustered at the end of the branchlets; flowers small (3—4 mm); corolla papillose; fruits globose, less than 1 cm in diam. . . . 8  
 8a. - sepals and petals connate up to  $\frac{1}{2}$  to  $\frac{1}{3}$  of their length . . . . . 8. **T. burserifolia** MART.  
 8b. - sepals connate up to  $\frac{1}{4}$  of their length; petals scarcely connate . . . . . 9. **T. subchoripetala** SWART

Sectio **Rhoifoliae** SWART in Rec. Trav. bot. néerl. XXXIX, p. 207 (1942).

Leaflets lanceolate to oblong, sometimes oblong-elliptic, always narrowed towards the apex, distinctly acuminate.

1. *Trattinickia demerarae* SANDW. in Kew Bull. 1931, 4, p.185 (1931); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.415 (1931).

Tree, usually large, up to 40 m high. Branchlets terete, slightly grooved, smooth, glabrous and fuscous, when adult dotted with elliptic, ferruginous lenticels. Leaves 3- to 4-, rarely, up to 8-jugate, 30—40 cm long; petioles semiterete, subulate, when adult scabrous, 7.5—12 cm long; interjuga terete, carinate, striate, nearly glabrous, 2.5—4.5 cm long; petiolules semiterete, canaliculate, transversely rimose, scabrous, when young slightly pilose, when adult glabrous, 4—8 mm long, the terminal ones 15—25 mm long; leaflets lanceolate to oblong, narrowed to the top, mostly 12.5—17.5 (10—22) cm long and 4.5 (3.5—5) cm wide, but the terminal ones wider and the basal ones shorter; top rather gradually acuminate; acumen tapering, ending obtusely, 15—8 mm long and 10—4 mm wide; base broadly cuneate, acute; coriaceous, glabrous, smooth or nearly smooth, above nitidous, beneath dull; with 16—19 (12—22) pairs of sec. nerves; prim. nerves above grooved on each side, beneath prominent, sec. and tert. nerves prominent. Inflorescences terminal, much-branched, fem. infl. 20 cm and their branchlets up to 14 cm long, masc. infl. 6—9 cm and their branchlets up to 4 cm long. Peduncles and branchlets angulose, densely cinereous tomentellous. Pedicels rather stout, polygonous, rather densely puberulous, 1—5 mm long, at the base with deciduous ovate, acute, puberulous, 5 mm long bracts and oblong bractlets. Flowers 3-merous, pinkish-brown to red, the masc. ones 5 mm, the fem. ones 6 mm long. Calyx campanulate to tubular, rather densely but minutely pubescent,  $\frac{2}{3}$  the length of the flower; its lobes triangular, obtuse, about as long as the tube. Corolla tubular, outside pubescent similar to the calyx, inside glabrous but with some long hairs near the apex, carnose; tube as long as the calyx and twice the length of the triangular, acute lobes. Stamens in the masc.fl. 1.5 mm, in the fem.fl. 1 mm long. Disc glabrous, 0.25 mm high. Pistil glabrous, in the masc.fl. as high as the stamens, in the fem.fl. ovoid, 2 mm high, 1.5 mm in diam. Drupe ovoid-globose, subacute, glabrous, 1 cm long and 1 cm in diam.

Type: For. Dept. Br. Guiana 915 in h.K.

Distribution: British Guiana and Suriname.

BR. GUIANA: N.W. Distr., Yarkita R., For. Dept. B.G. 915 (1929) in mixed forest, very plentiful, fl. masc. Apr. (K) (type); Mazaruni-station, Tutin 464 (1933), mixed forest, fl. masc. Aug. (K, U).

SURINAME: Corantyne R., Kaboeri, tree n. 633, BW. 4841 (1920) (U),

BW. 5925 (1922) fl. masc. Aug. (U); Para R., Zandery I, tree n. 29, BW. 1406 (1915) (U); id., tree n. 182, BW. 1449 (1915) (U), BW. 3912 (1918) fl. masc. Aug. (U), BW. 4373 (1919) fl. masc. and fr. Aug. (U); id., tree n. 208, BW. 1515 (1915) (U); id., BW. 6193 (1923) fl. fem. and fr. Sept. (U); Saramacca R., Sectie O, tree no. 16, BW. 4638 (1920) (U); id., tree n. 516, BW. 1325 (1915) (U); near Plantage Mariepastor, Kegel 1293 (1846) fr. May (GOET).

Vern. names: BR. GUIANA: ulu (Arow.); SURINAME: tiengimonnie (N.E.), olo (Arow.), ajawa, apoto-ajawa, ihoeloe-ilanao-ajawa (Car.).

This species is nearly related to *T. rhoifolia* Willd. and to *T. Lawrancei* Standl. but it differs from both by the smooth surface of its leaflets and their prominent tertiary nerves; moreover from *T. rhoifolia* by its terete and smooth branchlets and by its usually less numerous leaflets, which are narrower and provided with a cuneate base, and from *T. Lawrancei* by its smaller leaves which are always provided with a smaller number of leaflets.

**var. latifolia** SWART in Rec. Trav. bot. néerl. XXXIX, p. 207 (1942).

Leaves very large, 50 cm long; petiole and rhachis very long, together 26 cm; petiolules of the terminal leaflets 5 cm long; leaflets elliptic-oblong to oblong, ovate, 20 cm long, 8.5 cm wide; acumen rather short and only slightly tapering, 1 cm long, 0.5 cm wide.

Type: Krukoff 8855 in h.NY.

Distribution: Brazil, near the border of Ecuador and Peru.

BRAZIL: Amazonas, basin R. Solimoes, São Paulo de Olivença, creek of Belem, Krukoff 8855 (1936) planted by Indians, fr. Nov.-Dec. (NY).

Though its relation to *T. demerarae* Sandw. is from the geographic point of view rather unexpected Krukoff 8855 comes in its characters nearer to this species than to *T. Lawrancei* Standl.

2. *Trattinickia rhoifolia* WILLD., Linn. Sp. pl. ed.4, IV, p.975 (1805); DeCand., Prodr. II, p.89 (1825); Sprengel, Linn. Syst. Veg. ed.16, I, p.583 (1825); Don, Gen. Hist. Dichl. Pl. II, p.77 (1832); Dietrich, Syn. Pl. I, p.715 (1839); Engl. in Mart. Fl. Bras. XII, 2, p.282 (1874); id. in DC. Mon. Phan. IV, p.99 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.238 (1897) et ed.2, XIXa, p.415 (1931); Sagot in Ann. Sc. nat. S.6, XIII, p.290 (1882).

*Hedwigia rhoifolia* Baillon, Hist. d. Pl. V, f.294—295 (1874); id., Dict. Bot. III, p.22 fig. (1891).

Tree, rather large or even very large. Branchlets stout, 1 cm in

diam., polygonous, sulcate, when young densely covered with pale-ferruginous hairs, when adult glabrescent, fuscous and rugose. Leaves 4- to 7-juagte, 35—50 cm long, rarely larger; petioles stout, semiterete, subalate, with thickened base, rimose; interjuga terete, striate, carinate, like the petioles rather densely to sparsely ferruginous pubescent; petiolules semiterete, canaliculate, scarcely pubescent to nearly glabrous, rimose, 7.5 (2—15) mm, the terminal ones 2 (1—4) cm long; leaflets lanceolate-ovate to oblong-ovate, narrowed towards the apex, gradually or rather abruptly acuminate; acumen long, tapering and acute; base usually more or less cordate; margin entire; coriaceous, glabrous, distinctly scabrous, above nitidulous, beneath dull; with 15 (12—18) pairs of sec. nerves; prim. nerves above grooved on each side and glabrous, beneath distinctly prominent and scarcely pubescent, sec. and tert. nerves above hardly visible, beneath prominulous. Inflorescences subterminal axillary, much-branched, many-flowered, 7—22 cm long. Peduncles and branchlets stout, striate, densely and minutely ferruginous pubescent, when fruiting glabrescent and rimose. Pedicels short to very short, polygonous, rather densely and minutely pubescent; bracts elliptic-oblong, acute, about 5 mm long; bractlets oblong-lanceolate, 2 mm long. Flowers 3-merous, 5—7 mm long, pale-green to pinkish. Calyx campanulate, densely and minutely pubescent; its lobes as long as the tube. Corolla tubular, outside densely and minutely adpressedly pubescent, inside glabrous but with some long hairs near the apex. Stamens 6. Disc glabrous. Pistil glabrous, in the masc.fl. 1.5 mm high, in the fem.fl. ovoid, indistinctly 6-gonous, 3 mm high, 2 mm in diam., 2-celled. Drupe globose to subglobose, at both ends subacute, 1—1.25 cm in diam.

Type: Hoffmannsegg in Herb. Willdenow 18950 in h.B.

**subsp. Willdenowii** ENGL. in Mart. Fl. Bras. XII, 2, p.282, t.58 (1874); id. in DC. Mon. Phan. IV, p.99, t.II, f.25—29 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, f.134 D-E (1897) et ed.2, XIXa, f.412 D-E (1931).

*Trattimickia Ryanii* Didr. in Vid. Medd. Kjbhn. 1857, p.125 (1857).

Leaves 5 (4- to 7-)jugate, 40 (35—50) cm long; petioles 12 (8.5—15) cm long; interjuga 4 (2—6) cm long, petioles and rhachis 24—30 cm long; leaflets narrowed from the middle or from below the middle to the apex, 13 cm long and 4.5 cm wide; acumen 1.5—2 cm long and 1 cm wide. Inflorescences 17 (12—22) cm long, branchlets 3—7 cm long. Flowers 6—7 mm long. Calyx 4 mm long; its lobes oblong-triangular, acute. Corolla  $1\frac{1}{2}$ -times as long as the

calyx; its lobes oblong-triangular,  $\frac{1}{2}$  to  $\frac{2}{3}$  the length of the tube. Stamens in the masc.fl. half the length of the corolla, 3 mm.

**Type:** Hoffmannsegg in Herb. Willdenow 18950 in herb.B.

**Distribution:** Trinidad, the Guianas and northern Brazil.

**TRINIDAD:** Kugler and Williams 13098 (1934) white lands, forest fr. Dec. (K).

**BR. GUIANA:** Pomeroon-distr., Jenman 1918 (1882) fl. Aug. (K, NY); id., Moruka R., Delacruz 4555 (1927), fl. masc. July (F, NY, US); N.W. -distr., Waini R., For. Dept. B. G. 625 (1910) (K); Rupumuni R., Yupukari, For. Dept. B. G. 2178 (1931) at edge of savannah, fl. fem. Sept. (K, U).

**SURINAME:** Para R., Zandery I, BW. 6372 (1924) fl. masc. Febr. (U); Suriname R., Brownsberg, tree n. 1128, BW. 2513 (1916) fr. Nov. (U), BW. 2849 (1917) fr. May (U), BW. 6456 and 6629 (1924) fl. fem. Apr. (U); id., tree n. 1148, BW. 2935 (1917) fr. June (U).

**FR. GUIANA:** near Cayenne, Martin (K); id., Broadway 597 (1921) fr. June (BM, K).

**BRAZIL:** basin R. Solimoes, near Ega, Poeppig 2524 (1831) in forest, fl. fem. Sept. (W); without locality, Hoffmannsegg, herb. Willd. 18950, fl. masc. (B) (type).

**subsp. Sprucei** ENGL. in Mart. Fl. Bras. XII, 2, p.282 (1874); id. in DC. Mon. Phan. IV, p.99 (1883).

Leaves 6- to 7-jugate, rarely 4- or 5-jugate, 35 cm long; petioles 9 cm; interjuga 2.5 cm long, petioles and rhachis 21 cm long; leaflets narrowed from above the middle to the apex, 11 cm long and 4 cm wide; acumen 1.5 mm long and 7.5 mm wide. Inflorescences 9 cm long. Flowers 5 mm long. Calyx 1.75 mm long; its lobes broadly triangular, subobtuse. Corolla  $2\frac{1}{2}$ -times as long as the calyx; its lobes ovate-triangular,  $\frac{1}{3}$  to  $\frac{1}{2}$  the length of the tube. Stamens in the masc.fl.  $\frac{1}{3}$  the length of the corolla, 1.5 mm.

**Type:** (lecto-type): Spruce 1168 in h.P.

**Distribution:** equatorial Brazil (Amazonas and Para).

**BRAZIL:** Rio Negro, near Barra, Spruce 1125 (1850—1851) fl. masc. Dec.-March (B, BM, C, G, K, LE, M, NY, W); Amazone R., near mouth R. Solimoes, Spruce 1168 (1851) fl. fem. March (B, BM, K, M, P, W); basin R. Tapajoz, upper R. Cupary, Krukoff 1195 (1931) fr. Sept. (B, BM, G, K, NY, U).

**Vern. names:** BR. GUIANA: ulu, ooloo (Arow.), ahis-ali (Narrou); SURINAME: tiengi-monnie (N.E.); BRAZIL: jucuruba (ex Krukoff).

*Trattinickia Ryanii* Didr. has amply been described on a fruiting specimen "inter spirituosa Vahliana 148". I have been informed that in the Univ. Botan. Museum at Copenhagen today this specimen is not to be found, neither in the collection of plants on liquor,

nor in the herbarium, but Didrichsen's diagnosis corresponds quite well with that of *Trattinickia rhoifolia* Willd. ssp. *Willdenowii* Engl. and in the locality where the specimen described by Didrichsen was collected, "Insula Trinidad, Ryan". this subspecies too is known to occur.

**A n a t o m y :** Guill. in *Ann. Sc. nat.*, S.9, X, p.215, f.6, 7—1 (1909).

**3. *Trattinickia aspera* (STANDL.) SWART nov.comb.**

*Protium asperum* Standl. in *Trop. Woods* 1926, 8, p.4 (1926); id. in *Contr. U.S.N.H.* 27, p.224 (1928); Engl. in *E.-Pr. Nat. Pfl. fam. ed.2*, XIXa, p.414 (1931).

Tree, 10—20 m high; bole covered with a scabrous, greyish bark. Leaves 6-jugate, large; petioles semiterete, subalate, rimose, 30 cm long; interjuga similar to the petioles, 5.5 cm long; petiolules semiterete, canaliculate, rimose, 5 mm long, the terminal ones 35 mm; leaflets lanceolate to oblong-lanceolate, sometimes narrowed to the apex, the lateral ones slightly oblique, 17—23 cm long and 5.5—7.5 cm wide; apex gradually narrowed in a tapering, acute, 1.5 cm long and 1 cm wide acumen; base cuneate; margin slightly emarginate; subcoriaceous, on both sides glabrous and very scabrous, above nitidulous, beneath dull; with about 35 pairs of sec. nerves; prim. nerves on both sides prominent and provided with some long hairs, sec. and tert. nerves sparsely hispidulous, above prominulous, beneath distinctly prominent. Inflorescences subterminal, axillary, laxly paniculate, 17 cm long. Peduncles and branchlets angulose, sparsely hispidulous. Pedicels similar to the peduncles, 8—18 mm long. Flowers 3-merous. Drupe both in longitudinal and transverse section rhomboid, 10—11 mm long and 9—10 mm in diam., apex acute; pyrenes usually 2.

**Type:** Standley 41161 in h.US 1251938 and 1251939.

**Distribution:** Panama.

**PANAMA:** Canal Zone, Barro Colorado Island, Standley 41161 (1925) fr. Nov. (US); id., id. 40815 (1925) (US).

**Vern. name:** carano.

This species, which according to Standley occurs frequently on Barro Colorado Island, has the corrugate, nearly connate pyrenes of *Trattinickia*, but differs from all other species of the genus by the large size of its leaves and by the very scabrous surface and the large number of sec. nerves of the leaflets.



4. *Trattinickia peruviana* LOES. in Engl. Bot. Jahrb. XXXVII. p.569 (1906); Engl. in E.-Pr. Nat. Pfl.fam. ed.2, XIXa, p.415 (1931).

Tree. Branches stout, terete, slightly striate, very densely tomentellous, when adult glabrescent and scabrous, Leaves 6- to 7-jugate, about 35 cm long; petioles semiterete, near the incrassate base subalate, 8 cm long, like the rhachis and petiolules very densely ferrugineous-tomentellous; interjuga terete, above carinate, 2.5 cm long; petiolules semiterete, canaliculate, 2—4 mm long, the terminal ones 2 cm; leaflets oblong to oblong-ovate, mostly narrowed to the apex and the lateral ones slightly oblique, usually 11 cm long and 3.5 cm wide, but the terminal ones wider and the basal ones about half as long; apex gradually narrowed in a tapering, acute, 17.5 mm long and 5 mm wide acumen; base cuneate to rounded; subcoriaceous, on both sides scabridous and dull, above rather densely fuscous puberulous, beneath sparsely ferrugineous pubescent; with about 16 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. and tert. nerves above hardly visible, beneath prominent. Inflorescences terminal, rather many-flowered, 15 cm long. Peduncles and branchlets stout terete, striate to angulose, densely ferrugineous puberulous, when adult sometimes glabrescent; sec. branchlets up to 5.5 cm, tert. ones up to 2.5 cm long. Flowers 3-merous. Pedicel of the fruits 5 mm long, similar to the peduncles. Disc glabrous. Drupe globose to ovoid, glabrous or provided with some hairs, 1 cm in diam; pyrenes 2.

Type: Weberbauer (without number) in h.B.

Distribution: Peru (dept. Loreto).

PERU: dept. Loreto, prov. Moyobamba, Weberbauer (1904) alt. 800—900 m, in savannahforest, fr. Nov. (B).

Vern. name: carana.

This species differs from all other species of the genus by its strongly developed indumentum.

5. *Trattinickia Lawrancei* STANDL. in Rec. Trav. bot. néerl. XXXIX, p.208 (1942).

Tree, mostly large, 20 to 60 m high. Branches stout, 1 cm diam., smooth, glabrous, fuscous, provided with elliptic, ferrugineous lenticels. Leaves 7- to 9-jugate, 45—70 cm long; petioles semiterete, above subalate, 10—20 cm long, like the rhachis nearly glabrous; interjuga terete, above carinate, 3—5 cm long; petiolules semiterete,

canaliculate, scabrous, transversely rimose, glabrous, 5—7.5 mm long, the terminal ones 2—4 cm long; leaflets lanceolate to oblong, the lateral ones slightly oblique and narrowed to the apex, 13—17 cm long and 4—6 cm wide; apex gradually narrowed in a tapering, acute, 15—20 mm long and 7.5 mm wide acumen; base cuneate; coriaceous, scabridous to scabridulous, glabrous, above nitidulous, beneath dull; with about 20 pairs of sec. nerves; prim. and sec. nerves above grooved on each side, beneath prominent, tert. nerves above hardly visible, beneath prominulous. Inflorescences pseudo-terminal or terminal, many-flowered, 15—25 cm long. Peduncles very stout, like the branchlets angulose, striate, when young sparsely pubescent, when adult glabrescent and scabrous; sec. branchlets 10—15 cm, tert. ones 2 cm long. Pedicels, when fruiting, 5—15 mm long. Flowers 3-merous. Calyx cupuliform. Drupe globose, at both ends subacute, at the top provided centrally with a short rudiment of the stigmata, glabrous, 12 mm long, 10—12 mm in diam.; pyrenes 2.

Type: Lawrance 825 in h.F 756502 and 756503.

Distribution: eastern slopes of the Andes.

COLOMBIA: Boyaca, north of Bogota, El Umbo, Lawrance 825 (1934) alt. 1000 m, in high forest, fr. Sept. (F).

BRAZIL: Amazonas, basin. R. Madeira, Humayta, near Tres Casas, Krukoff 6315 (1934) on varzea-land, fr. Sept. (NY, U); id., id. 6442 (1934) on low terra firma, fr. Oct. (K, NY, U); id., near Livramento, Krukoff 6639 (1934) on terra firma, fr. Oct. (NY, U).

This species is related to *T. rhoifolia* Willd. but differs from the latter by its terete and smooth branchlets, its multijugate leaves, the glabrous petiolules and midrib of its slightly rough leaflets with cuneate base. From *T. demerarae* Sandw. it differs by the greater number of its scabridulous and indistinctly reticulate leaflets.

The name *Trattinickia Lawrancei* Standl. I only met in manuscript and the war made it impossible for me to get answer on my request whether the diagnosis was published already.

Among the Suriname-material is a specimen, Watramiri, tree n. 1644, BW. 2020 (1916) (U), consisting of some incomplete leaves only, which agree fairly well with those of this species.

6. *Trattinickia Glaziovii* SWART in Rec. Trav. bot. néerl. XXXIX, p. 208 (1942).

*Trattinickia Schwackeana* Glaziou in Bull. Soc. Bot. Fr. 52, Mém. 3, p.92 (1905) (nomen nudum); Guill. in Ann. Sc. nat., S.9, X, p.215 (1909).

Large tree. Branchlets rather stout, terete, slightly sulcate,

glabrous, smooth to scabridulous, cinereous, provided with elliptic rufescent lenticels. Leaves 4- to 6-jugate, 22—32 cm long, in all parts glabrous; petioles semiterete, at the base slightly incrassate, 5—6 cm long, like the rachis scabridulous, interjuga terete, striate, 2.5—3.5 cm long; petiolules semiterete, canaliculate, 3—5 mm long, the terminal ones 15—20 mm; leaflets lanceolate to oblong, mostly narrowed from above the middle to the apex, usually 6.5—11 cm long and 2.75—3 cm wide, but the terminal ones smaller and narrowed near the base, the lateral ones oblique and the basal ones shorter; apex gradually narrowed in a tapering, acute, 15 mm long and 5 mm wide acumen; base cuneate; coriaceous, scabridulous at both sides, above nitidous, beneath dull; with 11—12 pairs of sec. nerves; prim. nerves on both sides prominent, sec. and. tert. nerves above prominulous, beneath prominent. Inflorescences pseudoterminal axillary, branched from the base, many-flowered, 15 cm long. Branchlets stout, terete, like the pedicels, bracts, bractlets, calyx and outer side of the corolla sparsely and minutely fuscous pilose, sec. branchlets up to 8 cm long, tert. ones up to 1.5 cm. Pedicels nearly as long as the flowers; bracts oblong, obtuse half the length of the pedicels. Flowers 3-merous, brunnescent, 5 mm long. Calyx cupuliform, hardly  $\frac{1}{5}$  the length of the flower; its lobes broadly triangular, obtuse, as long as the tube. Corolla urceolate, 3 mm in diam., carnose; its lobes ovate, acute, as long as the tube. Stamens in the masc.fl. 1.4 mm long; anthers basifixed, oblong, 1.3 mm long. Disc annular, glabrous. Pistil in the masc.fl. rudimentary, ovoid-conical, 1 mm high, sub-3-lobed and provided with short hairs. Drupe a 4- to 5-angular glabrous pyramid, apex acute, 12 mm long, nearly 10 mm in diam.; pyrenes 2.

Type: Glaziou 13675 in h.P.

Distribution: Brazil.

BRAZIL: basin R. Madeira, Humayta, near Livramento, Krukoff 6891 (1934) on terra firma, fr. Oct. (K, NY, U); Quinta de São Christavão, Glaziou 13675 (1880) fl. masc. July (B, C, K, P).

As the name *T. Schwackeana* is found only in Glaziou's "Liste" it is merely a nomen nudum and as no relation between the type-specimen and Schwacke could be traced in order to avoid trouble in the nomenclature a new specific epithet was chosen. Glaziou l.c. adds "Quinta da Boa Vista, Rio Jan. Grand arbre cultivé". The locality on the label of the type therefore is uncertain and the type-specimen has to be considered as cultivated.

Sectio *Burserifoliae* SWART in Rec. Trav. bot. néerl. XXXIX, p.207 (1942).

Leaflets oblong-elliptic to orbicular-elliptic, never narrowed towards the apex, not or slightly acuminate.

7. *Trattinickia laxiflora* SWART in Rec. Trav. bot. néerl. XXXIX, p.209 (1942).

Small tree, 4.5—7.5 m high. Branchlets rather stout, 5 mm in diam., glabrous, scabrous, fuscous, provided with elliptic ferruginous lenticels. Leaves of variable aspect, mostly 3- to 4-jugate, rarely 2-jugate, 32.5—40 cm long, in all parts glabrous; petioles semiterete, subalate, at the base incrassate, 7.5 cm long, like the rhachis smooth; interjuga terete, striate, above subcarinate, 5.5—6 cm long; petiolules semiterete, canaliculate, when adult scabrous, 1—1.5 cm, the terminal ones 2.5—3.5 cm long; leaflets broadly elliptic, symmetrical, mostly 11—12.5 cm long and 6—7 cm wide, but the terminal ones wider and the basal ones smaller; apex obtuse but abruptly acuminate; acumen about 5 mm long and wide, obtuse; base nearly rounded; coriaceous, above nitidous and smooths beneath scabridulous; with 10—12 pairs of sec. nerves; nerves, above grooved on each side, beneath prominent. Inflorescences axillary or terminal, laxly branched, few-flowered, 25 cm long; branchlets 10 cm long, like the peduncles angulose and glabrous. Pedicels slender, 4.5 mm long, terete, striate, like the calyx sparsely and minutely puberulous bracts deciduous, lanceolate, 2.5 mm long; bractlets ovate, 5 mm long. Flowers 3-merous, 5 mm long. Calyx campanulate, 2.75 mm long; its lobes ovate-triangular, acute, nearly 5 times as long as the tube. Corolla tubular to urceolate, nearly 2 times the length of the calyx, outside sparsely and minutely puberulous to papillose, inside glabrous, carnose, deep red; its lobes ovate, nearly as long as the tube. Stamens 6, in the fem.fl. 1 mm long; filaments much dilated, 0.35 mm long; anthers elliptic, apiculate, 0.65 mm long. Disc annular, glabrous, 0.35 mm high. Pistil in the fem.fl. glabrous, 2.5 mm high; ovary conical; style thick, 0.75 mm long; stigma 2-lobed. Drupe ellipsoid, at both ends acute, glabrous, 12 mm long and 8 mm in diam.; pyrenes 2.

Type: Killip and Smith 24795 in h.US 1359108.

Distribution: central Peru.

PERU: dept. Junin, San Romon, Killip and Smith 24795 (1929) alt. 900—1300 m, fl. fem. and fr. June (F, NY, US); id., id. 24906 (1929) id., id. (F, NY, US).

This species is related to *T. burserifolia* Mart., but differs from

the latter by its wider leaflets, laxly branched and few-flowered inflorescences, longer pedicels, larger flowers and very short calyx-tube.

8. *Trattinickia burserifolia* (*burseraefolia*) Mart., Nov. Gen. et Sp. III, p.93, t.239 (1829); Engl. in Mart. Fl. Bras. XII, 2, p.283 (1874); id. in DC. Mon. Phan. IV, p.99 (1883); id. in E.-Pr. Nat. Pfl.fam. III, 4, p.238 (1897) et ed.2, XIXa, p.415 (1931); Benoist in Bull. Soc. bot. Fr. LXVI, p.357 (1919); Pittier in Trab. Mus. com. Venez. VIII, p.361 (1931). Non apud Gleason in Bull. Tor. bot. Cl. LVIII, p.377 (1931) quod ad *T. subchoripetala* Swart pertinet.

*Trattinickia burseraefolia* Mart. subsp. *obtusata* Engl. l.c. (1874, 1883); Pulle, Enum. Vasc. Pl. Surin. p.246 (1906).

*Trattinickia burseraefolia* Mart. subsp. *quinquejuga* Engl. l.c. (1874, 1883). Non apud Gleason in Bull. Tor. bot. Cl. LVIII p.377 (1931).

*Trattinickia Schomburgkii* Klotzsch in R. Schomb. Reisen in Br. Guiana III, p.1188) nomen nudum.

*Trattinickia guianensis* Klotzsch l.c. nomen nudum.

*Trattinickia humilis* Spruce mss. in sched. Spruce 2964 and 3252; Engl. l.c. (1874, 1883).

Tree, usually small and no over 10 m high. Branchlets rather stout, 5 mm in diam., terete, striate, glabrous, when young oliveaceous, when adult squamaceous, fuscous and provided with lanceolate ferruginous lenticels. Leaves mostly 3- or 4-jugate, sometimes 2- or 5-jugate, usually 20—25 cm long; petioles semiterete, at the base incrassate, 5—8 (2.5—9) cm long, like the rhachis and the petiolules fuscous and when adult transversely rimose; interjuga terete, striate, above carinate, 3.5—4 (1.5—6) cm long; petiolules semiterete, canaliculate, 10—15 mm long, the terminal ones 20—25 (15—40) mm; leaflets elliptic-oblong to elliptic, 9—11 (6—14) cm long and 4—5.5 (2.75—6) cm wide, the lateral ones slightly oblique; apex gradually to rather abruptly acuminate; acumen 5—10 mm long and 5—7.5 mm wide, obtuse; base broadly cuneate; coriaceous, above glabrous, smooth, nitidous and deep green, beneath sparsely puberulous, scabridulous, dull and glaucescent; with about 12 pairs of sec. nerves; prim. nerves above grooved on each side, beneath distinctly prominent, sec. and tert. ones on both sides prominulous, all nerves glabrous. Inflorescences axillary or terminal, branched from the base, 20 (10—25) cm long. Branchlets few, patent, angulose, striate, glabrous and scabridulous, up to 20 cm long, many-flowered. Pedicels angulose, 0.75—1.75 mm

long, like the small, oblong-lanceolate bracts and bractlets, the ultimate branchlets and the calyx rather densely and minutely puberulous. Flowers 3-merous, 3—4 mm long and 2—2.5 mm in diam. Calyx cupuliform, nearly half as long as the flower; its lobes triangular, obtuse, as long as the tube. Corolla tubular, outside papillose, inside glabrous but near the apex provided with some hairs, carnose, red; its lobes ovate-triangular, acute, about as long as the tube. Stamens in the masc.fl. as long as the tube of the corolla, in the fem.fl. shorter; filaments very short, much dilated; anthers elliptic, apiculate. Disc annular, 6-lobed, glabrous, 0.25 mm high.

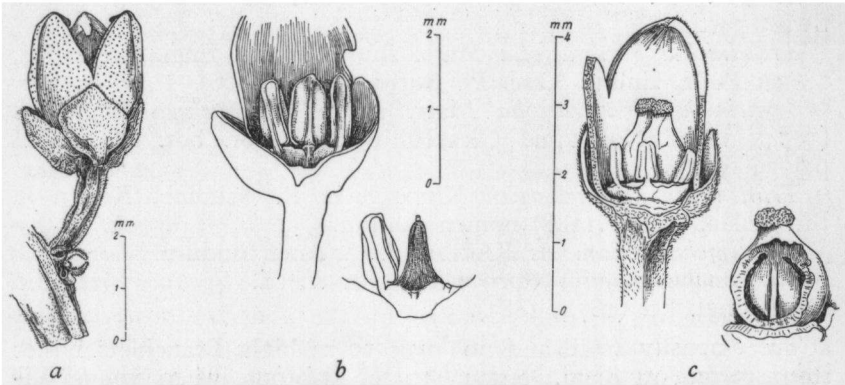


Fig. 8. *Trattinickia burserifolia* Mart. — a. flower; b. details of male flower; c. details of female flower.

Pistil glabrous, in the masc.fl. forming with the disc a hardly 1 mm high cone, in the fem.fl. 2 mm high; ovary conical-ovoid, 1.5 mm high; stigma 2-lobed, sessile. Drupe globose, glabrous, smooth, black, 0.75 cm in diam.; pyrenes 2.

Type: Martius (Obs. 3141) in h.M.

Distribution: equatorial South America, east of the Andes.

COLOMBIA: Mt. Araracoara, near Rio Yapura, Martius Obs. 3141, (no date) alt. 360 m, fl. masc. Jan. (M) (type); near San Carlos, Spruce 2964 (1853) in low forest, fl. fem. and fr. Apr. (BM, K, W).

VENEZUELA: Esmeralda, Spruce 3252 (1853) fr. Dec. (K, P).

St. VINCENT: Caley, fr. (W).

BR. GUIANA: Mt. Roraima, Schomburgk 595 (1842—43) fl. fem. and fr. (BM, G, K, M, W); id., id. 746 (1842—43) fl. masc. (BM, G, K, P, W); id., Tate 282 (1927) alt. 1600—1800 m (NY); Kaieteur Falls, Tutin 500 (1933) alt. 330 m, small thickets in savannah, fl. masc. Aug. (BM, K, U); id., Sandwith 1401 (1937) alt. 300 m, open rocky ground, fl. Sept. (K); basin Essequibo R., near mouth Onoro Creek, A. C. Smith 2705 (1937) on high land, dense forest, fr. Dec. (U); Demerara R., Wainibini Creek, For.

Dept. 2431 (1935) alt. 60 m, in open scrub, fl. Sept. (K); Demerara-Berbice watershed, For. Dept. 827 (1919) fr. Oct. (K); Demerara R., Malali, DelaCruz 2654 (1922) fl. fem. Oct.-Nov. (GH, NY, US); Hyde Park, Persaud 153 (1924) sandhill in forest, fl. Sept. (K); Pacaraima Mt., Schomburgk 903 (no date) fl. fem. (B, BRSL, L) (type of *T. Schomburgkii* Kltz., *T. Schomburgkiana* Kltz.); without loc., Schomburgk 1339 (1842) fl. masc. Aug. (B, BRSL) (type of *T. guianensis* Kltz.); id., id. 223 (1839) (BM); id., Jenman 4855 fl. masc. (B, K).

SURINAME: Para R., Zandery I, tree n. 207, BW. 2264 (1916) (U); Zandery I, BW. 364 (1913) fl. masc. Oct. (U); Plantage Berlyn, Wullschlaegel 1686 (no date) fr. (BR, W); Saramacca R., Sectie O, tree n. 22, BW. 314 (1915) fl. fem. and fr. May (U); id., tree n. 83, BW. 331 (1915) fl. fem. and fr. (U); id., tree n. 785, BW. 2451 (1916) fl. masc. Sept. (U), BW. 2884 (1917) (U), BW. 3368 (1917) fl. fem. and fr. Oct. (U); Marowynne R., Albina, Herb. Lambert (1819) fl. (K); without loc., Hostmann 668a (1846) fl. masc. (P).

FR. GUIANA: Gourdonville, Benoist 1529 (1914) fl. masc. Oct. (P).

BRAZIL: Amazonas, R. Branco, R. Surumi, Ule 8412 (1909) alt. 1000—1400 m, fl. fem. Sept. (B, G, K, L); id., R. Negro, Manaus, near Aleixo, Krukoff 7936 (1936) fl. masc. Aug.-Sept. (NY); id., id. 8028 (1936) fr. Aug.-Sept. (NY); id., R. Madeira, near Borba, Riedel 1492 (1828) fl. fem. and fr. July (B, K, LE); Para, Herb. Lusit., fl. masc. (P); without loc., Newmann, fl. masc. (G).

Vern. names: BR. GUIANA: ulu (Arow.); SURINAME: tingie<sup>o</sup> monnie, saly (N.E.), olo, ioellie-ballie (Arow.), ajawé, patjera-siepjorie (Car.); BRAZIL: almesca, breu (ex Krukoff).

The seize of variability shown by the abundant material now at our disposition makes it impossible to retain the subdivision of this species proposed by Engler l.c.; between his subsp. *obtusa* and *quinquejuga* all transitions are present.

**Anatomy:** Guill. in Ann. Sc. nat., S.9, X, p.215, f.7—2 (1909).

9. *Trattinickia subchoripetala* SWART in Rec. Trav. bot. néerl. XXXIX, p. 210 (1942).

*Trattinickia burseraefolia* Mart. in errore Gleason in Bull. Tor. bot. Cl. LVIII, p.377 (1931).

Probably a tree. Branchlets slender, terete, glabrous, scabrous, cinerascens. Leaves mostly 3- to 4-jugate, rarely 1- or 2-jugate, in all parts glabrous, 15 cm long; petioles semiterete, subalate, at the base incrassate, 3 cm long, like the rhachis smooth and fuscous; interjuga terete, striate, above slightly carinate, 3 cm long; petiolules terete, canaliculate, transversely rimose, scabrous, 6 mm long, the terminal ones 1 cm; leaflets broadly elliptic to obovate, slightly oblique, about 5.5 cm long and 3.5 cm wide; apex slightly emarginate to subobtusate but sometimes provided with a very short, 1 mm long and 2 mm wide, acute acumen; base broadly cuneate;

coriaceous, above smooth and nitidous, beneath scabridulous and dull; with about 10 pairs of sec. nerves; prim. nerves above distinctly grooved on each side, beneath distinctly prominent, sec. and tert. nerves prominent. Inflorescences terminal, rather laxly branched, 12 cm long. Peduncles and branchlets terete, striate, scarcely and minutely puberulous. Pedicels stout, teretiusculous, half the length of the flower, as long as the oblong-triangular, acute bracts, twice the length of the ovate bractlets, like the calyx all sparsely and minutely puberulous. Flowers 3-merous, 3.5 mm long. Calyx cupuliform, half the length of the corolla; its lobes broadly triangular, subobtruse, as long as the tube. Corolla campanulate-tubular, outside papillose, inside glabrous, carnose, deep red; tube very short; petals nearly free, elliptic-ovate, acute. Stamens 6, in the fem. fl. 1 mm long; filaments much dilated; anthers elliptic, 0.75 mm long. Disc annular, glabrous, 0.4 mm high. Pistil the in fem.fl. glabrous; ovary globose, 2 mm high, 2.5 mm in diam.; stigma sessile, 2-lobed. Drupe globose, glabrous, 6 mm in diam.

**Type:** Tate 210 in h.NY.

**Distribution:** southern Venezuela.

VENEZUELA: Esmeralda, Tate 210 (1928) alt. 110 m, rocky top, fl. fem. and fr. Oct. (NY).

This species is closely related to *T. burserifolia* Mart., but differs from the latter by its nearly free petals and moreover by its smaller and wider leaflets.



## LIST OF COLLECTORS' NUMBERS

Unnumbered specimens are indicated "s.n.". In parentheses the name of the genus is abbreviated: C. = *Crepidospermum*, H. = *Hemicrepidospermum*, P. = *Protium*, Te. = *Tetragastris* and Tr. = *Trattinickia*; the number refers to the number of the species concerned.

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## LIST OF VERNACULAR NAMES

The names have been spelled according to the orthography of the collector's notes on the labels or in the literature. In parentheses the name of the genus is abbreviated: P. = Protium, H. = Hemicrepidospermum, C. = Crepidospermum, Te. = Tetragastris, Tr. = Trattinickia; the number indicates the number of the species concerned.

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