NATURAL HISTORY OF PARADISE KEY AND THE NEARBY EVERGLADES OF FLORIDA.

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[With 64 plates.]

Paradise Key, an island in the heart of the Everglades of Florida, is almost unique from a biological point of view, presenting as it does a remarkable example of a subtropical jungle within the limits of the United States in which primeval conditions of animal and plant life have remained unchanged by man, and thus offering a striking contrast to the keys along the coast of Florida as well as to other Everglade keys in which normal biological conditions have been greatly disturbed by destructive fires, clearing of forests, or the construction of drainage canals, which not only affect the original physical conditions, but at the same time permit aquatic animals and plants previously unknown to penetrate into the Everglades. The region is also remarkable for the fact that it is a meeting place for many temperate and tropical types of plants and animals. On this account and from the fact that it offers a virgin field for collectors in most branches of natural history, it seems of the highest interest and importance that a careful study of its biological features should be made.

The writer was directed by the Secretary of Agriculture to make a survey of the region, which was begun in September, 1917, and resulted in collections in nearly all branches of natural history, the material of which has been studied and classified by specialists and deposited in the collections of the Smithsonian Institution, the United States National Museum, the Bureau of Entomology, and the Biological Survey.[1]

It is impossible within the limits of the present paper to give a detailed account of the various species of plants and animals collected, or to treat fully of the climatic, physical, and ecological con-

[1] For hospitality and aid during the survey the writer acknowledges indebtedness to those in charge of Paradise Key, particularly to the Park Warden, Mr. Charles A. Mosier, a born woodsman and accomplished naturalist.

ditions of Paradise Key, but the writer hopes to portray some of the most interesting animals and plants of the key itself as well as of the surrounding Everglades, and to call attention to their interrelationship and interdependence, in the parts which they play as hosts or guests, parasites or victims, food or feeders. Among the groups considered will be plants of the marshes and sloughs, the forest trees and their epiphytal covering of orchids, resurrection ferns, and bromeliads; climbing lianas, which here reach giant proportions; the native palms of southern Florida, and the plants peculiar to the pineland region, especially the saw palmetto and the interesting cycad, *Zamia floridana*.

Among the animals to be described are some of the most interesting mollusks, spiders, insects, fishes, bactrachians, reptiles, birds, and mammals; and finally an account will be given of the little-known aboriginal Indians who inhabited southern Florida at the time of its discovery by Ponce de Leon, as well as of their successors, the Seminoles, who still live in the Everglades.

ROYAL PALM STATE PARK.

The region under consideration lies in Dade County, Florida, about 90 miles south of Lake Okeechobee and 37 miles directly southwest of Miami, in latitude 25° 24′ north and longitude 80° 38′ west of Greenwich. In 1915 the State of Florida set aside Paradise Key, together with an area of adjacent swamp land, as a public park. This, together with an additional tract afterwards donated for the purpose, has received the name Royal Palm State Park. The park, which has an area of 3 square miles, includes, besides the key itself and adjacent marshland, a corner of pineland, called Palma-vista, the vegetation of which is similar to that of other pinelands of southern Florida.[1]

Paradise Key owes its preservation from fires and other destructive agencies chiefly to its isolation and to a deep slough near its eastward border which never becomes dry, even during periods of the greatest drought. Its conversion into a state park insures its conservation as a plant reserve and bird sanctuary and as a permanent field for biological research. Similar measures have been taken in other parts of the United States, and it is hoped that the example will be widely followed.

Dr. H. C. Oberholser, of the United States Biological Survey, in commending the creation of this park points out that the refuge which it offers to birds is one which is very greatly needed in southern Florida, and that its location is admirable for the purpose of preserving the wild life of the region.

[1] For an account of the creation of Royal Palm State Park the reader is referred to the account of Mrs. W. S. Jennings in the Tropic Magazine of April, 1916, and to an historical sketch of Paradise Key by Dr. J. K. Small in the Journal of the New York Botanical Garden, vol. 17, p. 41, 1916.

"The decrease of many species of birds," he says, "has been so marked in recent years that it is of great importance to have for them places where they can breed in undisturbed seclusion. If there do not already exist colonies of herons on this reservation, it would be very desirable to induce these birds, if possible, to take up their residence in the swamps, which I understand are a part of the park, so they could be protected, as they must be, if the various species of heron are to be preserved from extinction. For many birds, also, the Royal Palm State Park should prove to be a desirable haven and refuge, and it will undoubtedly help to preserve from extinction many of the interesting species that inhabit southern Florida."

CLIMATE AND RAINFALL.

Southern Florida, though usually blessed with an almost tropical climate, is sometimes subject in the winter months to severe storms from the north, in which the thermometer falls below the freezing point. But this is also true of some parts of the island of Cuba, which has repeatedly suffered frosts that have done great damage to the more tender vegetation. Along the coast, where the influence of the warm Gulf Stream is felt, much less damage has been done than farther inland. That these occasional cold spells have not seriously injured the vegetation of Paradise Key is shown by the presence in its flora of noble royal palms more than 100 feet high, tropical orchids, and other tender plants, and insects belonging to types essentially tropical. On the other hand many temperate species, both of plants and animals, extend their range southward to this region; although, as far at least as the animals are concerned, the temperate species are here represented by varieties or subspecies which take the place of the northern types.

Generally speaking, there is a rainy season during the summer and autumn and a dry season during the winter months, but the limits of these seasons are not constant or well defined. During the rainy season the Everglades are flooded with water, while in the dry winter months they are dry enough to be crossed on foot. The accompanying illustrations (pl. 1) show Paradise Key in the distance with the Everglades, both dry and flooded, in the foreground.

PHYSICAL GEOGRAPHY OF THE EVERGLADES.

The Everglades owe their characteristic features of marsh, sloughs, and shallow ponds, to their recent origin and their slight elevation above the sea level. Their general surface is not high enough to permit the formation of deep valleys by eroding streams; and the water appears to ooze slowly seaward, on the west side toward the southwest and on the east side toward the southeast.[1]

[1] See Sanford, Samuel, The topography and geology of southern Florida, in Second Annual Report of the Florida State Geol. Survey, p. 189. 1909.

The rock which underlies the Everglades and appears on the surface on the keys and pinelands of southern Florida is known to geologists as Miami oolite. Its outcrop at Long Key, the great rock barrier adjacent to the northern boundary of Royal Palm State Park, as well as at other points, was noticed by Army officers at the time of the Seminole War. Specimens from the vicinity of Paradise Key in the collection of the United States National Museum contain fossil bivalve shells; others (pl. 2) contain vermicellilike casts of annelids, and others hollow tubes, apparently formed by crustaceans in soft mud, now lined with crystalline calcite. This oolitic limestone, as Dr. T. Wayland Vaughan has pointed out, is not of animal origin, but a chemical precipitation of calcium carbonate in the form of minute granules; it plays a much greater part in the construction of Florida reefs than corals.[1] It was originally deposited in a shallow sea, just as similar sediment is now being precipitated in the Bahama Islands. Dr. Karl F. Kellerman, of the Bureau of Plant Industry, made a careful bacteriological study of samples of water and calcareous mud from the ocean bottom near the Bahamas and the Florida keys. He found the water laden with calcium bicarbonate and filled with certain bacteria which liberated ammonia. The action of the ammonia on the calcium bicarbonate caused a precipitation of calcium carbonate, which assumed the form of oolite. The bacterial origin of calcium carbonate had previously been suggested by the late George H. Drew of the Carnegie Institution, who succeeded in isolating an organism which he named *Bacterium calcis*. Doctor Kellerman repeated his experiments and confirmed his observations, referring the above-mentioned organism to the genus Pseudomonas, under the name *Pseudomonas calcis*.[2]

WATER PLANTS.

The deep slough to the eastward of Paradise Key (pl. 3), which has already been mentioned as its chief protection from destructive agencies, is filled with a dense growth of water plants: yellow water lilies, or spatter-docks (pl. 4); Sagittarias, with broad, three- petaled white flowers (fig. 1); pickerel weed, with spikes of blue flowers (fig. 2); water arums (fig. 3) related to our jack-in-the-pulpit and with roots equally filled with needle-like raphides which burn the mouth like fire; white-flowered floating hearts (fig. 4) resembling miniature pond lilies, but not botanically related to them; and tall water weeds (*Oxypolis filiformis*) belonging to the same family as the celery, but with hollow, quill-like tubes for leaves.

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[1] See Vaughan, T. Wayland, Sketch of the geologic history of the Florida coral reef tract and comparison with other coral reef areas. In Journ. Wash. Acad. Sci. 4: 26. 1914. See also "Corals and formation of coral reefs" by the same author, in the present volume.

[2] See Kellerman, Karl F., and Smith, N. R., Bacterial precipitation of calcium carbonate. Journ. Wash. Acad. Sci. 4: 400. 1914.

At first glance these water plants appear to be of no economic significance; but it is they which make animal life possible in the

FIG. 1.—*Sagittaria lancifolia.* *a*, GROWING IN DAMP SOIL; *b*, GROWING IN WATER. MUCH REDUCED.

FIG. 2.—BLUE-FLOWERED PICKEREL WEED, *Pontederia cordata*. MUCH REDUCED.

Everglades. Aquatic insect larvæ and water snails and bivalves which feed on their roots and submerged stems, yield food to small fishes; fishes, crustaceans, frogs and surface insects are the food of larger fishes, snakes, alligators, and birds. One of the most common occurrences is to see a magnificent osprey swoop down upon what appears a grassy prairie and rise with a good-sized fish in its talons.

FIG. 3.—WATER ARUM, *Peltandra virginica*. ITS ACRID STARCHY ROOT, CALLED TUCKAHOE, WHEN THOROUGHLY COOKED WAS EATEN BY THE INDIANS OF VIRGINIA. MUCH REDUCED.

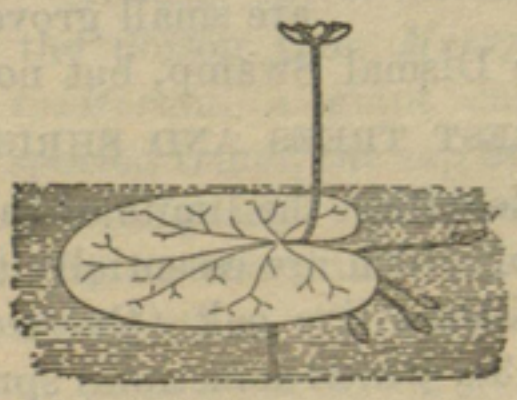

FIG. 4.—FLOATING HEART, *Nymphoides aquaticum*, A DAINTY WATER-PLANT OF THE EVERGLADES.

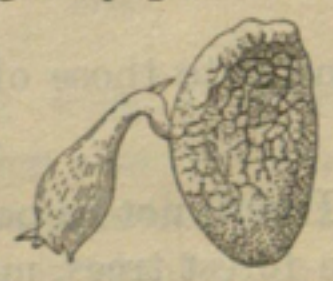

FIG. 5.—GERMINATING SEED OF THE WHITE SPIDER-LILY, *Crinum americanum*, SHOWING THE PECULIAR DEVELOPMENT OF THE BULB. HALF NAT. SIZE.

In addition to the plants just mentioned are numerous sedges (pl. 5) and grasses (pl. 6). No traveler in the Everglades will forget the terrible "saw-grass" (pl. 7), which is really not a grass but a sedge, the leaves of which as seen under the lens (pl. 8) are armed with very sharp, fine cutting teeth. Among the marsh ferns are *Acrostichum excelsum*, with coarse,

leatherlike fronds, and *Blechnum serrulatum*, with much thinner fronds which soon wilt when gathered. There is a beautiful Crinum, with white spiderlike flowers, and thick, fleshy seeds which have a peculiar method of germinating (fig. 5); stately cat-tails, bladderwort with fine, dissected aquatic leaves, and many other characteristic water plants, specimens of which have been deposited in the United States National Herbarium. It is interesting to note the absence of the water hyacinth and water lettuce which impede navigation in the streams and lakes of northern Florida.

MARSH SHRUBS.

Paradise Key is bordered by a growth of marsh-loving shrubs; among them, the amphibian willow; alligator apple (pl. 9); the wax myrtle, which yields wax from which candles may be made; the fragrant swamp bay, with an aromatic fragrance like that of bay rum; a magnolia with white flowers and silver-lined leaves; cocoa plums with edible fruit and a Baccharis (pl. 10), which bears the pistillate flowers on one bush and the staminate flowers on another. Not far from the park are small islets covered with thickets of mangroves with branching, stiltlike roots; and button mangroves (pl. 11) with nectar glands at the base of the leaf blades; and in several places are small groves of cypress (pl. 12), similar to those of the Dismal Swamp, but not nearly so extensive.

FIG. 6.—GUMBOLIMBO, *Elaphrium simaruba*; FRESH AND DRIED FRUIT. HALF NAT. SIZE.

FOREST TREES AND SHRUBS.

It will not be possible within the limits of this paper to enumerate the forest trees, most of which are essentially tropical. The largest, however, is the magnificent live oak (*Quercus virginiana*) of our Southern States (pl. 13), which sometimes spreads its moss-covered branches over an area 200 feet in diameter. The gumbolimbo (*Elaphrium simaruba*) gets its odd name from the Jamaica negroes, a corruption of *goma elemi*, the Spanish name of an aromatic balsam which exudes from its bark when wounded. In the Antilles it is sometimes called West Indian birch, on account of its papery red bark which peels off like that of certain birches; and in some parts of Spanish America its common name is *palo mulato*, from the color of its trunk. It bears transplanting remarkably well; sometimes large trees are taken up from hammocks and planted in private grounds, where they at once establish themselves. The fruit (fig. 6) is much relished by crows and other birds.

Other striking trees are the satinleaf (pl. 14) which takes its name from the golden brown, satinlike lining of its leaves; the laurel-cherry of the West Indies, the leaves of which when crushed have the characteristic bitter-almond odor of prussic acid; a beautiful mimosa-like Lysiloma, usually called wild tamarind, with fernlike foliage and smooth white trunk; the mastic tree, or wild olive (fig. 7); the bois-fidèle (incorrectly translated "fiddle wood") with racemes of fruit shown in figure 8, and the pigeon plum (*Coccolobis laurifolia*).

FIG. 7.—MASTIC TREE, *Sideroxylon foetidissimum* JACQ. INFLORESCENCE, FRUIT, AND SEEDS. HALF NAT. SIZE.

Of special interest is the strangling fig, *Ficus aurea*, which begins life somewhat like a mistletoe, sprouting from a tiny seed dropped on the limb of a tree. It soon sends down threads which take root when they reach the ground, and which grow together wherever they touch one another, forming a meshwork about the trunk of the host which is slowly strangled to death (pl. 15). This may well be designated the snake tree, or constrictor, of the vegetable world. Similar trees of the genus Ficus are found in many tropical countries. Botanically they are related to the many-trunked banyan of the East Indies, as well as to the familiar rubber plant of our conservatories.[1]

FIG. 8.—BOIS FIDÈLE, *Citharexylum fruticosum*; FRUIT AND LEAF. HALF NAT. SIZE.

Another forest monster is the poison tree, *Metopium toxiferum*, a giant sumach with a smooth spotted trunk, the sap of which acts very much like the poison ivy of our woods, causing eruptions on the skin. This tree is tropical in its distribution. On the south shore of the island of Cuba a surveying party of officers and men of the U. S. S. *Paducah* employed, in May, 1912, in clearing a base line near Caballona Channel, were badly poisoned by this tree, the effects of which they described as worse than those of *Rhus toxicodendron*. Notwithstanding this the berries are eaten with relish by many species of birds at a time when other fruits are scarce.

[1] Students of phytogeography are referred to the work of Dr. John W. Harshberger, of the University of Pennsylvania, on "The vegetation of South Florida," published in the Transactions of the Wagner Free Institute of Science of Philadelphia, vol. 7, part 3, October, 1914. In this work the plants of southern Florida will be found grouped according to plant formations or associations.

It is interesting to note that a closely allied tree, *Rhus vernicifera*, yields the celebrated Japanese lacquer, a kind of varnish prepared from the very poisonous milk juice, or latex, which exudes from incisions made for the purpose. Violent poisoning from this latex is common among the workmen engaged in manufacturing the lacquer, which is one of the most indestructible varnishes known in the arts. Stories are told of jewelers or cabinetmakers who, engaged in repairing very old pieces of lacquer ware, have been severely poisoned by the dust.

Among the smaller trees and forest shrubs of Paradise Key are several belonging to the Myrtle family, including the white stopper, naked stopper, spicewood, and the myrtle-of-the-river, the latter (*Calyptranthes zuzygium*) with opposite glossy leaves and clusters of fruit resembling blueberries. In addition to these are the paradise tree, or bitterwood; soapberry tree; *Krugiodendron ferreum*, or West Indian ironwood; marlberry; and a holly (*Ilex cassine*) with red berries but with leaves devoid of prickles, sometimes confused with the more northern species from which the Indians of Florida made their "black drink," but quite distinct from it. Specimens of all these together with other interesting shrubs and small trees from this locality have been deposited in the United States National Herbarium.[1]

CLIMBING PLANTS.

Many of the climbing plants are interesting from their manner of clinging to the trees which support them. *Hippocratea volubilis*, which, on account of its conspicuous swollen nodes, may be called the "jointed liana," takes root wherever it touches the ground, forming loops which trip up the unwary traveler, or perhaps catch him under the chin as he passes through the jungle. Its opposite, arm-like branchlets, which terminate in tendrils, clasp the tree trunks as the plant makes its way upward to the light. When it has established itself and spread over the branches, the arms, no longer of use, break off at the shoulders and leave the vine hanging like a great rope usually at some distance from the trunk, causing the observer to wonder by what means it had reached its point of support (see frontispiece). This plant covers the crown of a tree so thickly that its host is sometimes crushed under its weight. According to the park warden, more trees are overwhelmed and brought to earth by this incubus than by storms or destructive parasites.

Among the other climbers are several wild grapes and plants closely related to them, one of the most interesting of which, *Cissus*

[1] For botanical descriptions of these plants the reader is referred to Dr. J. K. Small's Flora of Miami, in which most of them will be found.

sicyoides, is sometimes called the water liana or hunters' vine, in the West Indies. If a section is cut from the stem of this plant, a cool, refreshing drink may be obtained from its sap by applying the mouth at one end and slightly tipping up the other. Its succulent stems are often found gnawed through by some animal; but, instead of dying, the plant continues to live and soon sends down cordlike roots which penetrate the earth like those of certain epiphytes. Among those which hold on by recurved prickles are *Erythrina arborea*, *Guilandina crista*, and *Pisonia aculeata*, all of them plants which usually occur elsewhere as scrambling shrubs, but which here become climbers. The first of these (pl. 16), which belongs to the Bean family, has bright red, slender flowers and pods constricted between the bright scarlet seeds; the second, belonging to the Cassia family, is the plant which bears the well-known polished gray, stony seeds called nicker nuts; the third, belonging to the Four-o'clock family, has peculiar, slender fruits (fig. 9) bearing five longitudinal rows of prickly glands by means of which they adhere to the plumage of birds and the fur of mammals. This plant often forms dense thickets, in trying to penetrate which any creature will be lacerated by the stout, sharp, recurved thorns which arm its branches and which give it its common names "cockspur," "pull-and-hold-back," and "wait-a-bit vine." On Paradise Key *Pisonia aculeata* sometimes reaches gigantic dimensions, climbing to the tops of the highest trees. Plate 17 is reproduced from a photograph, made for the author in September, 1917, of a specimen discovered by Mr. Mosier, with a stem 40.5 inches in circumference at a distance of 7 feet from the base.

FIG. 9.—COCKSPUR, *Pisonia aculeata*; FLOWERS, GLANDULAR FRUIT, AND RECURVED SPINES WHICH AID IT IN CLIMBING. REDUCED.

The tropical zarzaparillas ("climbing brambles") are represented by several subtropical species, the most remarkable of which is *Smilax laurifolia*, the "swamp bamboo brier," a lofty climber which grows in marshy places. A photograph of its thick, bamboolike root stocks is shown on plate 18. A closely allied species, *Smilax auriculata*, growing outside the park in drier situations, was the principal source of a delicious jelly, called "red coontie," formerly prepared by the Indians of the southeastern United States from the fecula contained in its root stalks and tubers.

ORCHIDS.

Most of the orchids of Paradise Key are modest and inconspicuous when compared with their gorgeous relatives in our conservatories; but some of them are prized for their odd forms or their fragrance, and all of them are attractive both to botanists and to laymen. Some of the most interesting are shown on plate 19. *Spathiger rigidus* (fig. 1)), a creeping epiphyte widely spread in the West Indies, with pale, yellowish-green flowers, blooms continuously throughout the greater part of the year. The spider orchid, *Auliza nocturna* (fig. 2), also West Indian in its distribution, takes its specific name from the exquisite fragrance which its large, white, narrow-petaled flowers exhale toward nightfall. The shell orchid, *Anacheilium cochleatum* (fig. 3), was first designated by old Hans Sloane in 1707, as a "mistletoe with a bulbous root and a showy, larkspurlike flower." The chintz-flowered orchid, *Oncidium undulatum* (fig. 4), has odd-looking, mottled flowers, also described by Sloane, who likened them to patches of Dutch chintz. *Macradenia lutescens* (fig. 5) is a modest, little plant with drooping flowers dotted with purplish brown. The marsh orchid, *Oncidium sphacelatum* (fig. 6), usually found growing on the edges of swamps, has conspicuous, yellow flowers spotted with wine color.

OTHER EPIPHYTES.

In addition to the epiphytal orchids other plants are found growing on the limbs and trunks of forest trees, among them the resurrection fern, which curls up during periods of drought and uncurls its fronds when moisture returns; a fleshy leaved Peperomia which creeps along the tree trunks; the well-known Dendropogon, or Spanish moss, which hangs in festoons from the branches (pl. 20); and its relatives of the pineapple family, the stiff-leaved bromeliads (pl. 21). It is interesting to note in connection with the latter that the bases of the leaves of many bromeliads collect water in which insects lay their eggs and undergo their transformations. In some parts of tropical America, in regions remote from water, certain dragon flies and even frogs habitually lay their eggs in such reservoirs, which have been collectively called an epiphytal swamp region, which has the important advantage over a true swamp that it never dries up.

In addition to the marsh ferns and the epiphytal resurrection fern already mentioned there are several other interesting species, including a delicate, little, filmy fern (fig. 10) growing among moss on the trunks and limbs of trees; the epiphytal grass fern, *Vittaria lineata*, and golden Phlebodium, with large fronds lobed like an oak leaf and dotted beneath with conspicuous sori (pl. 22), often

found growing from the old leaf axils on the trunks of cabbage palmettos; the strap fern, *Campyloneuron phyllitidis*, with undivided, strap-shaped fronds; the well-known "Boston fern" of our conservatories (*Nephrolepis exaltata*), and the closely allied sword fern (*N. biserrata*). Other species included in the flora are the brake, *Pteridium caudatum;* the beautiful royal fern (pl. 23); *Anemia adiantifolia* (pl. 24); and the wood ferns, *Dryopteris patens* and *D. angescens.*[1]

FIG. 10.—EPIPHYTAL FILMY FERN, *Trichomanes punctata.* ENLARGED.

FLORIDA PALMS.

Among the native palms of peninsular Florida are the royal palm (pl. 25) which has given its name to Royal Palm State Park; the saw palmetto so characteristic of the pinelands; the saw cabbage palm, *Paurotis wrightii*, of coast hammocks (pls. 26 and 27) which has sometimes been confused with the preceding; the cabbage palmetto, or cabbage palm (pl. 28); the small-seeded, dwarf, blue-stem palmetto, *Sabal glabra*, of northern Florida; the large-seeded, dwarf palmetto, *Sabal etonia*, of southern Florida; the silver palm of the pine woods near Miami and Homestead, *Coccothrinax argentea;* the Florida thatch palm, *Thrinax floridana;* and the brittle thatch, *Thrinax microcarpa*, which occurs at the lower extremity of the peninsula. The majority of these species are found also on the Bahamas and other islands of the West Indies; the large-fruited *Sabal etonia*, however, is endemic. The coconut palm is not a native of Florida, but may be regarded as a naturalized citizen of the State. In the accompanying illustration (pl. 28) are shown the seeds of most of these palms which differ so strikingly that they will serve to identify the various species. In addition to the seeds themselves the plate includes the dropping of a bird in

FIG. 11.—CABBAGE PALM, *Sabal palmetto*, SHOWING DECURVED LEAF-BLADES.

[1] For further information regarding Florida ferns the reader is referred to the beautiful little pocket manual of Dr. J. K. Small, entitled "Ferns of tropical Florida, 1918.

which a number of Thrinax seeds occur. Seeds of the royal pal may have found their way to the park in the same way, dropped b migrating birds from Cuba. In southern Florida trees of thi species as well as those of the cabbage palm and the introduce coconut are sometimes used with great effect to form avenues. It i interesting to note that the leaves of the cabbage palm, though usuall called fan-shaped, really have a short, decurved midrib (fig. 11) This feature, together with certain peculiarities of the inflorescenc leads Mr. O. F. Cook of the Bureau of Plant Industry to separat several species usually included under Sabal into a distinct genu which he has named Inodes.

PINELAND FLORA.

The only pine growing in the vicinity of Paradise Key is *Pinu caribaea* (pl. 29). This is one of the species which gives its name t the Isle of Pines on the south coast of Cuba. It covers vast areas o southern Florida (pl. 30), accompanied by an undergrowth pecul iarly its own. Next to the saw palmetto the most remarkable plan of the pinelands is a cycad, *Zamia floridana*, from which the Semi noles make a starch, commonly called coontie, or Florida arrowroot.

The ancestors of this plant and its congeners can be traced back t the giant cycads of the Carboniferous age. Among its relatives ar the "sago palms," *Cycas circinalis* and *Cycas revoluta*, so well know to horticulturists.[1] Closely allied species of the same genus occur i the West Indies, and of related genera in Mexico, Central Americ and Africa. All of them are remarkable for their peculiar method o cross-fertilization; and nearly all of them are valuable as sources o food.

Zamia and its allies occupy a place intermediate between flower ing plants and ferns. Like the former, they bear fruit with a tru endocarp or seed; but, like the latter, their sexual propagation is ac complished by means of spermatozoids provided with movable cilia resembling those of animals. The male and female plants are easil distinguished. The inflorescence of the male plant (pl. 31) is in th form of an erect cone, shaped somewhat like an ear of maize an composed of scales which bear on their under surface numerou pollen sacs. That of the female plant (pl. 32), much thicker an relatively shorter, is composed of broad scales, each bearing a pai of ovules quite devoid of any protective covering. The pollen borne by the wind, settles on the ovules, and sends down a tube int the tissue of the nucellus. Archegonia are formed; egg cells de velop, and in the pollen tube are produced spermatozoids whic fecundate the egg. The fertilization of *Zamia floridana* was studie

[1] See Bailey's Standard Cyclopedia of Horticulture, 2: 931 to 933. 1914.

by Dr. H. J. Webber. It was he who first described and figured these remarkable spermatozoids, which exceed in size those of all other living organisms.[1]

The ovules of *Zamia floridana* develop into beautiful orange-red fleshy fruits arranged about a central axis, like large grains of corn around a cob. These are at first covered by the peltate, triangular scales which bore them, but they fall off when fully ripe and form conspicuous bright-colored heaps in the pine lands where they grow. A second species of Zamia occurs in the shady woods of Paradise Key, but only male plants have thus far been found there. It has been referred by Small to *Zamia integrifolia*, a species in moist woods of middle Florida, particularly near the east coast. This species may be distinguished from *Z. floridana* by its leaflets, which are somewhat broader, and have 20–28 parallel veins, about twice as many as those of the latter. Both its leaves and its cones bear a close resemblance to those of the West Indian *Zamia media* with which it may possibly prove to be identical; while *Zamia floridana* more closely resembles *Zamia angustifolia* of the Bahamas.

Among other characteristic plants of the pinelands are the silver palm, the large-seeded *Sabal etonia*, sometimes called the goose-neck palmetto, and the tall cabbage palm, already mentioned; among the orchids, the tall, purple-flowered *Bletia purpurea* and the grass pink, *Limodorum pinetorum;* the pineland blueberry, *Vaccinium myrsinites;* the dwarf, white-flowered papaw, *Asimina reticulata*, the thorn twig, *Bumelia reclinata* (pl. 33) and the prickly, holly-leaved *Rhacoma ilicifolia*. Among the climbing plants, or twiners, are the beautiful, red-flowered morning-glory, *Exogonium microdactylum*, with flower buds resembling fuchsias; the conspicuous *Echites echites*, belonging to the Apocynaceæ, with salver-shaped flowers resembling enormous white jasmines, and a pair of long, slender seed pods inclosing silky seeds; two species of smilax, *S. bona-nox*, and *S. havanensis;* and occasional moonflowers, *Calonyction aculeatum*, climbing to the tops of trees. Among the ferns are the bracken, *Pteridium caudatum; Pteris longifolia; Anemia andiantifolia*, shown on plate 24; and in the old leaf axils of the cabbage palm *Phlebodium aureum*, on plate 23. In addition to these may be mentioned two plants which are confined to the southern Florida pinelands and do not occur elsewhere—*Chamaesyce pinetorum*, a low, spreading, hairy, small-leaved plant belonging to the Euphorbiaceæ; and the dwarf Florida privet, *Forestiera pinetorum*, belonging to the olive family, shown on plate 34.

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[1] Webber, Herbert J. Spermatogenesis and fecundation of Zamia. U. S. Dept. Agr., Bureau of Plant Industry, Bull. No. 2, 1901.

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ANIMAL LIFE.

It is impossible within the scope of this paper to give a detailed account of the animals of Royal Palm State Park. The insect fauna alone must certainly include thousands of species, only a few of which can here be mentioned.

The tree snails (see pl. 35) which form such an attractive feature of the forest, though varying greatly in color, are referred by zoologists to a single species, *Liguus fasciatus*. These beautiful creatures which spend their lives on the trunks of trees browsing upon microscopic cryptogamous plants, are air-breathing mollusks like their relatives the common snails, having their eyes on the ends of long tentacles (fig. 12) which they can fold in like the tip of a glove finger. Specimens sent by Mr. Mosier from Paradise Key are now domesticated in one of the greenhouses of the United States Department of Agriculture, having borne the trip from their native forest without apparent inconvenience. As in allied genera these animals have both sexes united in a single individual; so that each may become both a father and a mother. In mating they do not appear to discriminate as to color, for a pure white-shelled form may be seen paired with one which is yellow-banded or mottled like tortoise shell. They sometimes fall victims to another air-breathing mollusk, the cannibal snail, *Glandina truncata* (pl. 26, fig. 2), the young of which sometimes devour one another.

FIG. 12.—TREE SNAIL OF ROYAL PALM PARK, *Liguus fasciatus*, WITH EGG. BOTH SEXES ARE UNITED IN EACH INDIVIDUAL. NAT. SIZE.

Other snails of this family are the minute *Polygyra septemvolva* (pl. 36, fig. 3) and *P. uvulifera* (pl. 36, fig. 4) with flattened shells composed of many whorls coiled like a watch spring. Another little shell, *Helicina orbiculata* (pl. 36, fig. 5), is distinguished by having a little door, or "operculum," with which it closes the orifice of its shell. Among the pond snails are *Planorbis duryi* (pl. 3, fig. 6) and *Physa gyrina* (pl. 36, fig. 7), the latter with a thin polished, left-handed shell.

The great marsh snail, *Ampullaria depressa*, is of interest as the principal food staple of the Everglade kite, already mentioned. The colored illustration in the center of plate 35 was made from a living specimen sent to Washington from Royal Palm State Park. Its eggs, resembling flesh-colored pearls, are attached to the stems of water plants (fig. 13). Last of all must be mentioned the little bivalve, *Musculum partumeium* (pl. 36, fig. 9), which has a thin, orbicular shell through which its pulsating heart can be seen. It is

an interesting little creature, actively climbing among the submerged stems and leaves of plants, breathing in and expelling water by means of a double-barreled siphon.

Of greater economic importance than the large marsh snails above mentioned are the crawfishes of the Everglades, which are eaten in great quantities by many marsh birds, especially by white ibises and blue herons. Specimens collected in the immediate vicinity of Paradise Key (pl. 37) were identified by Mr. W. L. Schmitt of the United State National Museum as *Cambarus fallax* Hagen.

FIG. 13.—EGGS OF MARSH SNAIL, *Ampullaria depressa*, ON STEM OF WATER PLANT. NAT. SIZE.

The centipedes and scorpions of Royal Palm State Park are represented in the writer's collection by a single species each. The first, identified by Mr. O. F. Cook as *Theatops postica*, is interesting on account of its peculiarly hooked and thickened last pair of legs. Its bite, though poisonous, is not dangerous. The scorpion identified by Dr. Nathan Banks as *Centrurus gracilis*, like all of its allies, has pincerlike palpi resembling the claws of a crawfish, and a long tail terminating in a poison sting (pl. 38). Perhaps the most interesting feature of its anatomy is a pair of minute, diverging, comblike organs borne on its ventral side just behind the last pair of legs (fig. 14). The function of these little combs is not yet understood. An ally of the scorpions, which may be regarded as intermediate between them and the spiders, is the giant whip scorpion, *Mastigoproctus giganteus*, shown on plate 38. Its enormous palpi suggest the branching mandibles of a large stag beetle. In the scorpion the front legs are the shortest pair, while in the whip scorpion they are greatly elongated; but the greatest difference is in the tail, that of the whip scorpion being entirely devoid of a sting. Even the fangs of this ugly creature, so much dreaded by the natives wherever it is found, are said by Doctor Banks to be devoid of poison. When attacked it emits an acid, vinegarlike odor, from which the name *vinaigrier* has been given it by French creoles in the Antilles.

FIG. 14.—COMB-LIKE ORGANS OF SCORPION, *Centrurus gracilis*. THEIR FUNCTION IS UNKNOWN.

SPIDERS.

Among the spiders collected on Paradise Key are several of unusual interest. One of them, *Nephila clavipes*, constructs a beautiful web composed of fine, silken threads which glisten in the sun like burnished gold. Its silk has been woven into fabrics. A second species, *Miranda aurea*, forms a peculiar egg cocoon resembling a miniature paper balloon. A third species, *Phidippus audax*, spins no web at all, but catches its prey by jumping upon it and drags it backward to its den. It has iridescent jaws and bright red eyes, from which it may well take its name of "ruby-eyed monster."

The life histories of many spiders as well as of certain groups of insects are so tragic that the writer ventures here to repeat what has already been expressed by Maeterlinck; since it is so strikingly applicable to conditions on Paradise Key. With other classes of animals and even with plants man feels a certain kinship, but spiders and insects are not of his world; their strange habits, ethics, and psychology seem to belong to some other planet, where the conditions are more monstrous, more active, more insane, more atrocious, more infernal than in our own. It is hard for us to believe that these monsters are conceptions of that Nature whose privileged children we love to imagine ourselves to be. We are horrified at the atrocities they commit; their clandestine thefts, their ignoble parasitism; the bold robberies, the murders, cannabalism, mariticide, for which many of them seem especially adapted. Frightfulness and ruthlessness appear to be a very part of their nature; and we stand appalled when it dawns upon us that these creatures are far better armed and equipped for their life's work than we for ours. We almost dread them as our rivals and ultimate successors, as the dominant inhabitants of this globe.

THE SPIDER THAT SPINS TEXTILE SILK.

Outside the gauze screen of the park lodge veranda the writer noticed a geometrical spiderweb, in which insect victims of all descriptions had been ensnared, ranging in size from mosquitoes to huge grasshoppers and dragon flies. In the center of the web was the lady spider who had constructed it, and near its margin the diminutive male, who seemed to be hanging 'round in a shiftless sort of way, subsisting on such scraps of food as she might leave. Specimens of these spiders (fig. 15) were identified by Mr. C. R. Shoemaker of the United States National Museum as *Nephila clavipes*, a species celebrated from the fact that its silk has actually been woven into fabrics, specimens of which, in the form of bed curtains, were exhibited at the Paris Exposition. In order to obtain the silk a large number of females were kept in captivity, each by

herself in an iron ring isolated by water, fed with flies, and deprived of her silk each day. Each of the cocoons of this spider contains from 500 to 1,000 eggs. The newly hatched young show cannibalistic propensities from the very beginning; for they not only feed upon small insects which come in their way, but they devour one another. After two or three weeks in a web shared in common they scatter and each female proceeds to spin a web for herself. From this time they must be kept separate, or they would eat one another. In removing the silk the spider is gently seized and secured in a pair of stocks, and the thread steadily and carefully pulled from her spinnerets until it is exhausted. In this way a spider is made to yield about an ounce of silk during the summer. The thread is smoother, finer, and more brightly colored than that of the silkworm.[1]

FIG. 16.—*Miranda aurantia*, ADULT FEMALE AND MALE. THE FEMALE OFTEN DEVOURS HER PYGMY BRIDEGROOM AT THE END OF THE HONEY-MOON. NAT. SIZE.

As shown in the illustration, the male is much smaller than the female, from which it is also distinguished by its peculiar palpi, which correspond to claws of scorpions and the enormous pincers of the whip scorpion shown on plate 36, but which are in the spiders specialized into sexual organs. Doctor Wilder, who was the first to breed this species for their silk, contrasts the handsome female with the insignificant male, who neither toils nor spins, and who keeps at a respectful distance except when mating, and even then it is not unusual for the ogress bride to eat him up.[2]

FIG. 15.—*Nephila clavipes*, ADULT FEMALE AND MALE. ITS GOLDEN YELLOW SILK HAS BEEN SPUN AND WOVEN INTO BED CURTAINS. NAT. SIZE.

The Golden Miranda (also known as *Epeira*, or *Argiope riparia*) is a beautiful, black and yellow spider of the marshes (fig. 16). The female is nearly an inch in length, while the male is only about one-fourth as long, similarly colored, but with the markings less distinct and with very large palpi. The females make webs about 2 feet in

[1] See Emerton, J. H., The Structure and Habits of Spiders, pp. 70–72. 1878.
[2] See Wilder, B. G., How my new acquaintances spin. Atlantic Monthly, 18 : 130. 1866.

diameter in the marsh grass or bushes, with an up-and-down zigzag white band across the middle and a round thick spot where she takes her station. In the autumn she lays her eggs in a large, balloon-shaped cocoon like that already described (fig. 17). Both the eggs and the newly hatched young are subject to the attacks of parasitic insects.

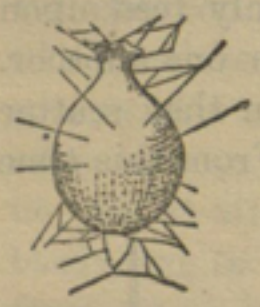

FIG. 17.—BALLOON-LIKE EGG-SACK OF *Miranda aurantia*. HALF NAT. SIZE.

TERMITES, OR WHITE ANTS.

Unlike their African relatives, which build great mounds, the termites of Paradise Key infest dead wood (pl. 39) and are therefore apt to escape notice except during the period of swarming. At least four species have been collected in the park by Mr. Thomas E. Snyder, office of Forest Insect Investigations, United States Department of Agriculture. The social organization of these little insects is of special interest. In addition to perfect winged males and females, and wingless workers and soldiers, there are nymphal and larval forms of males and females which never become winged. (See fig. 18.) The most interesting feature in connection with these little insects is their social life and the subdivision of labor in their communities. Though commonly called "white ants," and often referred to by travelers as "ants," they are not related to the true ants, but belong to the order Platyptera, more nearly allied to the May flies, dragon flies, and ant lions. One of the most remarkable phenomena of insect biology is the similarity of the functions of corresponding "castes" in such widely separated groups as the termites on the one hand and the ants and social bees on the other. Both groups of insects live in communities and have their queen mothers, royal consorts, and specialized workers, which are sexually imperfect. In the bees, however, the workers are imperfect females, while among the termites here considered, the castes of both soldiers and workers are composed of imperfect males as well as females. Another important point of difference is that newly hatched

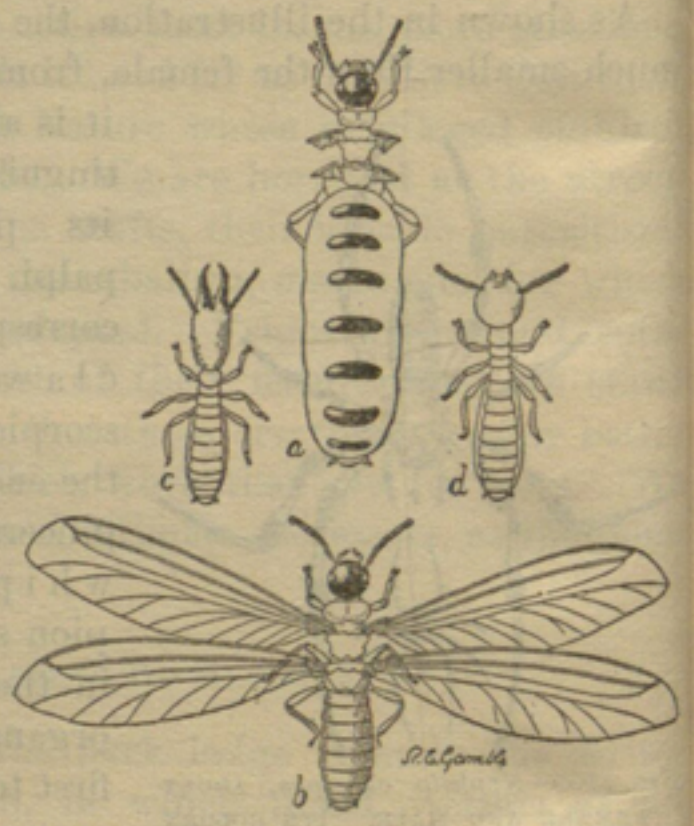

FIG. 18.—WHITE ANTS, *Leucotermes flavipes*. *a*, PREGNANT QUEEN; *b*, WINGED MALE; *c*, SABER-JAWED SOLDIER; *d*, BLIND WORKER AND NURSE. ENLARGED.

bees and wasps are helpless, footless grubs, while the young termite when it emerges from the egg is an active, crawling, six-legged creature, which soon begins to feed itself.[1]

DRAGON FLIES AND DEMOISELLES.

On plate 40 are shown five species of Odonata from Paradise Key, identified for the writer by Miss Bertha P. Currie of the United States National Museum, and her brother, Mr. Rolla P. Currie. While sitting on the screened veranda of the park lodge it was pleasant to watch these graceful insects, like squadrons of miniature airplanes, waging incessant war upon the besieging mosquitoes. It is not possible within the limits of this paper to speak of the early aquatic stages of these insects and their transformations. Attention has been called in connection with the Bromeliaceæ to the fact that in tropical America there are certain species which lay their eggs and undergo their transformations from the larval stage to the perfect insect in the water collected by the leaves of epiphytal plants of that family. In this connection the reader is referred to the recent work of the Calverts on the natural history of Costa Rica.[2] Some of the species shown in the illustration are quite widely distributed, but *Gynacantha nervosa*, the largest of the collection (pl. 40, fig. 2) is a very rare tropical species hitherto represented among the North American Odonata of the United States National Museum by a single specimen; and the dainty little demoiselle, *Argiallagma minutum* (pl. 40, fig. 4), which is even rarer, is quite new to the collection.

MARGARODES, OR GROUND PEARLS.

In the black soil of the forest, often in the clefts of limestone penetrated by the roots of plants, quantities of little opalescent globules are sometimes found. These beautiful little objects are the shells of Coccidae or scale insects, known as Margarodes or ground pearls. They occur also in the West Indies, on some of the islands of which they are strung into necklaces and made into purses. Very little is known concerning their life history. It was formerly thought that they occur on the roots of plants, but Mr. W. T. Swingle, who was the first to find them within the limits of the United States, in January, 1895, called attention to the fact that in no case did he find them attached to roots. In the accompanying illustrations, plate 41 shows a colony found by C. A. Mosier on Paradise Key, in

[1] For a detailed account of these interesting insects the reader is referred to the paper of Mr. Thomas E. Snyder, entitled "Biology of the termites of the eastern United States," published by the U. S. Department of Agriculture as Bureau of Entomology Bulletin No. 94, pt. 2, 1915.

[2] Calvert, Amelia Smith, and Philip Powell, A Year in Costa Rican Natural History, pp. 230–243. 1917.

fissures of oolitic limestone. On plate 42 are shown cysts, enlarged 6 diameters; and on plate 43 are shown necklaces and loose ground pearls in the collection of the Bureau of Entomology, collected by the late Prof. C. V. Riley and Mr. H. G. Hubbard in the West Indies.[1] This plate is reproduced from a photograph kindly furnished the writer by Dr. L. O. Howard, Chief of the Bureau of Entomology.

The family Coccidae, to which these interesting ground pearls belong, includes some very pernicious as well as some very valuable species. The former, known as scale insects, do great injury to fruit trees and other plants. Among the latter are several which are the sources of valuable dyes and lacs: the Mexican cochineal, which has become domesticated and is reared on certain species of Cacti; the classic kermes of the Old World, from which "crimson" (*carmesin*) takes its name and which was used for dyeing the curtains of the Jewish tabernacle; the "scarlet grains" of Poland, gathered from the roots of *Scleranthus perennis;* another species, infesting the roots of *Sanguisorba sanguisorba*, used by the Moors as a source of a beautiful rose color with which they dye fabrics of wool and silk; the Asiatic lac insects, which produce commercial lac, from which shell-lac, sealing wax, and lac dyes and certain lake pigments are derived. It is interesting to note that among the principal trees infested by these lac insects are certain species of Ficus; and that the *Ficus aurea*, the strangling fig of Paradise Key, is also infested by a Coccus, which Mr. Harold Morrison of the Federal Horticultural Board has identified as *Coccus elongatus*. An attempt might be made to introduce lac insects from India into southern Florida, to see if they would thrive on the native species of Ficus.

BUGS.

Among the Hemiptera of Paradise Key determined for the writer by Mr. E. H. Gibson of the Bureau of Entomology are *Acrosternum hilaris* (pl.. 44, fig. 3), a smooth, green insect allied to our squash bugs; *Leptoglossus phyllopus* (pl. 44, fig. 7), sometimes called the "leaf foot"; and *Metapodius femoratus* (pl. 44, fig. 8), the "thick thigh," which punctures fruits and sucks their juices. Less conspicuous are the brown bug, *Euschistus ictericus*, and *Edessa bifida*, the latter marked on the back by a whitish U-shaped figure. To this same class of insects belong the various tree hoppers, some of which are of odd shapes, simulating thorns and other natural objects.

ROACHES AND GRASSHOPPERS.

Among the Orthoptera of Paradise Key, determined for the writer by Mr. A. N. Caudell, United States National Museum, are *Eurycotis*

[1] See Proceedings of the Entomological Society of Washington, 3 : 148. 1894.

floridana (pl. 45, fig. 6), a large roach; *Gonatista grisea* (pl. 44, fig. 6), a mantis resembling the "praying mantis" of southern Europe in form, but differing from it in color, and distinct from it generically; a walking stick, *Thesprotia graminis;* and several grasshoppers, or locusts, including *Romalea microptera* (pl. 44, fig. 10, and pl. 45, fig. 4), remarkable for its great size and gaudy colors. In addition to these may be mentioned a katydid, *Scudderia texensis* (pl. 44, fig. 9) and a cricket, *Gryllus assimilis* (pl. 44, figs. 1 and 2).

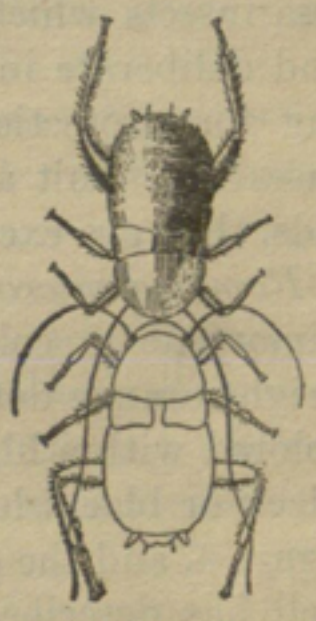

FIG. 19.—NEWLY MOLTED *Eurycotis floridana*, ABOUT TO DEVOUR ITS CAST-OFF EXOSKELETON. HALF NAT. SIZE.

A large specimen of the above-named roach was observed on the lodge veranda in the process of molting. Motionless, head downward, holding on to the side of the house by its six feet, its shell proceeded to split and an exact replica of the insect gradually emerged from it, but it was pure white except its two little black eyes, which were almost concealed by the anterior edge of its shieldlike thorax. At first it was soft and helpless, but it soon showed signs of life, and turning about (see fig. 19) it proceeded to devour its cast-off shell, even to the tips of the antennæ and the rigid, spiny, chitinized legs; so that there was not a vestige left of its old exoskeleton. This species, the only representative of the genus Eurycotis in the United States, is confined to Florida and Georgia. It has rudimentary wings and is incapable of flight. Its food consists of all kinds of organic substances, including textile fabrics and paper. Its only defense is a volatile, ill-smelling substance which it exudes from beneath the abdomen.

FIG. 20.—EGG CASE OF MANTIS, *Gonatista grisea*. FROM A SPECIMEN COLLECTED BY C. A. MOSIER. HALF NAT. SIZE.

Gonatista grisea, the common mantis of the park, presents an admirable example of camouflage; for its lichenlike mottled grayish coloration renders it almost invisible as it stations itself motionless on a branch or stem in wait for its insect prey. A specimen of its peculiar egg case, or *ootheca*, sent to the writer by the park warden, is shown in figure 20. It is almost identical in form and structure to that of its European cousin, the life history of which is even more terrible than that of the spiders; for instead of one husband, this lady Bluebeard is capable of devouring seven husbands in succession. In this connection the reader is referred to the great work of Fabre, who apropos of the mantids exclaims: "Ah! les féroces

bêtes! On dit que les loups ne se mangent pas entre eux. La Mante n'a pas ce scrupule." The details of her conduct as related by him are too horrible for translation.[1]

The Phasmidae, to which the walking sticks belong, are all wingless insects which mimic different kinds of twigs. They are slow and deliberate in their movements; they also are camoufleurs, relying for protection upon their deceptive resemblance and in some cases they emit an offensive repugnatorial spray. Unlike the mantids, they are exclusively herbivorous.[2]

Romalea microptera, the giant grasshopper already mentioned, is dimorphic in coloration. In the normal form the fore wings are bright orange dotted with black and the hind wings crimson or rose colored with a black border. The general color of the other form is black or blackish. The female of this species is shown on plate 45, figure 4, and the smaller-sized male on plate 44, figure 10. Mr. Caudell has described the means by which these insects produce their peculiar simmering noise, which he traces to certain spiracles on the side of the thorax.[3]

BEETLES AND THEIR ALLIES.

Among the most interesting Coleoptera of Paradise Key identified by the venerable entomologist, Mr. E. A. Schwarz, of the United States National Museum, are *Rhynchophorus cruentatus* (pl. 45, fig. 5), a large, black, weevil with two broad, dark red stripes on its thorax, and decurved snout (which gives to the genus its name), and antennæ jointed like elbows and terminating in broad knobs. It is allied to the genus Calandra and breeds in freshly cut or broken palmettos. The adult insect uses its snout not only for feeding but also for boring holes, into which it deposits its eggs. The larvæ—fleshy, footless grubs, with tubercules instead of legs, and thick, horny, curved jaws—burrow through the freshly cut stumps and when about to transform to the pupa stage they envelop themselves in a cocoon of twisted fibers. This species, which has hitherto been recorded but from few localities in the United States, was collected in the Royal Palm State Park on May 14, 1916, by Mr. T. E. Snyder, of the Office of Forest Insects.

Sharply contrasting with the above is the remarkably slender little weevil, *Brenthus anchorago* (pl. 45, fig. 7). It has a smoothly polished, jet black head and thorax, and its wing cases, as seen under the lens, are marked with deep parallel furrows composed of minute punctures and ornamented with two longitudinal lines of straw color.

[1] See Fabre, J. H., Moeurs des Insectes; morceaux choisis extraits des *Souvenirs entomologiques*, pp. 65–70.
[2] See Caudell, A. N., Proc. U. S. National Museum, 26: 863. 1903.
[3] See Caudell, A. N., Proc. U. S. National Museum, 26: 796. 1903.

This species has an almost straight, slender snout, and its antennæ are not elbowed like those of the Rynchophorus, but moniliform, like a necklace composed of many beads. Its life history has not been studied, but in a closely allied genus the females puncture the bark of an oak and deposit their eggs. The larva, a cylindrical grub, with three pairs of legs and an anal prop leg, bores into the solid wood.

Other Coleoptera collected in the park are a predatory tiger beetle, *Cicindela tortuosa*, dark colored above and metallic beneath; a water scavenger, *Philhydrus nebulosus;* a large click beetle, *Alaus oculatus*, which has the habit of springing up suddenly when laid down on its back; *Buprestis lineata*, whose grubs are known as hammer-heads or flat-headed borers; *Calopteron reticulatum*, with broad yellow and black bands; several lamellicorns (Scarabaeidae), including *Phileurus truncatus*, *Phileurus valgus*, the yellowish brown vine chafer, *Pelidnota punctata; Anomala marginata* Fabr., which, like the preceding, feeds on the leaves of wild grapes; the handsome, green *Euphoria limbalis;* and *Trichius delta*, easily distinguished by a delta-shaped spot on its back; several longicorns (Cerambycidae), including the twig girdler, *Oncideres cingulata*, the gumbolimbo borer, *Mallodon dasystomus* (determined by F. C. Craighead), and the very rare *Euryscelis suturalis.*

In addition to the above-mentioned species the collection includes several small leaf beetles (Chrysomelidae), several weevils infesting palmetto seeds, Calandrids injurious to maize and other grasses; and a number of minute bark beetles (*Xyleborus* spp.) belonging to the Scolytidæ, which have been described by Dr. Andrew D. Hopkins of the Office of Forest Insects. To speak of them in detail is beyond the scope of the present paper.

MOTHS AND BUTTERFLIES.

The most attractive insects of the Royal Palm State Park are undoubtedly the Lepidoptera. For the identification of those in his collection the writer is indebted to Dr. H. G. Dyar and Mr. Carl Heinrich, of the Bureau of Entomology. The order to which they belong takes its name, Lepidoptera, from the minute scales which cover the wings and give them their varied and beautiful color patterns. On plate 26 is shown one of these scales from the wing of a Papilio, or swallowtail butterfly, magnified 750 diameters; and on figure 21 the arrangement of these scales on a butterfly's wing, overlapping one another like shingles or tiles.

MOTHS.

The rarest and most interesting moth collected on Paradise Key is the West Indian *Perigonia lusca interrupta* Walker (pl. 47, fig. 1),

a variety of what may be called in English the "purblind hawk-moth." It is of a reddish brown color, with the hind wings banded with a deep orange. Like many other Sphingidæ it feeds upon the nectar of flowers, about which it hovers like a humming bird, and thrusting its long proboscis far down into their corolla tubes. Among the day-flying wasp-moths are the *Syntomeida ipomoeae* Harris, which frequents morning-glories, a handsome species with orange-and-black banded abdomen and black wings spotted with white (pl. 44, fig. 5); and the closely allied polka-dot wasp-moth, *Syntomeida epilais* Walker (pl. 44, fig. 4), with the abdomen tipped with bright orange-red and with black wings and thorax spotted with white. Another wasp-moth of the park is the little *Didasys belae* Grote (pl. 47, fig. 4), with orange-tufted abdomen and transparent windows in its dainty wings. This exquisite insect is essentially Floridian, and is the only species referred to the genus Didasys.

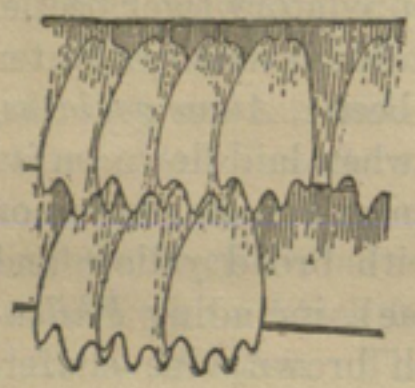

FIG. 21.—SCALES ON THE WING OF A BUTTERFLY, *Papilio sp.*, 90 TIMES NAT. SIZE.

Of much wider distribution is the beautiful little tiger moth, most appropriately named by Linnæus *Uthetheisa bella* (pl. 47, fig. 5). It has rose-colored hind wings bordered with black and orange, fore wings crossed by white bands dotted with black. Another interesting moth, belonging to the Noctuidæ, which fly by night, is *Xanthopastis timais* Cramer (pl. 45, figs. 1 and 2), the fore wings of which are a delicate rose color mottled with black and yellow, the hind wings of a silky mouse color, the thorax densely covered with erect black fur, the hairs of which as seen under the lens terminate in minute white club-shaped tips, and the abdomen clothed with black hairs. Its gaily banded larvæ, according to Doctor Dyar, feed upon "a species of lily." Specimens were collected by Mr. Thomas E. Snyder on Paradise Key where the adult insects have the peculiar habit of resting during the daytime on the trunks of royal palms, usually high above the tops of the other trees of the hammock. They are most abundant below the bushy fruiting spadices of the palms, and from a distance look like dark specks against the smooth, whitish, columnar trunks.

FIG. 22.—CASE OF LOG CABIN MOTH, *Oiketicus abbottii*, IN WHICH THE WINGLESS FEMALE SPENDS HER ENTIRE LIFE. HALF. NAT. SIZE.

Last of all must be mentioned little "log-cabin worm," *Oiketicus abboti* Grote, which constructs a case of sticks like a miniature crib (fig. 22). It is an obscurely colored little moth, related to our com-

mon bagworm (*Theridopteryx ephemeraeformis*). The larvæ are sheathed in these little baskets, and the female, who is wingless throughout her life, never emerges, but deposits her eggs in the larval skin which lines the basket in which she has developed.

BUTTERFLIES.

Three of the butterflies of Royal Palm State Park may be designated the regal group: the "monarch," *Anosia plexippus* L. (pl. 48, fig. 2); the "queen," *Anosia berenice* Cramer (pl. 48, fig. 1); and the viceroy of Florida, *Basilarchia floridensis* Streck. (Pl. 48, fig. 3.) Of these the first two are closely related, but the last belongs to a distinct genus, though resembling in general appearance the monarch. Both the monarch and the queen are said to be avoided by birds, predacious insects, and other insectivorous animals on account of the ill-tasting, acrid, juices secreted by them, and it is believed by many naturalists that the viceroy imitates its royal companions, or rather has gradually become modified so as to resemble them, owing to the protection which this resemblance assures it. The male of the monarch is distinguished from the female by a black scent pouch on each of the hind wings. It feeds upon milkweeds (Asclepiadaceae) and is widely distributed over the globe. The Florida viceroy resembles the more northerly *Basilarchia archippus*, but is darker colored and somewhat larger than that species. Its caterpillar, which has prominent tubercules on the back, is found upon willows (*Salix amphibia*).

ZEBRA BUTTERFLY.

The most interesting and foreign-looking of all the butterflies in the park is the yellow and black banded *Heliconius charitonius* L. (pl. 47, fig. 2), belonging to a tropical family, of which it is the only representative in the United States. Special attention has been called to this group by the naturalists, Alfred Russel Wallace and Thomas Belt, in connection with the phenomenon of mimicry. The Heliconii are said to be avoided by insect-eating birds and other animals. They are protected, according to Wallace, by their unpleasant, strong, pungent taste. Belt noticed that certain other butterflies of a distinct family, and even certain species of moths resembling them very closely, shared their immunity from attack. In "The Naturalist in Nicaragua" he calls attention to this fact. He tells how he watched certain insectivorous birds feed their young with various kinds of insects including butterflies, but never in a single instance did he see them bring a Heliconius to their nest, though Heliconii were abundant in the locality where the observations were made. He tried to feed Heliconii to a captive monkey, who greedily ate beetles

and other butterflies, but the monkey could not be induced to ea them. When a Heliconius was given him the monkey would take i politely and sometimes smell it, but he would invariably drop it afte holding it in his hand for a few minutes.[1] The butterflies an moths resembling them were also avoided; and the same was true o certain harmless insects resembling species provided with sting The caterpillar of the Zebra butterfly feeds on the little passio flower (*Passiflora suberosa*), which is quite common in the park. I is interesting to note that both the butterfly and this host plant oc cur in Cuba and the Lesser Antilles. In Florida the species range from the region of Indian River and the headwaters of the St. John to Cape Sable. It also occurs in Mexico and ranges southwar through the lowlands of Central America.

THE METAL-MARKS.

Calephelis caenius L., the "little metal-mark," is a very smal butterfly belonging to the family Lemoniidae, and the subfamil Erycininae. It is of a reddish brown color on the upper side brighter red on the under side. On both the upper and the unde sides the wings are profusely spotted with small steely blue metalli markings, arranged in more or less transverse series, especially o the outer margin. Expanse, 0.75 inch. Its life history is unknown This species is common in Florida, and ranges thence northward t Virginia and westward to Texas.[2]

ZAMIA BUTTERFLY.

The remarkable little "coontie" butterfly of the pinelands, *Eu maeus atala* Poey (pl. 45, fig. 8), belongs to the family which in cludes the little "blues" (Lycaenidae), but it is larger than most o its members. On Paradise Key it is only an occasional visitor, bu it occurs on Palma-vista, in the northeast corner of the park, where its food plant, *Zamia floridana*, grows.[3] According to Holland its early stages await description, but Mr. E. A. Schwarz, of the United States National Museum, has given an account of its life history with excellent illustrations. The butterfly, which also occurs in Cuba, is conspicuous, not only on account of its coloration, but also for its abundance. The larva is of a brilliant red color, with tufted protuberances on every segment. The butterfly lays its cream-col ored eggs, resembling microscopic, depressed, spineless sea-urchin shells, on the under side of the leaflets and along the midrib, o rachis of the leaves while they are still young and tender. In about

[1] See Belt, Thomas, The Naturalist in Nicaragua, p. 316. 1874.
[2] See Holland, The Butterfly Book, p. 232, pl. 28, fig. 16. 1898.
[3] See illustrations of this plant, pls. 31 and 32.

10 days the eggs hatch. Two weeks later the larvæ are full grown and assume the pupa state, which lasts 9 or 10 days before the perfect insect emerges.[1]

On plate 45, figure 9, is shown the closely allied *Eumaeus minyas*, which ranges from Texas to Brazil, and which in all probability passes its early stages on Cycadaceous plants related to Zamia.

THE NYMPHS.

Among the other butterflies of the park belonging to the subfamily Nymphalinae (which includes the Basilarchia described above) are the passion flower fritillary, *Dione* (*Agraulis vanillae*) L. (pl. 49, fig. 1), tawny and black above, with a few white dots, and beautifully spotted beneath with silver; the handsome peacock butterfly, or "buckeye," *Junonia coenia* Hübner (pl. 47, fig. 7), which is said to be very pugnacious toward other species; the white peacock, *Anartia jatrophae* L. (pl. 47, fig. 6), a faded-looking tropical species whose early stages have not yet been described; the dingy peacock, *Eunica tatila* (pl. 47, fig. 3), a dark-colored butterfly, with white spots and metallic, blue reflections on the upper surface of the wings and rows of many little eyes dimly visible on the under surface; and the portia, *Anaea* (*Pyrrhanaea*) *portia* Fabr. (pl. 49, fig. 3), a handsome species essentially tropical in its distribution, of a rich garnet color above and laved with yellow on the under surface of its fore wings.

THE SULPHURS.

Those found in the park include the cloudless sulphur, *Catopsilia eubule* L. (pl. 49, fig. 2 and fig. 5), the large orange sulphur, *Catopsilia agarithe maxima* Neum. (pl. 49, fig. 4), which pass their early stages on cassia plants, and the little cassia sulphur, *Eurema* (*Terias*) *euterpe* Menetries (pl. 50, fig. 3). In addition to these may be mentioned the "Florida white," *Tachyris ilaire* Godart, the male of which has the hind wings on the under side of a very pale saffron color.

SWALLOW TAILS.

Among the swallowtails of the park is the magnificent *Papilio cresphonates* Cramer (pl. 50, fig. 2), the larva of which is usually called "orange-puppy" from its habit of feeding on citrus trees. Here it is found on the native wild lime, *Zanthoxylum Fagara*, a shrub or small tree botanically allied to Citrus, which has its foliage dotted with minute aromatic oil glands. The butterfly has brown wings banded with bright yellow, and closely resembles *Papilio*

[1] See Schwarz, E. A., Notes on *Eumaeus atala*, Insect Life, vol. 1, pp. 37–40. 1888.

thoas of southern Texas. In southern Florida great damage is sometimes done to the orange groves by the caterpillar. Another beautiful swallowtail is *Papilio palamedes* Drury (pl. 50, fig. 4), which in its early stages feeds on the leaves of various bay trees; not only on those of the swamp bay (*Tamala pubescens*), belonging to the Laurel family, but also on the foliage of the sweet bay (*Magnolia glauca*), which belongs to a very distinct family, but is aromatically fragrant like the laurels, or true bays.

Among the more sober-colored butterflies of the park are two so-called skippers, *Pamphila ocola* (*Prenes ocola*, Edwards), the life history of which has not been studied, and the swallow-tailed *Eudamus proteus* L. (pl. 50, fig. 1), the caterpillar of which feeds upon leguminosæ and makes a rude nest for itself by drawing the edges of leaves together with strands of silk after having cut slits in them. By the farmers it is appropriately called the bean leaf roller, and is regarded as a pest.

ANTS, WASPS, AND BEES.

The hymenoptera of Paradise Key were kindly identified for the writer by Mr. J. C. Crawford and Mr. S. A. Rohwer, of the United States National Museum, and Mr. H. L. Viereck, of the United States Biological Survey. Several of the most remarkable species are shown on plate 51.

ANTS.

The carpenter ant, *Camponotus* (*Myrmothrix*) *abdominalis*, represented in Paradise Key by the subspecies *floridanus* (pl. 51, fig. 2), must have come into Florida from the West Indies.[1] Like its nearest relatives, this ant makes tunnels or galleries in dead wood, and, like other true Formicidæ, its colonies consist of several distinct forms or castes; in addition to males, females, and workers, a large-headed caste usually called soldiers. As in the termites, females and males are winged, while the workers and soldiers are wingless. Comstock, who has studied the habits of the closely allied carpenter ant (*Camponotus pennsylvanicus*) of the eastern United States, describes the nuptial flight of the males and females. Very soon after the honeymoon the male dies; and the pregnant female, tearing off her own wings, for which she has no further use, proceeds to form a new colony very much after the manner of the bumblebees and social wasps. On many occasions Comstock found a female carpenter ant in a small cleared space beneath the bark of a dead tree or log, either alone or accompanied by eggs, larvæ, or small workers. Usually the females are styled "queens," but this name is hardly applicable to

[1] Wheeler, W. M., Ants, Their Structure, Development, and Behavior, p. 151.

those of ants. They are simply the mothers of their colonies. Several of them may live together in perfect harmony, unlike the jealous queen bee, who suffers no rival to her throne. But, if not really a queen, the mother ant is treated with queenly consideration by her children, who feed her, care for her eggs as soon as she lays them, and administer to all her wants.[1]

In addition to the species just described is a form of the widely spread *Camponotus maculatus*, which occurs on every continent and many islands and is divided into a number of well-marked varieties, or subspecies; a small stinging ant (*Pseudomyrma gracilis?*) closely allied to tropical American species inhabiting the hollow thorns of bull-horn Acacias; and the tiny, yellowish "Pharaoh's ant" (*Monomorium pharaonis*) which is so often a pest on board ship as well as in houses.

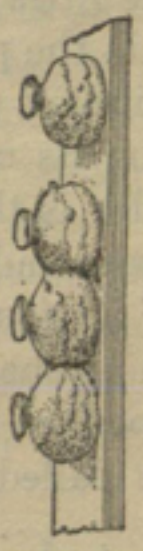

FIG. 23.—NESTS OF POTTER WASP, *Eumenes sp.*, OFTEN INVADED BY PARASITIC JEWEL WASPS, *Chrysis spp.* HALF NAT. SIZE.

POTTER WASPS AND JEWEL WASPS.

On the framework of the lodge veranda, outside the copper gauze, there were a number of little wasp nests resembling miniature ollas, or earthenware decanters. These were the work of a slender-waisted, black and yellow insect belonging to the genus Eumenes. Some of the nests were grouped in vertical rows (fig. 23), while others were solitary, closely resembling similar nests found on the stems of marsh plants in the adjoining Everglades (pl. 51, fig. 11). On opening some of the little ollas the remains of insect larvæ with which they had been stored were found, but accompanying these, instead of a baby Eumenes, a beautiful, little, jewellike wasp (*Chrysis sp.*) was found; in some cases of a brilliant sapphire luster, in others an emerald green (pl. 51, fig. 12). Specimens of these little insects caught near the nests, immediately rolled themselves up like miniature armadillos. Under the lens their brillant surface was found to be minutely and regularly pitted, each concave pit reflecting a brightly colored light, causing the insect to shine with exquisite luster. On plate 52 three specimens from Paradise Key are shown, enlarged 6 diameters. One of them is rolled up for defense as described. The abdomen is somewhat concave on the under side,

FIG. 24.—POTTER WASP, *Eumenes sp.*, WHICH BUILDS ITS NESTS ON THE VERANDA OF THE PARK LODGE. FROM SPECIMEN COLLECTED BY C. A. MOSIER. NAT. SIZE.

[1] See Comstock, J. H., Manual for the Study of Insects, 7th ed., pp. 634–636. 1907.

and is bent under the thorax when the insect rolls itself up. I its parasitic habits it resembles the ichneumons. On discovering th nest of a potter wasp it waits until the potter (fig. 24) is absent then the little rascal, not caring to make a nest of its own, deposit its egg in the potter's nest. Sometimes it is surprised in the act, an the indignant potter attacks it, but it rolls itself up into a ball, rely ing upon its metallic armor for protection, and the only damage i can suffer is the loss of its projecting wings. St. Fargeau observe a bee, who had surprised one of these little robbers *flagrante delicto* bite off its four wings; but she did not thereby save her young, fo as soon as she was gone the wingless Chrysis crawled into the nes and deposited its eggs. It is on account of this habit that the chrys ids are called cuckoo flies. The Germans call them *goldwespe* (gold wasps), for some of the European specie have a golden luster. To the writer the nam "jewel wasps" seems most appropriate. A least two species were collected in Royal Pal State Park, one belonging to the section Te rachrysis, and the other, identified by Mr. S. A Rohwer as *Chrysis parvula* (pl. 51, fig. 13) belonging to the section Trichrysis. On bein shown one of the clay nests above describe Mr. John Peabody Harrington of the Bure of American Ethnology at once recognized it resemblance in form to certain vessels of earthenware used by th Diegueno Indians of southern California as receptacles for the ash of their cremated dead.

FIG. 25.—SOLITARY WASP, *Odynerus quadrisectus*, WHICH CONSTRUCTS MUD CELLS IN CANES AND HOLLOW TUBES. NAT. SIZE.

OTHER PARASITIC WASPS.

Closely allied to the potter wasps, but somewhat less elegant i form, are the solitary wasps of the genus Odynerus, which construc cells of mud in tubular cavities and store them with small cater pillars for their own larvæ to feed upon. On the island of Guam a certain species of this genus was very abundant, filling with it cells empty cartridge cases, rolled-up magazines or newspapers le lying about, the hollow internodes of bamboos, and even gun barrel In each cell examined the writer found a small, green caterpillar which had been stupefied but not killed by the insect's sting. Th larvæ of the Odynerus in eating their animal food are much mor active than those of pollen-feeding insects, continuing to turn thei heads from side to side and living for some time after having bee taken from their cells.[1] One of the species collected on Paradise Ke was identified by Rohwer as *Odynerus quadrisectus* (fig. 25),

[1] See Safford, W. E., The Useful Plants of the Island of Guam. Contr. from th National Herbarium, 9:92. 1905.

pretty insect, somewhat like a yellowjacket, marked with four transverse yellow bands.

Campsomeris quadrimaculatus, the largest wasp of the park (pl. 51, fig. 7), takes its name from four bright yellow spots on its abdomen. This insect makes no nest, but burrows in the earth in search of grubs of beetles and other larvæ, in which it deposits its eggs. Contrasting with it in size is a square-headed little solitary wasp, *Hypocrabo decemmaculatus* (pl. 51, fig. 3), which stores its cells with small insects. Smaller than this are *Pristaulacus floridanus* (pl. 51, fig. 5), belonging to the ensign flies (Evaniidae), and a certain unidentified Braconid belonging to the genus Heterospilus, many individuals of which were found in the burrow of a borer.

HORNETS AND MUD DAUBERS.

A collection of Hymenoptera received from Mr. C. A. Mosier in March, 1918, included several hornets, mud daubers, and solitary wasps, kindly determined for the writer by Mr. H. L. Viereck. Among the hornets, or social wasps, were *Polistes rubiginosus*, of a reddish-brown color, which constructs unprotected nests resembling honeycomb in sheltered places, and *Polistes annularis*, somewhat smaller and darker colored, which ranges as far north as New Jersey. Among the mud daubers were *Scelephron cementarius*, a widely distributed species with very slender-pediceled abdomen, and legs variegated with yellow; the dark, steel-blue *Chalybion coeruleum;* the "thread waist" mud wasp, *Sphex vulgaris*, with the upper part of the abdomen adjoining the threadlike pedicel orange-colored; and the little slender *Trypoxylon collinum*, devoid of yellow bands on the abdomen, many of whose close allies store their cells with small spiders or insects. In addition to these there was a rare little solitary wasp, *Zethus* (*Didymogastra*) *poeyi*, with its abdomen separated from the thorax by a fusiform or pear-shaped peduncle, and with narrow wings directed backward but not overlapping.

BEES AND THEIR ALLIES.

Among the bees collected on Paradise Key the following have been identified by Mr. Crawford: *Bombus pennsylvanicus*, a widely spread bumblebee (pl. 51, figs. 8, 9, 10); *Xylocopa micans* Fabr., a carpenter bee, which excavates galleries in dry wood (pl. 51, fig. 1); several leaf cutters, including the rare *Megachile pollicaris* Say (pl. 51, fig. 4); a parasitic cuckoo bee (Coelioxys); and a metallic, green jewel bee (*Augochlora*) which digs burrows in the ground.

Perhaps the most interesting of all these are the leaf cutters belonging to the genus Megachile (pl. 51, fig. 4). These are the insects which cut circular disks from leaves with which to line their

nests. Some of them are carpenters as well as leaf cutters, and excavate tunnels in wood before cutting the disks. The lined tube, usually rounded at the bottom, is partially filled with a paste of pollen and nectar, upon which the egg is deposited and the hole is then stopped up with circular leaf disks a little greater in diameter than the tube itself.[1] Like the provident potter wasps the leaf cutter bees also have their enemies; the nests so carefully prepared for their tender offspring are infested by cuckoo bees, belonging to the genus Coelioxys. This genus is represented in the author's collection by three specimens of *Coelioxys dolichos* Fox (pl. 51, fig. 6), collected on Paradise Key by Mr. Mosier.

FLIES.

The Diptera of Paradise Key include many groups zoologically related but with very diverse habits: mosquitoes; horseflies and deer flies, which not only attack animals but which even pursue automobiles for miles; robber flies, which catch their insect prey on the wing; flower flies, which feed on nectar and pollen; parasitic tachina flies, which lay their eggs on living insects; and carrion-eating flesh flies.

MOSQUITOES.

Aedes niger, the most common mosquito in the vicinity of the park is congeneric with the yellow-fever mosquito (*Aedes calopus*), but it has never been known to communicate a malignant disease. Its bite, though painful, is not nearly so severe as that of certain other species, and is not followed by unpleasant consequences. Volatile aromatic oils rubbed on the face, neck, and other exposed parts yield temporary protection from their attacks, and campers resort to the use of smudges for smoking them out of their tents.[2] The writer has already referred to the part played by dragon flies in the destruction of mosquitoes. Their aquatic larvæ furnish food for young fishes. Some of the species undoubtedly deposit their eggs in the water reservoirs of the epipthytic Bromeliads already described.

A popular account of the mosquitoes of Florida was published by Dr. Hiram Byrd, of the Florida State Board of Health, in the Medical News, June 10, 1905.

Among the mosquitoes from Royal Palm State Park determined by Doctor Dyar are *Wyeomyia antoinetta*, *W. mitchelli*, *Culex similis*, *C. peccator*, *Psorophora posticatus*, *P. floridensis*, *Aedes niger*, already mentioned, *A. infirmatus*, *A. sollicitans*, *Anopheles quadrimaculatus*, and *A. crucians*.

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[1] See Comstock, Manual for the Study of Insects, 7th ed., pp. 667–668. 1907.
[2] See Howard, L. O., U. S. Department of Agr. Farmers' Bull. 444. 1915.

For a systematic treatment of the group the reader is referred to the monumental work of Howard, Dyar, and Knab, "Monograph of the Mosquitoes of North and Central America and the West Indies," published by the Carnegie Institution of Washington. 1912 to 1917.

HORSEFLIES AND DEER FLIES.

While sitting on the lodge veranda our attention was frequently attracted by passing teams, the horses of which were attended by boys whose business it was to protect them from the attacks of insects; from mosquitoes, I at first thought, but from horseflies, I was told by Mr. Mosier. These flies are very annoying in southern Florida, not only to horses and other animals but to human beings as well. The largest of them all, a magnificent emerald-eyed insect, called by the Seminole Indians *chilloc-o-dono*, is *Tabanus americanus* (pl. 45, fig. 3), the interesting nupital flight of which has been recently described by Mr. Thomas E. Snyder, of the Office of Forest Entomology, United States Department of Agriculture.[1]

Among the other horseflies collected on Paradise Key by Mr. Snyder were *Tabanus trijunctus* Walker (pl. 53, fig. 2), *T. melanocerus* Wied., and *T. lineola* Fabr. Mr. Snyder found *T. trijunctus* very common from Hobe Sound to Paradise Key, often flying after automobiles and railway trains; so annoying is it to painters and other workmen that they have to protect themselves from it by means of portable smudges. Of *T. lineola* he says that it is such a pest in some localities that horses and mules have to be protected from it by gunny sacking with holes cut for the eyes. Thus grotesquely clothed they suggest the mounts of the Ku-Klux Klan. Among the deer flies, belonging to the genus Chrysops, much smaller and more brightly colored than the horseflies, but equally bloodthirsty, were two species, *Chrysops flavidus* (pl. 53, fig. 6) and *Chrysops plangens*, both of which are pretty widely distributed in the eastern United States. Their predacious larvæ, like those of Tabanus, live in water, in mud, or under stones, and feed upon water snails and soft-bodied insects.

OTHER DIPTERA FROM PARADISE KEY.

The soldier fly, *Hermatica illucens*, shown on plate 53, figure 9, lays its eggs in decaying organic matter. Among the Syrphidae, or flower flies, are the little *Ocyptamus fuscipennis* (pl. 53, fig. 1), *Eristalus vinetorum* (pl. 53, fig. 4), *Eristalus albifrons*, and *Meromacrus acutus*. These insects, called "hover flies" by the English, from their habit of hovering over flowers, feed on nectar and pollen. The larvæ

[1] See Snyder, Thomas E., Notes on horseflies as a pest in southern Florida. Proc. Entomological Soc. of Wash., 18: 208. 1916.

of some of the species have a long, caudal appendage and are hence called "rat-tailed maggots." One peculiar larva collected by Mr. Mosier, the park warden, was referred to the genus Microdon by Mr. C. T. Greene, who says that it differs from all allied larvæ in the collections of the Museum in the peculiar form of its spiracles.

The wasplike Midas fly, *Mydas clavatus* (pl. 53, fig. 5), which has a golden band across its abdomen, takes its generic name from the Phrygian king Midas, concerning whom the legend relates that everything he touched was transformed to gold. Like the robber flies (Asilidae) it catches and devours other flying insects. Its larva is also carnivorous, subsisting mainly on the grubs of beetles. *Archytas hystrix* (pl. 53, fig. 8) is a stout tachina fly, somewhat resembling a bluebottle, but with a glossy brown body set with short stiff hairs. It lays its eggs on living insects, principally on caterpillars. Last of all may be mentioned the terrible little screw-worm fly, *Chrysomyia macellaria* (pl. 53, fig. 7), with a reddish brown face, a steel blue thorax, and a short, broad, black abdomen, which lays its eggs in wounds, or in the nostrils of living animals. It has even been known to deposit its eggs in the nostrils of human beings sleeping out of doors, but this is a rare occurrence. The eggs soon hatch and the larvæ, called "screw worms," eat away the flesh of the inner nose and pharynx, causing intense pain and sometimes death. This little fly causes little trouble in the Southeastern States, but in the Southwest it is a serious pest, infesting cattle, hogs, and other domestic animals. Some times it lays its eggs in the navels of new-born calves.[1]

FISHES.

The Everglade fishes in the vicinity of Royal Palm State Park have never been systematically collected. The highway from the park to Cape Sable now under construction has a canal bordering it, formed by the removal of material for the roadbed. The digging is accomplished by a dredge, the parts of which were brought from Miami on trucks and assembled in the canal. This canal is already well stocked with fishes which can be easily observed from the road. The fish fauna should be studied before the canal reaches the ocean; for many marine fishes will undoubtedly make their way up the canal and will destroy existing conditions, which may possibly lead to the destruction of some of the existing species. Among them are the alligator gar and mudfish, allied to the ancient ganoids; a bullhead catfish; three or four minnows, or shiners (Cyprinidae); rare Everglade killifishes, some of which bring forth their young alive; sunfishes, or so-called breams; and the widely distributed, big-mouth bass, or "trout."

[1] See Farmers' Bull., p. 857, U. S. Dept. Agr., 1917.

THE ALLIGATOR GAR, LEPISOSTEUS TRISTOECHUS.

This is a voracious fish remarkable for its armor plating of enameled rhomboid scales. The accompanying illustration (fig. 26) was made from a field sketch by Master Stewart Loveland, of Homestead, of a specimen 25 inches long, weighing 3 pounds, speared by him near Paradise Key. This species sometimes reaches enormous dimensions. A specimen in the State Museum at Springfield, Illinois, is 7 feet 2 inches long. It is widely distributed in streams flowing into the Gulf of Mexico, and also occurs in the fresh waters of Cuba. Many stories have been told of its ferocious nature and uncanny habits; it takes the place of the predacious sharks in the fresh waters of our country. Although it does not rank high as a food fish, it is sold in the markets of Tampico, Mexico, and other Gulf ports.

The family to which the alligator gar belongs (Lepisosteidae) is essentially American, like the mudfish (Amia) to be described below. Fossil species of the genus, however, are found in the Eocene of Europe as well as in that of America.

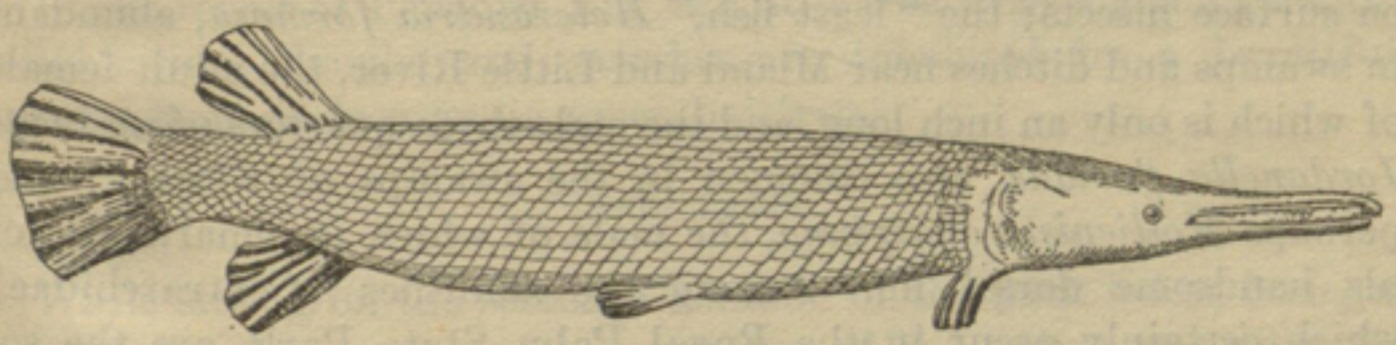

FIG. 26.—ALLIGATOR GAR, *Lepisosteus tristoechus*, FROM A FIELD SKETCH BY STEWART LOVELAND OF SPECIMEN SPEARED BY HIM NEAR PARADISE KEY. ONE-SIXTH NAT. SIZE.

THE MUDFISH, OR DOGFISH, AMIA CALVA.

This species is found in swamps, lakes, and rivers bordering the Gulf of Mexico, extending up the Mississippi and its tributaries as far north as the Great Lake region. It is especially abundant in swamps and sluggish waters abounding in aquatic vegetation, preferring rather shallow water, and feeding principally at night. Gamy and voracious, it is "one of the hardest fighters that ever took the hook." It frequently comes to the surface to breathe, especially in stagnant water; and can be kept in a rain barrel for a long time without change of water. It is said to survive periods of drought by burying itself in the mud. The male builds the nest and guards it after the eggs are laid; he is a good father, even accompanying and protecting the schools of young after they leave the nest. It is not highly esteemed for food, but is often eaten in the South. The mudfish is chiefly interesting on account of its close resemblance to ancient types of ganoid fishes. It is the only surviving relative

of a once large family represented by numerous fossils from the Jurassic of France and Bavaria and the Eocene of Europe and North America.

OTHER FISHES OF THE EVERGLADES.

The catfish caught in the slough near Paradise Key is in all probability *Ameiurus nebulosus*, a species which has been collected in Little River, a short distance north of Miami. Among the Cyprinidae are the golden shiner, *Abramis roseus*, a tiny species, only 2½ inches long when fully grown, which takes its name from the rosy color of the fins, iris, and snout of the male. Among the killifishes (Poeciliidae) of southern Florida, which are to be expected from the vicinity of Royal Palm State Park, are several species of Fundulus, some of which do not exceed 2 inches in length when fully grown; the viviparous "top minnow," *Gambusia affinis*, which lives mostly on surface insects; the "least fish," *Heterandria formosa*, abundant in swamps and ditches near Miami and Little River, the adult female of which is only an inch long, and the male three-quarters of an inch; *Jordanella floridae*, also common in the swamps of Florida; and perhaps *Mollienisia ongipinna*, the male of which is remarkable for his handsome dorsal fin. Among the sunfishes (Centrarchidae) which certainly occur in the Royal Palm State Park, are the so-called blue bream, or bluegill, *Lepomis incisor* (*Lepomis pallidus* Jordan), and *Lepomis holbrooki* (*Eupomotis holbrooki* Jord. and Everm.). A beautiful illustration in colors of the former is published in the Fishes of North Carolina, by Dr. Hugh M. Smith, United States Commissioner of Fisheries, who pays it the following tribute:

> This is the largest and finest of the sunfishes. It attains a length of 12 to 14 inches and a weight of a pound and a half, and when full grown is a magnificent species. As a game and food fish it stands high. * * * This fish has for many years been called *Lepomis pallidus* in the belief that Mitchill's name of *Labrus pallidus* applied to it; but a close examination of Mitchill's description shows that it could not have been intended for this species, and furthermore the bluegill is unknown in the locality from which the type of *pallidus* came. The earliest available name is *incisor* of Cuvier and Valenciennes.[1]

Drawings of both *Lepomis incisor* and *L. holbrooki* were made for the writer by Master Stewart Loveland of Homestead, who caught them in the slough near Paradise Key.

BIG-MOUTHED BASS, OR TROUT.

This species, known scientifically as *Micropterus salmoides*, is the largest and most important of the fresh-water basses, and is a fine

[1] See North Carolina Geological and Economic Survey, vol. 2, p. 242, pl. 9. 1907.

food and game fish. According to Dr. Hugh M. Smith, who figures it in the work above cited—

> It inhabits more sluggish and warmer waters than the other species, and thrives under more extreme conditions of environment and temperature. * * * It reaches its maximum weight in Florida, where examples weighing as much as 20 to 25 pounds have been taken in lakes.

After describing its nesting habits and the solicitous care of the newly hatched young by the parents, Doctor Smith continues:

> The food of the young fish consists of minute animals—crustacea, insects, etc. At a very early period, however, they begin to prey on their smaller brothers, and this cannibalism continues after they become adults. The larger fish are very voracious and aggressive feeders, taking all kinds of fish as well as small mammals, frogs, tadpoles, snakes, worms, insects, and also vegetable matter.[1]

FROGS AND TOADS.

In the forest of Paradise Key two little tree frogs abound; and the neighboring sloughs and marshes are inhabited by a beautiful, spotted leopard frog and a green bullfrog.

TREE FROGS.

While sitting on the screened veranda of the park lodge, besieged by clouds of mosquitoes, the attention of the writer was attracted by a number of diminutive tree frogs, some of them green, others brownish, on the outside of the copper-wire gauze. One of the smallest, whose body was scarcely bigger than a dime, made a sudden spring and caught a mosquito. Against the bright sky his little body was almost diaphanous and a dark speck could be seen in his stomach; it was the mosquito he had just swallowed. After another successful catch there were two specks, and continuing his good work the little creature soon had his stomach comfortably full. Then he folded his little arms close to his body and went to sleep. Closer examination showed that there were two species of these little frogs, the second distinguished from the one first noticed by lateral metallic bands. Alcoholic specimens were identified by Dr. Leonhard Stejneger as *Hyla squirrela* (fig. 27) and *Hyla cinerea*, respectively.

FIG. 27.—TREE FROG, *Hyla squirella*, WHICH WAGES INCESSANT WARFARE ON MOSQUITOES AND OFTEN NESTLES IN THE COROLLAS OF FLOWERS. NAT. SIZE.

In the woods these little creatures were commonly seen clinging to leaves from which they could scarcely be distinguished, and at Homestead, while awaiting transportation to the park, the writer

[1] See North Carolina Geological and Economic Survey, vol. 2, p. 247. 1907.

noticed a number of them on flowering Datura, in a funnel-shaped corolla of which one of them had established itself as a desirable station for securing his insect food.

MARSH FROGS.

The leopard frog of Royal Palm State Park, *Rana sphenocephala* Cope, regarded by Doctor Stejneger as a variety of our well-known *Rana pipiens*, is beautifully figured by Miss Dickerson in her Frog Book. To this species Miss Dickerson pays the following tribute:

> The southern leopard frog is perhaps the most beautiful frog in North America. It has not the delicate modest beauty of the wood frog, but it has distinction of form, richness of coloring, and intricacy of color patterns. It has not, like the wood frog, an expression indicating gentleness and tameness. Instead, a creature extremely alert and wild, possessing great powers of activity, is seen in the unusually large eyes and in the attentive pose of the slender body. * * * The male, *Rana sphenocephala*, has large vocal pouches, one at each side, above the arm. These frogs are wild and active. They leap long distances, and are difficult to catch. The species is evidently a very distinct one, not intergrading with *Rana pipiens*, but holding its own with the latter frog in the same localities in the southern part of the United States.[1]

The Florida bullfrog, *Rana grylio* Stejneger, is also described and figured by Miss Dickerson, who designates it as "a beautiful frog, very retiring and thoroughly aquatic in habit." It is usually of a vivid metallic green on the head and shoulders and olive on the posterior portion of its body, with a pointed head, bulging eyes, the ears of the male remarkably large and conspicuous, spheroid in shape, and of an orange-brown color with a green center, and the throat a bright yellow. It is probably this species which is common in the slough near Paradise Key, living among the dense aquatic vegetation among which it seeks refuge when disturbed. Miss Dickerson compares the sounds which it produces to "the grunting of a herd of pigs," thus differing from the familiar bass notes of the common bullfrog.[2]

REPTILES.

TURTLES.

Among the turtles of Royal Palm State Park is a large terrestrial box tortoise, a living specimen of which was received from the park warden. This was determined as *Terrapene major* (*Cistudo major* Agassiz), by Dr. Leonhard Stejneger, of the United States National Museum, to whom the writer is indebted for much information regarding the batrachians and reptiles of the region here considered.

[1] See Dickerson, Mary C., The Frog Book, pp. 186–188. 1906.
[2] Dickerson, op. cit., 226 to 228, pls. 85 and 86.

An aquatic turtle, collected by Mr. Arthur H. Howell, proved to be *Pseudemys floridana*, belonging to the group of river turtles. In addition to these Mr. Mosier reports the following species from the park: A snapping turtle, a soft-shelled or leather-backed turtle, a small water turtle with conspicuous red markings beneath, and a large, hard-shelled, water turtle, which is very good to eat. The well-known gopher of Florida, *Gopherus polyphemus*, so common on sand dunes near the coast, does not occur in the park.

ALLIGATORS.

Alligator mississippiensis is not uncommon in the slough at the eastern entrance to the park. During the writer's visit its bellowing could be distinctly heard from the lodge, especially in the early morning. These huge animals are not at all dangerous, but will flee at the sight of a man and will not show fight unless brought to bay. Young alligators feed mostly on fishes, frogs, and insects; the older ones also catch waterfowl and unwary mammals which come within reach. They drown their prey by holding it under water, but in order to swallow it they must raise their head above the surface. Alligators' eggs, which are about as large as those of a hen, but oblong in shape, are eaten in many parts of the South. They are nutritious and are as good as turtles' eggs. The young when hatched are about 8 inches long. Though they do not appear to thrive in captivity when brought north, they develop rapidly in their native surroundings.

In addition to the alligator there is a true crocodile in southern Florida, but it does not occur near the park. This animal, called by zoologists *Crocodilus acutus*, is closely related to *C. vulgaris*, the man-eating crocodile of Africa which was worshipped by the ancient Egyptians and took part in their religious pageants and processions. It is easily distinguished from the alligator by its narrower head and pointed snout. Specimens 11 or 12 feet long are not rare, and it sometimes reaches the length of 14 feet. Its range extends from Lake Worth to Cape Sable. South of the United States it ranges from central Mexico to Ecuador and the West Indies. Though showing vicious propensities in captivity it is naturally timid in its wild state.

> The sight of a child will send a 12-foot specimen rushing from its basking place for the water, and a man may even bathe with safety in rivers frequented by the species.[1]

LIZARDS.

Sharply contrasted with the giant saurian of the swamps are the little terrestial lizards commonly called skinks and chameleons. The

[1] See Ditmars, R. L., The Reptile Book, pp. 89–91. 1907.

Florida skink, *Plestiodon egregius*, is only 3½ or 4 inches when full grown. Its body is cylindrical and slender, almost wormlike, wi small, weak limbs. It is of an olive or reddish brown color with fou equidistant, longitudinal stripes margined with obscure dotted lin

The so-called chameleon, *Anolis carolinensis*, takes its comm name from its changing color. It is not related to the tr chameleons of the Old World so often celebrated in fabulous stori but belongs to the iguana family and bears a superficial resemblan to a miniature alligator. Specimens of this little animal were se on the screened veranda of the park lodge running about with ea upon the vertical walls and even on the ceiling, to which it adher by means of its peculiar, padded toes, while it was busily engaged i catching mosquitoes and other insects. In its habits it reminded t writer of the geckos so common in dwellings on the island of Gua Mr. Snyder states that they are very active in the woods when t termites swarm, devouring them in great quantities. Sometimes assumes a dull, brown color, at other times a vivid green. The mal have a throat pouch which they inflate, while uttering a peculi sound very much like that of a baby alligator, and they have a w of nodding their head that is odd and comical. Unlike the lit tree frogs frequenting the veranda, these little animals were ve timid, and quickly escaped when attempts were made to captu them.

SNAKES.

Among the harmless snakes of the park are two garter snake *Thamnophis sirtalis*, with three, yellow, longitudinal stripes and t more slender *Thamnophis sackeni*, with two, long, lateral stripes a the beginning of a short median stripe on the back of the nec Both of these species are semiaquatic, subsisting upon frogs a fishes as well as earthworms and toads; and they bring forth the young alive. Two water snakes are found in the sloughs and poo of the Everglades: the "spotted belly" *Natrix fasciata*, sometim erroneously called a moccasin, but easily distinguished from t poisonous water moccasin by its yellowish white abdomen spott with bright red blotches and clouded spots of black and gray; a the so-called green water snake, *Natrix cyclopion*, with an unspotte yellowish abdomen and yellow lips. Both of these species are harm less, but they simulate poisonous species by flattening themselves o and assuming a threatening attitude when cornered.

Among the racers or black snakes is the well-known gopher snak *Drymarchon corais couperi*, a variety of the large tropical Americ *D. corais*, sometimes 8 or 10 feet long, with a highly polished, blu black body, which has given it the name of indigo snake in certa localities. It has a gentle disposition and often lives about hous

in a semidomesticated state, subsisting principally on rats and mice. Children sometimes pick it up, and it seems to enjoy being petted. A fine, large specimen of this snake greeted the writer at the door of the lodge, when he alighted from the automobile which conveyed him to the park. The park warden gave a vivid description of the mating of a pair, in which both the male and female strutted in front of each other, as though trying to show off to the best advantage. Closely allied to this species is the black racer, *Coluber constrictor*, which does not kill its prey by squeezing, as commonly believed, but is a constrictor only in name. Both of these snakes are oviparous, the shell of the egg of the latter being white and tough and sprinkled with grains resembling coarse salt. Both species have the reputation of charming birds and small rodents, but this power is quite imaginary. The two species are easily distinguished, the gopher snake by its glossy body and reddish brown throat, chin, and upper lip plates, and the black racer by its dull slaty luster and milky white throat and chin. The closely allied coachwhip, or whip snake, *Coluber flagellum*, differs from the two preceding species in having a nasty, irritable disposition, and will not submit to being handled. Its body is slender, of a black or brown color above, becoming lighter toward the tail, and the under surface white, with the plates of the throat clouded along the edges. It is very swift, often climbing trees in quest of eggs and young birds, but it can not be called arboreal.[1]

The green tree snake, or magnolia snake, *Opheodrys aestivus* (*Cyclophis aestivus*), is a gentle creature of a uniform leaf-green above and bright yellow beneath. It lives among the branches of bushes and low trees, feeding upon grasshoppers, crickets, the larvæ of insects, and, according to Mr. Mosier, on small tree toads. In describing the vegetation of southern Florida hammocks, Dr. Small refers to this species as follows:

> Orchids, air plants, and ferns completely clothe the limbs of the larger trees. However, plants do not have a monopoly of the trees. There are also epiphytic lizards and epiphytic snakes. There is everywhere present a beautiful green snake. It inhabits the hammocks and it is especially abundant in those of the Everglades. It lies outstretched on the branches of shrubs and trees and glides along the branches from one tree to another with surprising ease. One has usually to be careful to look before laying hold of the limb of a tree for support, or he may grasp something of quite different consistency from that of wood. One reason why this little creature is so much at ease among shrubbery is the peculiar nature of its scales, each of which is distinctly keeled, so that the general surface of the body is roughened and thus able to hold on more securely to the branches along which it glides.

[1] See Ditmars, R. L., The Reptile Book, pp. 286–287. 1907.

HOG-NOSE, OR PUFF ADDER, *Heterodon contortrix* (*H. platyrhinus*).

Concerning this species, which he kept in captivity, Dr. Hira Byrd writes as follows:

> Among the snakes of my pit the puff adder acts the part of clown. He is a bluff. If you come upon him suddenly he spreads his hood like a cobra, an tries to frighten you with his looks. Failing, he blows like a rattlesnake. you are still undaunted, he takes to flight. If you do not permit that, and pr ceed to tease him, he then resorts to camouflage, which is to turn over on h back and, possumlike, play dead. He will even try to creep away on his bac I can't imagine the rattlesnake associating with the puff adder on terms social equality.[1]

This snake is easily recognized by its turned-up nose and its mo tled brown body.

THE COTTONMOUTH, OR WATER MOCCASIN, *Ancistrodon piscivorus*.

This species, so much dreaded by travelers in the Everglades, i closely allied to our copperhead, *Ancistrodon mokasen* (*A. contor trix*), which is sometimes called the highland moccasin. The top o its head is very dark, usually black, the chin and lower lips yello with three dark bars on the lip plates on each side of the mouth, an the abdomen is yellow blotched with dark brown or black, while th under portion of the tail is black. This coloration of the abdome serves to distinguish it from its harmless associates, with which it i sometimes confused, *Natrix fasciata*, which has a yellowish white ab domen spotted with red and black; and *Natrix cyclopion*, which has uniform yellowish abdomen. When surprised it has the habit o opening its jaws widely, disclosing its white mouth parts, from whic it takes its name of cottonmouth. In addition to fish, frogs, an other snakes, it feeds upon birds and small animals. It brings fort its young alive, usually seven to twelve.

RATTLESNAKES.

The pigmy rattlesnake, or ground rattler, *Sistrurus miliarius*, ma be recognized at once by its small size and minute rattle. The adult scarcely reach a length of 18 inches. Their warning rattle is so fain that it can be heard from the distance of only a few feet. The dia mond-back, *Crotalus adamanteus*, is the largest of all the rattlesnakes sometimes reaching a length of 6 to 8 feet. It is recognized at once b its rattle and its broad, flat head and distinctly narrowed neck. It is of an olive or grayish green color with a longitudinal chain o large, diamond-shaped patches outlined with bright yellow. With its long fangs and large poison glands it may be regarded as one of the most deadly poisonous snakes in the world. Doctor Byrd has mad

[1] Byrd, Hiram, Letter to writer dated Homestead, Fla., Nov. 15, 1917.

some interesting observations on the life history of the species, from their earliest stages to maturity. He was bitten on the finger by a specimen 12 days old while trying to feed it. He stopped circulation immediately by the use of an improvised tourniquet, and though experiencing certain odd sensations of chilliness, escaped serious injury. Unlike the solicitous mudfishes and basses of the neighboring Everglades, who protect their young for some time after they are hatched, rattlesnakes let their little ones shift for themselves as soon as they come into the world. Dr. Byrd could discover no evidence of parental affection among them; yet in admiration of their innate dignity, courage, and their disdain to strike without warning, he composed an ode in their honor, which ends with the following stanzas:

Yet all thy virtues wrest from man no lays,
Who sings of war and love, of bird and bee,
And e'en of rusty toad, but not of thee.
To thee he yields but hate or fear, not praise.

Indifferent thou to hatred, fear, or wrong,
Content in jungle drear to seek thy food
And make thy home and launch thy royal brood
In solitude,—I grudge thee not a song.

BIRDS.

The bird fauna of southern Florida is especially rich, not only on account of the mild climate, favorable to many subtropical species, but also because Florida is a highway for migratory species which spend their winters in the West Indies. Mrs. Kirk Munroe, president of the Cocoanut Grove Audubon Society, and Mrs. Hiram Byrd, who resides at Princeton, not far from Paradise Key, have interested themselves in observing the birds of this vicinity and making a census of its bird fauna. It is impossible within the scope of this paper to give a detailed account of the birds, but the reader's attention is called to some of the most interesting.[1] Since the writer's visit systematic studies of the birds and mammals of the park have been made by Mr. A. H. Howell, of the United States Biological Survey, who visited the region twice during the year 1918. The results of his investigations will be published later by the Survey.

In southern Florida many well-known birds, as well as mammals, are represented by varieties or subspecies quite distinct from the typical forms occurring farther north. In some cases the differences are in the relative proportions of certain parts; in others it may be in the coloration of one or both of the sexes. Thus we have a Florida

[1] Illustrations, descriptions, and scientific names of many of the birds here considered will be found in the admirable little pocket bird guides of Chester A. Reed, published by Doubleday, Page & Co.

quail, Florida crow, Florida wren, and the Florida cardinal, all which are essentially Floridian, and the Florida wild turkey, whi is fast disappearing. Other forms called Floridian, because th were first described from Florida, but which have a wider geograph cal range, are the Florida gallinule, several Florida hawks, t Florida screech owl and barred owl, and the Florida blue jay. One the most beautiful birds, a tropical species now fast disappear from Florida and occurring nowhere else in the United States exc in Texas, is the roseate spoonbill.

Of this species, known scientifically as *Ajaia ajaja* (pl. 54) M Kirk Munroe has written a most charming description, which t writer hoped to embody in the present paper, but which, on accou of limited space, can not be here presented in full.

> Once the roseate spoonbill inhabited the neighborhood of Paradise Key great flocks, but it is becoming rarer and rarer. * * * They are socia birds, always traveling and nesting in communities. The nests, usually bu among picturesque mangrove branches, look like a pile of rubbish, except the very center, where three or four whitish, brown-spotted eggs are plac Young spoonbills are covered with snowy down while they are nestlings. feeding they push their bill, indeed the entire head, down the parent's thr as far as possible to secure food, each greedy little fledgling taking its tu The spoonbill is sometimes called the shoveler on account of the peculiar sh of its beak, which it uses with wonderful skill in catching aquatic insects a crustaceans in the mud along the water's edge. Quantities of its beauti rose-colored feathers were sold to tourists a few years ago. In certain locali exploring naturalists came upon great piles of carcasses from which the bea tiful wings had been torn. No wonder that this unfortunate bird, whose bea tiful plumage like that of the egret has been its curse, has become almost extin in Florida. Thanks to the influence of the Audubon societies, the feathers wild birds are becoming more and more unfashionable, and it is hoped that t roseate spoonbill may thus escape extermination.

The white ibis, another bird belonging, like the spoonbill, to t heron order, is quite common in the vicinity of Royal Palm St Park. It is easily recognized by its white body plumage, blac tipped wings, and decurved, orange-red beak, with which it is mo adept in extracting crawfish and aquatic insects from the mud of t marshes. To the same order also belong the American bittern, brownish bird with greenish-yellow legs; the Ward heron, state "lady of the waters," with slate-colored back, mostly white und parts, and whitish crest; the little blue heron, not always blue, b sometimes pure white, also common about Paradise Key; and t black-crowned and the yellow-crowned night herons, whose "da begins after sunset," when they leave their roosts in the forests an fly forth to feed in the marshes.

Among the diving birds are the pied-billed grebe, also known the water witch or hell-diver, a bird easily recognized by its lob feet. The darters are represented by the uncanny water turkey,

snake bird (*Anhinga anhinga*), quite common in trees near the slough of the park. This bird, like a submarine, dives with the greatest ease and pursues its prey beneath the surface of the water.[1] There is little open water to attract ducks, but the park warden has every year observed, in the vicinity of the park, a few blue-winged teal, mallard, and Florida ducks (*Anas fulvigula*), the latter remaining throughout the entire year.

The turkey vulture commonly seen sailing in the sky above Paradise Key is *Cathartes aura* that ranges over North and South America, called *Tzopilotl* by the Aztecs and *Gallinazo* by Spanish Americans. Specimens of it were caught by Mr. A. H. Howell in traps set on the marshes for raccoons.

Among the birds of prey are the Everglade kite (*Rostrhamus sociabilis*), which feeds upon the large marsh snail already described and is known locally as the snail hawk; the swallow-tailed kite (*Elanoides forficatus*), with a deeply forked tail, white under parts and head and bluish black back, a bird quite common near the park and ranging to Central and South America; and the Mississippi kite (*Ictinia mississippiensis*). The hawks include the marsh hawk, sharp-shinned hawk, red-tailed hawk, Florida sparrow hawk, the osprey (fig. 28), and the Florida red-shouldered hawk. Many ospreys (*Pandion haliaetus carolinensis*) were observed by the writer flying over the Everglades between Paradise Key and Camp Jackson, occasionally darting down into the flooded grassy prairie and emerging with a good-sized fish in their talons. This species also occurs in Porto Rico, where it frequents both the coast and inland swampy lagoons.[2] On that island it is sometimes called *aguila* (eagle) on account of its noble eagle-like appearance. A magnificent specimen of the handsome red-shouldered hawk (*Buteo lineatus alleni*) perched habitually on the limb of a tree in front of the lodge during the visit of the writer to the park. From its station it pounced upon its prey, principally insects, lizards, and frogs, in the clearing before the building. It also catches snakes. The park warden

FIG. 28.—OSPREY, *Pandion haliaetus carolinensis*, WHICH CATCHES FISH IN THE FLOODED EVERGLADES.

[1] The writer is greatly indebted to Mr. Francis Harper, of the U. S. Biological Survey, for notes on the water birds of Florida.

[2] See the interesting report of Mr. Alexander Wetmore on the birds of Porto Rico, U. S. Dept. Agr. Bull. 326. 1914.

took this bird as an illustration of the conditions of life on Par dise Key, using the following parody on the well-known Hous that-Jack-built. "This is the hawk that caught the snake, that swa lowed the rat, that ate the fruit, that fell from the palm, that gre from the seed that the bird dropped."

Among the swamp dwellers are the limpkin (*Aramus vociferu* an odd bird intermediate between the cranes and rails, with oliv brown plumage streaked with white; and the Carolina rail, or so (*Porzana carolina*), a modest-colored, shy bird, which remains co cealed in the vegetation of the marshes during the day and does n reveal its presence until the late afternoon, when it begins to utter i whistling note, and continues it long after night has fallen. chorus of these birds has been compared to that of piping Hylas the early spring.[1] To this group also belong the purple gallinule a the Florida gallinule, the former with resplendent plumage, a bl shield on its forehead and a carmine bill tipped with yellow, the latt with brownish plumage, a red frontal shield and a broad red ba above its knee. Another allied bird is the coot, or mud hen (*Fuli americana*), distinguished by its whitish frontal shield and especial by its lobed or scalloped toes, which are not unlike those of a gre Kildeers (*Oxyechus vociferus*) are very common, filling the air wi their shrill cries, as though in a perpetual state of alarm.

In addition to the well-known mourning dove, there is a beautif little ground dove (*Chaemepelia passerina*) on Paradise Key. closely allied variety of the latter collected in Porto Rico by M Alexander Wetmore, of the United States Biological Survey, w found to have swallowed a number of ground pearls, or margarod already described, which Mr. Wetmore thinks may have been pick up by mistake for gravel to aid digestion.[2]

Other birds recorded from this region are the yellow-bill cuckoo; several woodpeckers, including the rare ivorybill; a scree owl, already mentioned, which offers a pleasant contrast to some the unspeakable spiders and insects mentioned in this paper by conjugal fidelity and parental affection, for it remains mated f life and defends its young most courageously; the whippoorwi which is a winter resident, the allied Chuck-will's-widow and t Florida nighthawk; our own little ruby-throated hummingbird; t kingbird; the crested flycatcher; the phœbe; purple martin; ba swallow; tree swallow; mockingbird; catbird; long-billed mar wren; and the Florida wren already mentioned. To the last-nam

[1] See Chapman, Birds of Eastern America, 3d ed., p. 143. 1896.

[2] Many other birds of this region occur also in the West Indies, or are there rep sented by closely allied varieties or subspecies. The reader's attention is called to M Wetmore's monograph on the Birds of Porto Rico already quoted, issued as U. S. De Agr. Bull. No. 326. 1914.

bird (*Thryothorus ludovicianus miamensis*) Mrs. Kirk Munroe has paid a well-deserved tribute.

Following these in the bird census of the park come the ruby-crowned kinglet; the wood thrush; Wilson thrush, Hermit thrush, American robin (*Planesticus migratorius*) and bluebird (*Sialia sialis*); the Florida blue jay, Florida crow, and the fish crow; a number of wood warblers, including the beautiful little ovenbird (*Seiurus aurocapillus*), which comes daily to the door of the park lodge to be fed with scraps from the table; the Florida yellowthroat; and the American redstart (*Setophaga ruticilla*). During the writer's visit to the park several individuals of this beautiful bird were frequent visitors to a blooming marlberry tree (*Icacorea paniculata*) in quest of insects attracted by its fragrant, elderlike blossoms.

The list of birds terminates with the names of several vireos, the scarlet tanager, summer tanager; the American goldfinch; the Savannah sparrow, which is a pest in the seed beds of neighboring truck farmers; the Florida cardinal, the female of which is more deeply colored than in our own variety; the blue grosbeak; the indigo bunting; and the many-colored painted bunting, or nonpareil. One would think that the last-named bird (*Passerina ciris*) would be highly conspicuous in its natural habitat; but Doctor Oberholser, who is a keen observer, says that it is often difficult to detect in the dense undergrowth which it frequents, for the bright colors of its varied plumage act as a kind of camouflage or disguise.

MAMMALS.

Among the strange animals which early explorers encountered in the New World the two which excited most wonder were the opossum and the strange, aquatic manatee, both of which were unlike anything ever before seen. The imperfect descriptions of the manatee gave rise to tales of sirens, and the exaggerated accounts of the animal which carried its young in pouches made of its own skin resulted in various fanciful pictures.

In southern Florida several of our familiar animals are represented by varieties slightly different from northern forms, varying either in color, size, or relative proportion of the parts. Thus the mammal fauna of the Royal Palm State Park includes the Florida opossum, *Didelphis virginiana pigra*, very similar to our northern type but somewhat smaller and with a longer and more slender tail; the cotton rat of south Florida, *Sigmodon hispidus spadicipygus;* the south Florida rice rat, *Oryzomys palustris coloratus*, aquatic in its habits and an excellent swimmer; the Florida cotton mouse, *Peromyscus gossypinus palmarius*, very abundant in the forest; the Flor-

ida marsh hare, *Sylvilagus palustris paludicola;* the Florida wild cat, *Lynx ruffus floridanus*, still very common in Paradise Key and in the hammocks between Royal Palm State Park and Miami, and even within the city limits of Miami; the Florida panther, *Felis coryi*, now nearly extinct, but said to be an occasional visitor to Paradise Key; the Florida otter, *Lutra canadensis vaga*, not uncommon in the sloughs of the park; the Florida raccoon, *Procyon lotor elucus*, of a more yellowish color than our northern type; the Florida bear, *Ursus americanus floridanus*, an occasional visitor to the park; the Florida deer, *Odocoileus virginianus osceola*, a dark colored, little animal, about one-quarter smaller than our Virginia deer.

In addition to the above mammals, the manatee, *Trichechus latirostris*, already mentioned, should be included; for, although it does not occur in the immediate vicinity of the park, it is not uncommon in the Miami and other streams close by, into which it enters to feed upon the aquatic vegetation. Its favorite food is the so-called manatee grass, *Cymodocea manatorum*, to which it gives the specific name. During the writer's visit to Miami he saw a fine specimen of this strange animal in captivity, which was fed daily with great quantities of this succulent weed.

For a résumé of the work which has thus far been done in this branch of zoology, the reader is referred to a paper on "The land mammals of peninsular Florida and the coast region of Georgia," by Outram Bangs,[1] in which it is pointed out that the chief cause of the occurrence of so many well-defined subspecies of animals is the isolated position of southern Florida which, like that of an island, has resulted in the segregation of groups and the development of special breeds or distinct forms.

INDIANS OF SOUTHERN FLORIDA.

Many of those who have visited southern Florida have had their attention called to the shell mounds and other prehistoric vestiges of human habitation found in many places along the coast. Some of the most remarkable of these, situated at Marco, or San Marcos, on the Gulf coast of southern Florida, were investigated in 1896 by the late Frank Hamilton Cushing, who, among other things, found the remains of remarkable terraces constructed almost entirely of the shells of conchs, *Fulgur perversum*, a species which takes its specific name from the perverse, or left-handed twist of its spiral shell. Among the objects unearthed were many made wholly or in part of these shells: Mattocks or hoes (fig. 29), war clubs, ladles for bailing canoes, drinking cups, spoons, and even boat anchors, the latter

[1] Proceedings Bost. Soc. Nat. Hist., 28: 157 to 235. 1898.

[2] See Cushing's report in the Proceedings of the American Philosophical Society, vol. 3[illegible] pp. 329–448. 1896.

made by securing several of the largest shells together, with cordage made of agave or yucca fiber, which also served as the cable. An interesting fact connected with these objects is that similar utensils made of this same shell, easily recognizable by its "perverse" spiral, have been unearthed in the mounds of the valleys of the Mississippi and its tributaries, which tend to connect the Florida mound builders with those of our great inner basin. Objects made from the shells of *Fulgur perversum* taken from the mounds of Florida, Arkansas, Tennessee, Ohio, Indiana, Illinois, and Missouri may be seen in the collections of the United States National Museum. Plate 55 is a photograph by Cushing of a terrace faced with these shells; plate 56 shows a ladle made of one of the shells with the inner whorls removed; and figure 30 shows a spoon unearthed in Florida compared with a similar one found in a mound in eastern Tennessee.[1]

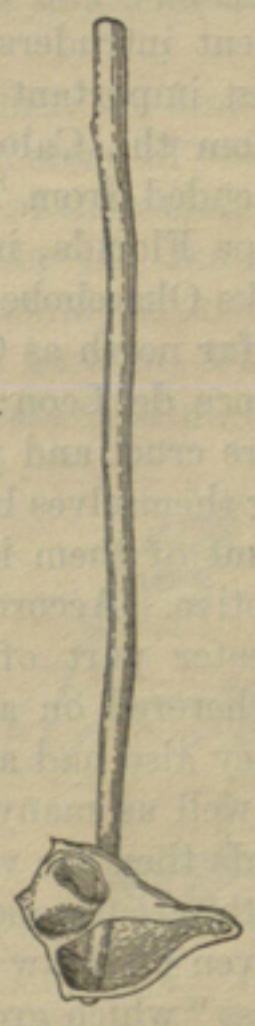

FIG. 29. — MATTOCK OR WAR-CLUB MADE FROM SHELL OF *Fulgur* (*Busycon*) *perversum*, SIMILAR TO SPECIMENS FOUND IN GRAVES OF THE MOUND-BUILDERS OF THE MISSISSIPPI VALLEY.

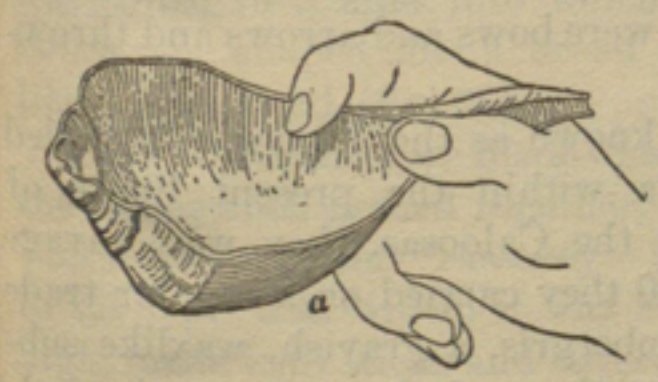

FIG. 30.—UTENSILS MADE OF SHELLS OF *Fulgur* (*Busycon*) *perversum*. *a*, CUP IN THE UNITED STATES NATIONAL MUSEUM FROM THE WEST COAST OF SOUTHERN FLORIDA; *b*, PERFORATED SHELL FROM MOUND IN EASTERN TENNESSEE. REDUCED.

Nearly all accounts of the aboriginal inhabitants of Florida refer to utensils made of these shells, especially in connection with the celebrated "black drink" ritual, in which the shells were used as dippers and drinking cups for serving this ceremonial decoction. The earliest illustrations,[2] however, evidently drawn from memory, erroneously represented these utensils as being made of a shell shaped like that of a nautilus instead of the species actually used.

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[1] See MacCurdy, in Proceedings of the Nineteenth International Congress of Americanists, p. 70, fig. 27. 1915.

[2] See Lemoine's illustration (1564) reproduced in the writer's paper on the Narcotic plants and stimulants of the ancient Americans, in the Smithsonian Report for 1916, pl. 14. 1917.

ABORIGINAL TRIBES.

Very little is known about the aboriginal Indians of souther Florida. The Seminoles, as every one knows, are comparativel recent intruders in this region. At the time of the discovery th most important tribe was known as the Calusas, or Caloosas, fro whom the Caloosahatchee River takes its name. Their territor extended from Tampa Bay southward to Cape Sable, eastward t Cape Florida, including the outlying *cayos*, or keys, and inland t Lake Okeechobee. They claimed authority over the east coast tribe as far north as Cape Canaveral. It was they who, in 1513, repelle Ponce de Leon and kept him from landing on their coast. The were cruel and piratical, killing shipwrecked mariners, and enrich ing themselves by robbing stranded vessels. The most authentic a count of them is given by Fontaneda, who lived among them as captive. According to him, they ate bread made of certain roots th greater part of the year, but sometimes the roots could not b gatherered on account of floods to which the country was subjec They also had an abundance of fish and of roots resembling truffle as well as many other kinds, and when they went hunting deer o birds they ate venison or fowl's flesh. These Indians did not we clothing; the men went naked, except for tanned deerskins or ma woven of straw of which they made breechcloths; the women wo moss "which grows from the trees, resembling oakum or wool, whic is not white but gray, and with these weeds they covered themselv around the waist."[1] Their weapons were bows and arrows and throw ing sticks or spears.

In the sixteenth century a tribe known as the Tequestas occupie the coast of southeastern Florida within the present limits o Dade and Monroe counties. Like the Caloosas, they were savag and piratical. About the year 1600 they carried on a regular trad with Habana in fish, skins, and ambergris, a grayish, waxlike sub stance secreted in the liver or intestines of the spermaceti wha (*Catodon macrocephalus*). This is lighter than water and som times occurs in great masses floating on the surface of the ocea Formerly it was collected in considerable quantities on the shores o the Bahama Islands and the east coast of Florida. When heated emanates a delightful fragrance, on which account it was at on time much used in perfumery. It was also used in medicine and b lieved to have aphrodisiac properties.

[1] Estos Indios no visten Ropa, ni menos las Mujeres; andan desnudos los Hombr si no es unos Pellejos de Venado curtidos, con que hacen unos Bragueros y se cubr solamente sus Verguenzas, y las Mujeres, unas Pajuelas que nacen de los árboles manera de Estopa ó Lana, y no es blanca, sino parda, y con aquellas Yerbas se cubr dellas á la redonda de la Cinta."

The most complete account available of the Indians who preceded the Seminoles in southern Florida is that of Jonathan Dickenson, who in 1699 while on a vessel bound from Jamaica to Philadelphia, with his wife and infant child, was wrecked on the southeast coast of Florida.

Several editions of his narrative have been published, the first one appearing in Philadelphia in 1699. It is a pathetic story of suffering. He, his wife, and his companions were stripped of their clothing and all their possessions and most cruelly treated by the Indians, but the Indian women, taking pity on his infant child, suckled it when its mother's milk was exhausted. From his account, which agrees essentially with that of Fontaneda, an accurate idea may be gleaned of the appearance of the Indians, their food, domestic economy, weapons, etc.

They were of fine physique. The men went naked except for a triangular breechcloth plaited of straw and wrought with divers colors, with a belt of the same material about four fingers wide. A string from the lower corner passed between the legs and was tied to the two ends of the belt which met behind the back, and from the knot hung a bunch of silk grass (fiber of Yucca filamentosa) of a flaxen color resembling a horse's tail. They also had deerskin cloaks. Their long hair was coiled in a knot into which were stuck two bones, one shaped like a broad arrow, the other like a spearhead (fig. 31).

FIG. 31.—ABORIGINAL INDIAN OF SOUTHERN FLORIDA DRINKING FROM SHELL CUP.

Their wigwams were made of small poles stuck in the ground, with the upper ends arched together, and thatched with palmetto leaves. The wigwam of the "cassekey" (cacique) was "about a man's height to the top," and within it was a "cabin," or platform, about a foot high, made with sticks and covered with a mat, which served as a settee and couch. At one village the cacique's house was about 40 feet long and 20 feet wide, covered with palmetto leaves, and within it on one side and at the two ends there was "a range of cabins or barbecue." In some places the houses were built upon mounds artificially constructed of shells. Dickenson describes a flood caused by a violent gale from the northeast, which caused the water to rise in the chief's house and obliged him to seek refuge in a house on a higher mound. The household utensils consisted of mats, bags of woven straw used for storing dried berries, baskets, gourds, and drinking cups made of sea shells. Though he does not describe their earthenware he mentions pots in which they brewed their ceremonial drink called cassine. Palmetto leaves were used as trays in serving food

Concerning their food Dickenson says:

> These people neither sow nor reap nor plant any manner of thing whatsoeve nor care for anything but what the barren sands produce. Fish they have plenty as they please, but sometimes they would make it scarce for us, so th a meal a week was most commonly our portion, and three meals a rarity.

Oysters, clams, and other shellfish were also included in the menus, and they must have had venison and other game occasionall for Dickenson mentions the use of deerskins for clothing. In fis ing, torches were sometimes used at night, and Dickenson noticed young Indian spearing fish with great dexterity by means of "striking staff," which he threw at the fish and brought them shore on the end of his staff. In two hours he got as many fish would serve 20 men. This striking staff or spear must have be similar to a harpoon, with a foresha Among the objects from southe Florida in the United States Natio Museum there are wooden spears ha ing the foreshaft pointed with shar teeth. In addition to the spears, th are armed with bows and arrows, a many of them carried Spanish knive They also had other objects of Eur pean origin which they had obtain from wrecks, and one of them had supply of ambergris which he h collected along the shore and whi he expected to sell to the Spaniar at a good price.

FIG. 32.—COCO PLUM, *Chrysobalanus pellocarpus*. HALF NAT. SIZE.

Among the wild fruits eaten by th Indians, Dickenson mentions "seaside coco plums" (*Chrysobalan Icaco*) (fig. 32), "seaside grapes" (*Coccolobis uvifera*) (pl. 57 and palmetto berries, great stores of which were kept in their house The latter, which were undoubtedly the drupes of the saw palmet (*Serenoa serrulata*) (pl. 58), may be considered the principal veg table food staple of the Indians south of Jupiter Inlet. Dickens found the coco plums and seaside grapes refreshing, but of the pa metto berries he says:

> Not one amongst us could suffer them to stay in our mouths, for we co compare them to nothing else than rotten cheese steeped in tobacco juice.[1]

Notwithstanding his dislike of these berries when he first en countered them, Dickenson and his companions became accustome

[1] That this comparison is most apt was proved by the writer, who tested some dr drupes of *Serrenoa serrulata* in the collection of the Bureau of Plant Industry. They a not unlike small dates in appearance, with a seed resembling a brown bean, surround by scant pulp. The latter tasted very much like rancid cheese, with a slightly sweet taste like that of certain kinds of chewing tobacco. (See pl. 28.)

to them, even stealing a bag of them for provisions on starting out for the north, and deploring the loss of a small quantity which was accidentally burned at night. Large supplies of palmetto berries were paid as tribute to the "King, or young Cassekey," of a town near the present site of Palm Beach, by the Indians of Santa Lucia, who were his vassals. On reaching St. Augustine, Dickenson says, his palate had become so changed by a diet of these berries that he could not endure the taste of salt.

The Indians were very fond of cassine (an infusion of *Ilex vomitoria*), which they used not only ceremonially, but also as a refreshing beverage. This plant (pl. 59) does not grow in southern Florida. Dickenson describes the joy with which the Indians received from the north a supply of its leaves, together with some vegetable product which they used as a tobacco substitute. Of tobacco they were immoderately fond. The Spanish officials in Florida, like those on the island of Guam in early days, used tobacco leaves in paying the Indians for supplies and for labor. At the time of which Dickenson wrote, the use of *Ilex vomitoria* tea was as common among the Spaniards of Florida as that of *Ilex paraguariensis* among the colonists of Paraguay and Uruguay. Like the latter it contains caffeine and is a pleasant stimulant. When very strong and taken immoderately it acts as an emetic.

From an ethnological point of view Dickenson's description of a ceremony accompanied by drinking cassine is the most interesting part of his narrative. His account follows:

> The Indians were seated as aforesaid, the Cassekey at the upper end of them, and the range of cabins was filled with men, women and children, beholding us. At length we heard a woman or two cry, according to their manner, and that very sorrowfully, one of which I took to be the Cassekey's wife; which occasioned some of us to think that something extraordinary was to be done to us; we also heard a strange sort of a noise, which was not like the noise made by a man, but we could not understand what, nor where it was; for sometimes it sounded to be in one part of the house, sometimes in another, to which we had an ear. And indeed our ears and eyes could perceive or hear nothing but what was strange and dismal, and death seemed to surround us; but time discovered this noise to us—the occasion of it was thus:
>
> In one part of this house, where a fire was kept, was an Indian man, having a pot on the fire, wherein he was making a drink of a shrub (which we understood afterwards by the Spaniards, is called Casseena) boiling the said leaves, after they had parched them in a pot; then with a gourd, having a long neck, and at the top of it a small hole, which the top of one's finger could cover, and at the side of it a round hole of two inches diameter. They take the liquor out of the pot and put it into a deep round bowl, which, being almost filled, contains nigh three gallons; with this gourd they brew the liquor, and make it froth very much; it looks of a deep brown color. In the brewing of this liquor was this noise made, which we thought strange; for the pressing of the gourd gently down into the liquor, and the air which it contained, being forced out of the little hole at the top, occasioned a sound, and according to the time

and motion given, would be various. This drink when made and cool to sup was in a shell first carried to the Cassekey, who threw part of it on the ground and the rest he drank up, and then would make a loud hem; and afterwards the cup passed to the rest of the Cassekey's associates, as aforesaid; but no other man, woman or child must touch or taste of this sort of drink; of which they sat sipping, chattering, and smoking tobacco, or some other herb in stead thereof, for the most part of the day.

* * * * * * *

In the evening, we being laid on the place aforesaid, the Indians made a drum of a skin, covering therewith the deep bowl in which they brewed their drink, beating thereon with a stick, and having a couple of rattles made of a small gourd, put on a stick with small stones in it, shaking it; they began to set up a most hideous howling, very irksome to us; and sometime after came many of their young women, some singing, some dancing. This was continued till midnight, after which they went to sleep.

Of another ceremony he writes as follows:

It now being the time of the moon's entering the first quarter the Indians had a ceremonious dance which they began about 8 o'clock in the morning. In the first place came in an old man and took a staff about 8 feet long, having a broad arrow on the head thereof, and thence half way painted red and white like a barber's pole. In the middle of this staff was fixed a piece of wood shaped like unto a thigh, leg, and foot of a man, and the lower part of it was painted black. This staff being carried out of the Cassekey's house was set fast in the ground, standing upright; which being done, he brought out a basket, containing rattles, which were taken out thereof and placed at the foot of the staff. Another old man came in and set up an howling like unto a mighty dog, but beyond him for length of breadth, withal making a proclamation. This being done, and most of them having painted themselves, some red, some black, some with black and red, with their bellies girt up tight as well as they could girt themselves with ropes, having their sheath of arrows at their backs, and their bows in their hands; being gathered together about the staff six of the chiefest men in esteem amongst them, especially one who is their doctor, took up the rattles and began an hideous noise, standing round the staff with their rattles, and bowing without ceasing to it for about half an hour. Whilst these 6 were thus employed, all the rest were staring and scratching, pointing upwards and downwards, on this and the other side, every way, looking like men frightened or more like furies. Thus they behaved till the 6 had done shaking their rattles; then they all began to dance, violently stamping on the ground for the space of an hour or more, without ceasing; in which time they sweat in a most excessive manner, so that by the time the dance was over, by their sweat, and the violent stamping of their feet, the ground was trodden into furrows; and by morning the place where they danced was covered with maggots; thus often repeating the manner, they continued till about 3 or 4 in the afternoon, by which time many were sick and faint. Being gathered into the Cassekey's house they sat down, having some hot casseena ready, which they drank plentifully of, and gave greater quantities thereof to the sick and faint than to others; then they eat berries. On these days they eat not any food till night.

The next day, about the same time, they began their dance as the day before; also the third day they began at the usual time, when many Indians came from other towns, and fell to dancing, without taking any notice one of an

other. This day they were stricter than the other two days, for no woman must look upon them; but if any of their women went out of their houses they went veiled with a mat.[1]

The Indians had narrow canoes in which they crossed inlets and rivers. When they visited outlying keys or wrecks they lashed two canoes together by transverse poles upon which they made platforms for carrying their effects. In this way they sometimes navigated as far as the island of Cuba. They appeared to be under the sway of the Spanish and showed hostility to all Englishmen or castaways whom they suspected of being English. Dickenson tells of the arrival of Spanish soldiers from St. Augustine, and describes the chagrin of the Indians when, instead of ill treatment, the Englishmen met with kindness at the hands of their rescuers, by whom they were taken to St. Augustine.

It may be of interest here to note the use of the acorns of the live oak (pl. 60) by the Florida Indians, who, after removing the bitter tannic acid by soaking the kernels in water, ground them up and made them into cakes or mush. The early Spaniards, when their supply of Mexican chocolate was exhausted, used these acorns as a substitute for cacao in preparing a chocolatelike drink, not, however, altogether satisfactory as a substitute, with which they regaled their guests.

In the wars between the Spanish and the English the Indians above described were loyal to the Spaniards, while the Creeks and several other more northerly tribes were allies of the English. Finally, in 1763, when Florida was ceded by Spain to England the "Spanish Indians" sought refuge on the outlying keys and many of them removed to Cuba. Among those that remained in Florida were the Muspahs, who maintained their individuality until the close of the Second Seminole War. Unfortunately nothing is known of the languages of these south Florida tribes, so that their linguistic relationship to other tribes can not be determined.

SEMINOLES.

As already stated, the Seminoles are comparatively recent intruders. They belong to the Muskhogean stock, and are therefore related to the Choctaws, Chickasaws, and Creeks, but not to the Timucuas encountered by the French Hugenots at the mouth of the St. Johns River. They are the descendants of immigrants from lower Creek towns who retreated to southern Florida in the eighteenth century.[2] The name by which they are now known, signify-

[1] Dickenson, Narrative of a Shipwreck in the Gulph of Florida, 6th ed., pp. 47–49. 1803.

[2] Much misinformation has been published regarding the origin of the Seminoles. One recent writer refers to them as descendants of the Aztecs, and at the same time connects

ing "runaways," was first applied to them about the year 1775. I is often stated that they are a mixed race, owing to intermarriag with refugee negroes; but it is quite certain that those now living i southern Florida (see pls. 61 and 62) are of pure blood, of fin physique, and dignified mien, speaking a language allied to the Choc taw uncorrupted by English. It is not within the scope of this pape to relate their history or to trace the causes which led to the Seminol wars, and the removal of a large proportion of the tribe west of th Mississippi. Those now living in Oklahoma have been organize into what is called the Seminole Nation. Concerning those remain ing in Florida, much interesting information is given by Clay Mac Cauley in the Fifth Report of the Bureau of American Ethnology The reader is also referred to Mrs. Minnie Moore-Wilson's sympa thetic account of these Indians in her work entitled "The Seminole of Florida"; and to the various works of Anthony Weston Dimock dealing with Florida adventure, especially "Florida Enchantments" and "Dick Among the Seminoles." To Mr. Dimock the writer i indebted for the accompanying illustrations (pls. 61 and 62).

Unlike the Indians described by Dickenson, the Seminoles prac tice agriculture, cultivating maize, sweet potatoes, pumpkins squashes, introduced melons, peanuts, sugar cane, guavas, pineapples and various citrus fruits. Among the wild fruits eaten by them ar seaside grapes (*Coccolobis uvifera*) (pl. 57) and coco plums (*Chry balanus Icaco* and *C. pellocarpus*) (fig. 32); but in MacCauley's lis the berries of the saw palmetto (*Serenoa serrulata*) are conspicuous for their absence. On the other hand, the Seminoles have an impor tant food staple not mentioned by Dickenson, though the plant yield ing it was very abundant in the region through which he passed. This is the koonti or coontie, a kind of cornstarch prepared from th roots of *Zamia floridana* (pl. 63), already described in this paper.

So highly do the Seminoles esteem the koonti that they declare i to be a special gift from God. An Indian named Ko-nip-ha-too re lated to MacCauley a legend in which it was declared that long ago the "Great Spirit" sent Jesus Christ to the earth with the precious plant from which it is prepared, and the place of his descent was at Cape Florida, where he gave the koonti to the red men.[1]

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them with the ancient Egyptians and the Hebrews. The evidence offered to establish their relationship with the last named is that of a certain bishop, who heard a Seminole choir repeat the name *Jah-vey*, and identified it with that of Jehovah. The Indians confirmed "the wonderful, yes, startling observation" made by the bishop; and from the use of this name, chanted in the depth of the Everglade, "one may work back to the prehistoric ruined temples of Mexico and Yucatan, so similar to those of Egypt; and thus may find in Seminole speech a language link to connect the new world with the old." It is scarcely necessary to state that there is no linguistic relationship between the Moskhogean stock to which the Seminoles belong and the Aztecs of Mexico or the Mayas of Yucatan.

[1] See Fifth Annual Report Bur. Am. Ethn., p. 513. 1888.

Another coontie starch was obtained by the Florida Indians from the roots of certain species of smilax, commonly called China brier, but not specifically identical with the species described by Linnæus under the name *Smilax pseudo-china*. Three species were in all probability used for this purpose: *Smilax laurifolia*, growing in swampy places; the very similar *Smilax lanceolata*, growing in drier situations, and *Smilax auriculata* (pl. 64), growing in hammocks and on coastal sand dunes. William Bartram has given the following description of the preparation of red koonti from the roots of smilax:

> They chop the roots in pieces, which are afterwards well pounded in a wooden mortar, then, being mixed with clean water in a tray or trough, they strain it through baskets; the sediment, which settles to the bottom of the second vessel, is afterwards dried in the open air, and is then a very fine, reddish flour or meal; a small quantity of this mixed with warm water and sweetened with honey, when cool, becomes a beautiful, delicious jelly, very nourishing and wholesome; they also mix it with fine corn flour, which being fried in fresh bear's oil makes very good hot cakes or fritters.[1]

Dr. John R. Swanton, of the Bureau of American Ethnology, has called attention to the fact that the name "koonti," "coonti," or "conte," is etomologically identical with "kánta" of the Alabama Indians now residing in Texas. His account follows:

> In the course of my investigations among the Alabama (Alibamu) of Texas, I heard much of this plant, called by them *ka' nta*, and obtained a specimen of it, which Mr. Paul Standley of the National Museum has identified as *Smilax lanceolata*. It is evidently identical with a smilax that had been previously described to me as coonti by an old Creek Indian born in Alabama before the removal of the Creeks, "a brier that climbed up on trees like a vine."

After repeating Bartram's account of the preparation of smilax coontie as quoted above, he continues:

> Hawkins also says the China brier "is called coonte," and he describes the way in which flour was extracted from it. It is therefore evident that at least two species of smilax were known as coonti by the ancient Creeks, and since the cycadaceous plant which now bears that name among the Florida Seminole is confined to southern Florida, it is evident that it could have been used only after the Seminole reached that country from the north. Originally it is evident that the term must have been applied to several species of smilax having large reddish roots.[2]

The roots of three species of smilax were tested for starch, at the writer's request, by Dr. Henry Hasselbring, of the Bureau of Plant Industry: *Smilax laurifolia*, *S. lanceolata*, and *S. auriculata*. The first showed no vestiges of starch, though this may have been because the rootstocks were old and woody. The second contained starch, but

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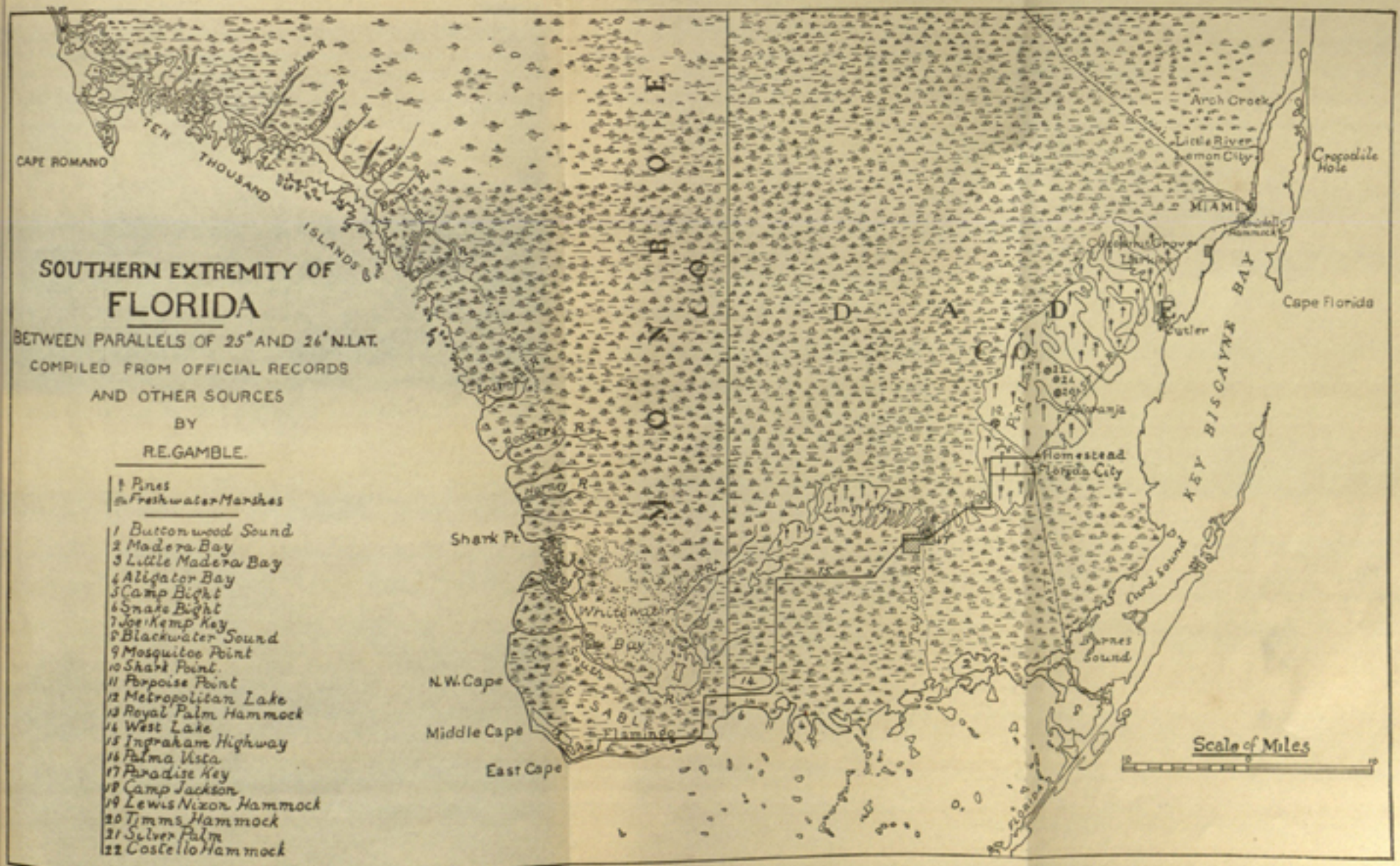
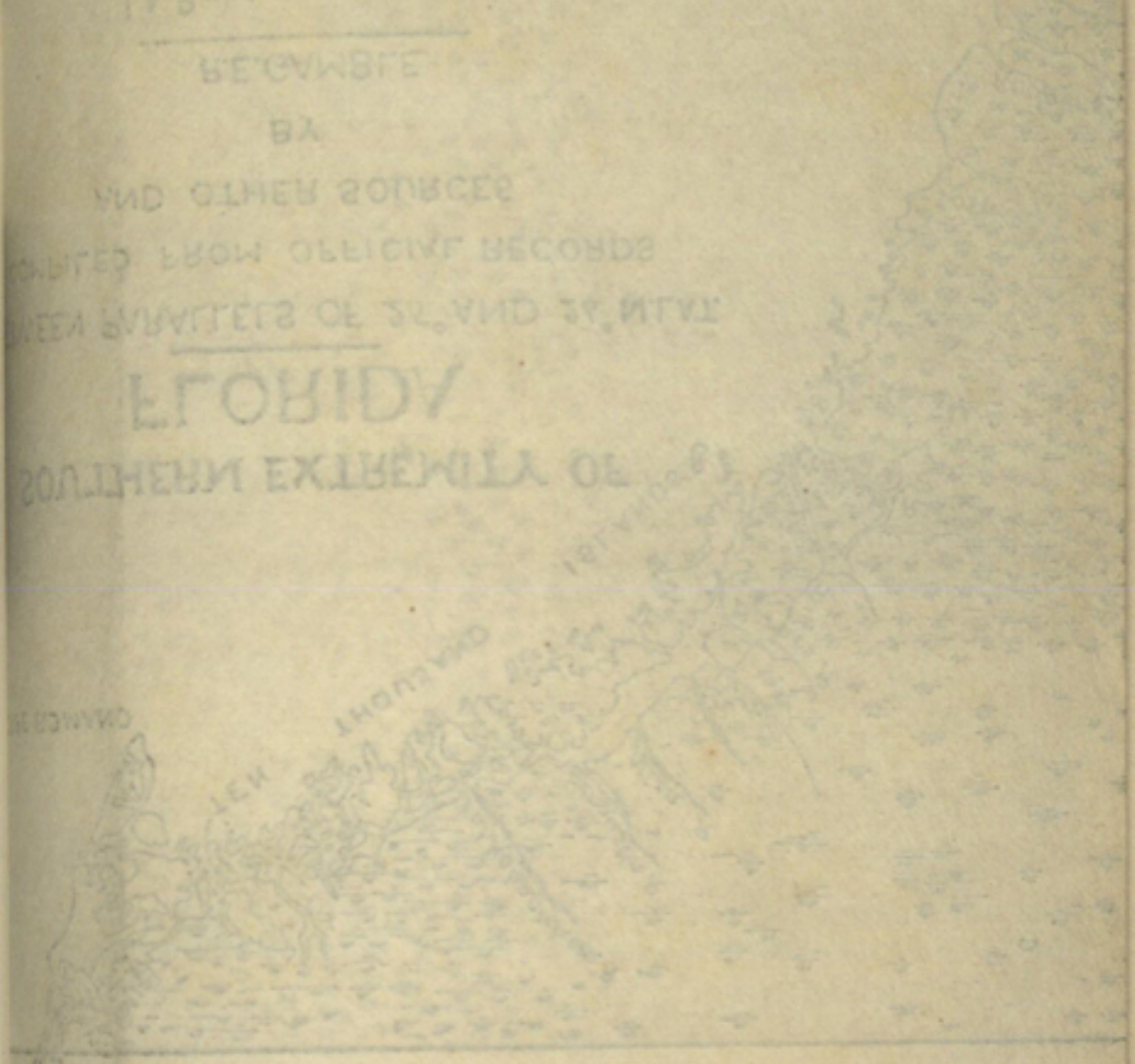
[1] Bartram, William, Travels through North and South Carolina, Georgia, East and West Florida, etc., p. 241. 1791.

[2] American Anthropologist, vol. 15, pp. 141, 142. 1913.

this could not be extracted from the powdered rootstock in sufficient quantities to make a jelly. The third, figured on plate 64, which contained an abundance of starch, was subjected to a process like that described by Bartram, and yielded a delicate flesh-colored jelly, slightly acidulous and somewhat astringent. This jelly was quite equal to arrowroot when sweetened with sugar, for which it could be used as an excellent substitute.

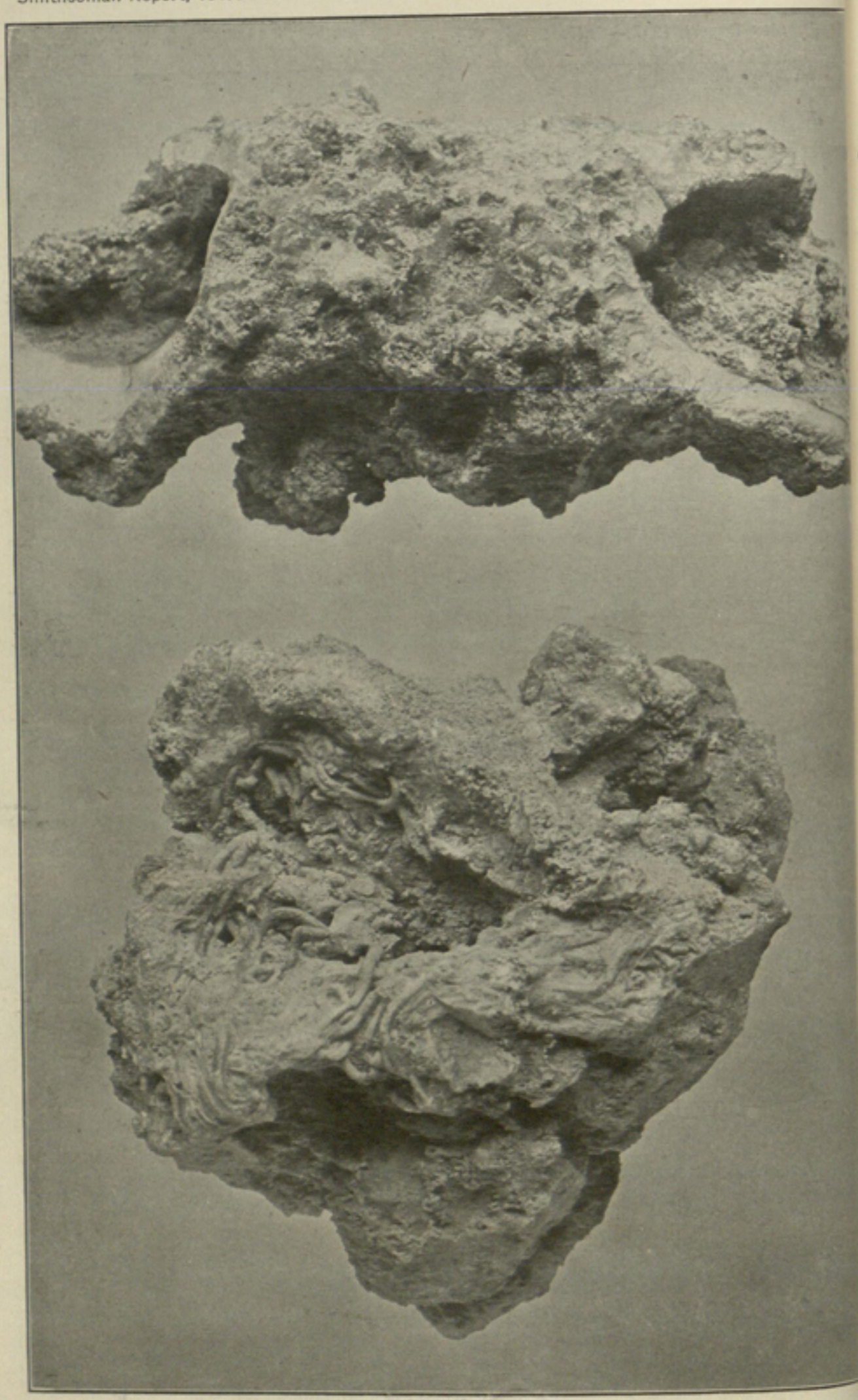
It has been impossible within the limits of this paper to give a complete list of the plants thus far collected in the region here considered. It is hoped that such a list may be published later.


SOUTHERN EXTREMITY OF
FLORIDA
BETWEEN PARALLELS OF 25° AND 26° N.LAT.
COMPILED FROM OFFICIAL RECORDS
AND OTHER SOURCES
BY
R.E.GAMBLE.
1 Pines
2 Freshwater Marshes
1 Buttonwood Sound
2 Madera Bay
3 Little Madera Bay
4 Alligator Bay
5 Camp Bight
6 Snake Bight
7 Joe Kemp Key
8 Blackwater Sound
9 Mosquitoe Point
10 Shark Point
11 Porpoise Point
12 Metropolitan Lake
13 Royal Palm Hammock
14 West Lake
15 Ingraham Highway
16 Palma Vista
17 Paradise Key
18 Camp Jackson
19 Lewis Nixon Hammock
20 Timms Hammock
21 Silver Palm
22 Costello Hammock
CAPE ROMANO
TEN THOUSAND ISLANDS
Shark Pt
N.W. Cape
Middle Cape
East Cape
Whitewater Bay
Flamingo
Homestead
Florida City
Arch Creek
Little River
Miami
Cutler
Cape Florida
Crocodile Hole
KEY BISCAYNE BAY
Card Sound
Barnes Sound
Scale of Miles



1. VIEW OF PARADISE KEY FROM THE NORTHEAST, DRY SEASON, SHOWING ROYAL PALMS.

2. SAME VIEW AS ABOVE; EVERGLADES FLOODED.

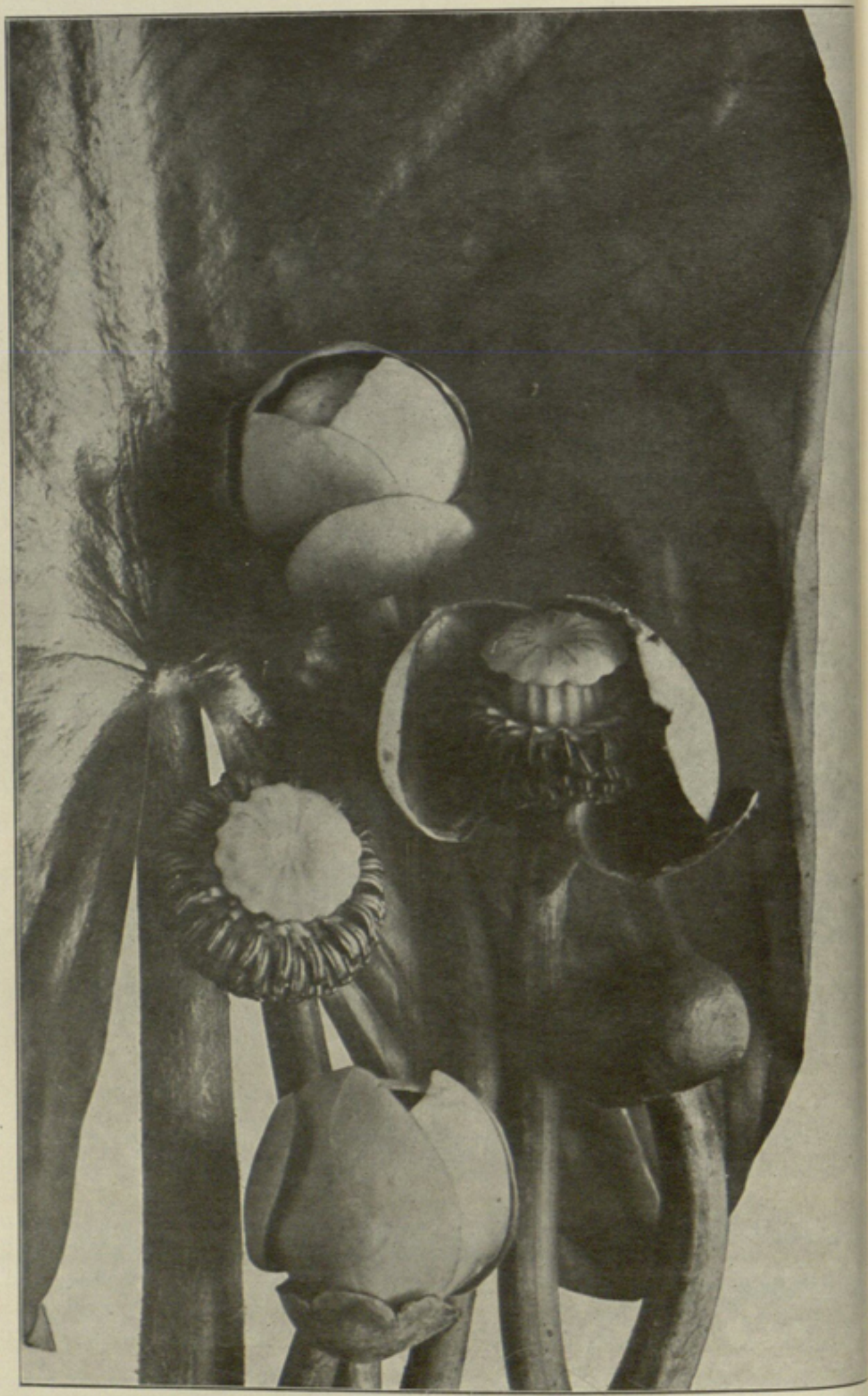


OOLITIC LIMESTONE FROM ROYAL PALM STATE PARK, SHOWING CRUSTACEAN TUBE AND ANNELID CASTS ORIGINALLY FORMED IN CALCAREOUS MUD DEPOSITED IN A SHALLOW SEA.

Natural size. Photographed from specimens in United States National Museum.

SLOUGH AT THE EASTERN ENTRANCE TO ROYAL PALM STATE PARK, FILLED WITH A DENSE GROWTH OF YELLOW WATER LILIES (NYMPHAEA ADVENA, OR A CLOSELY RELATED SPECIES), PICKEREL WEEDS, ARROWHEADS, AND OTHER WATER PLANTS.

Photograph by Wilson Popenoe.



YELLOW WATER LILIES, OR BONNETS (NYMPHAEA ADVENA).

Natural size.

SEDGES FROM ROYAL PALM STATE PARK.

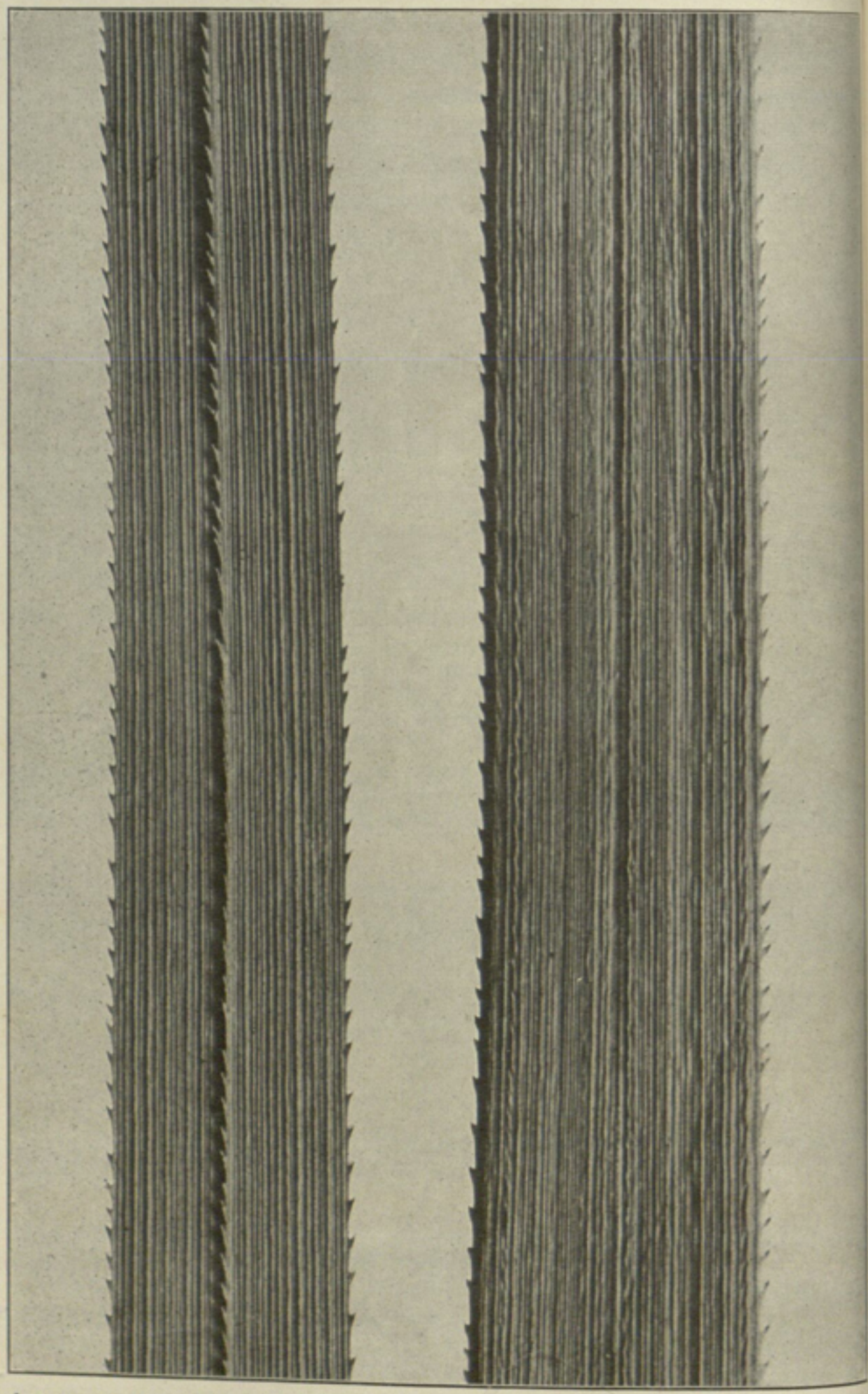
(1) *Rhynchospora corniculata;* (2) *Rhynchospora tracyi;* (3) *Cyperus speciosus;* (4) *Cyperus haspan;* (5) *Fuirena breviseta;* (6) *Dichromena colorata.* Natural size.

GRASSES FROM ROYAL PALM STATE PARK.

(1) *Manisuris rugosa;* (2) *Paspalum monostachyum;* (3) *Panicum virgatum;* (4) *Panicum condensum;* (5) *Andropogon cabanisii;* (6) *Phleum pratense;* (7) *Chloris glauca;* (8) *Panicum nitidum.* Natural size.

MARISCUS JAMAICENSIS (CLADIUM EFFUSUM TORR.), THE DREADED "SAW GRASS" OF THE EVERGLADES.

Natural size.



LEAVES OF SAW GRASS (MARISCUS JAMAICENSIS) ENLARGED SO AS TO SHOW CUTTING TEETH OF MARGINS AND KEEL.

ALLIGATOR APPLE (ANNONA GLABRA).

Very abundant on Everglade Keys. Its remarkably light wood is used for corks and for floats of fishing nets. Natural size.

BACCHARIS GLOMERULIFERA, A SHRUBBY COMPOSITE VERY COMMON IN MARSHES AND THE MARGINS OF EVERGLADE KEYS.

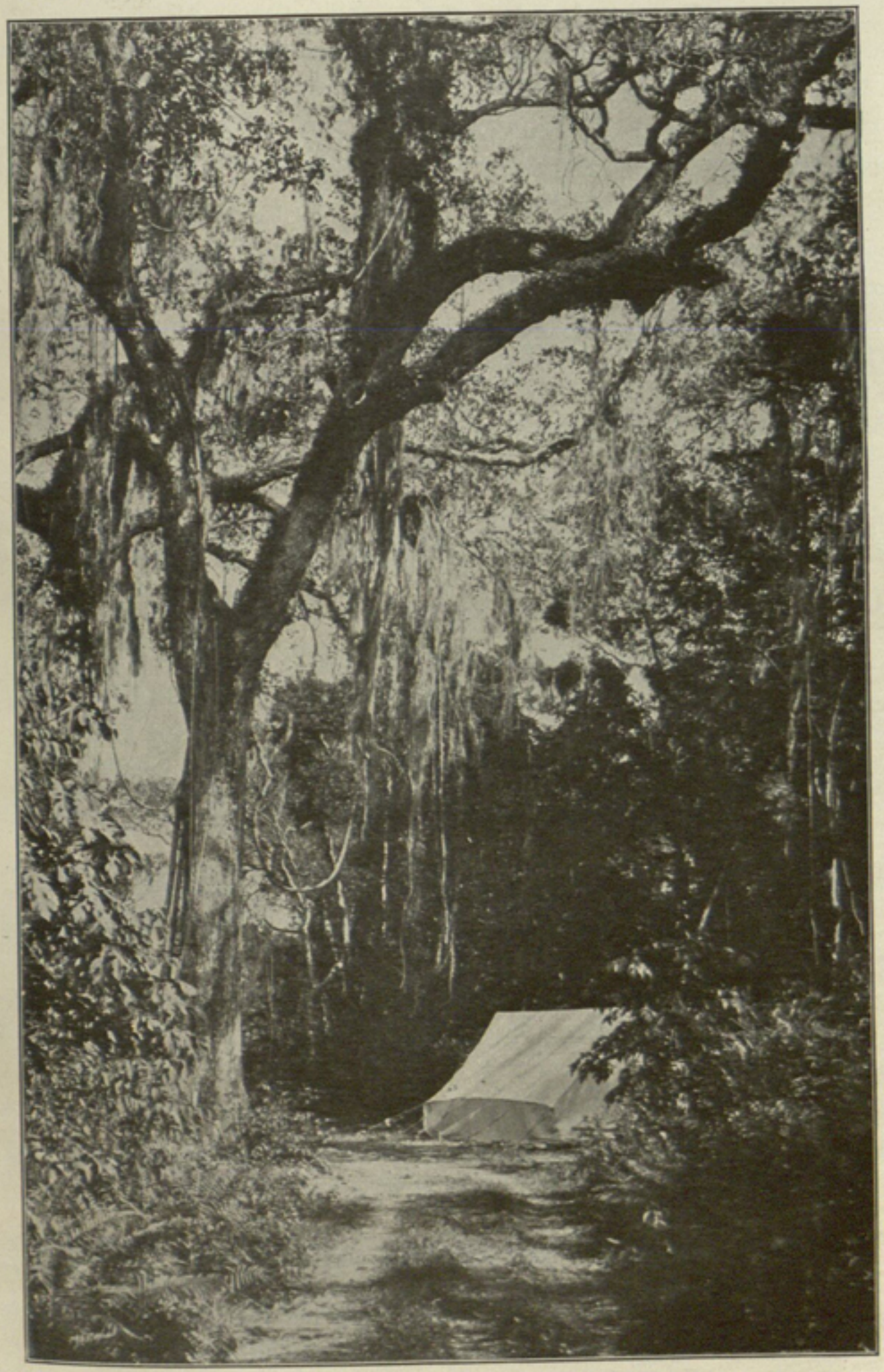
The male and the female flowers are borne on separate plants. Natural size.

BUTTON MANGROVE (CONOCARPUS ERECTA), SHOWING CLUSTERS OF FRUIT AND NECTARIES ON EACH SIDE OF THE PETIOLES.

Photograph of specimens collected by C. E. Mosier from the neighborhood of Royal Palm State Park. Natural size.

SWAMP CYPRESS (TAXODIUM DISTICHUM), SHOWING BUDDING BRANCH AND MATURE FRUIT.

Natural size.



ROYAL PALM STATE PARK. TENT OF WARDEN NEAR EASTERN ENTRANCE.

Photograph by Wilson Popenoe.

SATIN-LEAF (CHRYSOPHYLLUM OLIVAEFORME), SHOWING FLOWERS, FRUIT, AND SATIN LINED LEAVES.

Natural size.

ROOTS OF STRANGLING FIG (FICUS AUREA) EMBRACING CABBAGE PALM.

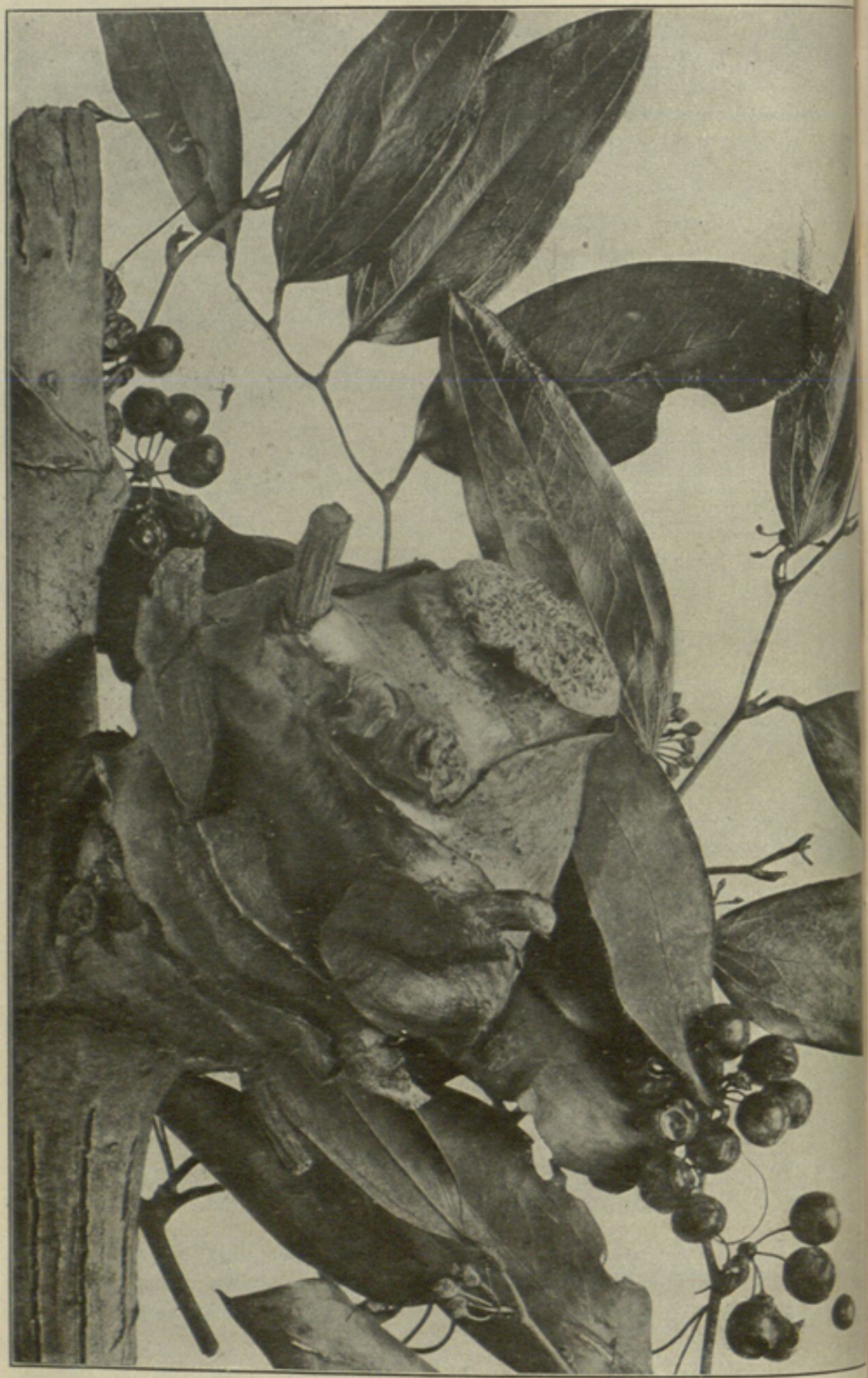
Photograph by Wilson Popenoe.

ERYTHRINA ARBOREA, USUALLY A SCRAMBLING SHRUB OF MODERATE SIZE BUT HERE GROWING IN THE FORM OF A LIANA.

Specimen growing near the eastern entrance to the park. Photograph by Roy D. Goodrich.

PISONIA ACULEATA, CALLED COCKSPUR ON ACCOUNT OF ITS SHARP RECURVED SPINES; A PLANT OF WIDE TROPICAL DISTRIBUTION; USUALLY A SCRAMBLING SHRUB. HERE A GIANT LIANA OF THE FOREST.

Showing C. E. Mosier, the park warden, at the base of the plant. Photograph by Roy D. Goodrich.

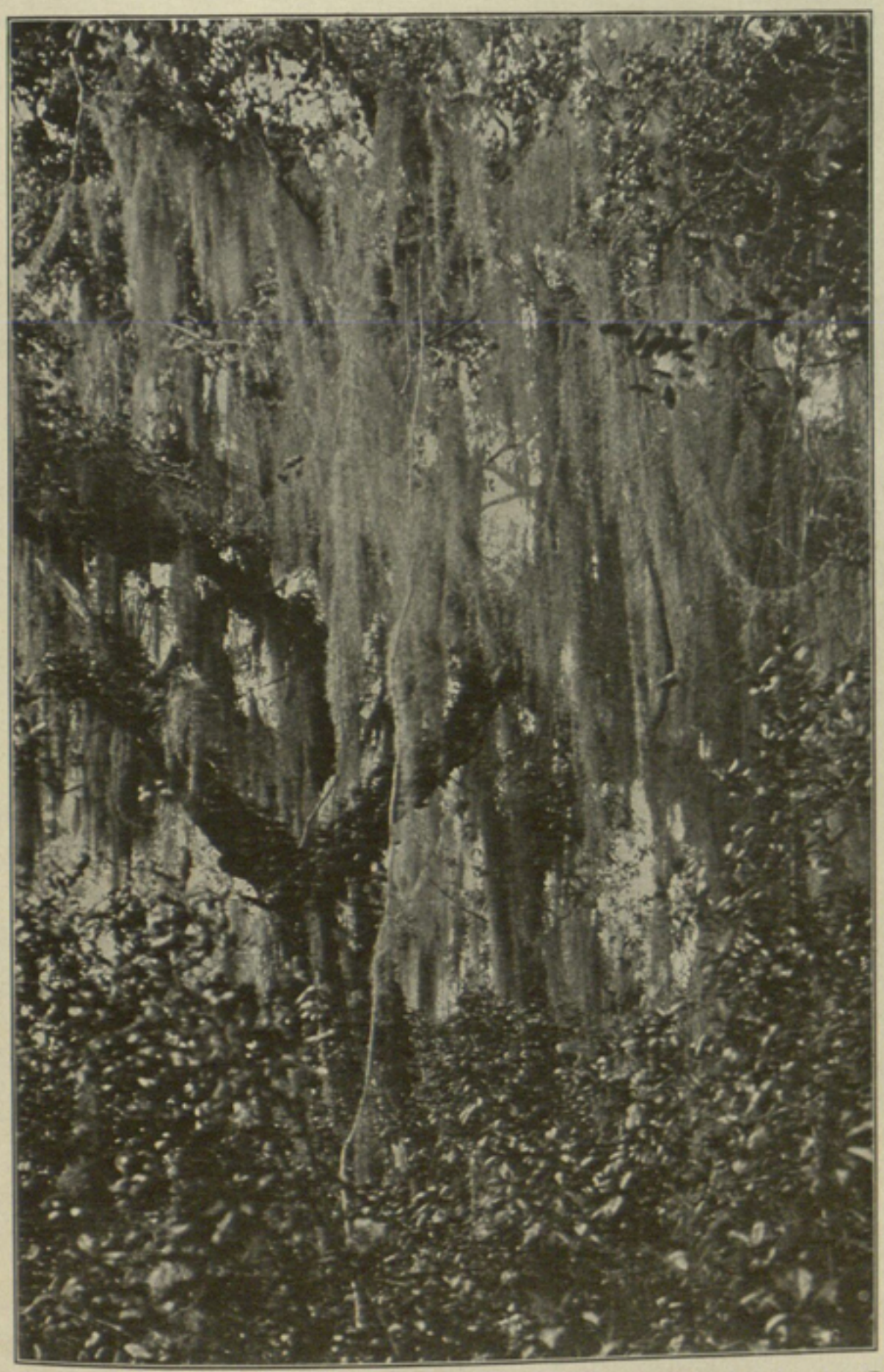


SWAMP BAMBOO-BRIER (SMILAX LAURIFOLIA), SHOWING JOINTED TUBEROUS ROOTSTOCK.

The globose elastic seeds were sometimes strung into necklaces by the aboriginal Indians. Natural size.

BREUKER & KESSLER CO. PHILA.

ORCHIDS OF PARADISE KEY

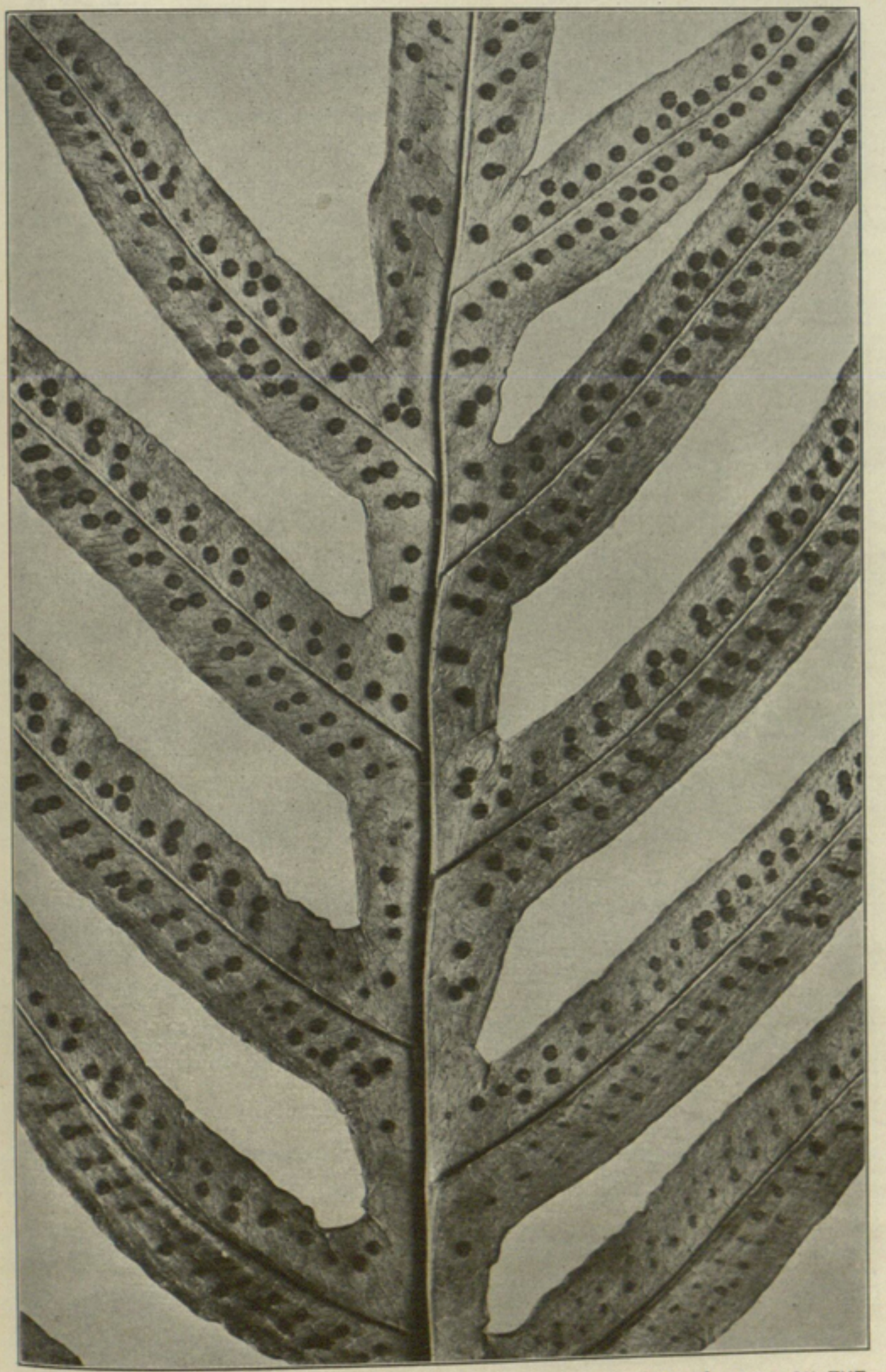


SPANISH MOSS (DENDROPOGON USNEOIDES), AN EPIPHYTE BELONGING TO THE PINE-APPLE FAMILY, USED BY THE ABORIGINAL INDIANS FOR MAKING SKIRTS AND APRONS.

Photograph received from Mrs. W. S. Jennings.

TILLANDSIA UTRICULATA, AN AIR-PLANT, OR EPIPHYTE, BELONGING TO THE PINEAPPLE FAMILY.

Photographed by Wilson Popenoe.



PHLEBODIUM AUREUM, A FERN GROWING IN THE AXILS OF OLD LEAVES ON THE TRUNKS OF CABBAGE PALMS. PORTION OF A FROND.

Natural size.

THE ROYAL FERN (OSMUNDA REGALIS); STERILE AND FRUITING FRONDS.

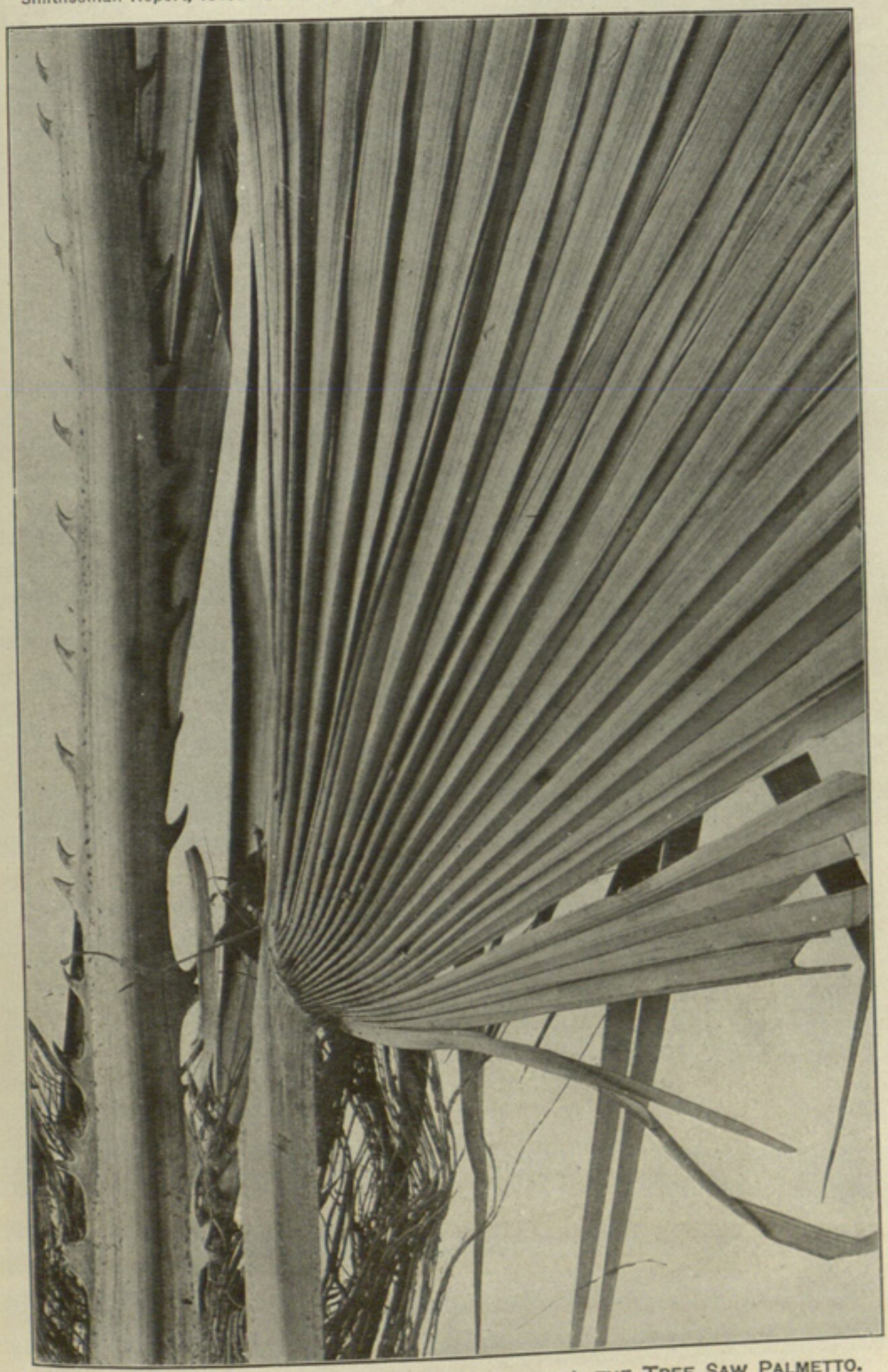
Natural size.

ANEMIA ADIANTIFOLIA (ORNITHOPTERIS ADIANTIFOLIA SW.), STERILE AND FRUITING FRONDS.

Natural size.

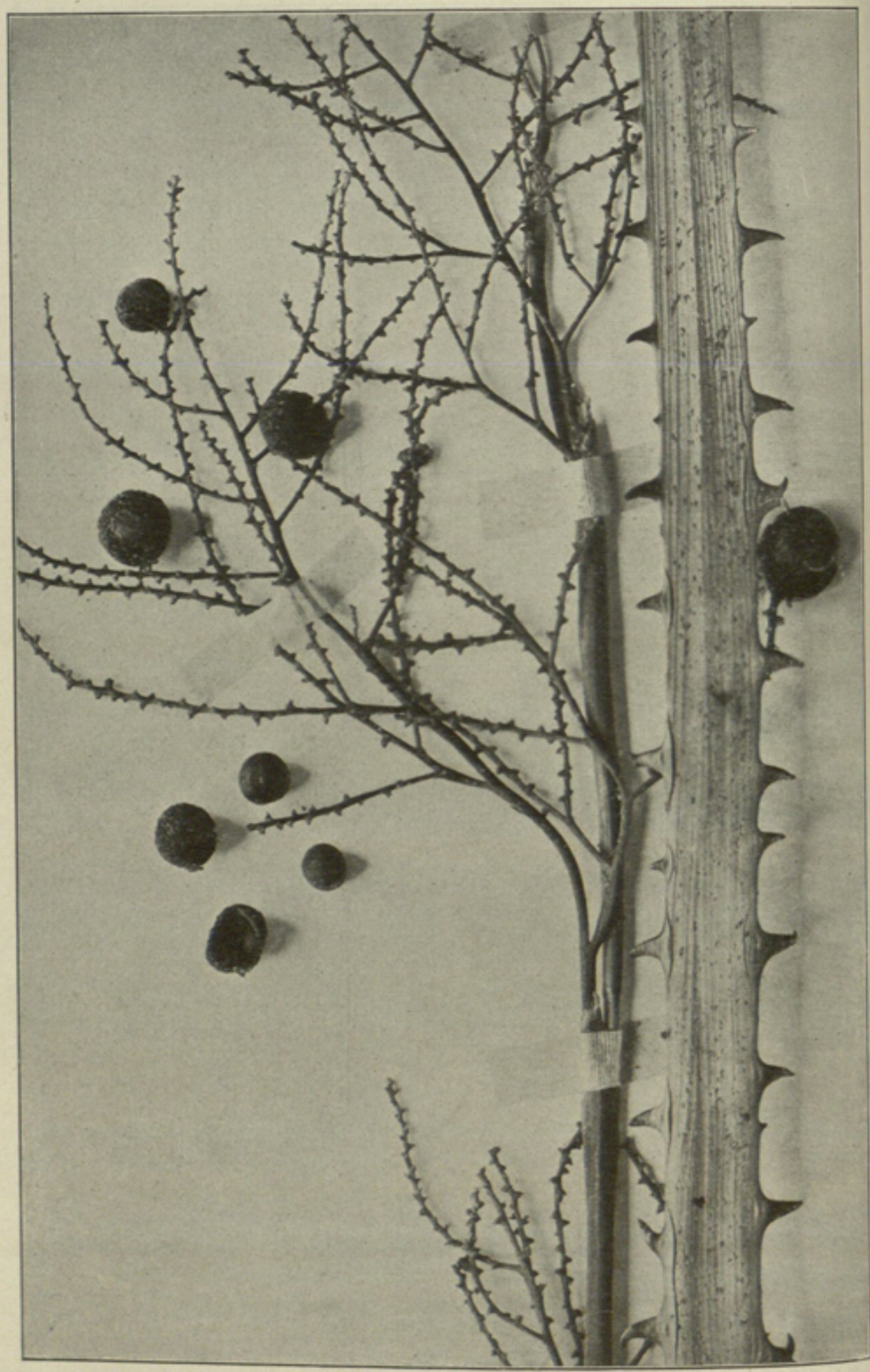
ROYAL PALMS (ROYSTONIA REGIA) OF PARADISE KEY, FROM WHICH ROYAL PALM STATE PARK DERIVES ITS NAME.

Photograph by Wilson Popenoe.



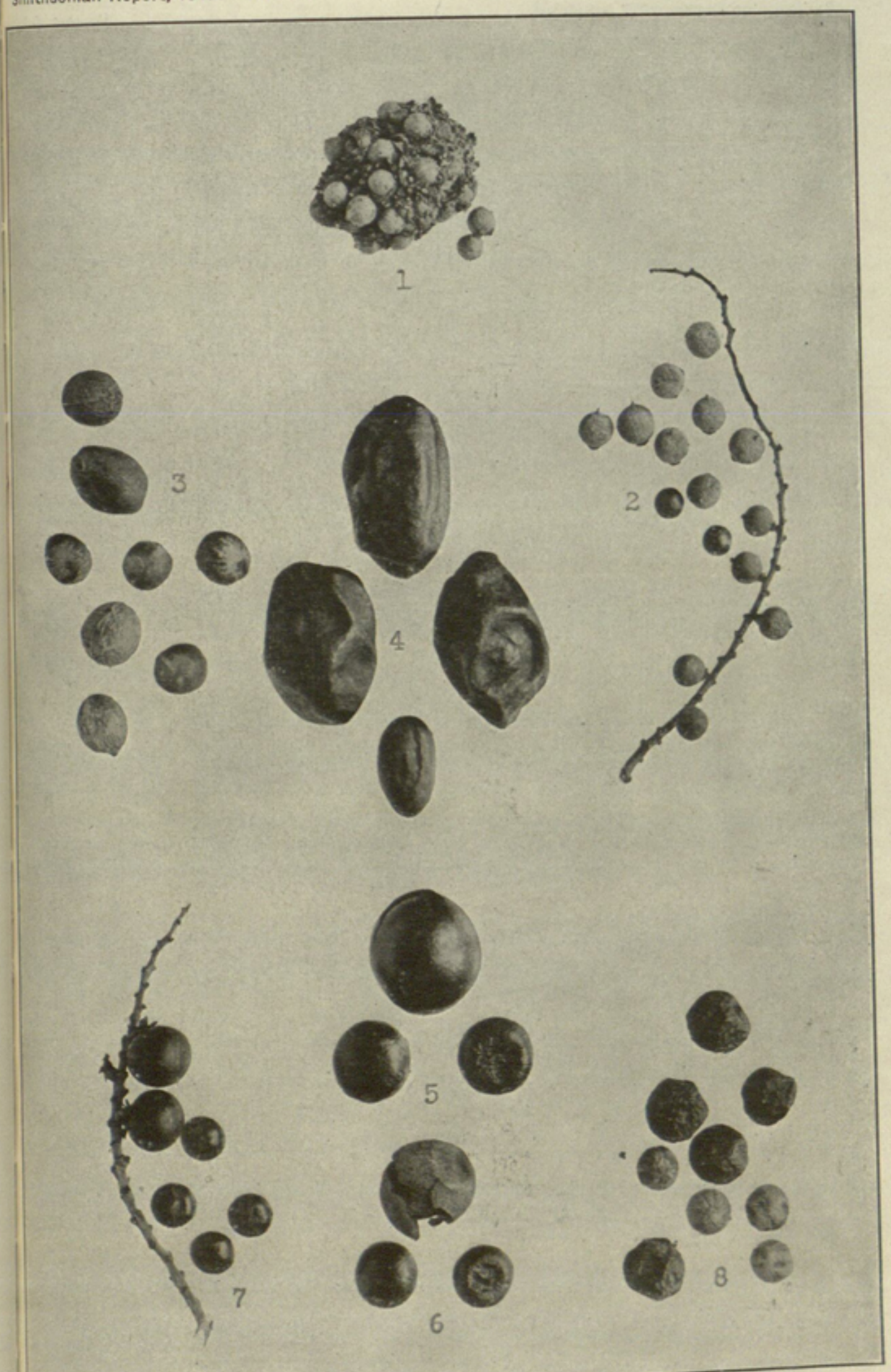
PAUROTIS WRIGHTII (SERENOA ARBORESCENS SARG.), THE TREE SAW PALMETTO.

This species forms clumps on the south coast of Florida, but does not occur within the limits of the park.
Natural size.



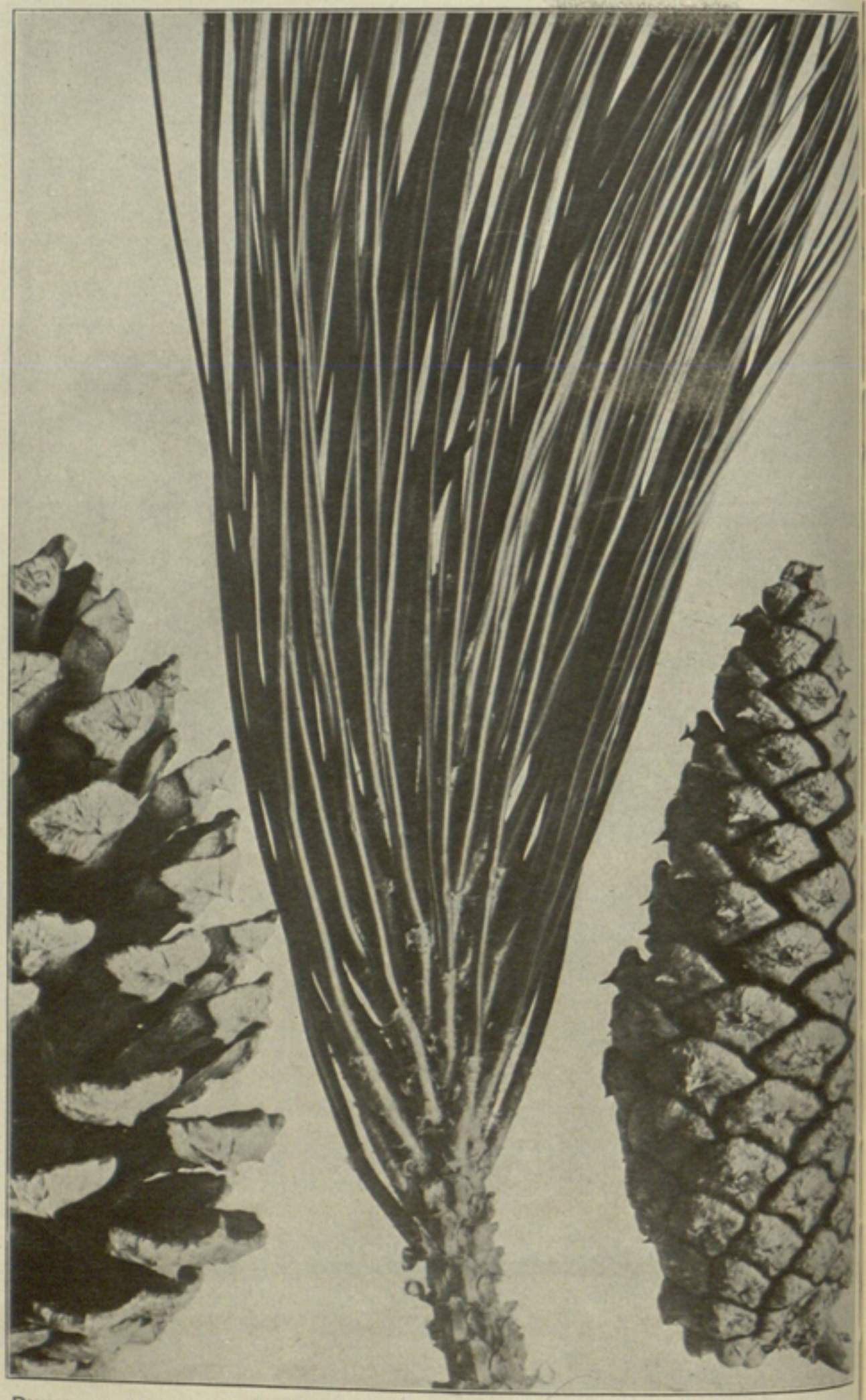
ARMED PETIOLE OF THE TREE SAW PALMETTO (PAUROTIS WRIGHTII).

Compare its fruit with the large date-like fruit of the dwarf Saw Palmetto, from which it is generically distinct.



FRUIT AND SEEDS OF FLORIDA PALMS.

1, Bird dropping from Paradise Key containing seeds of Thatch Palm (Thrinax), indicating means by which palms may be distributed; 2, Fruit and seeds of *Thrinax microcarpa;* 3, Same of Royal Palm (*Roystonea regia*); 4, Date-like fruit of dwarf Saw Palmetto (*Serenoa serrulata*) eaten by the Indians; 5, Goose neck Palmetto (*Sabal etonia*); 6, Common Cabbage Palm (*Sabal palmetto*); 7, Blue-stem Palmetto (*Sabal glabra*); 8, Silver Palm (*Coccothrinax argentea*). Natural size.

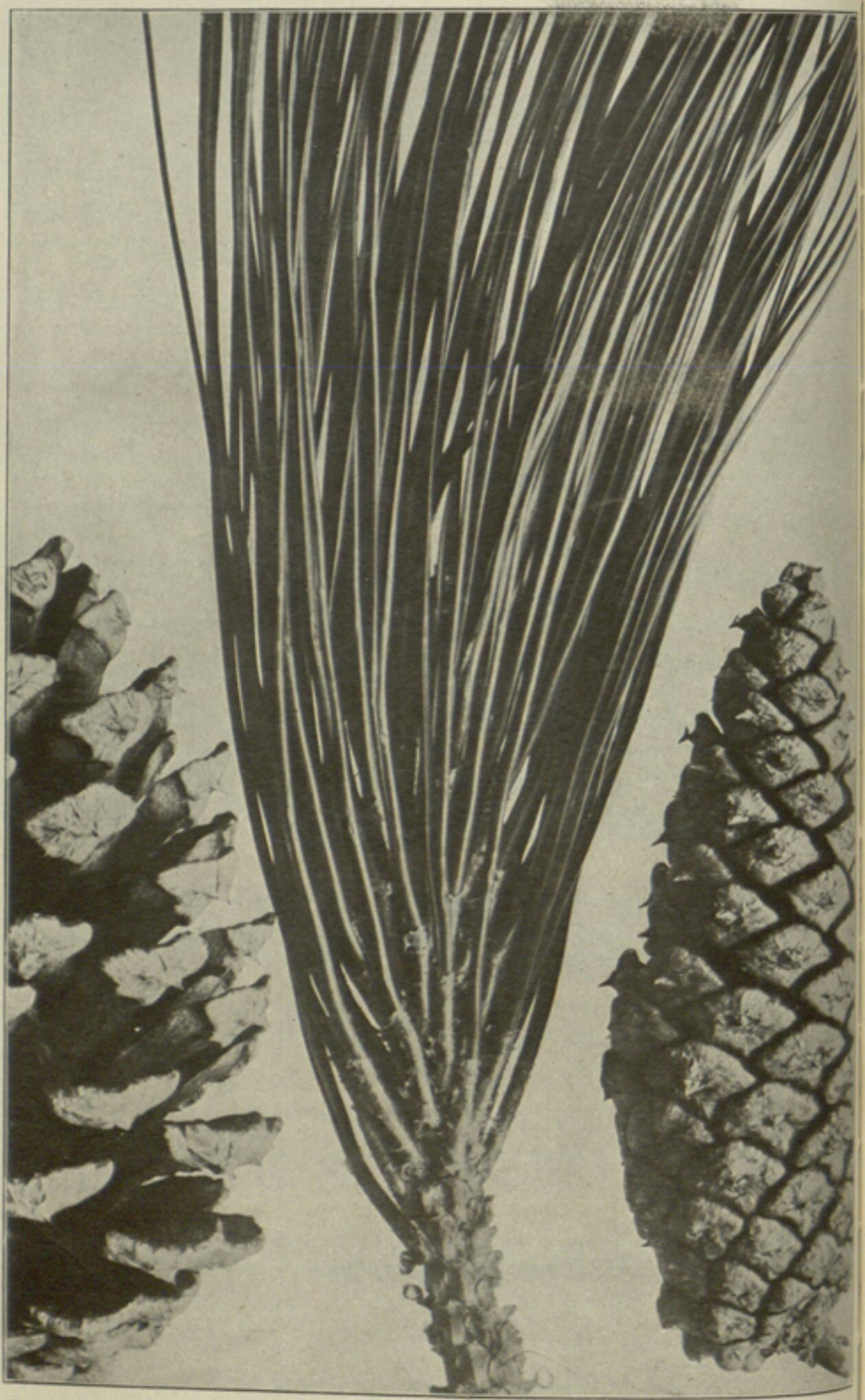


PINUS CARIBAEA, THE ONLY PINE GROWING IN THE VICINITY OF ROYAL PALM STATE PARK. FASCICLED LEAVES; OPEN AND CLOSED CONES.

Natural size.

PINE LAND NEAR ROYAL PALM STATE PARK.

Beneath the pines (*Pinus caribaea*) grow the dwarf Saw Palmetto, the Silver Palm, the Cycad, *Zamia floridana*, a crimson-flowered morning-glory (*Exogonium microdactylum*) and the Twining Apocynaceous, *Echites echites*. Photograph by Wilson Popenoe.



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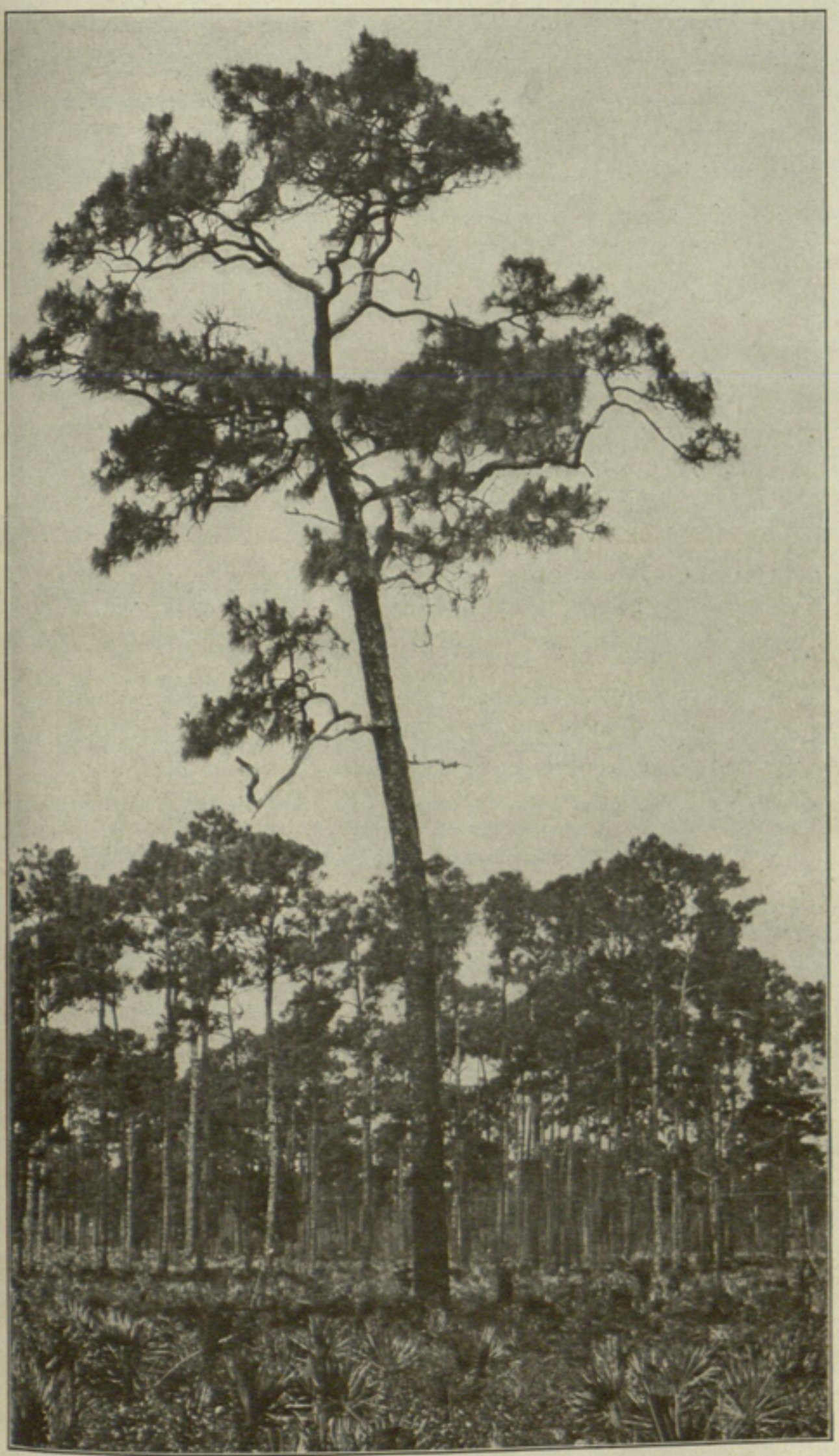

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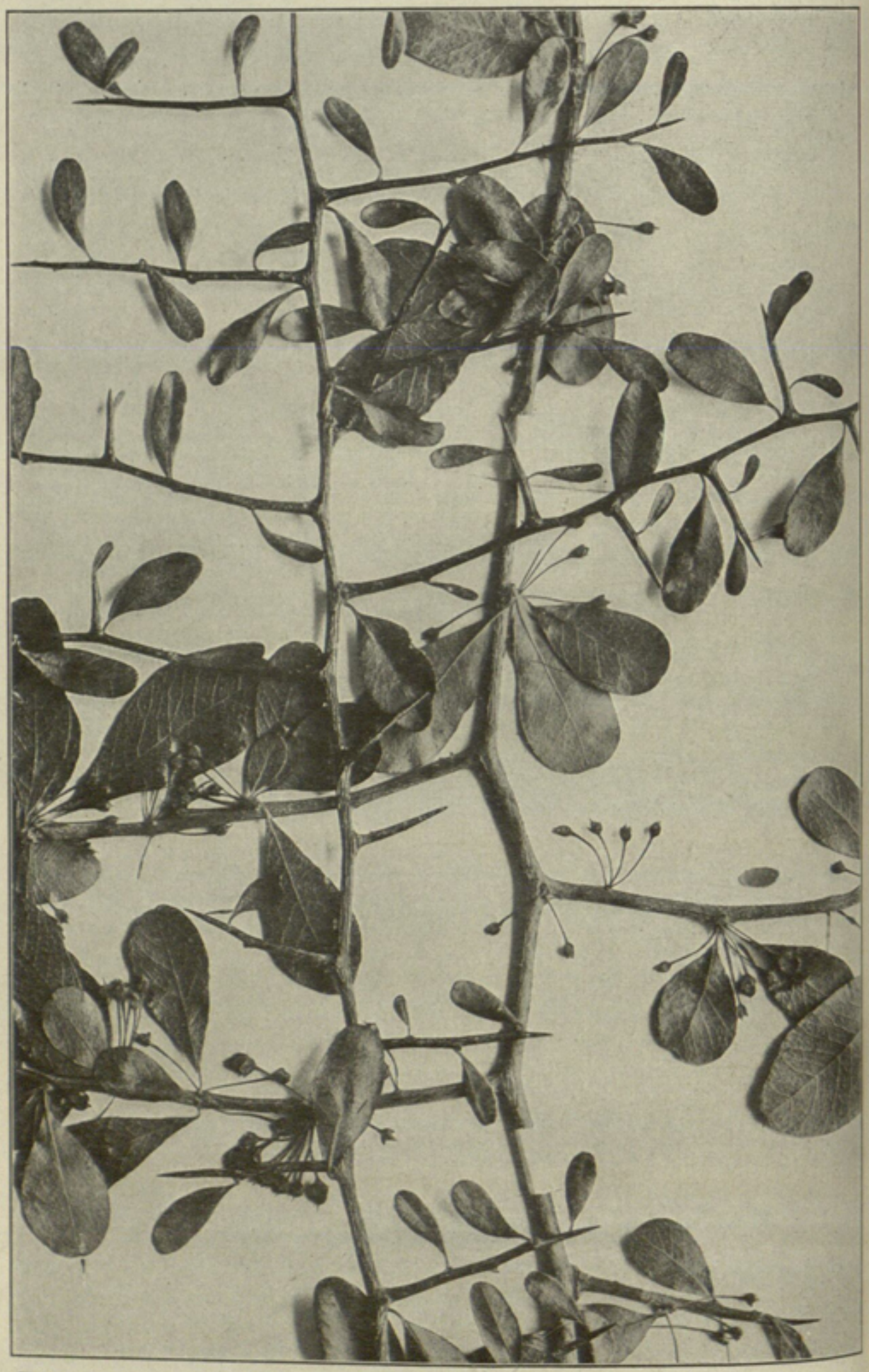
ZAMIA FLORIDANA, AN ENDEMIC CYCAD FROM THE STARCHY ROOT OF WHICH FLORIDA ARROWROOT IS MADE; MALE INFLORESCENCE.

Natural size.

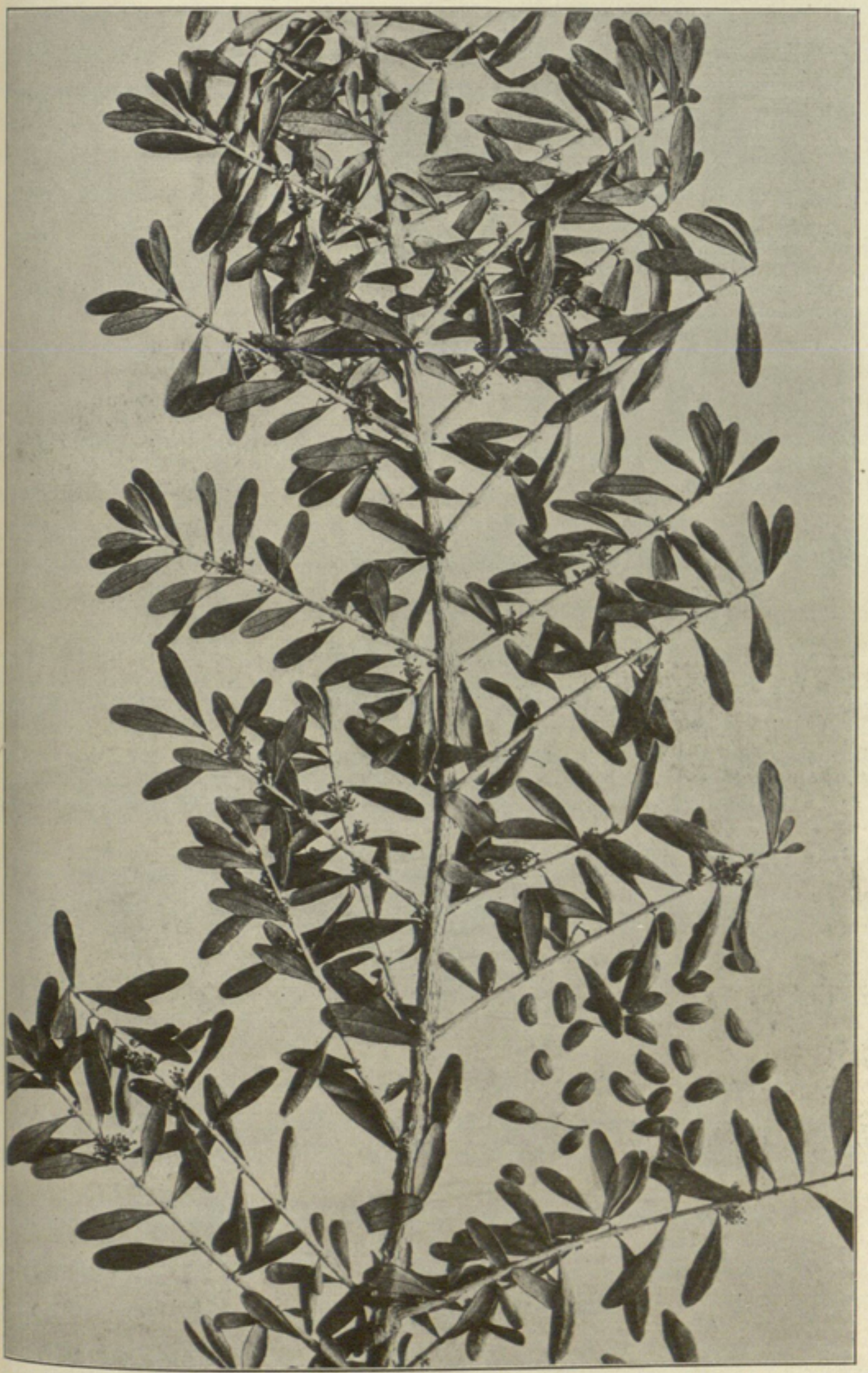
ZAMIA FLORIDANA; FEMALE CONE, SHAPED LIKE AN EAR OF MAIZE, BEARING ROWS OF SEEDS INCLOSED IN SCARLET ARIL AND COVERED BY A VELVETY PERICARP.

Natural size.



THORN TWIG, BUMELIA RECLINATA, A PINE-LAND SHRUB BELONGING TO THE SAPOTE FAMILY.

Natural size.

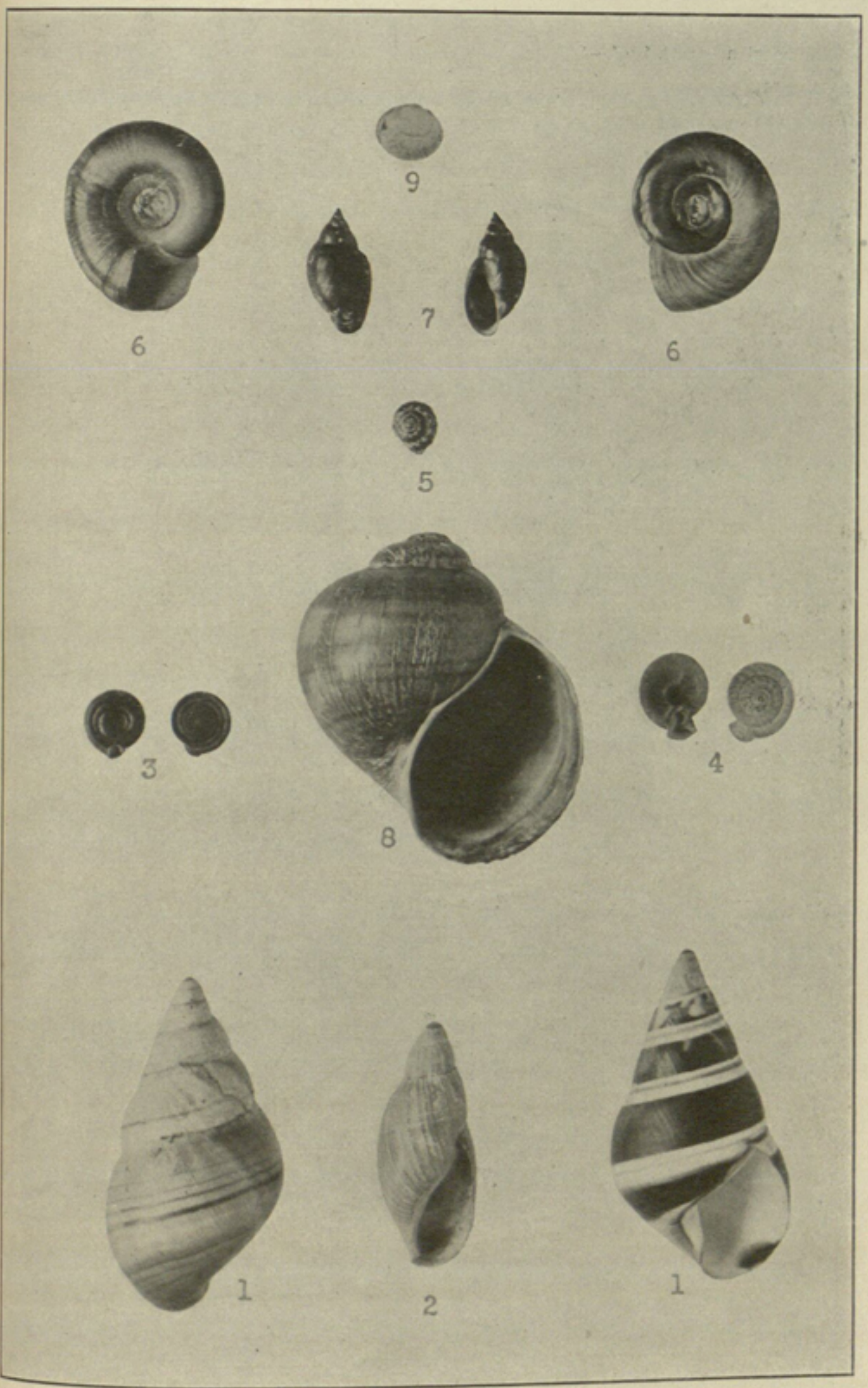


DWARF FLORIDA PRIVET, FORESTIERA PINETORUM, AN ENDEMIC PINE-LAND SHRUB OF SOUTHERN FLORIDA.

Natural size.

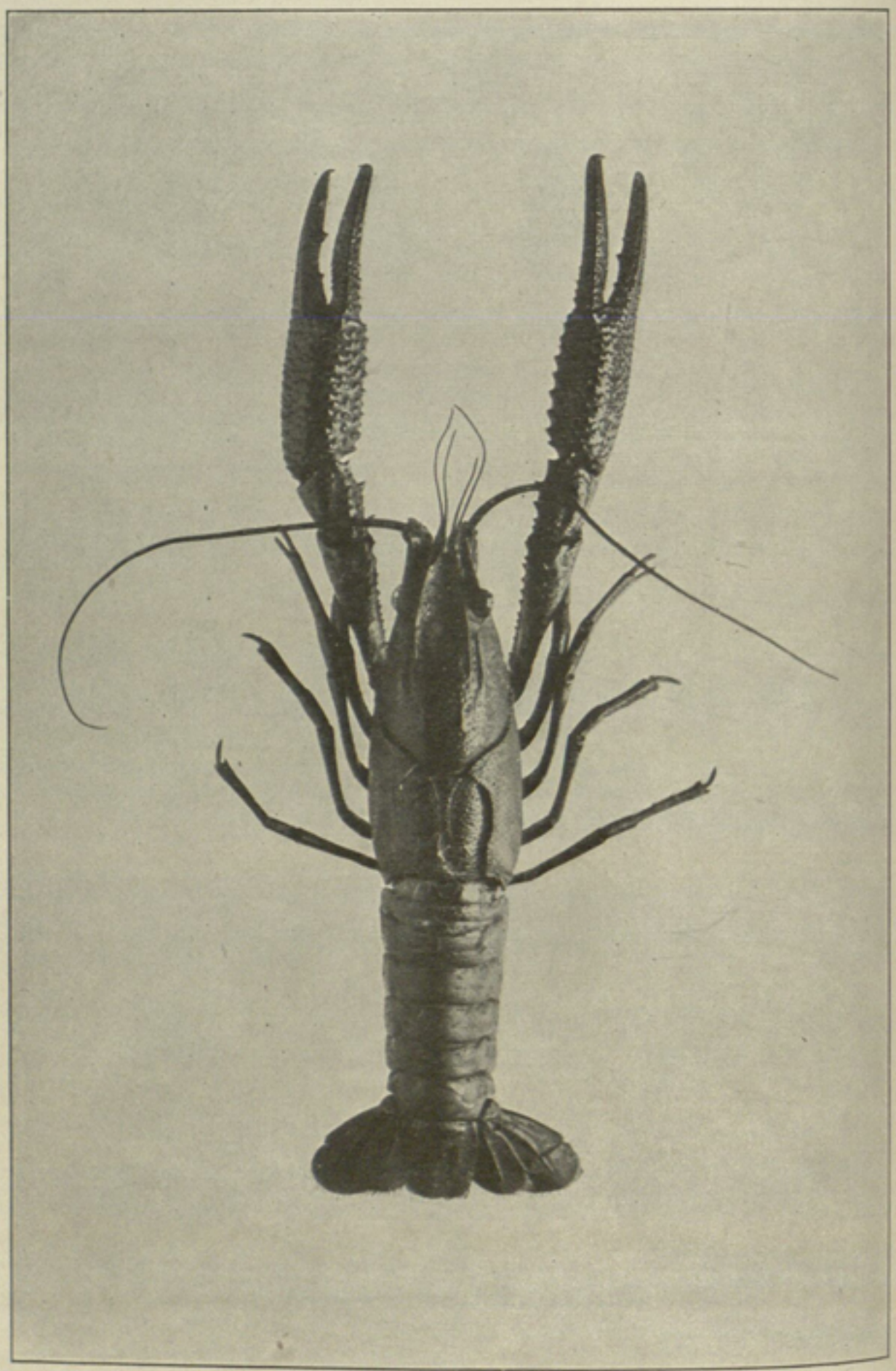
TREE SNAILS AND MARSH SNAILS OF PARADISE KEY

BREUKER & KESSLER CO., PHILA.



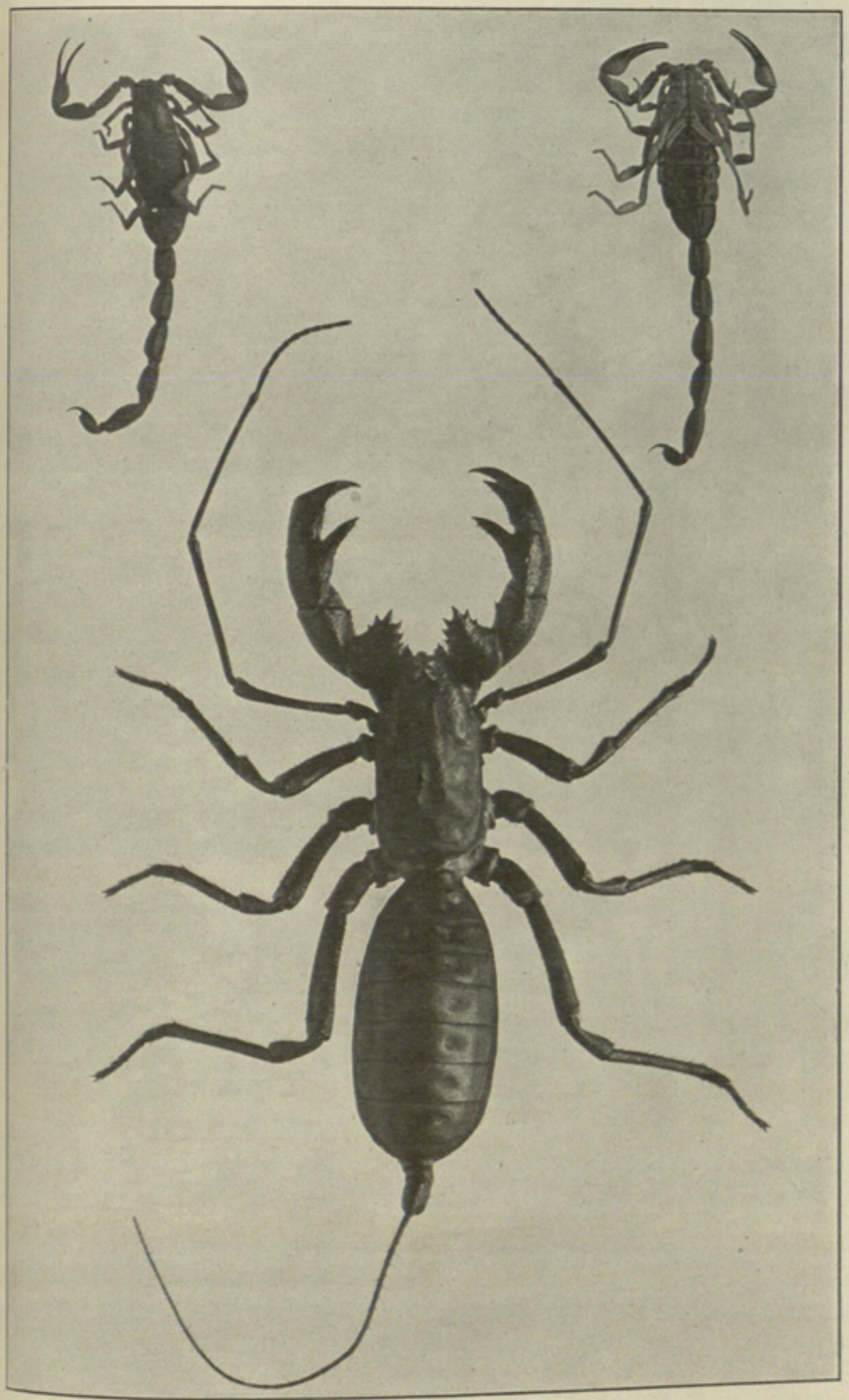
MOLLUSKS OF ROYAL PALM STATE PARK.

1, Tree snails, *Liguus fasciatus;* 2, Cannibal snail, *Glandina truncata;* 3, *Polygyra septemvolva volvoxis;* 4, *Polygyra ovulifera;* 5, *Helicina orbiculata clappi;* 6, *Planorbis duryi;* 7, *Physa gyraena;* 8, *Ampullaria depressa;* 9, *Musculium partumeium.* Natural size.



EVERGLADE CRAWFISH (CAMBARUS FALLAX), AN IMPORTANT FOOD-STAPLE OF THE WHITE IBIS AND OTHER MARSH BIRDS.

Natural size. Determined by W. L. Schmitt.

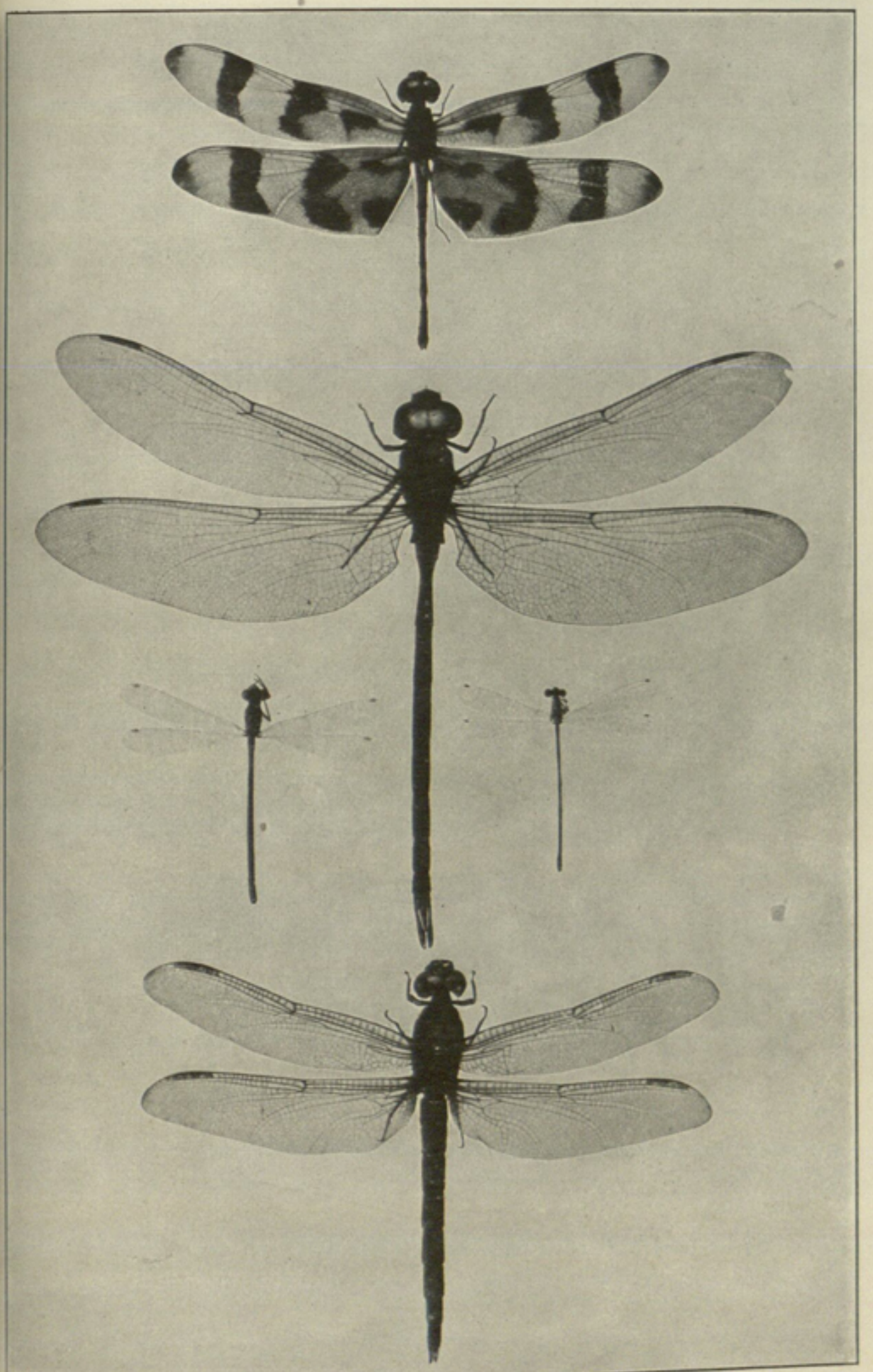


SCORPIONS (CENTRURUS GRACILIS) AND WHIP SCORPION (MASTIGOPROCTUS GIGANTEUS) FROM PARADISE KEY.

Determined by Dr. Nathan Banks. Slightly enlarged.

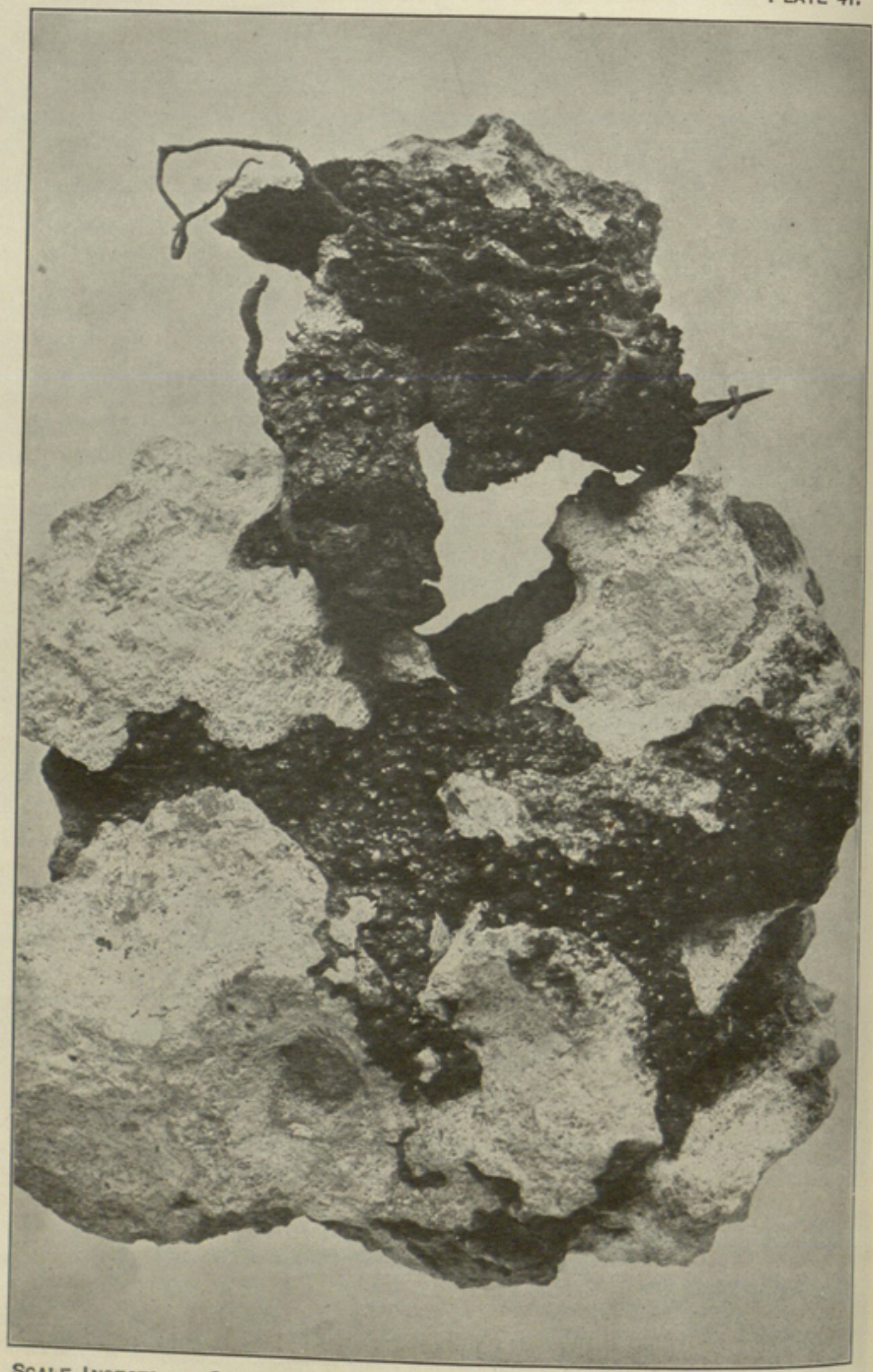
DOOR CASING OF SOUND OAK TIMBER RIDDLED BY WHITE ANTS (LEUCOTERMES), SHOWING RUNWAYS COATED WITH EARTH AND EXCRETED WOOD.

Natural size. Photograph by Thomas E. Snyder.



DRAGON FLIES OF ROYAL PALM STATE PARK.

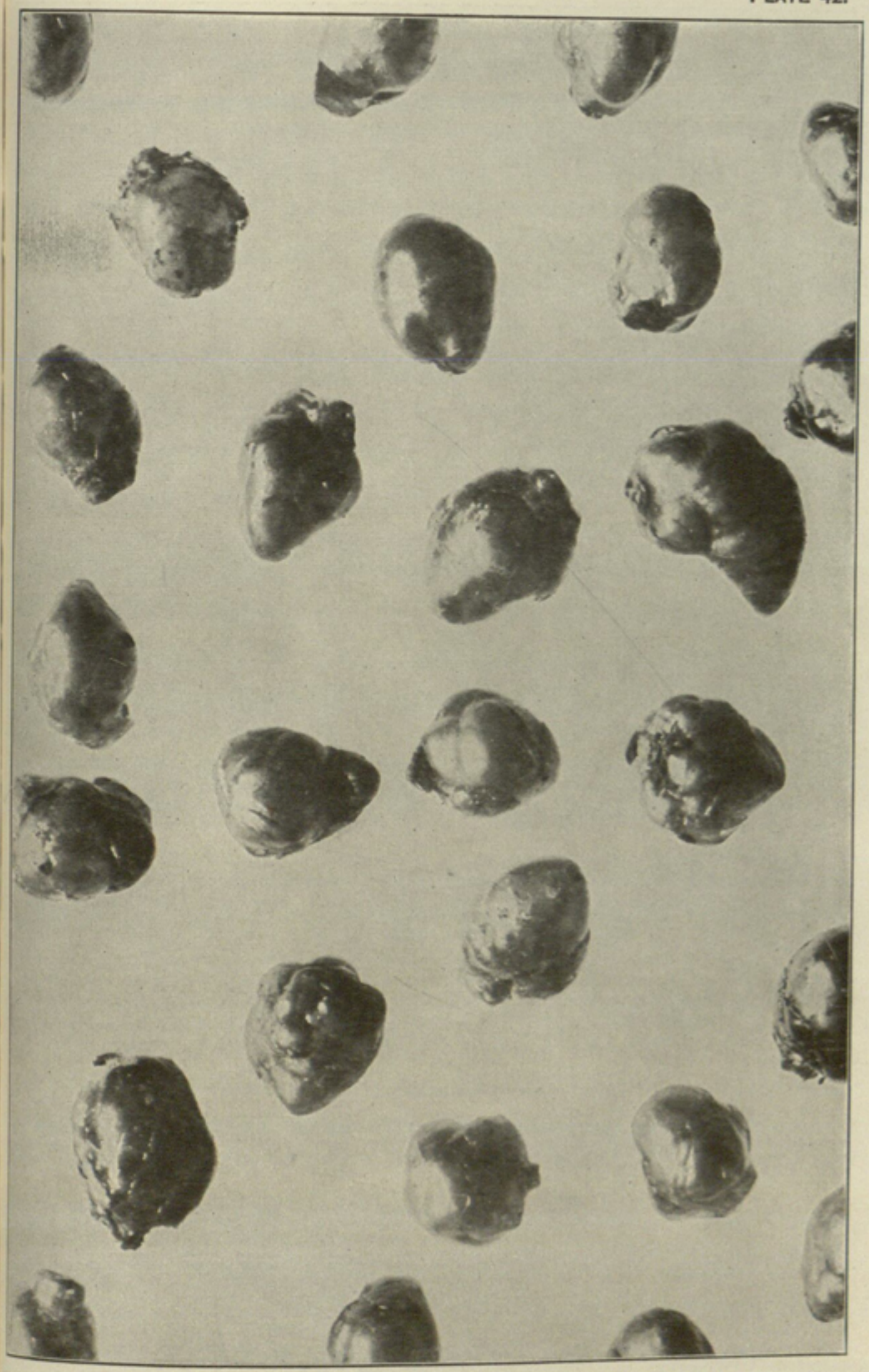
1, *Celithemis eponina;* 2, *Gynacantha nervosa;* 3, *Ischnura ramburii;* 4, *Argiallagma minutum;* 5, *Libellula auripennis.* Natural size. Determined by Bertha P. Currie.



SCALE INSECTS, OR COCCIDAE, MARGARODES FORMICARUM, CALLED GROUND-PEARLS FROM THEIR RESEMBLANCE TO OPALESCENT BEADS OF GOLD.

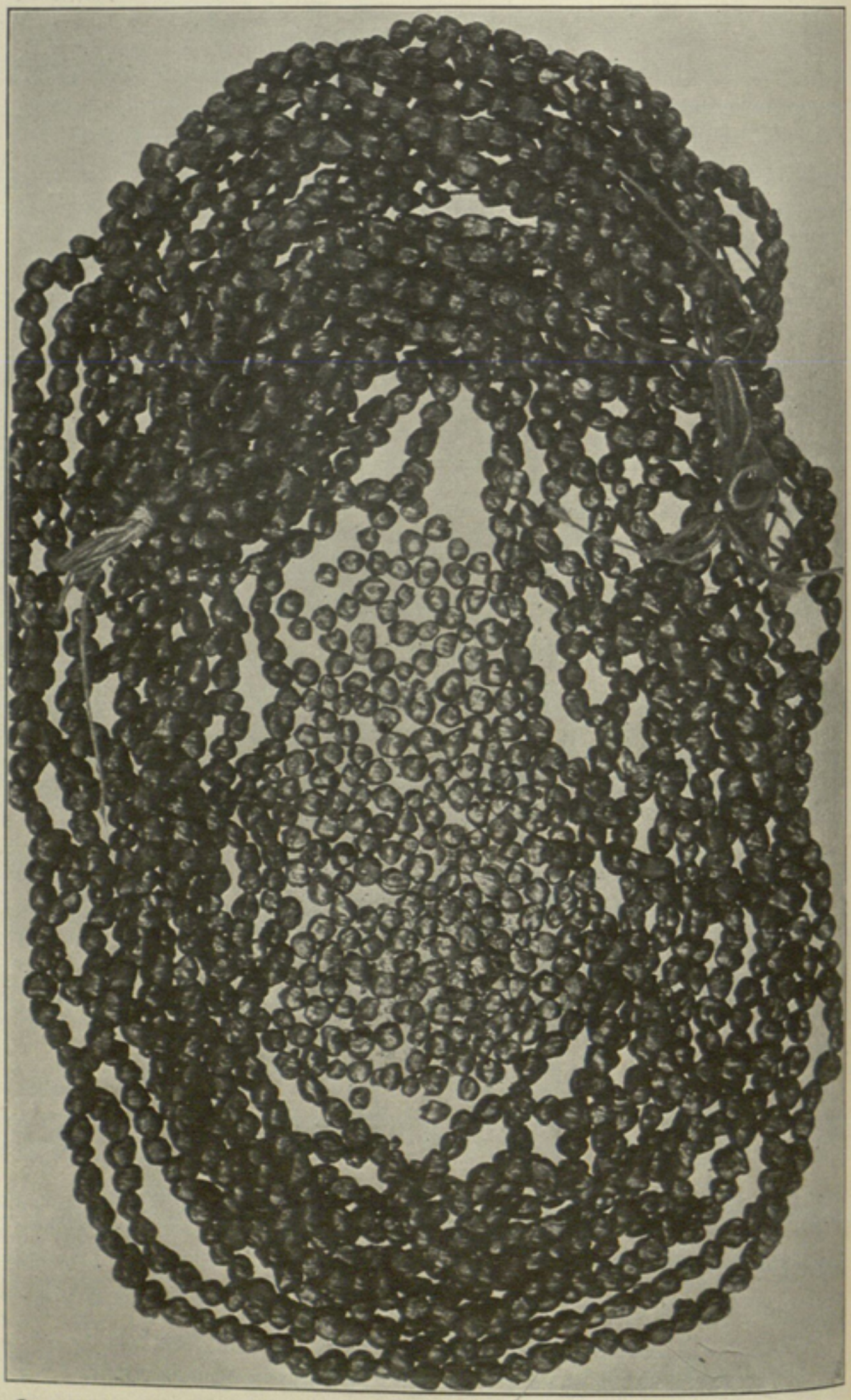
Collected alive in black soil in fissure of oolitic limestone near Park Lodge by C. E. Mosier. Natural size.

PLATE 42.



GROUND-PEARLS, MARGARODES FORMICARUM, FROM PARADISE KEY.

Enlarged 6 diameters. Collected by C. E. Mosier.

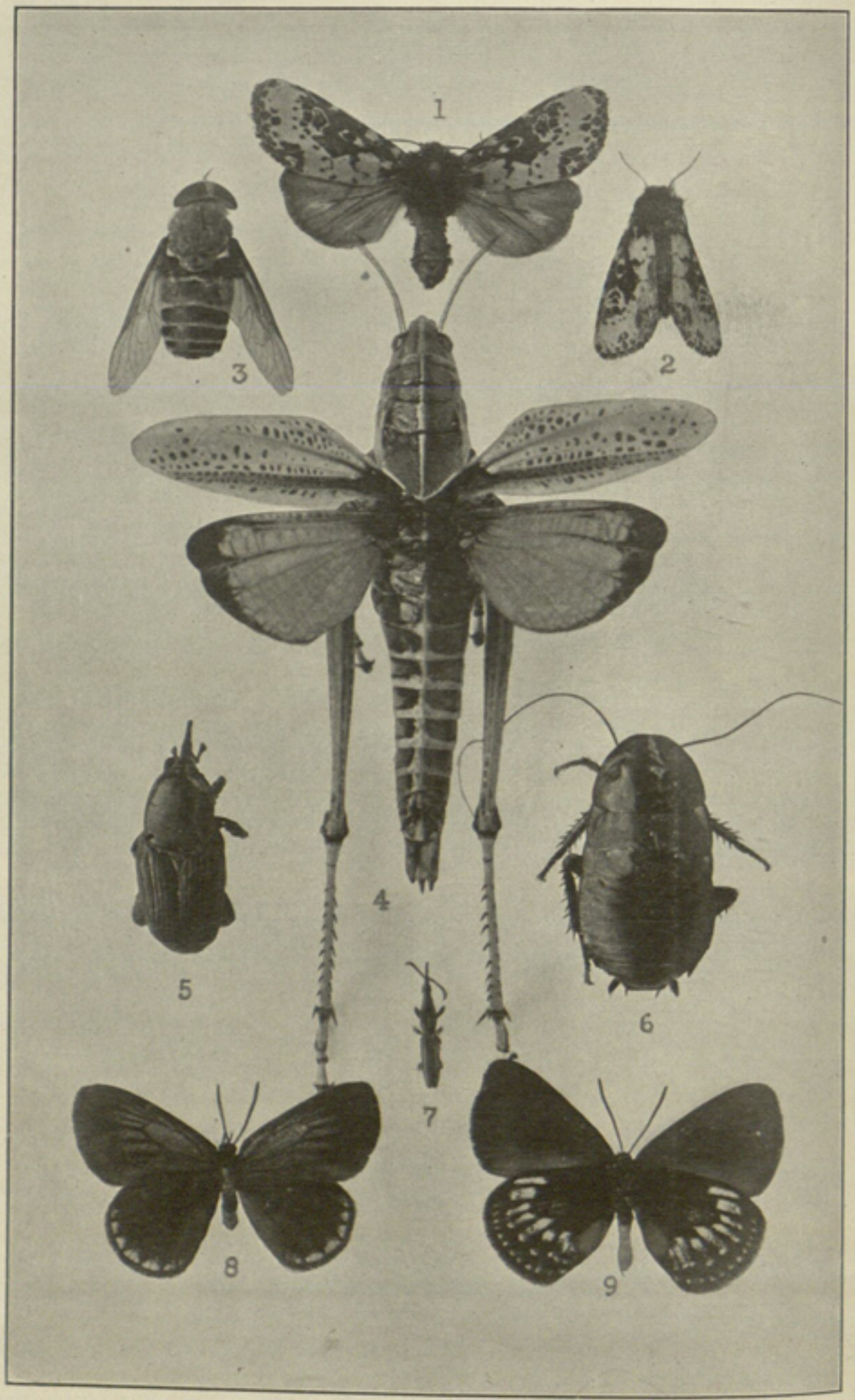


STRINGS OF GROUND-PEARLS, MARGARODES FORMICARUM, DISCOLORED BY AGE. SURROUNDING FRESHER SPECIMENS OF A GOLDEN COLOR.

Collected by C. V. Riley and H. G. Hubbard in the West Indies. Natural size. Photograph received from Dr. L. O. Howard.

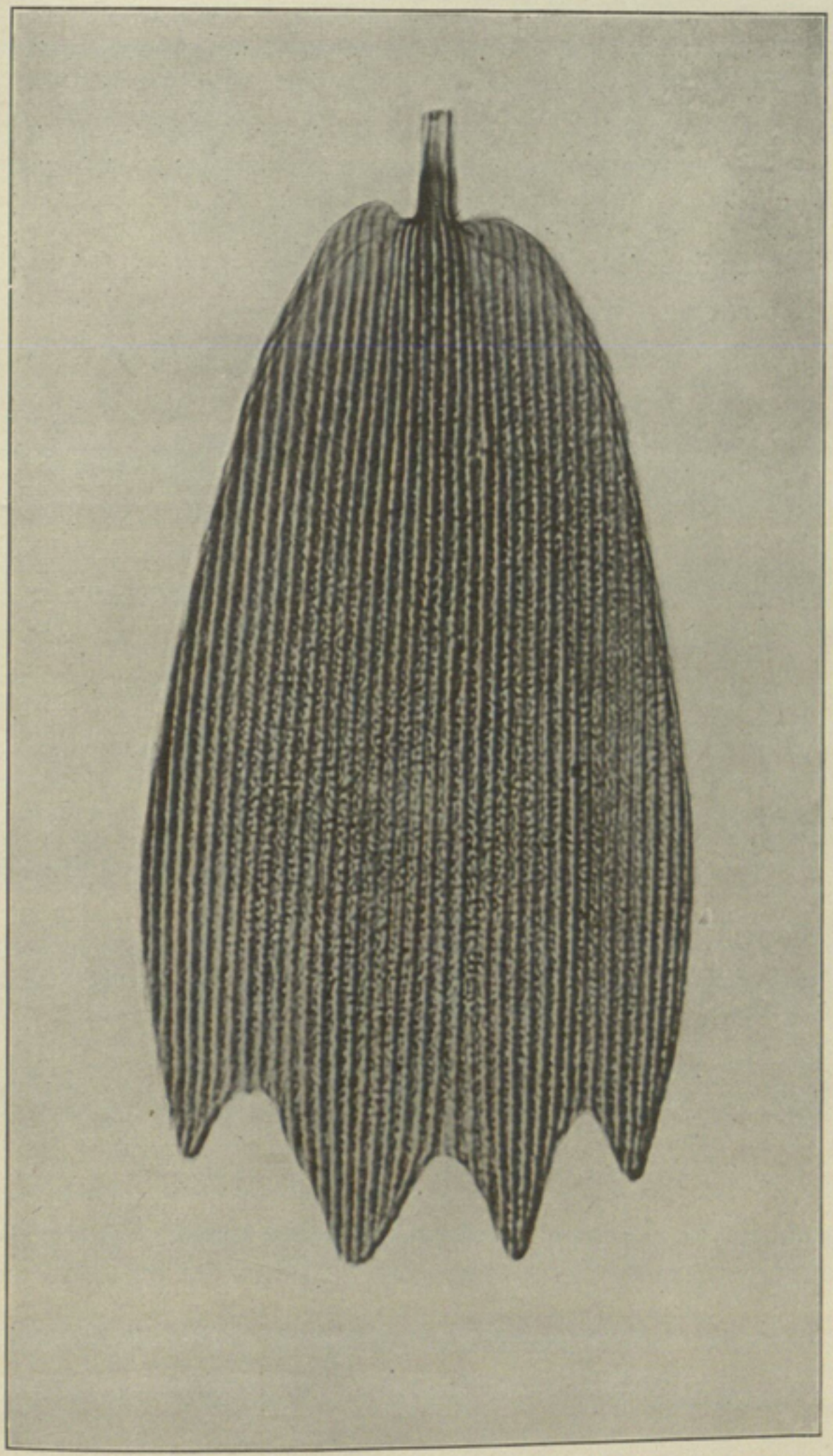
INSECTS OF PARADISE KEY.

1, House Cricket (*Gryllus assimilis*), female; 2, Male of same species; 3, *Acrosternum hilaris;* 4, Polka-dot Wasp Moth (*Syntomeida epilais*); 5, Orange-banded Wasp Moth (*Syntomeida ipomoeae*); 6, Southern Mantis (*Gonatista grisea*); 7, Leaf-foot Plant Bug (*Leptoglossus phyllopus*); 8, Big-thigh Plant Bug (*Metapodius femoratus*); 9, Katydid (*Scudderia texensis*); 10, Grasshopper (*Romalea microptera*), male. Natural size.



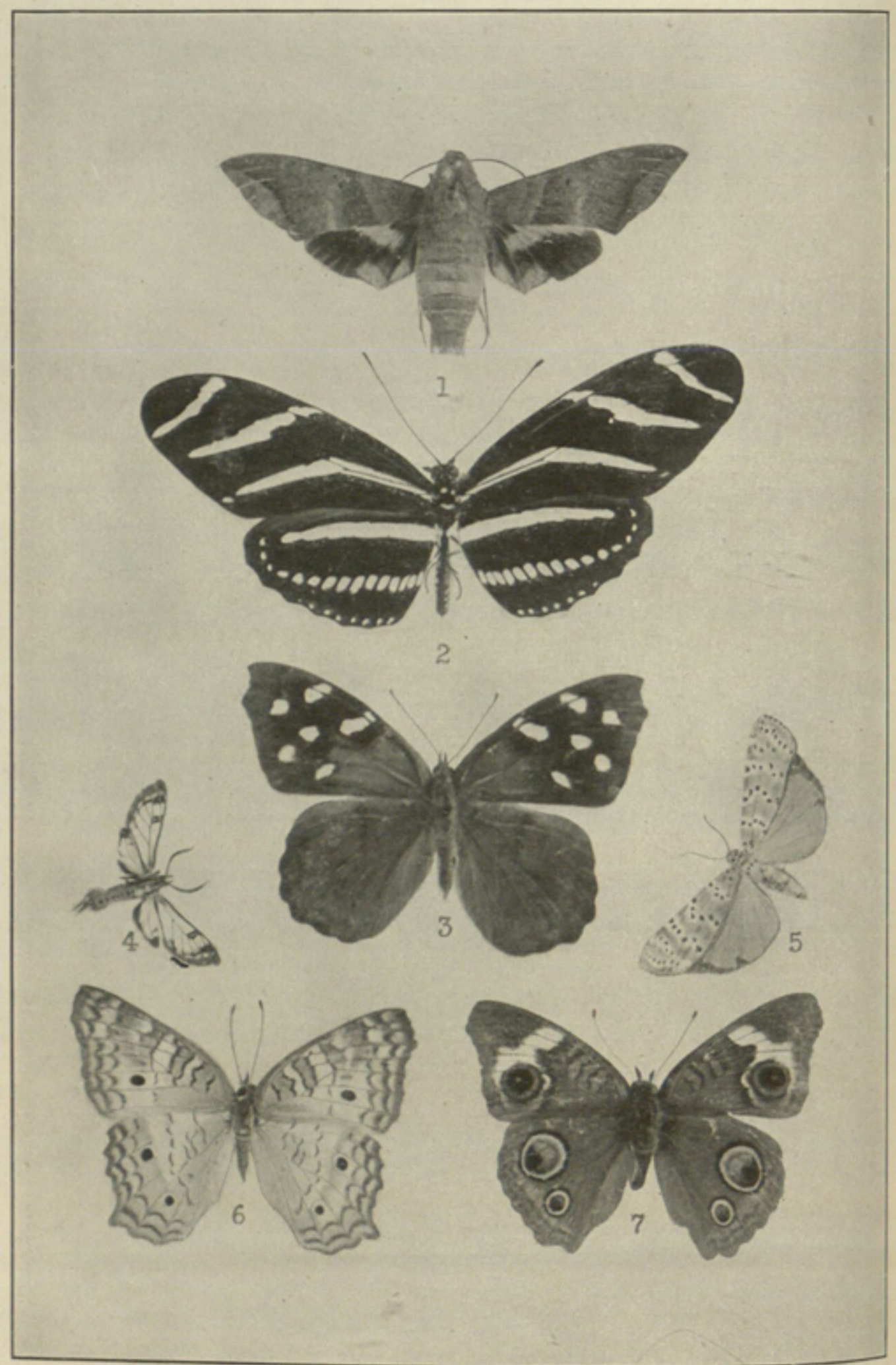
INSECTS OF PARADISE KEY.

1, Water-Lily moth (*Xanthopastis timais*); 2, Same with wings folded; 3, Great horsefly (*Tabanus americanus*); 4, giant grasshopper (*Romalea microptera*); 5, Palmetto weevil (*Rhynchophorus cruentatus*); 6, Roach (*Eurycotis ingens*); 7, Gumbo-limbo weevil (*Brenthus anchorago*); Zamia butterfly (*Eumaeus atala*); 9, Cycas butterfly (*Eumaeus minyas*). Natural size.



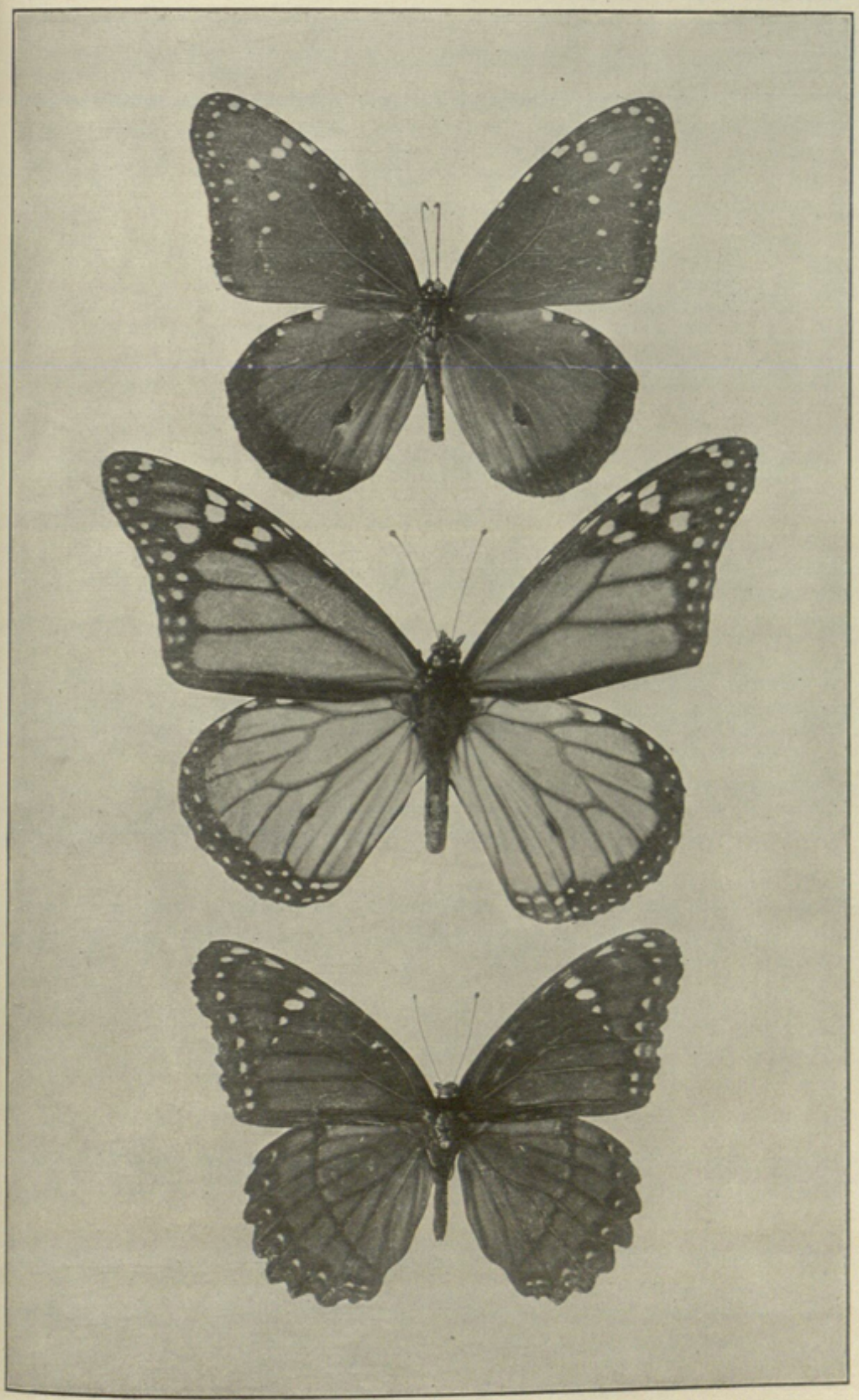
SCALE OF A BUTTERFLY'S WING (PAPILIO SP.) MAGNIFIED 750 DIAMETERS.

Photograph by Raymond Thrasher.



MOTHS AND BUTTERFLIES FROM PARADISE KEY.

1, *Perigonia lusca interrupta;* 2, *Heliconius charitonius;* 3, *Eunica tatila;* 4, *Didasys belae;* 5, *Utetheisa bella;* 6, *Anartia jatrophae;* 7, *Junonia coenia.* Natural size.



REGAL BUTTERFLIES FROM PARADISE KEY.

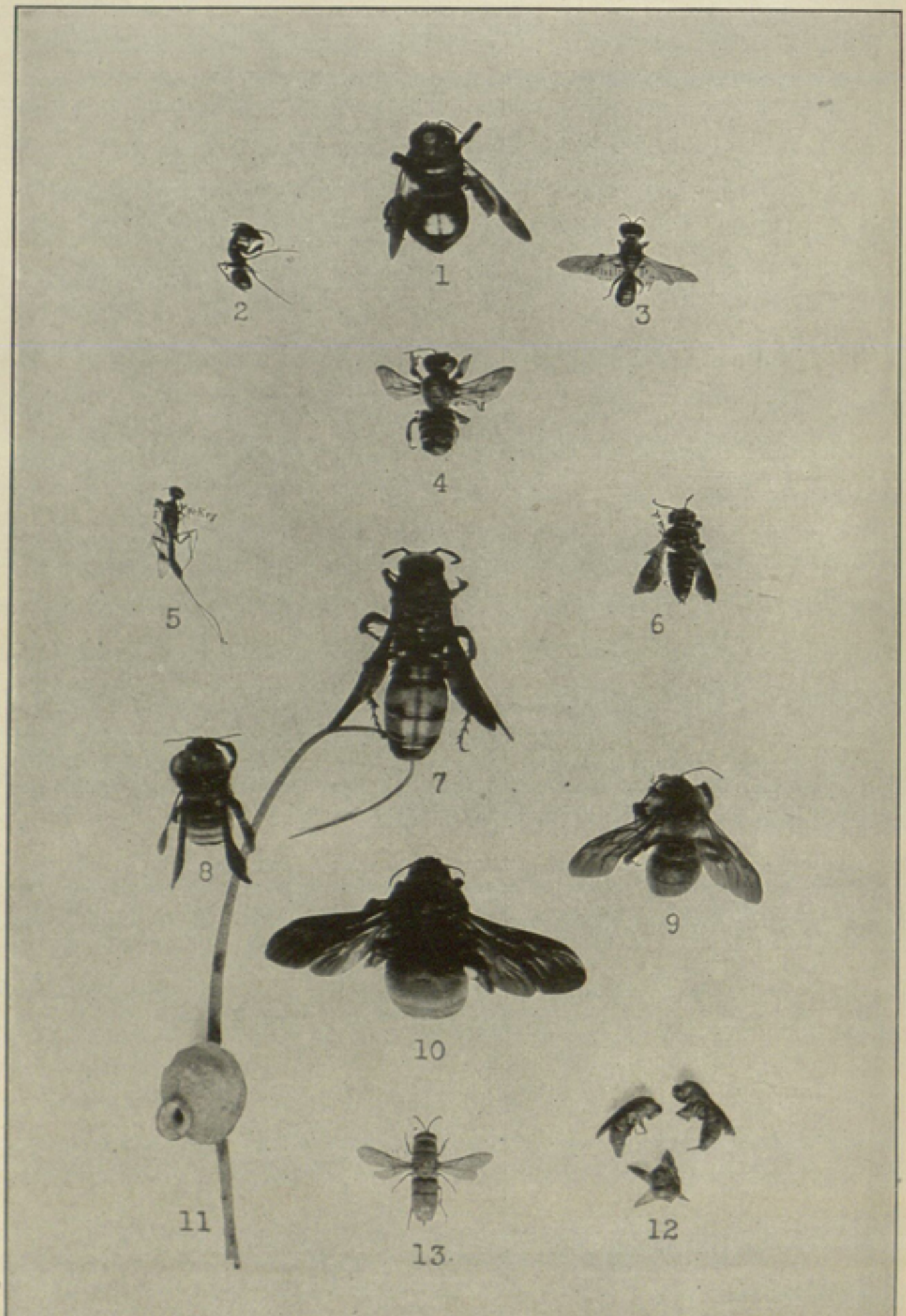
1, The Queen, *Anosia berenice;* 2, The Monarch, *Anosia plexippus;* 3, The Florida Viceroy, *Basilarchia floridensis.* Natural size.

BUTTERFLIES OF PARADISE KEY.

1, *Dione* (*Agraulis*) *vanillae;* 2, *Catopsilia eubule,* male; 3, *Anae* (*Pyrrhanea*) *portia;* 4, *Catopsilia agarithe maxima;* 5, *Catopsilia eubule,* female. Natural size.

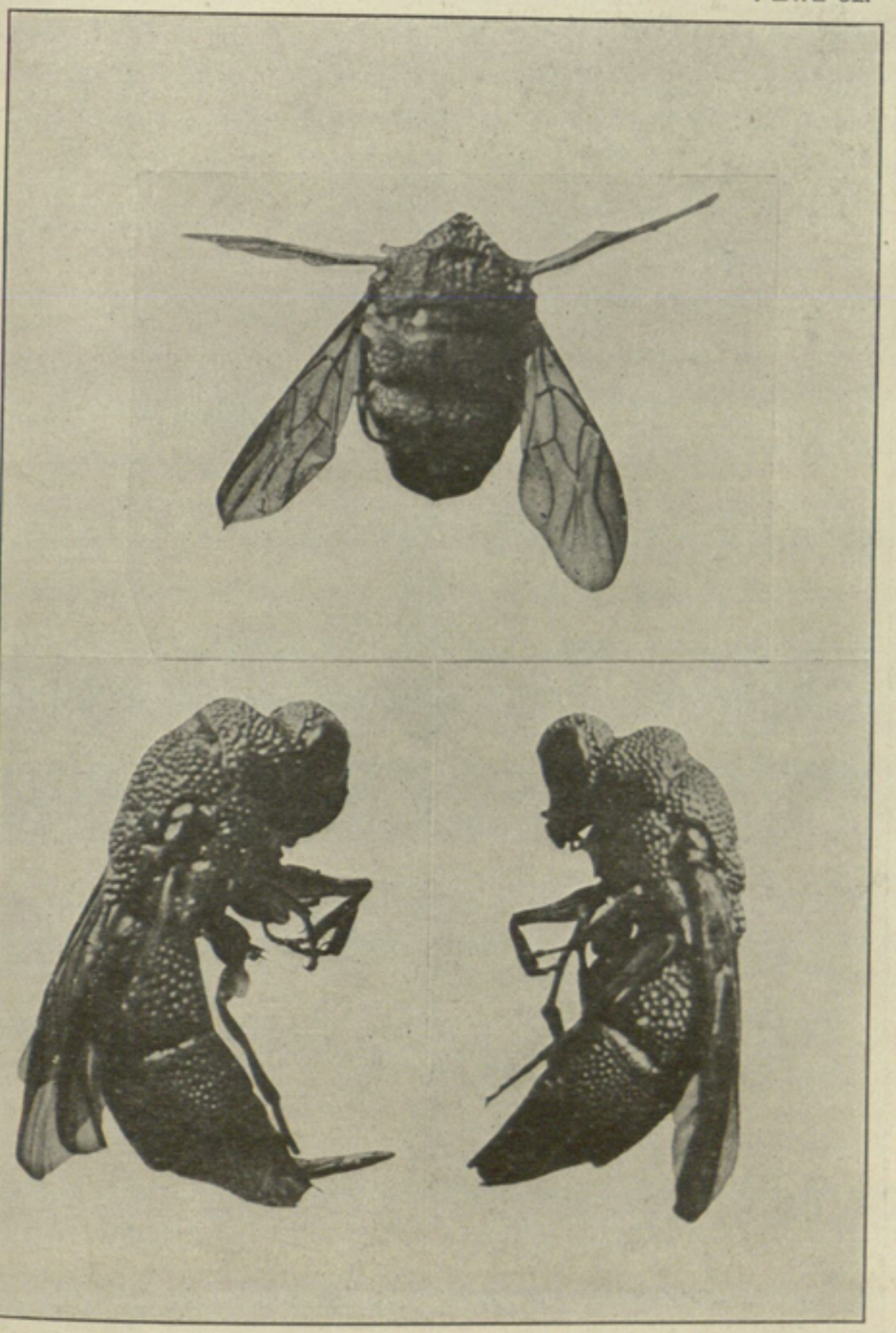
BUTTERFLIES OF PARADISE KEY.

1, *Eudamus proteus;* 2, *Papilio cresphontes;* 3, *Eurema* (*Terias*) *euterpe;* 4, *Papilio palamedes.*



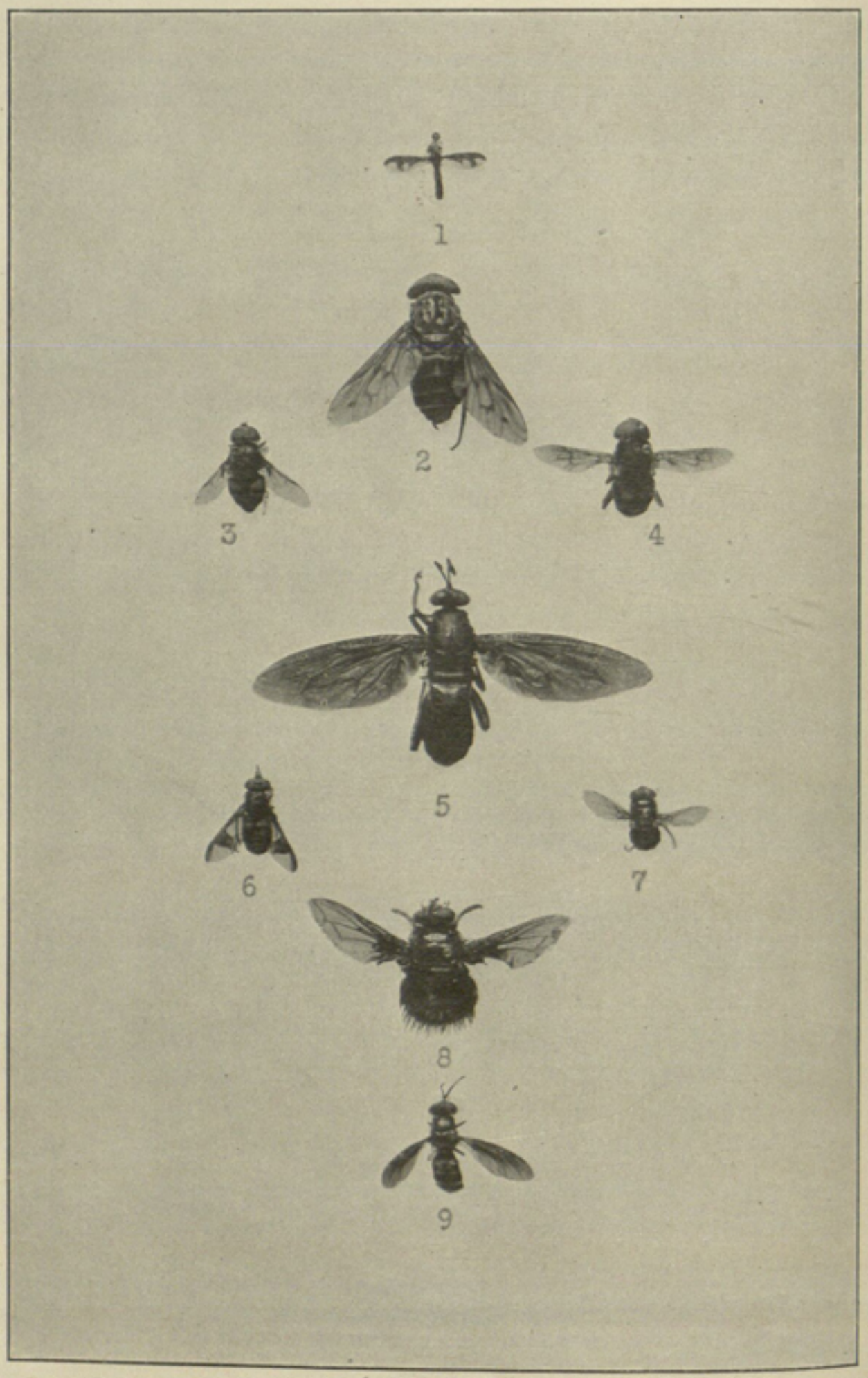
HYMENOPTERA OF PARADISE KEY.

1, *Xylocopa micans;* 2, *Camponotus abdominalis floridanus;* 3, *Hypocrabro decemmaculatus;* 4, *Megachile pollicaris,* a leaf-cutter; 5, *Pristaulacus floridanus;* 6, *Coeliorys dolichos,* a cuckoo bee; 7, *Campsomeris quadrimaculatus;* 8, 9, 10, *Bombus pennsylvanicus,* worker, male, and queen; 11, Nest of potter wasp (*Eumenes*); 12, Jewel wasps (*Chrysides*) found in potter's nests; 13, Jewel wasp, *Trichrysis parvula.* Natural size.



JEWEL WASPS (TRICHRYSIS PARVULA) FOUND IN NESTS OF POTTER WASP (EUMENES), WHICH THEY ENTER TO DEPOSIT THEIR EGGS.

The upper one is rolled up like an armadillo for self-protection. Enlarged 6 diameters.



DIPTERA OF PARADISE KEY.

1, Flower fly, *Ocyptamus fuscipennis;* 2, Horsefly, *Tabanus trijunctus;* 3, Flower fly, *Eristalis transversus;* 4, Flower fly, *Eristalis vinetorum;* 5, Midas fly, *Mydas clavatus;* 6, Deer fly, *Chrysops flavidus;* 7, Screw-worm fly, *Chrysomia macellaria;* 8, Tachina fly, *Archytas hystrix;* 9, Soldier fly, *Hermetia illucens.* Natural size.

BREUKER & KESSLER CO. PHILA.

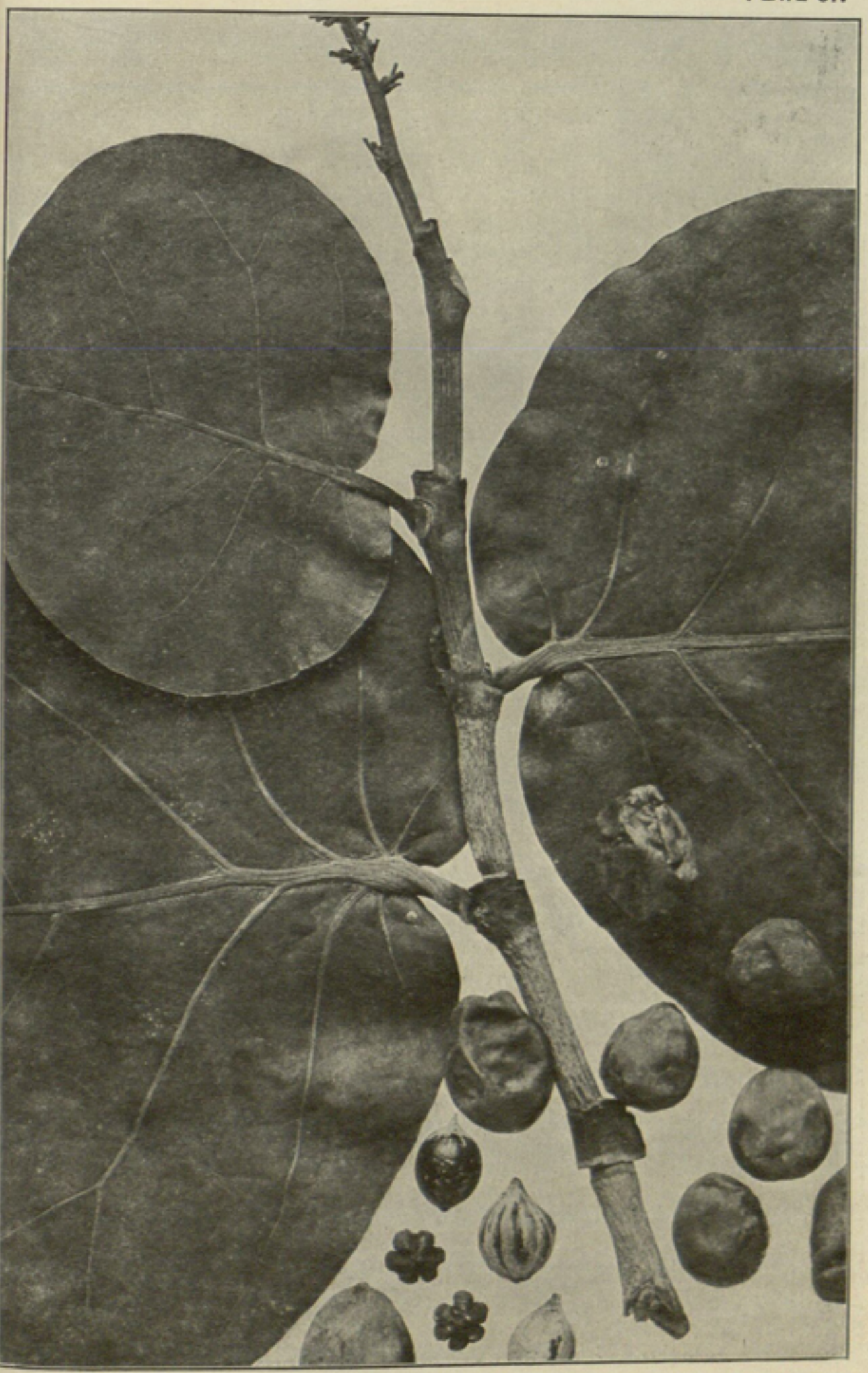
ROSEATE SPOONBILL — FAST DISAPPEARING FROM THE EVERGLADES

PREHISTORIC TERRACE MADE OF CONCH SHELLS (FULGUR (BUSYCON) PERVERSUM) BY ABORIGINAL INDIANS OF SOUTHERN FLORIDA.

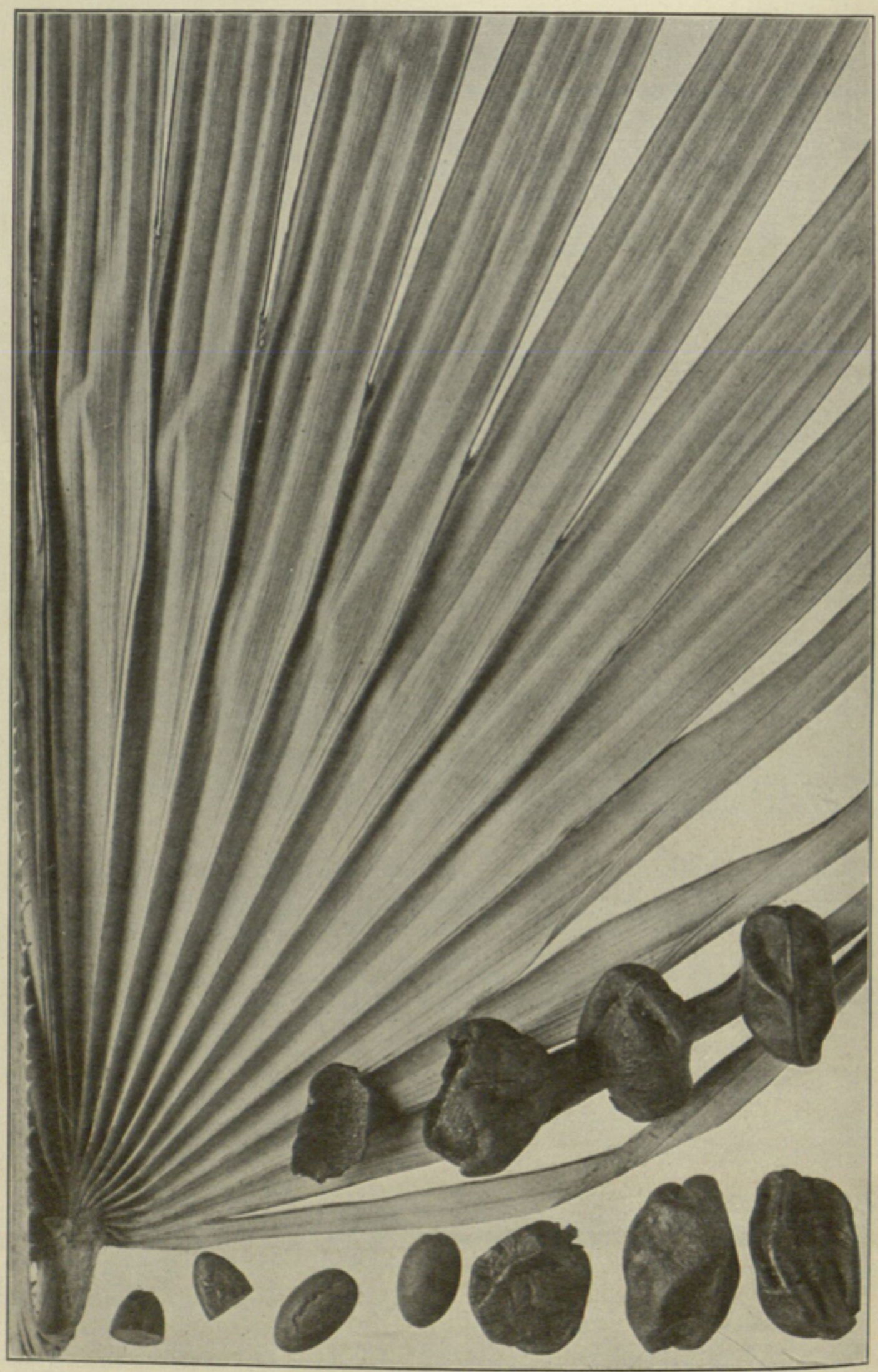
Similar shells are found in burial mounds of the Mississippi Valley and its tributaries. Photograph by Frank Hamilton Cushing.

LADLE MADE FROM SHELL OF FULGUR (BUSYCON) PERVERSUM, USED BY ABORIGINAL INDIANS OF SOUTHERN FLORIDA.

Photograph of specimen in United States National Museum. About two-thirds natural size.



"SEASIDE GRAPES" (COCCOLOBIS UVIFERA), A FOOD-STAPLE OF THE ABORIGINAL INDIANS OF SOUTHERN FLORIDA.



FRUIT OF THE DWARF SAW PALMETTO (SERENOA SERRULATA), MUCH RELISHED BY THE ABORIGINAL INDIANS OF SOUTHERN FLORIDA IN SPITE OF ITS ACRID RANCID TASTE.

LEAVES OF ILEX VOMITORIA, USED BY THE ABORIGINAL INDIANS OF FLORIDA FOR MAKING THEIR CEREMONIAL "BLACK DRINK."

LIVE OAK (QUERCUS VIRGINIANA) FROM ROYAL PALM STATE PARK.

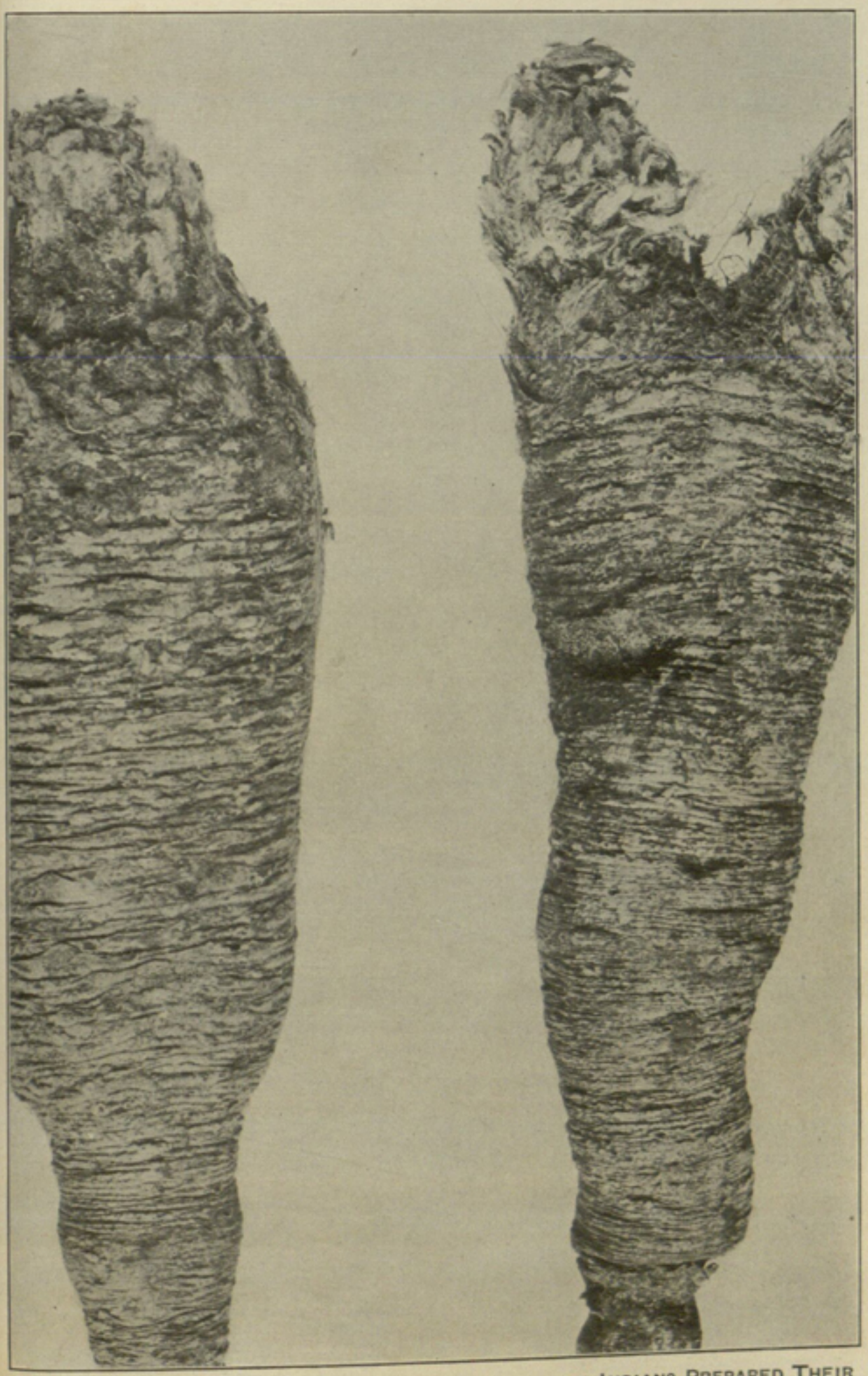
The acorns were used in early times as a food staple. The Spaniards sometimes used them for making a chocolate-like drink.

SEMINOLE INDIAN BOYS POLING A CANOE IN AN EVERGLADE SLOUGH.

Photograph by Julian A. Dimock.

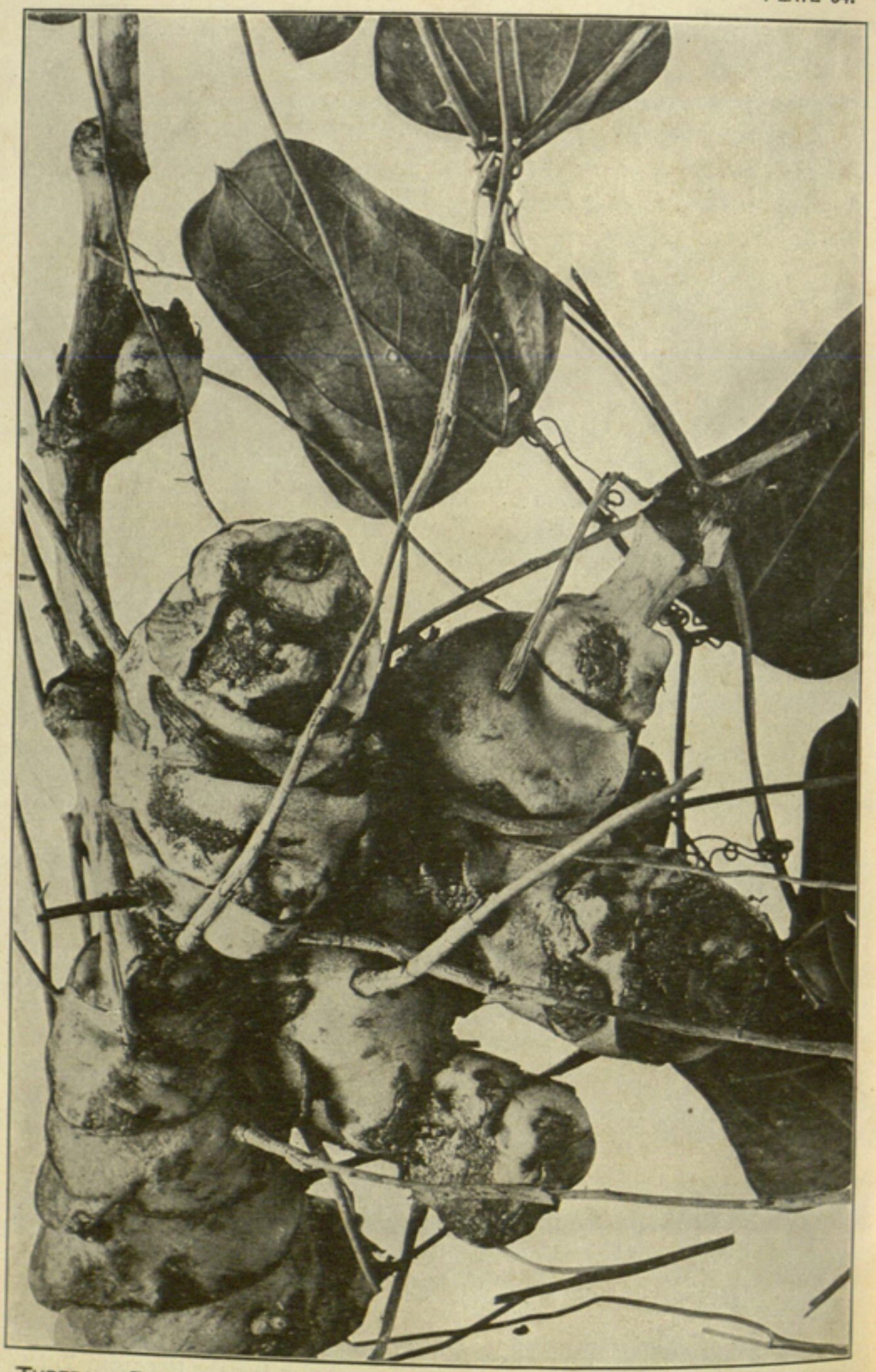
SEMINOLE INDIAN OF THE EVERGLADES OF FLORIDA AND HIS SON.

Photograph by Julian A. Dimock. The Seminoles are related to the Creeks and Choctaws.



ROOTS OF A CYCAD, ZAMIA FLORIDANA, FROM WHICH THE INDIANS PREPARED THEIR EDIBLE "COONTIE" (FLORIDA ARROWROOT).

Photograph of specimens obtained from the arrowroot factory of Mr. Hurst, near Miami.



TUBEROUS ROOTS OF SMILAX AURICULATA, THE SOURCE OF THE "RED COONTIE" OF THE SOUTHERN INDIANS.

Photograph of specimens collected near Miami by William Marmick. Natural size.