

The genus *Guarea* comprises about one hundred species, distributed throughout tropical America. The plants are either shrubs or trees, some of the latter attaining the size of a large apple tree. The leaves are equally pinnate, with a bud at the top of the rachis, between the last pair of leaflets, and are usually large. The number of leaflets is rather constant within the species, rarely varying by more than one or two pairs. In size and form the leaflets are very variable, so that these characters are of little service in determining the species, unless we have a long series of specimens for examination. Neither are the fruit characters very useful for specific distinction, in most cases, as they vary greatly in size with maturity, and the form varies considerably with the stage of development. When young, they are fig-shaped or pear-shaped. Occasionally they retain this form, but usually become nearly spherical as they mature. It is thus in the flower characters that we must look for our constant marks of specific distinction, and dissection is necessary in determining them. The filaments of the stamens are coherent into a cup or tube and the anthers are concealed within this tube and below its margin, which may be either truncate or crenate. It is probably from this stamen tube that the natives have derived their local name "trompillo," meaning "a little trumpet." It is the variation in the shape and size of this cup and the character of its margin and the place of location of the anthers, with their form and size and method of attachment, which gives us our best characters for specific distinction. Good characters are also found in the size and form of the anthers and in their attachment, and in the form of the calyx and its relation as to size and shape with the corolla. Moreover, the calyx and corolla are valvate in some species, imbricate in others. The shape, size and character of the ovary and style are also quite characteristic.

HISTOLOGY OF COCILLANA AND SUBSTITUTE BARKS.

BY C. W. BALLARD.

Commercial supplies of cocillana have been frequently adulterated not only with allied barks from non-official species of *Guarea* but also with various foreign barks. The botanical identity of these substitutes has been more or less in doubt and is one of the problems which has been partially solved by the Mulford Expedition. The four samples described in this monograph were furnished by Dr. H. H. Rusby and were collected by him during his travels in the Amazon region while in charge of the exploration. The material includes specimens of genuine cocillana (*Guarea Rusbyi*) and three substitute barks, namely—*Guarea Bangii*, an unidentified *Guarea* and a species of *Nectandra*. *Guarea Bangii* resembles true cocillana more closely than the other two substitutes but the differences between it and the genuine article are sufficiently great to render its identification a simple matter. The other substitutes differ greatly from cocillana in appearance and physical characters.

GENERAL DESCRIPTIONS.

Cocillana (Guarea Rusbyi).—This bark occurs as flattened and slightly curved fragments more or less mixed with thinner strips of wood. The fragments range in width up to 80 millimeters and in length up to 250 millimeters. The thickness

is between 5 and 15 millimeters thus exceeding the maximum stated in National Formulary IV. The outer surface is marked by fairly deep longitudinal fissures which are irregular in their course. The external surface often shows lichens which are gray to greenish gray in color and which mask the natural light brown color of the cork. The inner surface is yellowish brown to pinkish brown in color and shows coarse longitudinal striations often with projecting fibers. The fracture is rather soft excepting that the innermost layers are fibrous and splintering, showing numerous projecting fibers at the break. A view of the fractured surface shows that the cork or outer bark region is comparatively thin, comprising about one-fourth or one-third of the entire specimen. The powdered material has a slight odor but it is hardly characteristic. The taste is astringent and slightly nauseating.

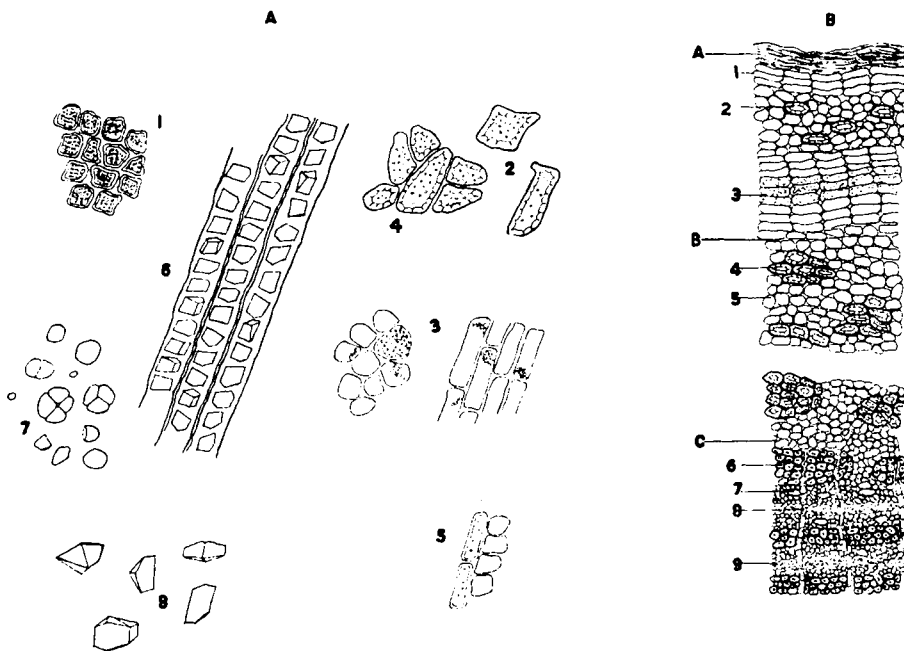
Substitute Cocillana (Guarea Bangii).—This bark occurs as flattened strips, the samples at hand being up to 800 millimeters in length, 50 millimeters in width and not exceeding 5 millimeters in thickness. The outer surface is roughened showing a few prominent longitudinal ridges and fissures. Due to overgrowth of the cork the ridges are usually accompanied by fissures. Quantities of white, grayish and greenish lichens may be present and may cover the natural reddish brown color of the cork. The inner surface is yellowish brown in color and similar in appearance to that of *Guarea Rusbyi*. The fracture is tougher and much more fibrous than in the genuine cocillana and shows projecting splinters or fibers throughout the entire bark. The odor is non-characteristic and the taste is slightly astringent.

Substitute Cocillana (Guarea, Unidentified Species).—This sample of bark is in the form of flattened and curved fragments up to 250 millimeters in length, 80 millimeters in width and not exceeding 5 millimeters in thickness. The outer surface is granular in appearance with occasional longitudinal fissures and numerous grayish to grayish green lichens. Where not obscured by lichens the external color of the bark is a pinkish brown. The inner surface is reddish brown with numerous coarse yellowish striae. The fracture varies from even to uneven and is clean with the possible exception of a few large fiber groups toward the inner surface. The fractured surface shows numerous tangentially arranged groups of yellowish fibers in several layers and upon fracture the bark tends to split along these layers into veneer-like fragments. The odor is non-characteristic and the taste is slightly astringent.

Substitute Cocillana (Nectandra, Unidentified Species).—This bark occurs as slightly curved fragments. The samples submitted range up to 200 millimeters in length, 50 millimeters in width and not exceeding 3 millimeters in thickness. The outer surface shows a very few transverse ridges and numerous prominent raised lenticels of circular form. Where the surface is not covered with grayish or white lichens, the color is a dull grayish brown. The inner surface is medium brown in color and although showing numerous irregular fine ridges is not rough and fibrous as are the *Guareas*. The fracture is fairly even and practically non-fibrous. The fractured surface shows a very thin layer of cork and numerous isolated yellowish fiber groups are apparent in the inner portions of the specimen. The odor is faintly aromatic and camphoraceous. The taste is mildly camphoraceous.

HISTOLOGICAL DESCRIPTIONS.

Cocillana (Guarea Rusbyi).—Owing to the friable nature of this bark it is extremely difficult to prepare sections. Plate B represents a composite drawing made from several sections. The outer surface of transverse sections may show several more or less detached layers of periderm or secondary cork. This periderm consists of partially obliterated cork cells, isolated stone cells and parenchymatic elements. A second layer of well-developed cork cells usually occurs beneath the periderm. The middle bark consists largely of parenchyma filled with starch but bands or groups of thick-walled stone cells also occur in this region. The inner bark shows large groups of yellow bast fibers many of which contain crystals. The medullary rays are wavy, one cell in width and poorly defined except for their dark color. The rays extend through the fiber groups and cross the strips of dark-colored parenchymatic cells located in this portion of the specimen. Scattered among the dark parenchyma cells are larger thin-walled elements which probably serve as secretion cells.



Cocillana (Guarea Rusbyi).

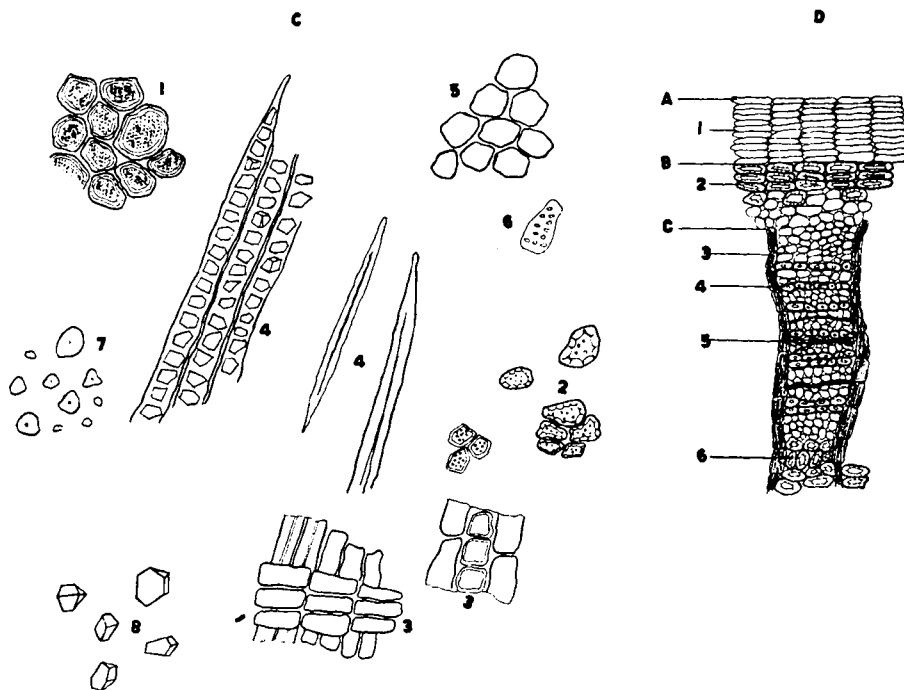
Plate A.—1, cork; 2-4, stone cells; 3, parenchyma with starch; 5, medullary rays; 6, crystal-bearing fibers; 7, starch; 8, crystals.

Plate B.—1, cork; 2-4, stone cells; 3, cork; 5 bark parenchyma; 6, fiber bundles; 7, secretion cells; 8, medullary rays; 9, secretion channels; A, outer bark; B, middle bark; C, inner bark.

Crystal-bearing fibers and stone cells are very abundant in the powdered bark. The stone cells are yellowish in color, thick walled, porous and angled to irregular in form. Parenchyma is apparent in both transverse and longitudinal views and dark-colored cork masses are present in fair amount. The prismatic crystals occur in the fibers and free in the field ranging in size between 10 and 25 microns.

Starch occurs in single and compound grains composed of two, three or four. The single grains range from 5 to 10 microns and the compound from 10 to 25 microns. The powder is a grayish brown color.

Substitute Cocillana (Guarea Bangii).—Transverse sections of this bark show a well-developed cork composed of about twelve layers of clear, rectangular, thin-walled, light brown cells. The middle bark region is comparatively narrow and consists largely of rectangular, thick-walled porous stone cells arranged in several regular layers. The inner bark forms the greater portion of the specimen and shows medullary rays, bast fibers, stone cell groups and bark parenchyma. The rays appear as wavy lines of dark brownish cells and are but one cell in width.



Substitute Cocillana (Guarea Bangii).

Plate C.—1, cork; 2, stone cells; 3, medullary rays; 4, fibers; 5, bark parenchyma; 6, porous parenchyma; 7, starch; 8, crystals.

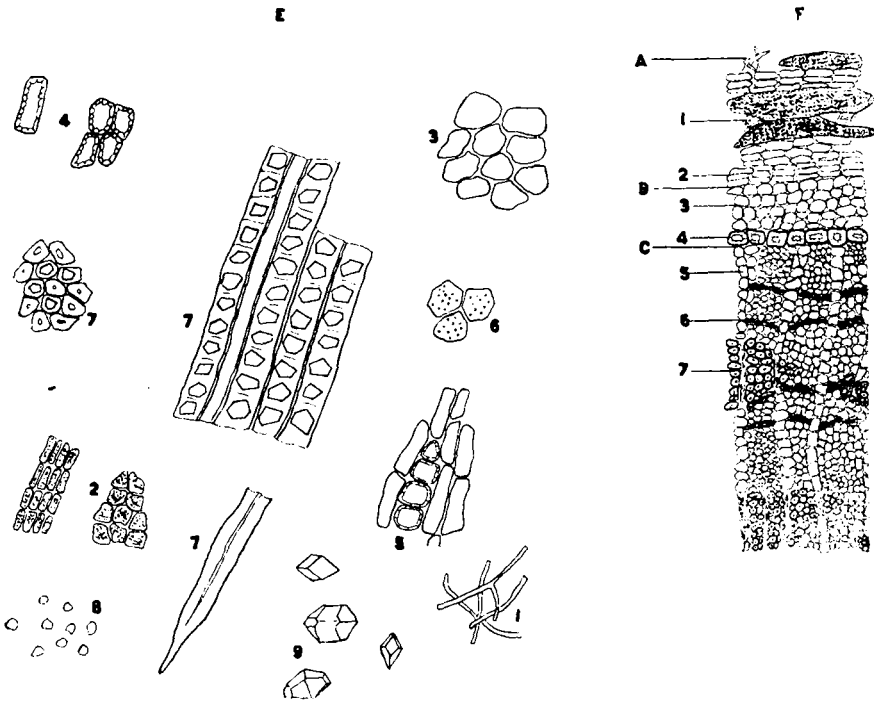
Plate D.—1, cork; 2-6, stone cells; 3, medullary rays; 4, fibers; 5, intercellular channels; A, outer bark; B, middle bark; C, inner bark.

The bast fibers are light yellow and occur in bands one or two cells in width and extending between adjacent lines of ray cells. The stone cells in this portion of the bark are represented by a few large groups which may extend over several rays and which are traversed by lines indicating the course of the rays which intersect the group. The bark parenchyma is of the usual type and shows numerous large anastomosing intercellular spaces filled with a brownish content.

The powdered material shows masses of crystal-bearing fibers together with isolated and broken fibers of the non-porous type. The yellowish stone cells occur singly for the most part and are fewer and smaller than those in genuine

cocillana. The medullary rays and cork cells show up well in powdered material. Parenchyma of the usual type together with small amounts of a distinctly porous form may be distinguished. The crystals are of the prismatic type and are not as numerous or as large as in *Guarea Rusbyi*. These crystals range between 10 and 15 microns in size. Starch is rather scarce and occurs in single grains ranging between 5 and 8 microns in size. The powder is a light chocolate-brown.

Substitute Cocillana (Guarea, Unidentified Species).—The outer surface of transverse sections of this bark occasionally shows several more or less detached layers of periderm or secondary cork. Lichens are apparent both on the outer surface of this periderm and in the spaces between it and the underlying cork layers.



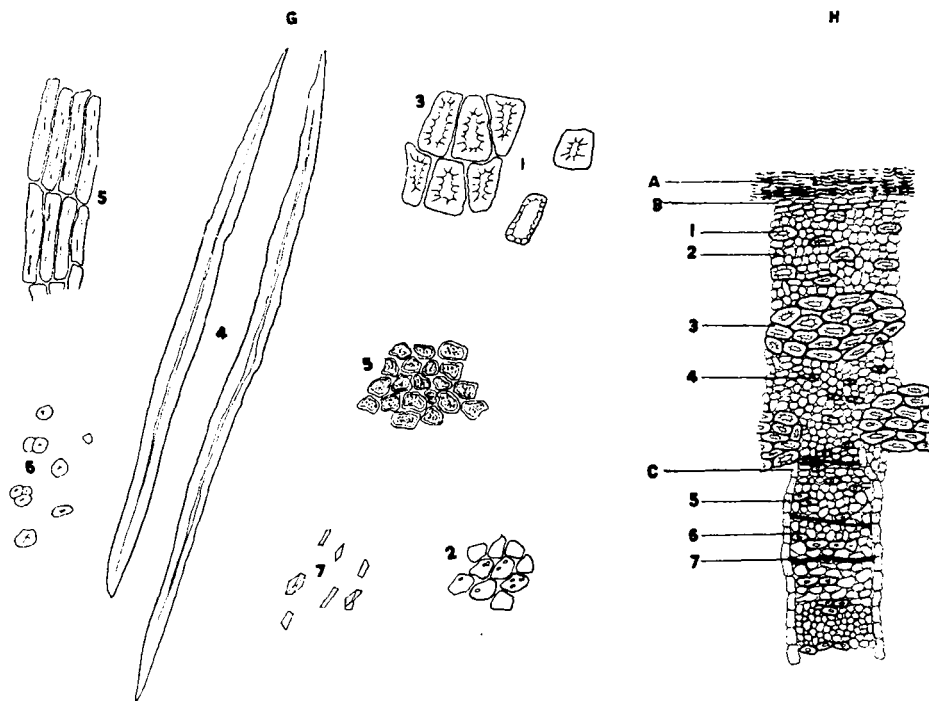
Substitute Cocillana (*Guarea spec.*).

Plate E.—1, lichen filaments; 2, cork; 3, bark parenchyma; 4, stone cells; 5, medullary rays; 6, porous parenchyma; 7, fibers; 8, starch; 9, crystals.

Plate F.—1, lichen growths; 2, cork; 3, bark parenchyma; 4, stone cells; 5, medullary rays; 6, intercellular channels; 7, fiber groups: A, outer bark; B, middle bark; C, inner bark.

The periderm cells are very dark colored and cell structure is almost indistinguishable. The cork cells are light colored, radially elongated and form a band of about five layers of cells in thickness. The middle bark region is comparatively narrow and is separated from the inner bark by an almost uninterrupted single layer of thick-walled rectangular stone cells. The inner bark shows large elliptical groups of yellowish bast fibers. The medullary rays, one cell in width, are clearly distinguished in the fiber groups but appear to be merged with the bark parenchyma in the other parts of the bark. Crystals are clearly apparent in many of the fibers.

The most prominent elements in the powder are the short crystal-bearing fibers and the numerous large prismatic crystals. Practically all of the fibers are in broken condition and a majority of them contain crystals. The majority of the stone cells are of a thin-walled porous type and they are comparatively few in number. Fragments of lichen tissues and porous parenchyma are occasionally present. Cork tissues and bark parenchyma containing crystals also occur in fair amounts. The prismatic crystals range between 15 and 35 microns in size and show many variations in form. Starch occurs sparingly and in single circular or angled grains averaging about 5 microns in size. The powder is a pinkish brown color.



Substitute Cocillana (*Nectandra spec.*).

Plate G.—1, 3, stone cells; 2, parenchyma with starch; 4, fibers; 5, cork; 6, starch; 7, crystals.

Plate H.—1, 3, stone cells; 2, bark parenchyma; 4, 6, fibers; 5, medullary rays; 7, intercellular channels; A, outer bark; B, middle bark; C, inner bark.

Substitute Cocillana (Nectandra, Unidentified Species).—The outer surface of transverse sections of this bark shows a thin band composed of four or five layers of cork cells. Owing to the dark color of this cork layer, the individual cells can only be distinguished with difficulty. The middle bark region forms the greater portion of the specimen. The stone cells of the middle bark occur in large compact masses and also as isolated cells scattered in the bark parenchyma. Bast fibers also occur in the middle bark but are more plentiful in the inner bark. The inner bark is traversed by medullary rays one or two cells in width and extending in an almost straight course. The ray cells are much darker in color than the

surrounding tissues. Bands of bast fibers together with parenchyma and sieve elements occur between the lines of ray cells. Large thin-walled cells possibly concerned with the secretion of the aromatic constituent also occur in this part of the bark.

The most striking element in the powder is the fibrous tissue, and the fibers occur singly, are non-porous, non-striated and with a slightly roughened outer wall. The fibers are very long and measurements show many reaching one millimeter in length. The stone cells usually occur in groups and are yellowish in color. The individual stone cells are angled to irregular in form and are porous. Both thick- and thin-walled types occur although the former predominate. The cork and parenchymatic tissues are of types usual in barks and are not especially characteristic. The starch occurs in single and compound grains up to three, the single grains ranging between 5 and 10 microns. The crystals are small, narrow prisms not exceeding 15 microns in length and about one-third as broad. The powder is a dull brown color.

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MISCELLANEOUS CHEMICAL PAPERS.*

THE ACTION OF LIGHT ON SOLUBLE FERRIC PHOSPHATE.

BY N. R. MUELLER.†

The action of light on so-called Soluble Ferric Phosphate of the U. S. Pharmacopoeia (1900) and on the preparations into which it enters, has given rise to a number of disturbances that interfere more or less seriously with prescription practice. One of the most unsatisfactory classes of preparations in this respect are the elixirs into which this and similar compounds enter. Because of the unsatisfactory character of these, the Elixir of the Phosphates of Iron, Quinine and Strychnine was prepared a year ago¹ according to a number of formulas. Practically all of the formulas employed were modifications of an original formula, suggested for the purpose of overcoming the unsatisfactory character of the elixir when made according to the original formula. Nevertheless, practically all of the elixirs thus prepared, which differed more or less from each other, agreed in this particular that they were alike unsatisfactory, especially when exposed to light.

Inasmuch as the complexity of the elixir precludes the proper diagnosis of the case, it seemed fruitless to continue the study of improvement along the empirical lines heretofore pursued. It seemed much more rational to ascertain which ingredient or which combination of ingredients is affected by light. Leaving out the sugar and alcohol for the present, the first series of preliminary tests was made with aqueous solutions of soluble ferric phosphate. In the second series of preliminary

* From the laboratory of Edward Kremers.

† Abstract of thesis submitted for the degree of Bachelor of Science (Pharmacy Course), University of Wisconsin, 1915.