TERTIARY FOSSIL PLANTS FROM THE DOMINICAN REPUBLIC.

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INTRODUCTION.

During the reconnaissance of the Dominican Republic, made during 1919 under the direction of T. Wayland Vaughan for the Dominican Government, fossil plants were collected at seven different localities. Most of this material is very poor, and determinable forms are confined to the five following of these localities:

At locality 8685 (D. C. 5) a brown sandy clay collected by C. W. Cooke and D. D. Condit furnished a specifically undeterminable *Inga*. At locality 8739 (D. C. 65) a gray friable sandstone furnished a specifically undeterminable *Melastomites* collected by D. D. Condit. At locality 8607 (C–21—19) C. W. Cooke collected *Calyptranthes domingensis*, new species, from a late Tertiary or Pleistocene clay, exposed in a bluff on Samaná Bay about 1½ miles east of Sanchez. The fourth locality, No. 8684 (D. C. 4), has furnished most of the determinable forms. This is a yellowish sandy clay exposed in a cut near the pier at Sanchez, and the collectors were C. W. Cooke and D. D. Condit. The fifth locality, about 1 mile west of Los Bancos, Azua Province, furnished the type of *Sophora cookei*.

The total number of forms identified is eleven, a much too small a number to give a correct idea of the botanical facies or of the geological age beyond the obvious facts that they indicate a tropical habitat and a Tertiary age. There are no traces of ferns or palms, and the majority of the forms, such as *Pisonia*, *Sophora*, *Sapindus*, *Calyptranthes*, *Bucida*, and *Bumelia*, are obviously strand types, as might well be true of the remainder. There are no traces of any of the typical plants of the Mangrove association, nor Lauraceae or Moraceae, all types normally present in tropical Tertiary floras.

The only previous record of fossil plants from the whole island, other than a reference to their presence by Gabb, is the determination by the writer of the genera *Inga*, *Nectandra*, and *Eugenia* in material collected by Miss C. J. Maury in the valley of Rio Yaque del Norte in connection with her work on the Mollusca of that region, and quoted by her in the discussion of the faunas.

LIST OF STATIONS AT WHICH DETERMINABLE FOSSIL PLANTS WERE COLLECTED.

8564 (D. C. 77A–19). Azua Province, Rio San Juan, about 1 mile west of Los Bancos. D. D. Condit, collector. May 21, 1919.

8607 (C–21–29). District of Samaná, bluff on Samaná Bay, about 1½ miles east of Sanchez. C. W. Cooke, collector. April 26, 1919.

8684 (D. C. 4). District of Samaná, cut in clay near pier at Sanchez, eastward-dipping beds, fossil plants and few mollusks. D. D. Condit and C. W. Cooke, collectors. April 1, 1919.

8685 (D. C. 5). District of Samaná. Beach 400 feet east of collection D. C. 4 (8684) Sanchez, mollusks and plants. D. D. Condit and C. W. Cooke, collectors. April 1, 1919.

8739 (D. C. 65). District of Monte Cristi, about 5½ miles up Gurabo River from Gurabo Adentro, fossils from below conglomerate. D. D. Condit, collector. May 9, 1919.

LIST OF FOSSIL PLANTS FROM THE DOMINICAN REPUBLIC.

Species.	Station.				
	8564	8607	8684	8685	8739
Poacites, species			×		
Pisonia conditi Berry, new species			×		
Inga sanchezensis Berry, new species			×		
Inga, species indeterminable				×	
Pithecolobium samanensis Berry, new species			×		
Sophora cookei Berry, new species	×				
Sapindus hispaniolana Berry, new species			×		
Calyptranthes domingensis Berry, new species		×			
Bucida sanchezensis Berry, new species			×		
Melastomites domingensis Berry, new species			×		
Melastomites species indeterminable					×
Bumelia reclinatafolia Berry, new species			×		
Guettardia cookei Berry, new species			×		

DESCRIPTIONS OF SPECIES.

Order GRAMINALES.

Family POACEAE.

Genus POACITES Brongniart.

POACITES, species.

Description.—The collection from Sanchez contains very abundant but fragmentary remains of what is evidently some grass or sedge, more probably the former. The remains are lax, linear in form,

and range in width from 2 mm. to 3 mm., with a well-marked midvein and very faintly marked parallel lateral veins. They are of no botanical importance.

Although the name *Poacites* is one that has been applied indiscriminately to a variety of Paleozoic and Mesozoic objects of varied botanical affinity, it is so appropriate for fragments of grass foliage of uncertain relationship that I have ventured to use it in the present connection.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Order CHENOPODIALES.

Family NYCTAGINACEAE.

Genus PISONIA Linnaeus.

PISONIA CONDITI, new species.

Plate 21, fig. 1.

Description.—Leaves of small size, lanceolate, and slightly inequilateral in general outline, widest in the middle and equally pointed at the apex and base. Margins entire. Texture coriaceous. Length about 3.25 cm. Maximum width about 1.1 cm. Petiole very short and stout, only a millimeter or two in length. Midrib stout and prominent. Secondaries thin, immersed; five or six alternate camptodrome pairs diverge from the midrib at angles of about 45 degrees. These small leaves are characteristically inequilateral by having the basal margin flat on one side and curved on the other with the distal margin flat on the opposite side and curved on the other side. Named for the collector, D. D. Condit.

The genus *Pisonia* contains over a dozen fossil species from the Upper Cretaceous through the Tertiary in the Northern Hemisphere. In this country there are three species in the Wilcox Eocene, two in the lower Jackson, and a fifth in the Alum Bluff formation of Florida. None of these are especially close to the present form.

The existing species of *Pisonia* are numerous and occur chiefly in the Tropics, predominantly in the Western Hemisphere. The genus is still present in the flora of Santo Domingo.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35451, U.S.N.M.

Order ROSALES.

Family MIMOSACEAE.

Genus INGA Willdenow.

INGA SANCHEZENSIS, new species.

Plate 21, fig. 11.

Description.—Leaflets of fairly large size, ovate lanceolate and markedly inequilateral in outline, widest below the middle with an acuminate tip and an acute base. Margins entire. Texture subcoriaceous. Length about 9 cm. Maximum width about 3 cm. Petiolule missing. Midrib thin. Secondaries thin, camptodrome, of a considerably different aspect in the opposite halves of the lamina. Tertiaries mostly obsolete.

The present species is rather similar to *Inga oligocaenica* Berry [1] from the Culebra formation of Panama. Less than a score of fossil species are known, the genus being sparingly represented in the European Tertiary, although the modern species, which number over 200, are confined to the American Tropics. There are several species in the Antilles, but the majority of the recent forms are continental. Among modern forms that have come to my notice *Inga maritima* Bentham of Brazil is much like the present fossil species.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35452, U.S.N.M.

Genus PITHECOLOBIUM Martius.

PITHECOLOBIUM SAMANENSIS, new species.

Plate 21, fig. 2.

Description.—Leaflets broadly ovate and inequilateral in general outline, sessile, with a blunt apex and a broadly rounded base. Margins entire. Texture subcoriaceous. Length about 3.2 cm. Maximum width 1.8 cm. Midrib stout, curved. Secondaries thin, about 9 pairs diverge from the midrib at wide angles and fairly regular intervals, curve upward and are regularly camptodrome. Tertiaries comprise marginal loops and percurrent nervilles between the secondaries.

This leguminous leaflet is closely allied to the few fossil species that have been referred to this genus and to numerous existing species, as for example, the leaflets of *Pithecolobium unguis-cati* Linnaeus) Bentham, a tree widespread over the Antilles. More) than 100 existing species are known. They occur in both Tropics but perhaps three-fourths are American, many of them, such as the widely planted rain tree (*P. saman* Bentham), being large trees.

[1] Berry, E. W., U. S. Nat. Mus. Bull. 103, p. 32, pl. 16, fig. 2, 1919.

The fossil species heretofore recognized include two from the Wilcox Eocene, one from the Catahoula formation (Oligocene) of Louisiana, one from the supposed lower Miocene of Columbia, and two from the Pliocene of Bolivia. The present species is most suggestive of *P. oligocaenum* Berry,[2] from which it differs in its rounded base, its sessile habit, and more numerous secondaries.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35453, U.S.N.M.

Family PAPILIONACEAE.

Genus SOPHORA Linnaeus.

SOPHORA COOKEI, new species.

Plate 21, fig. 12.

Description.—Leaflets elliptical and slightly inequilateral in general outline with an equally rounded apex and base, the latter slightly the wider. Texture coriaceous. Length about 2.5 cm. Maximum width, at or below the middle, about 13.5 mm. Leaflets sessile. Midrib stout and prominent. Secondaries mediumly stout, five subopposite to alternate pairs diverge from the midrib at wide angles and form a wide camptodrome loop in the marginal region. Tertiaries obsolete. Named for C. W. Cooke.

This species is unfortunately based upon a single specimen, so that the complete characters and limits of variation can not be made out. It is exceedingly close to a number of previously described forms from the Tertiary of the southern United States as well as Europe, and to the leaflets of several existing species of the American tropics, as for example, *Sophora tomentosa* Linnaeus, a cosmopolitan tropical strand plant distributed through the agency of ocean currents by means of its buoyant seeds. The present species is similar to *Sophora henryensis* Berry[3] and to the smaller leaflets of the very abundant *Sophora wilcoxiana* Berry,[4] both species of the Wilcox Eocene. It is also similar to *Sophora claiborniana* Berry[5] of the Claiborne Eocene and to *Sophora europaea* Unger of the later Tertiary of Europe.[6]

There are about 25 existing species of shrubs and small trees referred to the genus Sophora, scattered in the warmer parts of both hemispheres and found on all tropical seashores.

Occurrence.—Locality No. 8564. Azua Province, Rio San Juan, 1 mile west of Los Bancos.

Holotype.—Cat. No. 35454, U.S.N.M.

[2] Berry, E. W., U. S. Geol. Surv. Prof. Paper 98M, p. 239, pl. 55, fig. 10, 1916.
[3] Berry, E. W., U. S. Geol. Surv. Prof. Paper 91, p. 243, pl. 52, fig. 2, 1919.
[4] Idem., p. 241, pl. 47, figs. 1-13.
[5] In press.
[6] Unger, F., Foss, Fl. v. Sotzka, p. 57, p. 42, figs. 1-5, 1850.

Order SAPINDALES.

Family SAPINDACEAE.

Genus SAPINDUS Linnaeus.

SAPINDUS HISPANIOLANA, new species.

Plate 21, fig. 3.

Description.—Leaflets of small size, ovate lanceolate in general outline with a broad abrutply pointed base and a much extended acuminate tip. Margins entire. Texture subcoriaceous. Length about 4.5 cm. Maximum width, in the lower half of the leaflet, about 1.3 cm. Petiolule missing or wanting. Midrib mediumly stought; straight. Secondaries thin, mostly immersed; numerous equally spaced camptodrome pairs diverge from the midrib at wide angles. Tertiaries obsolete.

These small leaflets appear to represent a new species of Sapindus. They are approximately equilateral and smaller than most of the fossil species but may be compared with *Sapindus georgiana* Berry[7] from the lower Jackson of Georgia, which, except for their somewhat narrower form, are exceedingly close to the present species. The existing species are numerous in the warmer parts of both hemispheres, including several species of soapberry of the Antillean beaches. Among these the present species is very similar to *S. marginatus* Willdenow of the Florida keys, which is a rare and little known form that may be present still in the Antilles. The fossil species are exceedingly numerous from the Upper Cretaceous through the Tertiary.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35455, U.S.N.M.

Order MYRTALES.

Family MYRTACEAE.

Genus CALYPTRANTHES Swartz.

CALYPTRANTHES DOMINGENSIS, new species.

Plate 21, figs. 9, 10.

Description.—Obovate subsessile leaves of small size and leathery texture, with a broadly rounded tip, widest above the middle, from which it tapers to a cuneate base. Margins entire, evenly rounded. Length about 2.5 cm. Maximum width about 1.6 cm. Midrib stout, prominent. Secondaries thin, immersed, numerous, and subparallel; they diverge from the midrib at wide angles, pursue a rather straight outward course, and are abruptly camptodrome

[7] Berry, E. W., U. S. Geol. Surv. Prof. Paper 84, p. 143, pl. 27, fig. 11, 1914.

in the marginal region. Tertiaries thin, subparallel, with secondaries with which they unite at acute angles.

This species has the characteristic venation of the genus, known in the fossil state only from the Wilcox Eocene of the United States[8] and the Gatun formation of the Canal Zone.[9] In form the present species approaches *Bumelia*, but the venation is decidedly different. A somewhat similar venation is displayed in the genus *Chrysophyllum* of the family Sapotaceae where, however, the normally pointed leaves are not typically, but occasionally obovate or retuse, and in which the venation is not identical with the fossil. The genus *Calyptranthes* contains about 70 existing species ranging from Mexico and the West Indies to southern Brazil and exclusively American except for certain doubtfully determined forms from the Fiji Islands, Africa, Mauritius, and Java. The present fossil species may be compared with the existing *Calypyranthes syzygium* (Linnaeus) Swartz, a shrub or small tree of Haiti and other islands of the Antilles.

Occurrence.—Locality No. 8607. Bluff on Samaná Bay, about 1½ miles east of Sanchez, District of Samaná.

Holotype.—Cat. No. 35456, U.S.N.M.

Family COMBRETACEAE.

Genus BUCIDA Linnaeus.

BUCIDA SANCHEZENSIS, new species.

Plate 21, fig. 8.

Description.—Leaves obovate in form, widest distad a short distance below the broadly rounded and slightly emarginate apex, narrowing rapidly to the narrowly cuneate or decurrent base. Margins entire. Texture coriaceous. Length about 5 cm. Maximum width about 3.75 cm. Petiole missing. Midrib stout and prominent. Secondaries ascending and camptodrome in the wider distal part of the leaf becoming flatter and straighter in the narrowed basal half of the leaf where their camptodrome endings become modified to form a pseudomarginal vein. Tertiaries obsolete.

This characteristic leaf appears to represent a Tertiary species of *Bucida*, a genus which is monotypic in the existing flora, its single living species being a strand and coastal marsh plant of the perimeters of the Caribbean and throughout the Antilles, and just reaching the tip of the Florida peninsula. The genus has not heretofore been recognized in the fossil state.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35457, U.S.N.M.

[8] Berry, E. W., U. S. Geol. Surv. Prof. Paper 91, p. 319, pl. 90, fig. 5, 1916.
[9] Berry, E. W., U. S. Nat. Mus. Bull. 103, p. 39, pl. 18, fig. 1, 1919.

Family MELASTOMATACEAE.

Genus MELASTOMITES Unger.

MELASTOMITES DOMINGENSIS, new species.

Plate 21, fig. 7.

Description.—The very fragmentary specimens representing the genus *Melastomites* do not really merit a specific name since they are too meager for any adequate diagnosis. Since, however, more representative material may be a long time in coming to light, and it is important to have a name of this form to use in discussion, and since also where a fossil form is certainly not a representative of one already described and which can be subsequently recognized there is no reason for using "species" instead of a real name.

Fragments indicate an ovate form pointed at both ends, with an entire margin, a prominent and stout curved midrib, stout acrodrome primaries, and less stout marginal acrodrome vein on either side which may be modified to slightly arch from end to end of the straight tertiaries extending outward from the lateral primaries. The latter are united with the midrib by thin, close-spaced, transverse-curved, inosculating tertiaries. The indicated size of these leaves is about 8 cm. in length and 3 cm. in maximum width.

A small fragment of a leaf of *Melastomites* of either this or an unknown species is contained in a collection made by D. D. Condit from a gray friable sandstone lying beneath a conglomerate 5½ miles up the Rio Gurabo from Gurabo Adentro (Loc. 8739).

The genus *Melastomites* was proposed by Unger [10] and contains several species in the Oligocene, Miocene, and Pliocene of Europe. A form referred to this genus from the Upper Cretaceous of Westphalia is probably Lauraceous. A single American species is known from the Wilcox Eocene,[11] and a second has been described recently from the Culebra formation of Panama.[12] The family is a large one in the existing flora, about 2,500 of the 3,000 species being found in the American Tropics.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35458, U.S.N.M.

[10] Unger, F., Gen. et sp. pl. foss., p. 480, 1850.
[11] Berry, E. W., U. S. Geol. Surv. Prof. Paper 91, p. 327, pl. 97, figs. 1-3, 1916.
[12] Berry, E. W., U. S. Nat. Mus. Bull. 103, p. 40, pl. 18, fig. 2, 1918.

Order EBENALES.

Family SAPOTACEAE.

Genus BUMELIA Swartz.

BUMELIA RECLINATAFOLIA, new species.

Plate 21, fig. 4.

Description.—Exceedingly coriaceous obovate leaves with slightly revolute margins, widest in the distal half, with a broadly rounded, sometimes slightly emarginate, apex and a gradually narrowed cuneate base. Length about 4.1 cm. Maximum width about 1.8 cm. Petiole short and very stout, about 2 mm. in length. Midrib stout and prominent, usually slightly curved. Secondaries immersed in the thick substance of the leaf.

With the exception that the secondaries are immersed in the leaf substance, this species is identical with the existing *Bumelia reclinata* Ventenat of the North American mainland. It is, however, almost equally close to several Antillean forms, as, for example, the Ants wood or Downward Plum (*Bumelia angustifolia* Nuttall).

The genus *Bumelia*, with over a score of existing species, is confined to the warmer parts of America, although present in Europe during the Tertiary. Its fossil species are numerous from the Upper Cretaceous onward, and represented in the Wilcox Eocene, Vicksburg and Alum Bluff formation.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35459, U.S.N.M.

Order RUBIALES.

Family RUBIACEAE.

Genus RUBIACEAE Endlicher.

GUETTARDA COOKEI, new species.

Plate 21, figs. 5, 6.

Description.—Leaves of small to medium size, elliptical in general outline, equally pointed at both ends, with full entire margins and subcoriaceous texture. Length ranging from 4 cm. to 6 cm. Maximum width, midway between apex and base, ranging from 2 cm. to 3 cm. Petiole missing. Midrib stout, straight, and prominent on the underside of the leaf. Secondaries numerous, fairly stout, prominent on the underside of the leaf; about nine subopposite to alternate pairs diverge from the midrib at fairly regular intervals and angles of about 60° to 70°; they are at first rather straight and then

curve upward in a subparallel manner and are camptodrome. Tertiary system comprises intermediates between and subparallel with secondaries and numerous percurrent and well-marked nervilles.

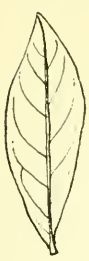
Only a single fossil species of *Guettarda* has, so far as I know, hitherto been recognized. This is a quite different form from the Wilcox Eocene of the Mississippi embayment region. The recent species number about 50 and are chiefly found in tropical America, one—a small coastal tree—reaching southern peninsular Florida (*Guettarda elliptica* Swartz), which has leaves much like those of the present fossil species. The genus is well represented at the present time in the Bahamas and throughout the Antilles.

Occurrence.—Locality No. 8684. Cut in clay near pier at Sanchez, District of Samaná.

Holotype.—Cat. No. 35460, U.S.N.M.

EXPLANATION OF PLATE 21.

FIG. 1. *Pisonia conditi* Berry, new species. Locality 8684.
2. *Pithecolobium samanensis* Berry, new species. Locality 8684.
3. *Sapindus hispaniolana* Berry, new species. Locality 8684.
4. *Bumelia reclinatafolia* Berry, new species. Locality 8684.
5, 6. *Guettarda cookei* Berry, new species. Locality 8684.
7. *Melastomites domingensis* Berry, new species. Locality 8684.
8. *Bucida sanchezensis* Berry, new species. Locality 8684.
9, 10. *Calyptranthes domingensis*, Berry, new species. Fig. 10 enlarged twice to show venation. Locality 8607.
11. *Inga sanchezensis* Berry, new species. Locality 8684.
12. *Sophora cookei* Berry, new species. Locality 8564.



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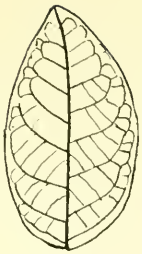

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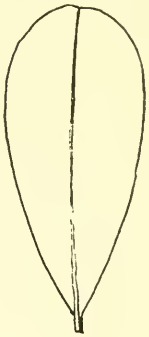

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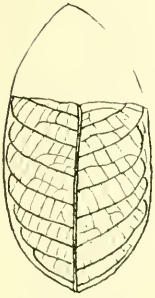

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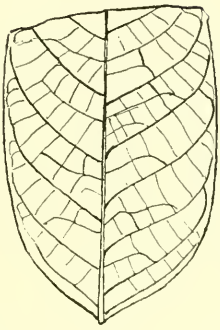

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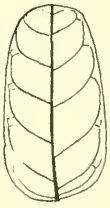

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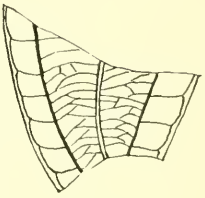

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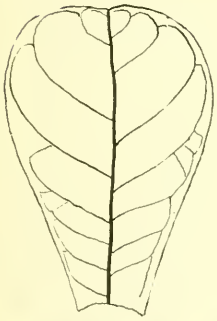

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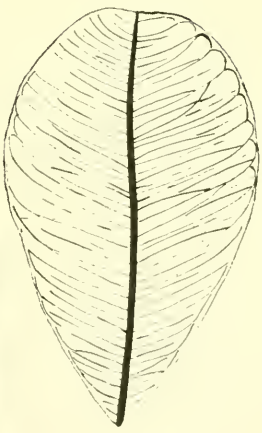

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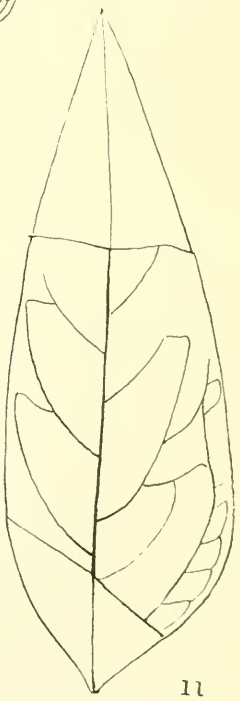

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TERTIARY FOSSIL PLANTS FROM THE DOMINICAN REPUBLIC.

FOR EXPLANATION OF PLATE SEE PAGE 127.