

arises as to the validity of some formulas that have been assigned to minerals which have been separated by heavy solutions.

The calcium carnotite will be described in detail by Mr. Merwin and the author in a later paper.

MINERALOGY.—*Two varieties of calciovolborthite (?) from eastern Utah.* W. F. HILLEBRAND, Bureau of Standards, and H. E. MERWIN, Geophysical Laboratory. To appear in the American Journal of Science and the Zeitschr. Kryst. Mineral.

Descriptions in some detail will appear in the above named journals of two hydrous minerals, one essentially a vanadate of copper, the other an arsenovanadate of copper and calcium. The minerals were briefly mentioned by J. M. Boutwell in Bulletin 260 of the U. S. Geological Survey a number of years ago, but analyses were not published. Better material not being forthcoming the analyses are now put on record, together with results of recent optical study. For the present both minerals are referred to calciovolborthite, since the molecular ratios show closer relationship to that imperfectly described species than to any other. One variety is yellow green, with little arsenic, the other, highly arsenical, is greenish yellow. The latter is pseudomorphic after the former. The locality of occurrence is Richardson, in the canyon of the Grand River, Utah.

BOTANY.—*Ivory palms in Panama.* O. F. Cook, Bureau of Plant Industry.

New materials for the study of the ivory palms (Phytelephantaceae) have become available in the collections of economic plants secured in Panama in 1911-12 by Prof. H. Pittier of the United States Department of Agriculture. The series is more extensive than any obtained by previous explorers and throws light on the geographical distribution, morphology and classification of this long-neglected family. It may be that special students and collectors of palms have felt at liberty to neglect the ivory plants because some botanists have denied that Phytele-

phas is really a palm, tho there is no adequate reason for such a separation. The nearest relatives of *Phytelephas* are to be found in other American families, such as the *Cocaceae* and *Manicariaceae*, whose status as true palms has never been questioned.¹

GEOGRAPHICAL DISTRIBUTION OF IVORY PALMS

The new specimens from Panama were obtained in four different localities; two near the Caribbean Coast, one near the middle of the Isthmus and one near the Pacific Coast. In each case a different species was secured, and all four of the species appear to be different from two others previously represented in the Economic Herbarium of the Department of Agriculture. In addition to the places where specimens were collected Professor Pittier heard reports of the existence of ivory palms to the north of the Isthmus, and this information is substantiated by Dr. A. E. Heighway of Bocas Del Toro, Panama, who states that ivory palms exist in small numbers in several places, most of them back a few miles from the coast, along the foothills. Thus it appears that the geographical distribution of the ivory palms extends beyond the Isthmus, so that the family *Phytelephantaceae* must be included in the flora of North America.

The genus *Phytelephas* was based originally on two Peruvian species, from the eastern slopes of the Andes. One species has been described from the Pacific coast of Ecuador and another from the Magdalena Valley of Columbia. Thus only four definitely localized species are known from South America to six in the region of Panama. The existence of so many local species in the narrow limits of the Isthmus makes it seem probable that more careful study of the South American members of the group will result in the discovery of a much larger number of specific forms. Even on general biological grounds it would not be expected that species with such large heavy seeds would retain their continuity over wide areas of distribution. The first requirement for an adequate taxonomic treatment of the group is to

¹ O. F. Cook, Relationships of the ivory palms. Contributions U. S. National Herbarium 13: 133. 1910.

learn the characters which enable the species to be distinguished. In this respect the materials from Panama are of special value for they show several new lines of specialization not previously employed in the diagnosis of species.

NEW CHARACTERS IN IVORY PALMS

External sculpture of fruits. The species are all alike in having the external shell of the fruit divided into raised polygonal areas, each bearing a pyramidal tubercle or spine, but the areas are larger in some species than in others and have larger or more robust spines. In coarsely sculptured species the spines attain a length of about 2 cm.; in other species they are only half as long.

Cortical fibers. These form a lining of close-set bristles on the inner wall of the external shell of the fruit, to which they are firmly attached. Indeed, the shell seems to be formed by a progressive hardening of the corky tissue in which the bases of the fibers are embedded. The species differ notably in the development of the cortical fibers, some having only short weak fibers and others long stiff fibers. In most cases the fibers are about as long as the external spines, but they may be longer or shorter.

Pulp fibers. The space between the cortical fibers and the true mesocarp fibers that form a coating around the nuts is occupied at first by a fleshy pulp. In some species the pulp seems to be entirely fleshy, so that only an empty space is left inside the cortical lining after the pulp has disappeared. In other species there is an open framework of loosely connected fibers, especially near the base of the fruit.

Mesocarp fibers. In addition to the pulp fibers there is a complete fibrous sheath around each of the nuts, not unlike the mesocarp of some of the cocoid palms, except that the fibers are not attached to the shell of the nut. Some species of ivory palms have the mesocarp fibers rather coarse and stiff, while in others they are very fine and thin and are compacted into a fabric, tough in some cases and brittle in others. Finally there are cases where the mesocarp fibers are so slightly developed that no coherent layer is formed and the dried pulp breaks away from the surface of the nuts in angular scales. The mesocarp sheath may

be closely adherent to the endocarp or shell of the nut, or free and readily separable from the nut. One species has the sheath much larger than the nut as though separated in the fresh state by a layer of pulp.

Style. In most of the species the style disappears in advance of the maturity of the fruit, but one of the new species from Panama has a persistent woody style.

Columella. Most of the species have a short column or bundle of compacted fibers suspended from the center of the cortex of the fruit in the position of a placenta. The species with the persistent style also has a more specialized, persistent columella extending down between the nuts nearly to the position of the hilum.

Hilum. The hilum is very prominent in some species and nearly flat in others. The shape differs from long oval or elliptical to nearly round. The fibrovascular pits are irregular and scattered over the surface of the hilum in some species while in others the pits are nearly round and confined to a relatively small area in the middle of the hilum.

Adhilum. This name is applied to a peculiar specialization of the shell of the nut to form a distinct process or spine at the upper angle of the margin of the aperture, close to the hilum. In some species the adhilum is a small rounded prominence or angular tooth, but in other cases it is developed into a slender acicular spine. The adhilum is formed of the same hard material as the shell of the nut, but is so brittle that it is usually broken off in removing the mesocarp, which may explain why it has not been noticed before.

Seed coats. The shell of the nut has a lining of fine fibrous material through which the branches of the raphe are distributed. In some species this lining is free from the true seed coat and in others completely united with it. In the former case the branches of the raphe are not exposed, but appear as raised veins on the lining of the shell. In the latter case the branches of the raphe are exposed on the kernel as it comes from the shell, because the fibrous lining is torn apart into two irregularly separated layers, one adherent to the inner surface of the shell, the other to the true seed coat.

DIAGNOSES OF NEW SPECIES FROM PANAMA

Phytelephas pittieri. Trunk erect, attaining a height of about 8 meters, with a diameter of about 25 cm.; leaves about 12 with short petioles and about 70 pairs of pinnae equally spaced along the rachis; male inflorescence cylindrical, about 1.20 meters long; male flowers with 300-400 stamens, fruits 8-9 in a head, with large external spines. Collected at Puerto Obaldia, Panama, August, 1911, by H. Pittier (No. 4323); type in U. S. National Herbarium, No. 716082.

Phytelephas cornutus. Trunk decumbent, creeping by numerous roots; leaves about 20, with about 90 pairs of equally spaced pinnae; fruits 5-6 in a head, with 6-7 nuts in each fruit; cortex with rather long and slender spines, and a persistent woody style; cortical fibers long and slender, not densely crowded, compacted under the style into a persistent hardened columella about 2 cm. long; pulp and mesocarp fibers only slightly developed, the latter forming a very thin fragile layer adherent to the surface of the nut; hilum surrounded by a prominent margin bearing the adhilum as a long slender spine. Collected in the Rio Fató Valley, near Nombre de Dios, Panama, August 16, 1911, by H. Pittier (No. 4230); type in U. S. National Herbarium, No. 691786.

Phytelephas brevipes. Trunk very short; male inflorescence about 15 cm. long; fruits broad and flat, or slightly depressed in the middle, 9 in a head, with 6 nuts in a fruit; cortex with rather coarse robust spines and rather short cortical fibers; pulp fibers distinct, but few; mesocarp fibers abundant, formed into a tough cloth-like sac entirely free from the nut and with an open space between; nuts rather large, usually strongly compressed; adhilum submarginal, transverse, triangular, carinate on the upper face. Collected at Gasapasabana, Upper Mamoni River, Panama, October, 1911, by H. Pittier (No. 4473); type in U. S. National Herbarium, No. 679633.

Phytelephas brachinus. Trunk robust, decumbent, attaining a length of about 3 meters and a diameter of about 40 cm.; fruits somewhat rounded or lenticular, scarcely depressed in the middle, but sloping to the sides, 5-6 in a head, with 5-6 nuts in each fruit; cortex with rather small slender spines, cortical fibers very short and weak; pulp fibers slender and sparse; mesocarp fibers very delicate and weak, but forming a rather tough, parchment-like membrane adherent to the bony endocarp; nuts short and with the upper surface sloping outward; hilum small, oval or elliptic, not prominent, with a cluster of small rounded pits near the middle; adhilum represented by a small rounded triangular prominence. Collected at Garachiné, San Miguel Bay, near the south coast of Panama, by H. Pittier; type in U. S. National Herbarium, No. 691785.

Phytelephas brachelus. Fruits obconic or obpyramidal, with a strong central depression, 9 in a head, with 6-7 nuts in each fruit; cortex with very short spines, about 0.5 cm.; cortical fibers well developed, attaining a length of about 1 cm.; pulp and mesocarp fibers thin, the latter

rather abundant and forming a rather thick, partly adherent covering of the endocarp; nuts rather long; hilum basal, somewhat prominent, nearly circular, with scattered coarse pits; adhilum represented by a slight swelling above the margin. Supposed to come from Panama, but the locality unknown. Fruit head received from J. R. Smith, Waterbury, Conn., in Economic Herbarium of U. S. Department of Agriculture, bearing U. S. National Herbarium No. 691784.

More extended descriptions with numerous photographic illustrations have been prepared for publication, in connection with a general review of the South American species.

BOTANY.—*A new genus of davallioid ferns.*¹ WILLIAM R. MAXON.

In revising the treatment of the pteridophyta for the second edition of the *Flora of the Southeastern United States* the writer has found it necessary to remove from the genus *Odontosoria* the species known latterly as *Odontosoria clavata* (L.) J. Smith and to refer it to a new genus, *Sphenomeris*. The publication of this volume having been delayed, it seems desirable to publish this name elsewhere, since a paper² dealing with the species of true *Odontosoria* (with references to *Sphenomeris*) is already in proof and may conflict in date of publication with that of the *Flora*.

In the unpublished treatment of *Odontosoria* just mentioned it is pointed out: (1) That the genus *Odontosoria*, as recognized by Diels in the *Pflanzenfamilien* of Engler and Prantl, comprises two sections or subgenera, the first (*Eu-Odontosoria*) containing rather small species of erect or ascending habit and determinate growth, the second (*Stenoloma*) containing three nominal species of indefinite scandent growth; (2) that these two groups are entitled to recognition as distinct genera; and (3) that, adopting this view, it is necessary to apply the name *Odontosoria* to the second group, the large climbing species, rather than to the first, as has been done erroneously by Diels. The grounds for this disposition are then presented, together with a review of the

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² *Contr. U. S. Nat. Herb.* **17**, part 2 (unpublished).