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Item: <https://www.biodiversitylibrary.org/item/53162>

Article/Chapter Title: Gleicheniaceae-Betulaceae

Author(s): Paul C. Standley

Page(s): Page [I], Page II, Page III, Page [IV], Page V, Page [VI], Page 1, Page 2, Page 3, Page 4, Page 5, Page 6, Page 7, Page 8, Page 9, Page 10, Page 11, Page 12, Page 13, Page 14, Page 15, Page 16, Page 17, Page 18, Page 19, Page 20, Page 21, Page 22, Page 23, Page 24, Page 25, Page 26, Page 27, Page 28, Page 29, Page 30, Page 31, Page 32, Page 33, Page 34, Page 35, Page 36, Page 37, Page 38, Page 39, Page 40, Page 41, Page 42, Page 43, Page 44, Page 45, Page 46, Page 47, Page 48, Page 49, Page 50, Page 51, Page 52, Page 53, Page 54, Page 55, Page 56, Page 57, Page 58, Page 59, Page 60, Page 61, Page 62, Page 63, Page 64, Page 65, Page 66, Page 67, Page 68, Page 69, Page 70, Page 71, Page 72, Page 73, Page 74, Page 75, Page 76, Page 77, Page 78, Page 79, Page 80, Page 81, Page 82, Page 83, Page 84, Page 85, Page 86, Page 87, Page 88, Page 89, Page 90, Page 91, Page 92, Page 93, Page 94, Page 95, Page 96, Page 97, Page 98, Page 99, Page 100, Page 101, Page 102, Page 103, Page 104, Page 105, Page 106, Page 107, Page 108, Page 109, Page 110, Page 111, Page 112, Page 113, Page 114, Page 115, Page 116, Page 117, Page 118, Page 119, Page 120, Page 121, Page 122, Page 123, Page 124, Page 125, Page 126, Page 127, Page 128, Page 129, Page 130, Page 131, Page 132, Page 133, Page 134, Page 135, Page 136, Page 137, Page 138, Page 139, Page 140, Page 141, Page 142, Page 143, Page 144, Page 145, Page 146, Page 147, Page 148, Page 149, Page 150, Page 151, Page 152, Page 153, Page 154, Page 155, Page 156, Page 157, Page 158, Page 159, Page 160, Page 161, Page 162, Page 163, Page 164, Page 165, Page 166, Page 167, Page 168, Page 169

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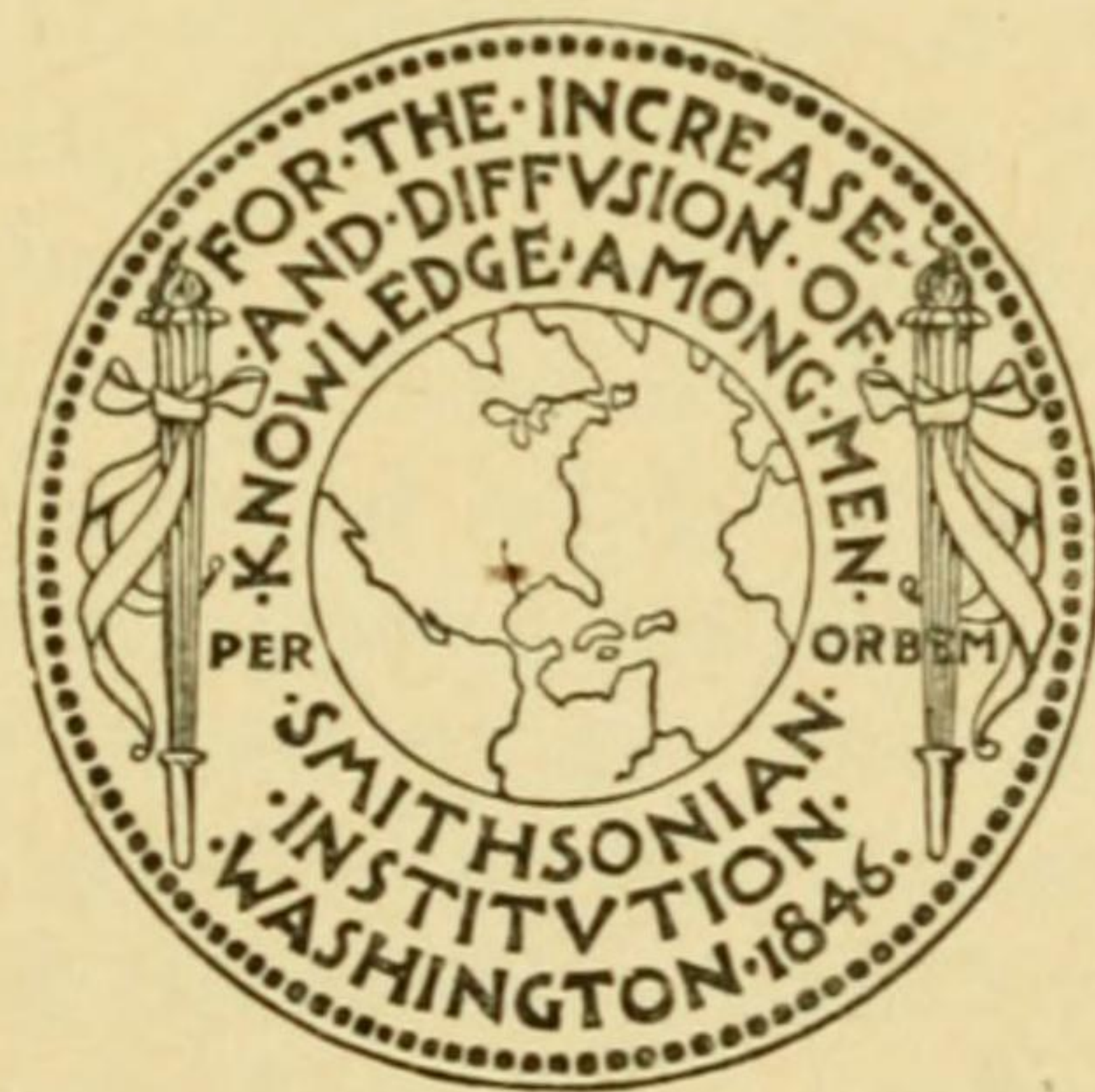
FROM THE

UNITED STATES NATIONAL HERBARIUM

VOLUME 23, PART 1

TREES AND SHRUBS OF MEXICO
(GLEICHENIACEAE-BETULACEAE)

By PAUL C. STANDLEY



WASHINGTON
GOVERNMENT PRINTING OFFICE

1920

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM.

II

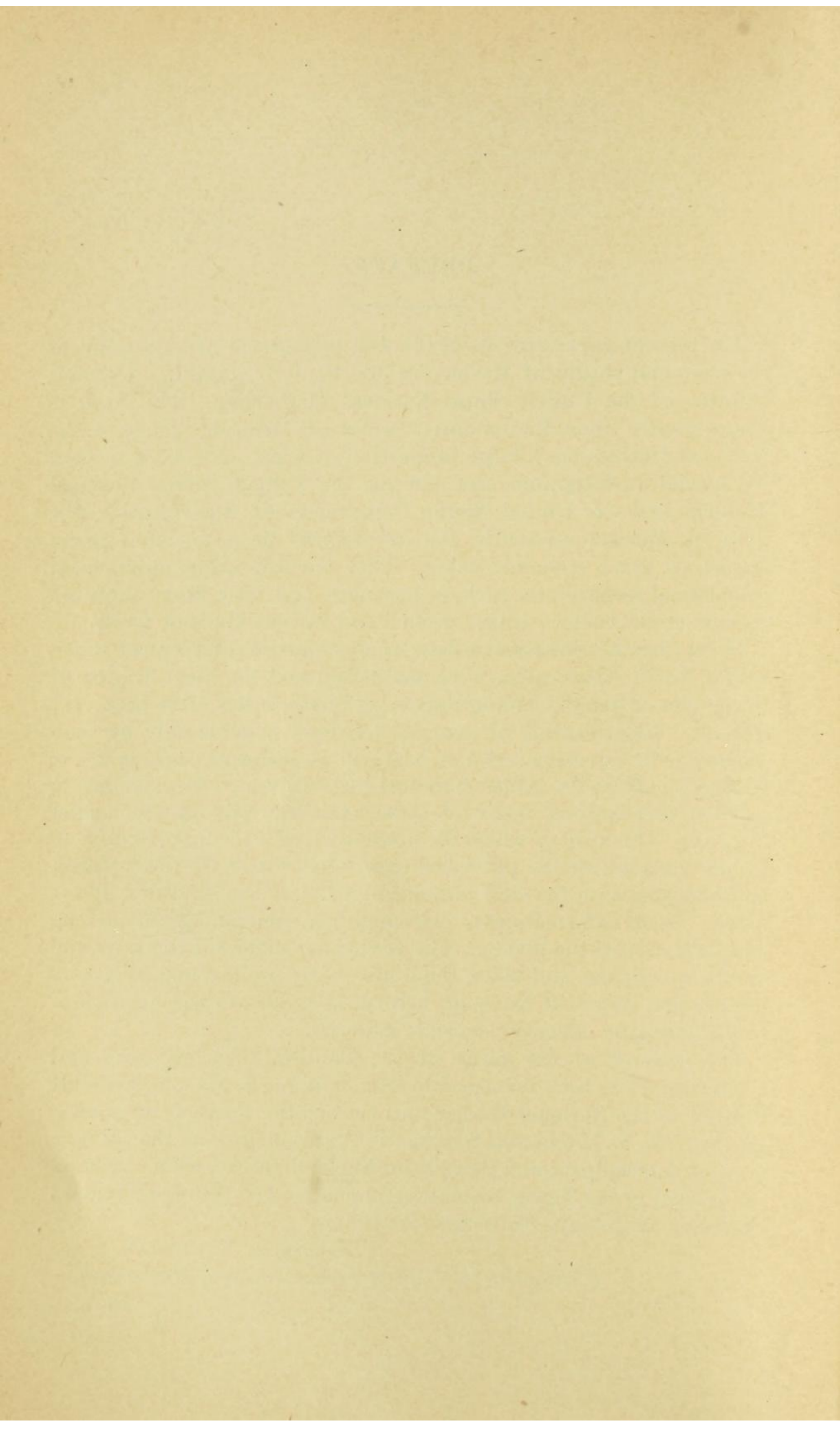
PREFACE.

The present paper consists of the first installment of an account of the trees and shrubs of Mexico, by Mr. Paul C. Standley, Assistant Curator of the United States National Herbarium. The work is based wholly upon the extensive series of Mexican plants in the National Herbarium, a large proportion of which have been secured by special investigators sent out by the United States National Museum and the United States Department of Agriculture. The flora of Mexico, especially the arborescent flora, includes many species of great economic value. They furnish many products of commercial importance, such as henequen and ixtle fiber, palm oil, lumber, cacao, rubber, drugs, alcohol, and various kinds of fruits.

Heretofore no descriptive flora of any portion of tropical continental North America has been published, and the identification of the species of plants yielding important products has often been very difficult. Identification of material has been possible only by comparison with extensive series of herbarium specimens, such as are to be found only in the larger botanical institutions, or by reference to isolated descriptions, many of these available only in the largest libraries. The work of which the present paper is the first installment brings together all the published species of woody Mexican plants, and furnishes keys for their identification, as well as brief descriptive notes. Much information is presented also concerning commercial and local uses of the plants. The vernacular names of the trees and shrubs are given, and since these are fairly well standardized by local usage, they will be found helpful as guides to the identity of fragmentary or otherwise difficult material.

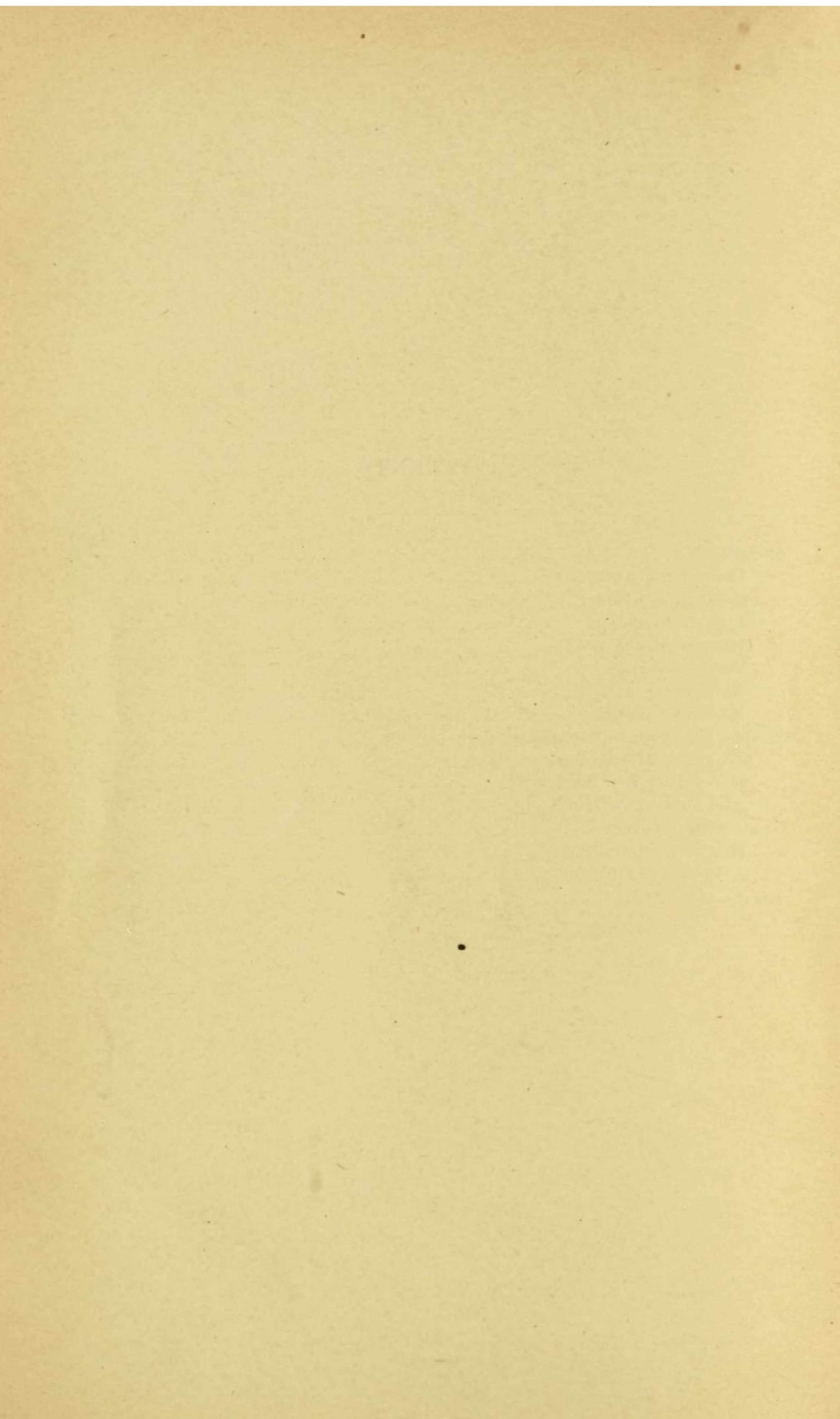
The account of the ferns of the families Gleicheniaceae and Cyatheaceae has been furnished by Mr. William R. Maxon, Associate Curator of the National Herbarium; that of the Poaceae, or grasses, by Prof. A. S. Hitchcock, Systematic Agrostologist of the Department of Agriculture; and that of the Amaryllidaceae, which includes the difficult genus *Agave*, or century plants, by Dr. William Trelease, Professor of Botany, University of Illinois.

FREDERICK V. COVILLE,
Curator of the United States National Herbarium.



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TREES AND SHRUBS OF MEXICO.

By PAUL C. STANDLEY.

INTRODUCTION.

The most interesting regions of the earth from a botanical standpoint are those which possess a tropical climate. There physical conditions are most favorable for the growth of plants, and not only is vegetation much more luxuriant than in temperate countries, but the number of species, especially of trees and shrubs, is vastly greater. West Virginia and Costa Rica, for instance, are temperate and tropical areas of approximately equal size; but only 1,600 species of ferns and flowering plants are known from West Virginia, while the flora of Costa Rica includes more than three times and probably four times that number. Large areas in Mexico are neither tropical nor even subtropical, but no region of the globe, probably, possesses a richer or more interesting flora. Mexico has an area of 767,000 square miles, which, although only about one-fifth that of the United States, exhibits a greater range of climatic conditions. The extremes of elevation much exceed those of the United States, ranging from sea level to over 5,200 meters. Almost every conceivable plant formation is represented—the wet tropical forests of the southern lowlands, the temperate deciduous and coniferous forests of the central plateau and of the ranges of the Sierra Madre, the alpine zones of the high peaks like Orizaba, Popocatepetl, and Ixtaccihuatl, and the great barren or cactus deserts which reach their best development in the northern states.

The botanical features of Mexico have attracted attention from the days of the earliest explorers. Many botanists have visited the country in the last hundred years, yet the flora is still but imperfectly known. Almost every collector at the present day makes discoveries of remarkable species previously unknown to science, and some plants are still unknown botanically although their supposed medicinal properties, or their products, such as fruit, lumber, fiber, and gum, are well known locally and are frequently even of com-

mercial importance. In the immense mountain ranges there are hundreds of difficult peaks and almost inaccessible canyons whose exploration is extremely tedious; in the south the tropical forests are penetrated with difficulty, and the lofty branches of their trees are almost inaccessible to the collector; away from the Sierra Madre are innumerable isolated masses of mountains and hills, still unvisited by a botanist, which must yield a host of localized species. Consider, in addition, the fact that Mexico is still very imperfectly supplied with transportation facilities and it becomes evident that many years must elapse before a comprehensive knowledge of the flora is possible.

It is unfortunate, and at the same time remarkable, that no flora of any part of tropical continental North America has ever been prepared. Indeed, in this respect all of North America has made little progress as compared with Europe, some parts of Asia, Australia, and Africa, or even South America. The flora of tropical Africa, the most recent of all the great regions of the earth to be explored by European peoples, has been adequately treated in botanical literature; and the flora of Brazil has been described in a monumental series of volumes, of which any country might well be proud, but whose equal no other country possesses. For no political unit of North America has a modern descriptive or even a synoptical flora ever been published.

The only publication approaching a flora of Mexico which has ever been completed is the Botany of the *Biologia Centrali-Americana*, compiled by Hemsley and issued from 1879 to 1888. This, though including no descriptive notes (except incidentally) nor any means of identifying the species, is a comprehensive work, listing all the species of the higher plants known at that time from Mexico (excluding Baja California) and Central America. Ranges and definite localities are given for all the species, together with the more important synonymy. It is superfluous to state that after almost 40 years this work has lost much of its former usefulness, as a result of recent botanical discoveries. Nevertheless the five volumes of the *Biologia* will always remain an invaluable and classic work upon tropical American plants.

Botanical exploration in Mexico has now progressed to the point where a descriptive flora of the region is practicable, and such a compilation is urgently needed. The work here offered is intended to include a complete list of the woody plants known from Mexico, with keys for their determination. This arbitrary and artificial division of the Mexican flora was chosen for treatment because it contains those species which are the most conspicuous elements of the vegetation, as well as those which are of most importance from an economic standpoint. It includes, moreover, the larger portion of the Mexican

species. Later, it is to be hoped, someone else may have an opportunity to treat at length the herbaceous species or the flora as a whole. While it is only too evident that the available collections of Mexican plants are inadequate to furnish a complete illustration of the flora of the country, the offering of such a work as can be prepared with the material at hand needs no apology, for it is certain that the larger part of the woody plants, and especially those of economic importance, have already been collected.

It is not deemed advisable to include in the present publication an account of the general features of the flora. These have already been dealt with at length by other authors, particularly Hemsley¹ and Ramírez.²

PLAN OF THE WORK.

COLLECTIONS STUDIED.

In this list of Mexican plants it is intended, of course, to account for all the trees and shrubs which have been collected in Mexico or reported from that country. The account is based wholly upon the collections in the United States National Herbarium, although the published species not represented there have been included in the keys when possible. The National Herbarium contains the largest and most complete representation of Mexican plants that has been assembled, a large proportion of the material having been obtained by special collectors sent into the field by the United States National Museum and the United States Department of Agriculture. In addition, the herbarium contains many collections received from other institutions and individuals, the more important of which were obtained by the following collectors: F. Altamirano, F. W. Anthony, Brother G. Arsène, J. L. Berlandier, M. Botteri, M. Bourgeau, T. S. Brandegee, G. N. Collins, C. Conzatti, O. F. Cook, F. V. Coville, C. K. Dodge, C. B. Doyle, H. Galeotti, G. F. Gaumer, E. A. Goldman, J. M. Greenman, C. V. Hartman, A. S. Hitchcock, E. W. D. Holway, M. E. Jones, E. Kerber, E. Langlassé, F. M. Liebmann, F. E. Lloyd, D. T. MacDougal, F. S. Maltby, E. A. Mearns, C. F. Millspaugh, Charles Mohr,³ E. W. Nelson, Brother Nicolas, C. R. Orcutt,

¹ Biol. Centr. Amer. Bot. 4: 138-315. 1887.

² La vegetación de México, pp. 1-271, with 2 maps. Mexico, 1899.

³ Charles Mohr (1824-1901) was a native of Germany, who came to the United States in 1848. He visited Mexico in 1857 and was a guest of Sartorius at his home in Mirador. He made botanical collections in the region of Orizaba. Here he was associated with Botteri, and his collection numbers, in some cases at least, are the same as Botteri's. His collections are in the United States National Herbarium. Dr. Mohr is best known for his "Plant Life of Alabama," published as volume 6 of the Contributions from the United States National Herbarium.

Edward Palmer, C. C. Parry, Henry Pittier, C. G. Pringle, C. A. Purpus, B. P. Reko, J. N. Rose, J. N. Rovirosa, H. H. Rusby, W. E. Safford, H. C. Seaton, J. G. Schaffner, Arthur Schott, C. L. Smith, L. C. Smith, C. H. T. Townsend and C. M. Barber, Charles Wright, W. G. Wright, L. J. Xantus.

SPECIES INCLUDED.

It is manifest that the group here chosen for treatment is an artificial one. It is impossible to draw a sharp line between the woody and herbaceous plants, although in the vast majority of cases such a classification is easily made. Many truly woody plants are so small that they are not looked upon commonly as shrubs, and many herbaceous plants become so large as to remind one of small trees. Plants which are essentially annuals, and which in regions where freezing temperatures occur never live more than one season, may in tropical regions develop more or less woody stems. Moreover, in herbarium specimens, which as a rule consist merely of terminal portions of branches, it is often impossible to conclude that a plant is a shrub except from analogy or from information furnished by collectors. The writer would have preferred to treat only of the trees of Mexico, which are far less numerous than the shrubs and would have required less space for their elaboration; but the separation in the herbarium of trees and shrubs involves still greater difficulties than the separation of woody and herbaceous plants. We have so little published information regarding the size of Mexican plants, and most collectors show such an aversion to furnishing notes concerning their collections, that the classification of woody plants as trees and shrubs is evidently quite impracticable with our present knowledge. The writer's policy as to the species to be included has been a liberal one, and although it is possible that some species have been omitted which should have been included, it is certain that their number is small. On the other hand, many species have probably been included which should have been omitted, but this fact will increase rather than detract from the usefulness of the work. Some species have been listed as shrubs, rather against the judgment of the writer, because of data reported by collectors.

The statements given here concerning size are the best that can be compiled from published notes and from information furnished by collectors' labels. The information available is not so complete as is desirable and in some cases may be misleading. It has not been the intention to publish a descriptive manual, and the brief descriptive notes given under most of the species are intended merely to supplement the keys and to indicate the most striking features of each species. Keys are given for the determination of genera and

species and one for the determination of families. The last is adapted from a key to the families of tropical American plants published recently by Mr. Henry Pittier.¹ It is very difficult, if not impossible, to prepare a key to the families of tropical plants which will enable one always to refer a plant to its family, because many of the plants are still imperfectly known, and because there are in some families many exceptions to the typical plan of organization of the group. With complete material of a given plant, however it is hoped that the present key will usually be adequate for indicating its family position.

It has been intended to give references to the names of all woody plants published or reported from Mexico, disregarding, however, certain obviously incorrect names which have not received notice in more recent or important works. Casual references are made in addition to the more common cultivated exotic species. Published names not illustrated by material examined by the writer or not identifiable from the descriptions accompanying them have been listed as "doubtful species" at the end of their respective genera. The plan has been to list as a valid species or as a synonym each specific name based upon Mexican material, but it has not been deemed necessary to list all the combinations under various genera, unless their citation seemed to serve some useful purpose. The writer has not attempted to classify all the names of Mociño and Sessé, which occur in their *Plantae Novae Hispaniae* and *Flora Mexicana*, for these names have justly received little attention from taxonomists, and their determination would require an amount of labor quite inconsistent with any advantage that would result. Some of these names, however, have been referred to in their proper places. A very few of Mociño and Sessé's names are valid, but it is only by accident that such is the case.

RANGES OF THE SPECIES.

The range in Mexico ascribed to each species is based chiefly upon material in the National Herbarium, but reliable published reports have been taken into account when they indicated noteworthy extensions of range. It is probable that in many cases the species have wider ranges than is indicated, but the limits of distribution can not be determined definitely until more extensive explorations have been carried out. Much more comprehensive collections are needed from all parts of Mexico, but especially from the states of Tabasco, Michoacán, Guerrero, Oaxaca, and Chiapas. Those available from

¹Clave analítica de las familias de plantas fanerógamas de Venezuela y partes adyacentes de la América Tropical. Pp. 1-108. Caracas, 1917.

Tabasco and Chiapas are particularly inadequate, and doubtless many of the listed species occur there, even if the ranges as here stated do not indicate the fact. If a species occurs in Oaxaca and also in Guatemala, it may safely be assumed that it is found in Chiapas, although the writer has not felt at liberty to report its occurrence there unless he has actually seen specimens from that State. The range outside Mexico is given for those species which extend into other countries, and when no such range is indicated it is to be assumed that the species is endemic.

TYPE LOCALITIES.

For the majority of the species there has been included a statement concerning the type or the type locality. The nomenclatorial type of a species is the specimen which served as the basis of the original description of the species, and the type locality is the one at which the specimen was collected. A knowledge of type localities is of great importance in taxonomic work, especially when it becomes necessary to divide into two or more species material which has been referred previously to a single one. It is of interest also to collectors who may visit these places and who may take an interest in recollecting such plants at their original stations. It is to be expected, generally, that the form of a species occurring in the region of the type locality is the typical one. In the case of many species described from Mexico, particularly the earlier ones, the source of the specimens on which they were based was given merely as "Mexico," without indication of any precise locality. In such instances the writer has made no reference to the type locality, which is, of course, practically unknown. Neither has it seemed worth while to refer to the type locality in the case of species described from "tropical America," "West Indies," or other similarly vague regions.

VERNACULAR NAMES.

The vernacular names listed have been gathered from various sources. Many have been taken from the labels accompanying herbarium specimens. All those found in literature which has come to the writer's attention have been listed if there was reason to suppose them accurate. The most extensive work dealing with Mexican vernacular plant names is the "Sinonimia vulgar y científica de las plantas Mexicanas," compiled by Dr. José Ramírez, with the assistance of Señor Gabriel V. Alcocer, published in the City of Mexico in 1902. This is a very extensive list and a valuable one, based partly upon the investigations of the authors, and also upon many previously published lists. It is unfortunate that many of the Latin

names are obviously erroneous and others doubtful, but the same statements are likely to be true of most lists of similar nature. The present writer is under particular obligations to Dr. Blas P. Reko, who has kindly permitted the use of a very extensive list of the vernacular names current in Oaxaca, which he has compiled. Valued assistance has been rendered likewise by Dr. Alfonso Herrera, Director de Estudios Biológicos, of the Mexican Government.

The names applied to plants vary greatly in different parts of Mexico, largely because of the diverse languages which preceded Spanish in different parts of the country, and which are still spoken in many regions, notwithstanding that Spanish is the language used by the great majority of the inhabitants. The Spanish names are the most generally used, as a rule. Many of them date back to the time of the Conquest, and are the same as names in common use for Spanish plants of more or less similar aspect, although often of no close relationship. In many instances the Carib names of West Indian plants were brought to Mexico by the early explorers and applied to the same or similar plants growing in the latter region. In the case of plants first discovered in Mexico, and quite unlike anything previously known to them, the Spaniards often adopted the native Mexican names, especially those of Nahuatl origin. It is interesting to observe how generally some of the Nahuatl names—often greatly modified in spelling and pronunciation, it is true—are now used among the Spanish-speaking people of North America, often in regions far remote from those where the Nahuatl language was ever spoken. Many of them are in common use among the Spanish-speaking people of Arizona and New Mexico, and some, like “mesquite,” have become recognized English words.

A large number of Nahuatl plant names are known, and many are listed here. Many more have been reported—particularly by Hernández—whose application is obscure or unknown. The Nahuatl language was the one spoken at the time of the Conquest by the inhabitants of the Valley of Mexico. The people of this prosperous region possessed a great love for flowers as objects of admiration and adornment, and were familiar with the properties and uses of many plants, consequently their botanical vocabulary was a remarkably large one. Less is known of the plant names of other parts of Mexico. Many names are known, however, from the Maya, which is the original and more or less current language of the Yucatán Peninsula and adjacent regions. Some names are available, also, from the Tarascan language of Michoacán; the Otomí, of north-central Mexico; and the Mixtec and Zapotec, of Oaxaca and Chiapas. Besides the vernacular names employed in Mexico, the writer has listed those from Central America, Colombia, and Venezuela, and from those islands of the West Indies in which Spanish is spoken, excluding, so

far as possible, those of local native dialects. The importance of recording native names can not be urged too strongly upon collectors. These names are often used very uniformly over wide areas and are, on the whole, probably better standardized than the English names employed in the United States. This is perhaps not remarkable, in view of the fact that many of the Spanish names have been in use for four centuries, and the native names much longer.

The vernacular names here cited are followed by parentheses in which are listed the states or countries in which they are known or reported to be used. If there is no further comment or indication, it may be assumed that the names are correctly applied. In many cases the vernacular names have been reported by a single authority, and in some cases the propriety of their application is doubtful; in such instances the vernacular name is followed by the name of the authority (in italics) to whom the writer is indebted for it.

ECONOMIC NOTES.

The economic notes also have been gathered from a wide variety of sources. A large amount of information concerning the uses of plants has been published in Mexico, and these data have been used freely. References have been given to the uses made of the plants in other regions, particularly Central America and the West Indies. Some of the information here presented is taken from the published and unpublished notes of Dr. Edward Palmer, who was engaged for many years in the botanical exploration of Mexico and made extensive observations on the local uses of plants. The Mexican flora contains a very large number of species of economic value, some of which, like the cacao and Mexican rubber tree, are of great commercial importance. The number of plants which yield edible fruit is very large. It would seem, also, that almost every species is employed locally for medicinal purposes, but too much importance should not be attached to the data reported regarding such uses, for, although many of the plants do possess therapeutic properties, in the far greater majority of cases the properties attributed are chiefly or wholly fictitious.

The Republic of Mexico, the region which is covered by the present work, is not a natural phytogeographic area, its boundaries being nowhere coincident with those of any limit of vegetation. It would be very difficult to draw a natural boundary along the northern frontier, and equally so on the south. There is no sharp break in the continuity of specific distribution on the south until the Isthmus of Panama is reached, and even here the break is not too pronounced, for a large number of species of woody plants are known to range from the arid regions of Colombia and Venezuela

to the similar arid areas of western Mexico. It would have been desirable to extend the scope of the present work to include Central America, but such an extension would have doubled, probably, the number of species treated. As the work now stands, it will be found useful for determination of a large proportion of the species native to Central America, as well as of those occurring in the United States in the region of the Mexican border.

To facilitate more thorough taxonomic study of the groups here treated, there have been listed, when practicable, references to monographic accounts of each family or genus, in which there will generally be found complete descriptions of the species. In most cases only the most recent monograph has been listed, but in some instances earlier systematic accounts have been mentioned if they seemed to furnish useful information or to be more easily accessible.

HISTORY OF BOTANICAL EXPLORATION IN MEXICO.

Botanical history in Mexico may be considered to have begun with the landing of the Conquistadores, for the earliest letters of Cortés to the King contain references to the curious vegetable products of the country. The true history of botanical activity in Mexico begins at a much earlier date, for the native inhabitants, who had already reached a high degree of civilization, may be said to have begun scientific researches. No other primitive people, probably, ever took so great an interest in botanical matters, and at the time of the Conquest none of the nations of Europe were much superior to the Mexicans in botanical knowledge. In one respect, at least, the latter had made greater progress in botanical activity, for they had established a botanical garden, on an elaborate scale, something that was not attempted in Europe until a still later date. Not only had the Aztec people acquired an intimate knowledge of the economic qualities of the plants with which they came in contact, a knowledge possessed by all primitive peoples, but they had developed an esthetic appreciation of plants for their beauty alone, a fact which indicates a rather high state of moral development. Flowers were cultivated extensively in the Valley of Mexico, and were brought in great quantities to the markets, where they were purchased for personal adornment and for the decoration of residences and temples. This love of flowers has persisted to the present time among the Mexican people, and cut flowers still occupy much space in the markets everywhere in the Republic.

Beginning with Hernández, a large number of botanical explorers from Europe and from the United States have visited Mexico, and many native Mexicans have contributed to our knowledge of the

vegetable productions of the country. It is not the writer's purpose to enumerate the men who have assembled the collections upon which the scientific knowledge of the Mexican flora is based, but references to most of them will be found in footnotes scattered through the systematic account of the flora. The earlier collectors have been discussed by Hemsley,¹ and the most complete information upon the subject has been published by León.² Several of the earliest enterprises for the botanical exploration of Mexico are so remarkable, and must be referred to so frequently in the text, that it seems essential to describe them in some detail. These are discussed below.

FRANCISCO HERNÁNDEZ.

His interest in the North American colonies having been awakened, perhaps by the reports made by the civil and religious authorities of the region, Philip II of Spain gave orders to his physician, Francisco Hernández, to prepare an account of the natural history, antiquities, and political conditions of New Spain.³ In order to give him a rank suitable to the importance of the work he was to undertake, Hernández was honored with the title of Protomédico of the Indies. He sailed from Spain in 1570, accompanied by his son. Although Philip II was very liberal in his appropriations for the expenses of the expedition, he appears to have underestimated the magnitude of the task, and it seems that Hernández was often embarrassed by his lack of financial resources. Hernández, however, compensated for this by his intense application to his work. He visited almost all parts of New Spain, observing all matters of natural history and collecting a vast amount of information. His enthusiasm led him to risk his health and life with experiments made upon his own person to determine the medicinal properties of plants discovered in the course of his travels. While upon a journey to Michoacán, he narrowly escaped death as a result of an experiment with the latex of "chupire." His health was finally undermined by his excessive labors, the worry caused by his financial embarrassment, and the hostility shown by some of those in authority. Five years had been the period assigned for the completion of his task, and at the end of that time, in 1575, he had 16 folio volumes ready for publication. Two years longer, however, he remained in Mexico, continually engaged

¹ Biol. Centr. Amer. Bot. 4: 117-137. 1887.

² Nicolás León, Biblioteca Botánico-Mexicana, catálogo bibliográfico y crítico de autores y escritos referentes a vegetales de México y sus aplicaciones, desde la Conquista hasta el presente. México, 1895. This work contains a remarkably complete and very valuable bibliography of Mexican botany. It is unfortunate that so many of the publications listed are inaccessible in even the largest libraries of the United States.

³ The name formerly applied to Mexico.

with the objects of his commission, and refusing to practice his profession for lack of leisure from his researches, although he states that he thus lost the opportunity of gaining more than 20,000 pesos. Taking advantage of his title of Protomédico, he assembled many of the Mexican physicians and directed them to test the native drugs and to inform him of the results obtained. He himself carried on experiments in the hospitals with drug plants whose properties he wished to determine.

In September, 1577, Hernández returned to Spain. He left in Mexico three or four copies of his manuscripts and sketches. Besides his manuscripts and herbarium, he carried to Spain many seeds and living plants to adorn the royal gardens. His execution of his Mexican commission must have satisfied the Spanish authorities, for he was offered a similar mission to Peru and other parts of the Indies, which he refused because of a desire to attend to the printing of his reports. His expectations in this direction, however, were destined to be sadly disappointed, for instead of being sent to the printer the manuscripts were buried in the library of the Escorial, although, as a Mexican writer remarks, "*with every honor,*" for they "were beautifully bound, in blue leather covered and worked with gold, with clasps, corners, and ornaments of silver, all very heavy and of excellent workmanship and design." Notwithstanding this unfortunate and ironical conclusion of Hernández's expectations, Colmeiro asserts that he had seen "a sample impression of the colored plates which were projected for his natural history, with an estimate of the cost, to judge from which the edition would have been of uncommon beauty, and perhaps the first of its kind for that time."

Wearied by his disappointments, Hernández survived only a short time, and died January 28, 1578. Neither the exact date of his birth nor his birthplace is known, nor the place where his remains rest. He left 16 folio volumes, six of text, describing the animals, plants, and minerals of Mexico, and 10 of drawings representing these objects; also various miscellaneous manuscripts dealing with medicine, Mexican antiquities, and moral and religious philosophy. He had prepared a translation of Pliny's National History, and had written at least two philosophical works in verse. Except for a few fragments, all these works were destroyed by the fire which consumed the Royal Monastery of the Escorial in June 1671. Of the manuscripts left in Mexico nothing is known, and it is probable that all were lost within a few years after their preparation.

Soon after Hernández's death the King moved to remedy the delay in the publication of his works by commissioning another of his physicians, Dr. Nardo Antonio Recchi, a native of Naples, to take

charge of them. The latter apparently extracted from the manuscripts the portion which he believed would be most useful to the medical profession, for it is evident that most of the matter he selected was of this sort. Some doubts have been raised regarding Recchi's competency to perform the task assigned him; nevertheless except for his connection with the matter it is improbable that any portion of Hernández's work would ever have been published. Recchi's manuscript, however, met with no better treatment than the original one, for it too remained unpublished, and was taken later by its compiler to Naples. After Recchi's death it came into the possession of his nephew, from whom it was purchased by Prince Federico Cesi, a devoted student of natural history. By him it was turned over to the Accademia dei Lincei, whose members undertook the arrangement and annotation of the manuscript and finally prepared it for publication. Through the Spanish ambassador at Rome funds for printing were secured, and the work of Hernández, thus modified, was at last given to the public. There is considerable uncertainty regarding the actual date of publication, but the date of completion is believed to have been 1651.¹ An abridged edition appeared as early as 1628, and extracts had been published by various authors at still earlier dates. An edition of the work prepared by Ortega was issued at Madrid in 1780.

Hernández's work is of great historic interest because of the fact that it is the first extensive publication dealing with the botanical features of Mexico. It contains a great mass of information regarding the plants of that country, some of which, relating to practices of the early inhabitants, had been forgotten before other botanists visited the region. A large part of the observations relate to medicinal properties of plants, and these are interesting even if not of much practical importance. It is unfortunate that the identity of many of Hernández's plants must remain a matter of conjecture, because his descriptions are usually drawn in such general terms, and the illustrations accompanying them are often equally vague. The book, however, will always possess an attraction for those interested in herb lore if not for the taxonomist. It must be remembered that the work, as we have it, is not that of Hernández himself, but only a compilation or an extract, and that the original manuscript if it

¹ *Rerum medicarum Novae Hispaniae thesaurus, seu plantarum animalium, mineralium mexicanorum historia ex Francisco Hernández, novi orbis medici primarii, relationibus in ipsa mexicana urbe conscriptis a Nardo Antonio Reccho collecta ac in ordinem digesta: a Joanne Terrentio, Joanne Fabro et Fabio Columna Lynceis notis et additionibus illustrata. Cui accessere aliquot ex Principis Federici Caesii frontispiciis theatri naturalis phytosophicae tabulae una cum quam plurimis iconibus.* Pp. 1-950+1-90. ill. Rome, 1651.

could have been published as prepared would doubtless have been of much greater value.

In recent years Mr. W. E. Safford, of the U. S. Department of Agriculture, has spent much time in identifying the plants treated by Hernández. He has published numerous papers upon the subject, and references to some of these will be found in the body of the present paper.

EXPEDITION OF CHARLES III.

The most elaborate botanical undertaking in the history of Mexico was undoubtedly the famous expedition of Charles III of Spain. That ruler decided to institute a survey of the natural resources of his extensive dominions beyond the sea, and for the execution of the project explorers were chosen from among the most learned scientists of Spain, parties of whom were sent to several of the Spanish possessions. One of these expeditions was dispatched to the Philippines and another, headed by Ruiz and Pavón, to Peru. Since Mexico was one of the two most important of the Spanish possessions, the party sent to that country, New Spain, as it was then known, was chosen with particular care.

It was headed by Dr. Martín Sessé y Lacasta, who was to have charge of a proposed botanical garden. The other members of the commission were D. Juan Diego del Castillo; D. José Longinos; D. Juan Cerda, a draftsman; and Dr. Vicente Cervantes, who was to establish a chair of botany in the City of Mexico. The members were chosen by D. Casimiro Gómez Ortega, the director of the botanical garden of Madrid.

The commission arrived in Mexico in 1788, and on the 1st of May at 5 in the evening there was inaugurated with great solemnity a department of botany in the University. Sessé delivered an inaugural dissertation which was preceded by the installation of the men chosen for the various professorships, conducted by the rector of the University. There were present the royal audience, the doctors, all of the religious societies, the regidores, military officials, and many members of society. The viceroy was unable to be present, but he was represented by D. Francisco Xavier Gamboa.

The University was illuminated at night and after a brilliant concert, according to a contemporaneous newspaper account, "there were lighted magnificent fireworks, ingeniously executed by that pyrotechnic artist, D. Joaquín Gavilán. Three trees, known in this kingdom under the name of papayo, closely imitating nature in the delineation of their leaves, flowers, and fruits, gave a clear picture of the sex of plants, which, being separated in this genus, was represented in the following manner: Two female trees, clothed with their respective flowers, and fruits of different stages of devel-

opment, indicated the method by which the latter take their development from the flowers of the male plant, which, as such, was without fruits and occupied the center, sending out sparks of fire, which, directed to the female plants, represented perfectly the pollen transported through the air to fertilize the female flowers.

“At the foot of the male tree were placed various decorations alluding to the features of a garden, which illuminated the Plaza with brilliant, spectacular, and fascinating lights of different colors and changed gradually into others no less entertaining. As the three trees disappeared there appeared an inscription in letters of fire which said, AMOR URIT PLANTAS, which is what the illustrious Carolus Linnaeus holds in his ingenious dissertation, *Sponsalia Plantarum*.”

At the same hour on the following day the botanical course was opened under the direction of Cervantes in the residence of the chief engineer of the city, D. Ignacio Castera, who also offered his garden as a laboratory. The botanical lectures were attended not only by the young students of the University but by numerous professional men, one of whom was D. José Mariano Mociño. The city government lent assistance to the new undertaking by setting apart for a botanical garden a parcel of land, a portion of which is now occupied by the home of the Instituto Médico Nacional.

Mociño was a young physician, native of Mexico, who so distinguished himself in his botanical studies that only seven months after the establishment of the botanical course he was appointed member of the scientific commission. A fellow student, Maldonado, was given a like appointment, that he might engage in the work of dissections. These two, besides Castillo and Longinos, were directed to explore the more remote parts of New Spain, while Sessé reserved for himself the exploration of the central regions of Mexico, and Cervantes confined his attention to his professorial duties.

Mociño's explorations extended on the south to the coast of Tabasco, which he visited in December, 1794, continuing his course into Guatemala. In company with Castillo he went north to the Tarahumare country, into what is now Chihuahua, and later he traveled in California, and as far as Nootka Sound, and still later in Jalisco, Michoacán, and other regions. Mociño survived the peril and fatigue of his travels, but not so Castillo, who died in the City of Mexico, July 26, 1793.

Besides Cerda, the official artist of the expedition, D. Atanasio Echeverría,¹ a native of Mexico, was employed in making drawings of botanical and other objects. A pharmacist, D. Jaime Senseve, also was appointed to the commission, and likewise D. José Antonio

¹ The genus *Echeveria*, of the family Crassulaceae, was named in his honor.

Alzate y Ramírez, the latter a distinguished scientist, born in Mexico, who published numerous articles dealing with Mexican plants.

Longinos engaged in the formation of collections of various objects and explored many parts of New Spain, his route extending even to the Californias. He visited also Guatemala and Yucatán, and died in the port of Campeche in 1803. Some of his collections were sent to Madrid and part remained in Mexico.

Mociño was the most enthusiastic and diligent of all the members of the commission. He was likewise the most adventurous, and in the ascent of the Volcán de Tuxtla, in 1793, he came near losing his life. He ended his field work in 1801, and in the Hospital de San Andrés he conducted experiments with the medicinal plants he had collected. He was able to communicate to others some of his enthusiasm for natural history, and many people began to take an interest in the subject, one of the results of which was the formation of an extensive museum. His chief interest, however, was the task, in association with Sessé, of arranging and describing his botanical collections, with the view of publishing a work entitled *Plantae Novae Hispaniae*. He had already prepared a *Flora Mexicana*, and specimens from his collections had been sent to Lagasca and Cavanilles, who described some of them as new species. In addition, living plants and seeds were forwarded to the Botanical Garden of Madrid.

Finally, in 1804, Sessé and Mociño made an end of their explorations and set sail for Madrid, with a rich herbarium and a series of 1,400 colored drawings, as well as their precious manuscripts. Cervantes remained in Mexico as director of the botanical garden and professor of botany.

Sessé and Mociño were filled with hope of the immediate publication of the results of their labors, but the bitter disappointment experienced by Hernández was to be the share of these two botanists also. They were given a cool reception and no facilities whatever for printing their reports. Hope of soon meeting with success in his ambitions induced Mociño to accept a meager pension from the Government, and he lived as a member of Sessé's family until the death of the latter in 1809. He manifested a deep interest in all scientific matters; he was appointed director of the cabinet of natural history of Madrid, gave courses in zoology, and with the assistance of another Mexican, D. Pablo de La Llave, arranged the zoological collections of the museum.

Mociño seems to have been on good terms with the French, who invaded Spain about this time, but he became involved in difficulties because of his refusal to recognize one Barrois as president of the Academy of Medicine, of which he was a member. When the French Army withdrew from Madrid, Mociño remained, presuming that he had not compromised himself by acting as a teacher of nat-

ural history during the occupation, but in this he was mistaken, for soon after he was seized, thrown into prison, and placed in chains, and thus he remained until the French Army returned. Thereupon he was released and permitted to return to the museum. Again the French retreated, and Mociño, who was now far advanced in years (the date of his birth is not known), resolved not to risk his fortunes again with the Spanish authorities, and took his departure, bearing with him in a cart his manuscripts and drawings. By night he slept in the cart, and by day he walked beside it, until it was taken from him by a French officer. He managed, however, to save his possessions and to escape from Spain, and as it was evidently unsafe for him to return to Madrid he took refuge at Montpellier. He was nearly blind and was reduced to beggary, from which he was rescued by certain French scientists.

In Montpellier he became acquainted with De Candolle and Dunal, who joined with him in assigning names to the new species of plants he had discovered. To De Candolle he turned over his manuscripts and drawings, and that famous Swiss botanist seems to have been the first of those who had seen them to have formed an adequate idea of their value. Mociño often visited De Candolle's lecture room, and one day the latter had occasion to deliver a eulogy of the Mexican botanist, unaware that the subject of his praise was present. When the latter's presence was pointed out to him, De Candolle embraced Mociño effusively and pressed him to take the chair and elucidate the subject that had suggested his name. Overcome by the occasion, Mociño burst into tears and was unable to speak a word.

After passing a few years at Montpellier, the adoption of the constitution in Spain gave Mociño hope that he might be permitted to return to Madrid. He besought such permission of the government, and it was finally granted. In April, 1817, consequently, he asked of De Candolle, who was now in Geneva, the return of his papers. The request was evidently made in urgent terms, but De Candolle was determined to keep copies of the drawings and descriptions, and hastened to have these made. De Candolle says that "About 120 persons came voluntarily to offer me their time and brushes; most of them were ladies of society; but there were also professional artists and a multitude of persons who were strangers to me. The young people united in the common task. The whole city was busy for 10 days, and the diligence of all those who knew how to use a brush or pencil was really affecting. * * * As a result of this diligence the collection of Mociño was almost wholly copied in the time fixed." "De Candolle never recounted this affectionate demonstration of his fellow citizens," says Dunal, "but his eyes filled with tender tears." The number of drawings thus copied

was 1,100, and from them 274 new species were published in the *Prodromus*. Tracings of the sketches were distributed to many of the herbaria of Europe.

Mociño returned to Spain, where he received a warm welcome from the Minister of Marine, D. Juan Sabat, who gave him lodging in his home and assisted him in other ways. Mociño later started upon a voyage, but had proceeded only as far as Barcelona when he was overcome by illness, and he died in that city in 1819. Thus he failed to realize any of his hopes for the publication of the results of his long years of exploration and study, nor were the fruits of his labors destined to reach the public until still many more years had passed.

His drawings passed into the possession of the physician who attended him in his final illness, and it is not known what finally became of them. His manuscripts and other papers, including a "Flora de Guatemala," are in the Botanical Garden of Madrid, where the herbarium of the expedition is said to have been deposited in 1820. Some of the specimens reached the Lambert Herbarium, and it is believed that Mexican specimens at Kew and at the British Museum, labeled as having been collected by Pavón, are from the Sessé and Mociño collections. Presumably they were distributed by Pavón, and his name was affixed to the labels through some error. Pavón is not known to have visited Mexico.

The Sociedad Mexicana de Historia Natural learned that the manuscript of the *Flora Mexicana* existed at Madrid, and as early as 1870 made an attempt to secure a copy of it, but it was 15 years before the attempt was successful. It was desired also to secure the illustrations for publication, but this was found impracticable. The *Flora Mexicana* was finally published in the City of Mexico in 1888 by the Sociedad Mexicana de Historia Natural, and a second edition, with numerous corrections, was printed by the Instituto Médico Nacional in 1894. The *Plantae Novae Hispaniae* was printed by the former society in 1886, and was reprinted by the Secretaría de Fomento for the Chicago Exposition of 1893.

It was thus more than a hundred years after the organization of the expedition that the results of its investigations were finally made public. Perhaps no other botanical project has ever had so interesting a history, and none, it may safely be said, has ever been attended with so many dramatic incidents. If they had been published when first written, the two floras would have become historic. They were better prepared than most of the botanical works of their day, although their authors had a very broad conception of specific limits and referred many of the Mexican plants to species of the Old World tropics with which they were not even congeneric. When the works were actually printed they had long been obsolete, and most

of the plants dealt with had been described years before by other authors, sometimes under the same names but usually not. Aside from the sentimental interest that was gratified by the publication of the manuscripts, it is a matter of regret that botanical nomenclature was further taxed with so many useless synonyms. Indeed, but little attention has ever been paid by botanists to the numerous new names recorded in these two works.

ALEXANDER VON HUMBOLDT.

Alexander, Baron von Humboldt, one of the most illustrious men of his period, was born in Berlin in 1769. He was granted permission by the court of Spain to explore the Spanish possessions in America, and in 1799, in company with Aimée Bonpland, he sailed from Coruna. He landed at Cumaná, Venezuela, and starting from that point he explored New Andalusia (Venezuela) and Spanish Guiana. Thence he went to Cuba, and later to other parts of South America. In March, 1803, he landed at Acapulco, and followed the usual route of that day to the capital, where he made the acquaintance of Cervantes, Cal, Alzate, and many other scientists. He explored thoroughly the Valley of Mexico, and made collections also in Hidalgo, Querétaro, Guanajuato, Puebla, Jalisco, Michoacán, Guerrero, and other regions. Altogether, ten months were spent in Mexico, and in 1804 Humboldt and Bonpland returned to Paris, where the former remained for many years. He died in Berlin in 1850.

The rich material obtained by the expedition was sufficient to occupy the many years which Humboldt devoted to scientific study. The botanical collections were gathered chiefly by Bonpland, but the senior member of the expedition made extensive observations upon vegetation which served as the basis for classic works upon phytogeography. The Mexican collections included about 950 species, a large proportion of which were described as new. Along with the material from other regions they were turned over to Kunth, who published seven volumes describing them.¹ Humboldt and Bonpland also published jointly two large volumes dealing with some of the most interesting of their discoveries.² So far as modern botanical

¹ *Nova genera et species plantarum quas in peregrinatione ad plagam aequinoctialem orbis novi collegerunt, descripserunt, partim adumbraverunt Amat. Bonpland et Alex. de Humboldt. Ex schedis autographis Amati Bonpland in ordinem digessit Carolus Siegesmund Kunth. Accedunt Alexandri de Humboldt notationes ad geographiam plantarum spectantes. Vols. 1-7. pl. 1-700. Paris, 1815-1825.*

² *Plantae aequinoctiales, per regnum Mexici in provinciis Caracarum et Novae Andalusiae, in Peruvianorum, Quitensium, Novae Granatae Andibus, ad Orenoci, Fluvii nigri, fluminis Amazonum ripas nascentes. In ordinem digessit Amatus Bonpland. Vols. 1, 2. pl. 1-143. Paris, 1808-1809.*

work is concerned, the *Nova Genera et Species* is the first important work treating of Mexican plants. The collections obtained in South America were much more extensive than those from Mexico, and for Venezuela, Colombia, Ecuador, and Peru the work is of even greater importance than for Mexico. Humboldt and Bonpland were the first to make known to science many of the most common and characteristic Mexican plants.

Besides these and other systematic works, Humboldt published accounts of his voyages, which are replete with original observations upon matters of natural history. He was the father of the science of plant geography, and published several classic works upon the subject, the best known of which is his *Essai sur la Géographie des Plantes*.¹

Bonpland was born in 1773 in the French city of Rochelle. Some time after his return to Europe, in 1816, he decided to establish himself in America, and went to Buenos Aires, where he gave courses in natural history. He traveled in the more remote parts of Argentina, Paraguay, and Bolivia, and finally settled in Paraguay where he established a factory for the preparation of maté. This act seems to have aroused the jealousy of the dictator Francia, and in 1821 a band of his agents attacked the finca, killed some of the employees, and wounded Bonpland himself. The latter was put in chains and kept nine years in captivity, but later was released and devoted his attention to agricultural pursuits. He died in 1858.

SYSTEMATIC TREATMENT.

KEY TO THE FAMILIES.

Subkingdom Pteridophyta.

Plants without flowers or seeds, but producing spores. Ferns.

Rhizomes creeping, very slender, producing mostly ascending or reclining vinelike leaves of indeterminate growth; sporangia relatively few, subglobose to pyriform, dehiscing vertically; sori flattened.

GLEICHENIACEAE.

Rhizomes erect or ascending, mostly arborescent, bearing a terminal crown of large leaves; sporangia numerous, ovoid, dehiscing horizontally; sori essentially globose.....CYATHEACEAE.

¹Friederich Alexander von Humboldt et Aimé Bonpland. *Essai sur la géographie des plantes; accompagné d'un tableau physique des régions équinoxiales, fondé sur des mesures exécutées depuis le dixième degré de latitude boréale jusqu'au dixième degré de latitude australe pendant les années 1799-1803.* Pp. 1-155. Paris, 1805.

Also, Friederich Alexander von Humboldt. *De distributione geographica plantarum secundum coeli temperiem et altitudinem montium, prolegomena.* Pp. 1-249. *pl.* Paris, 1817.

Subkingdom Spermatophyta.

Plants with flowers which produce seeds. Flowering plants.

KEY TO THE CLASSES.

Ovules and seeds borne on the face of a bract or scale; stigmas wanting.

1. GYMNOSPERMAE.

Ovules and seeds borne in a closed cavity; stigmas present.

2. ANGIOSPERMAE.

CLASS 1. GYMNOSPERMAE.

Leaves pinnate, broad; cotyledons united.....CYCADACEAE.

Leaves entire or denticulate, narrow, usually needle-like or scalelike; cotyledons distinct.

Stems jointed. Leaves reduced to whorled scales.....GNETACEAE.

Stems not jointed.

Ovulate flowers solitary; fruit baccate, small. Leaves short, linear.
TAXACEAE.

Ovulate flowers few or numerous; fruit a dry or fleshy cone, often large.
PINACEAE.

CLASS 2. ANGIOSPERMAE.

KEY TO THE SUBCLASSES.

Cotyledon 1; stems endogenous; leaves parallel-veined.

1. MONOCOTYLEDONEAE.

Cotyledons normally 2; stems exogenous; leaves not parallel-veined.

2. DICOTYLEDONEAE

Subclass 1. Monocotyledones.

Ovary inferior. Leaves mostly basal, often spine-toothed.

AMARYLLIDACEAE.

Ovary superior.

Perianth rudimentary, of scales, green or greenish, never corolla-like.

Grasses.....POACEAE.

Perianth of 2 distinct series, the inner series usually corolla-like.

Ovules solitary in each cell of the ovary. Palms; leaves usually compound or deeply lobed.....PHOENICACEAE.

Ovules 2 to many in each cell.

Inflorescence a fleshy spadix surrounded by a spathe; leaves succulent.

Plants usually epiphytic and scandent.....ARACEAE.

Inflorescence not a spadix.

Styles present; stems not scandent, unarmed; leaves linear or dagger-shaped.....LILIACEAE.

Styles none; stems scandent, armed with spines; leaves broad.

SMILACACEAE.

Subclass 2. Dicotyledones.

KEY TO THE SERIES.

Perianth segments wanting or all similar (especially in texture and color), rarely somewhat unequal, 5 or fewer.....1. APETALAE.

Perianth segments in 2 series, calyx and corolla, rarely similar but then more than 5.

Petals distinct, rarely coherent above but distinct below.

2. POLYPETALAE.

Petals united below (at least at the base) or throughout.

3. GAMOPETALAE.

Series 1. APETALAE.

Ovary superior, almost superior, or naked.

Perfect and pistillate flowers without a perianth.

Ovary with 2 or more cells.

Ovary 2-celled, with 1 ovule in each cell; styles 2. Leaves alternate, simple; flowers in catkins.....BETULACEAE.

Ovary 3 or 4-celled.

Ovary 3-celled; styles 3, or 1 but with 3 or 6 stigmas; fruit a 3-celled capsule.....EUPHORBIACEAE.

Ovary 4-celled; styles 2 or 4, or a 2-lobed sessile stigma; fruit 4-celled, indehiscent. Leaves fleshy, terete.....BATIDACEAE.

Ovary 1-celled.

Leaves reduced to whorled scales. Fruit conelike...CASUARINACEAE.

Leaves not reduced to whorled scales.

Ovule 1 in each cell.

Leaves opposite, stipulate; stamen 1; ovule pendulous.

CHLORANTHACEAE.

Leaves alternate, or opposite and estipulate; stamens 2 to 16; ovule erect.

Fruit a drupe, covered with pale wax; seeds without endosperm; leaves estipulate, dentate.....MYRICACEAE.

Fruit a small berry; seeds with endosperm; leaves stipulate, entire. Flowers in long slender dense spikes...PIPERACEAE.

Ovules more than 1 in each cell. Seeds with a tuft of hairs; leaves stipulate.....SALICACEAE.

Perfect and pistillate flows with a perianth.

A. Ovary 1, 1-celled.

B. Ovule 1.

Leaves stipulate.

Leaves deeply lobed, alternate.....ROSACEAE.

Leaves simple.

Styles 3, distinct or connate at the base. Stipules often sheath-like.....POLYGONACEAE.

Style 1 and undivided, or bipartite, or of 1 or 2 sessile stigmas.

Flowers perfect, racemose. Leaves alternate.

PHYTOLACCACEAE.

Flowers unisexual.

Stamens more numerous than the perianth segments; staminate flowers with a perianth.....EUPHORBIACEAE.

Stamens as many as the perianth segments or fewer; staminate flowers sometimes without a perianth. Leaves alternate.

Flowers solitary or clustered; juice not milky...ULMACEAE.

Flowers spicate, racemose, or capitate; juice milky.

MORACEAE.

Leaves estipulate.

Perianth imbricate in bud. Leaves entire or dentate, simple.

Perianth segments 6, rarely fewer, the stamens then more numerous than the segments but not twice as many.

Anthers dehiscent by recurved valves; style 1; seeds without endosperm. Leaves alternate, aromatic. **LAURACEAE.**

Anthers dehiscent by longitudinal slits; styles 2 or 3; seeds with endosperm. Leaves usually alternate. **POLYGONACEAE.**

Perianth segments 2 to 5; stamens as many as the segments or fewer. Leaves alternate or opposite.

Flowers with thin chaffy bracts; filaments united, at least at the base. **AMARANTHACEAE.**

Flowers with herbaceous bracts; filaments distinct. Leaves often succulent. **CHENOPODIACEAE.**

Perianth valvate or open in bud. Style 1 or none; stigma 1.

Stamens inserted on the perianth. Leaves deeply lobed, alternate. **PROTEACEAE.**

Stamens free from the perianth.

Filaments wholly connate; anthers dehiscent extrorsely. Leaves alternate, entire. **MYRISTICACEAE.**

Filaments free or connate only at the base; anthers dehiscent introrsely or laterally.

Stamens 3 or 4, equal in number to the perianth segments and opposite them. Leaves alternate; plants often with stinging hairs. **URTICACEAE.**

Stamens more numerous or fewer than the perianth segments, rarely of the same number, but the plants then with opposite leaves, and the stamens 5 or alternate with the perianth lobes. Leaves alternate or opposite, entire.

. **ALLIONIACEAE.**

BB. Ovules 2 or more in each cell.

Ovules 2 in each cell.

Flowers dioecious; styles 3, or the stigma sessile.

. **EUPHORBIACEAE.**

Flowers perfect or polygamous; style 1.

Stamens 3 or 4; style terminal; leaves estipulate, alternate.

. **PROTEACEAE.**

Stamens 8 or more, rarely fewer, but the style then basal; leaves usually stipulate, alternate.

Style basal, or if terminal the stamens numerous; leaves simple.

. **ROSACEAE.**

Style terminal; stamens 8 or 10; leaves pinnate.

. **MIMOSACEAE.**

Ovules 3 or more in each cell. Leaves alternate.

Ovules attached to the ventral suture of the ovary.

Stamens 4, without filaments; leaves simple, estipulate.

. **PROTEACEAE.**

Stamens 5 or more, with filaments; leaves compound, stipulate.

. **MIMOSACEAE.**

Ovules attached to several parietal placentae or to a basal or central placenta.

Stamen 1. Leaves entire, estipulate; flowers spicate.

. **LACISTEMACEAE.**

Stamens numerous.

Ovary borne on a long gynophore; seeds without endosperm.

CAPPARIDACEAE.

Ovary sessile or nearly so; seeds with endosperm.

FLACOURTIACEAE.

AA. Ovary 1, several-celled, or the carpels several and distinct.

Ovaries several, distinct.

Stamens with connate filaments, hypogynous. Leaves alternate, stipulate.....STERCULIACEAE.

Stamens with distinct filaments, or the filaments wanting, the stamens in the latter case perigynous.

Perianth segments distinct; leaves opposite, compound; plants scandent.....RANUNCULACEAE.

Perianth segments of the perfect and pistillate flowers more or less united, those of the staminate flowers sometimes distinct but the plants then with alternate leaves; plants erect.

Ovules 2; leaves stipulate, pinnate.....SIMAROUBACEAE.

Ovule 1; leaves estipulate, simple.....MONIMIACEAE.

Ovary 1.

Ovule 1 in each cell.

Flowers perfect.....RHAMNACEAE.

Flowers polygamous or dioecious.

Leaves compound, estipulate; stamens 8.....SAPINDACEAE.

Leaves simple, stipulate; stamens 4 or 5, or 10 to 20.

Stamens 4 or 5.....RHAMNACEAE.

Stamens 10 to 20.....BUXACEAE.

Ovules 2 or more in each cell.

Ovules 2 in each cell.

Leaves stipulate.

Style 1, undivided; ovary 5-lobate. Leaves alternate.

STERCULIACEAE.

Styles several; ovary usually 3-lobate.....EUPHORBIACEAE.

Leaves estipulate.

Flowers perfect; seeds without endosperm.....ACERACEAE.

Flowers unisexual; seeds with endosperm.....BUXACEAE.

Ovules 3 or more in each cell.

Stamens 15 or fewer.....TILIACEAE.

Stamens very numerous.....ELAEOCARPACEAE.

Ovary inferior, almost inferior, or half inferior.

Ovary 1-celled, or sometimes incompletely several-celled.

Ovule 1.

Stamens as many as the perianth segments and alternate with them; perianth corolla-like. Flowers in involucrate heads.

ASTERACEAE.

Stamens as many as the perianth segments and opposite them, or fewer or more numerous; perianth calyx-like or wanting.

Leaves stipulate.

Leaves opposite.....CHLORANTHACEAE.

Leaves alternate.....MORACEAE.

Leaves estipulate.

Leaves pinnate. Plants trees or shrubs; flowers in catkins.

JUGLANDACEAE.

Leaves simple, sometimes reduced to scales.

Plants trees; fruit winged.....HERNANDIACEAE.

Plants small shrubs, often parasitic; fruit not winged.

Leaves opposite or verticillate, sometimes reduced to scales;
plants parasitic-----LORANTHACEAE.

Leaves mostly alternate; plants not parasitic.

CHENOPODIACEAE.

Ovules 2 or more.

Ovules 2 to 4. Leaves alternate, simple-----COMBRETACEAE.

Ovules 6 or more.

Plants erect trees; fruit an acorn; flowers in catkins----FAGACEAE.

Plants scandent shrubs; fruit not an acorn; flowers not in catkins.

ARISTOLOCHIACEAE.

Ovary completely several-celled.

Ovule 1 in each cell; leaves simple, stipulate.

Ovary cells and styles or stigmas 3 or 4. Leaves opposite or alternate,
entire or dentate -----RHAMNACEAE.

Ovary cells and styles or stigmas 2. Leaves entire, opposite.

RUBIACEAE.

Ovules 2 or more in each cell; leaves simple, estipulate.

Plants scandent; perianth 3-lobed or 1 or 2-lipped; leaves alternate.

ARISTOLOCHIACEAE.

Plants erect; perianth 4 to 8-lobed or parted; leaves opposite or alternate.

MYRTACEAE.

Series 2. POLYPETALAE.

A. Ovary wholly or half inferior.

B. Perfect stamens 10 or fewer.

Ovule 1 in each cell of the ovary.

Stamens as many as the petals and opposite them.

Ovary 1-celled; plants parasitic. Leaves opposite or verticillate, entire.

LORANTHACEAE.

Ovary 2 to 4-celled; plants not parasitic. Leaves opposite or alternate,
entire or dentate-----RHAMNACEAE.

Stamens as many as the petals and alternate with them, or fewer or
more numerous.

Style 1, simple or cleft only at the apex, or the stigma 1 and sessile.

Fruit an achene. Flowers in dense globose heads; leaves alternate,
usually lobate-----PLATANACEAE.

Fruit not an achene. Leaves alternate or opposite.

Petals contorted in bud. Leaves simple, entire or dentate.

ONAGRACEAE.

Petals valvate in bud.

Leaves entire; flowers not in umbels-----CORNACEAE.

Leaves lobed or compound; flowers in umbels--ARALIACEAE.

Styles 2 or more, free or connected only at the base, or the stigmas 2
or more and sessile. Leaves alternate.

Ovary half inferior; fruit capsular; flowers in globose heads.

Leaves palmately lobed-----HAMAMELIDACEAE.

Ovary wholly inferior; fruit baccate; flowers in umbels.

ARALIACEAE.

Ovules 2 or more in each cell of the ovary.

Styles 2 or more, united only at the base.

Leaves alternate-----FLACOURTIACEAE.

Leaves opposite-----HYDRANGEACEAE.

Style 1, simple or cleft only at the apex, or stigma 1 and sessile.

Petals valvate in bud.

Stamens 8 to 10, twice as many as the petals; calyx lobes valvate in bud; leaves alternate or opposite.....**COMBRETACEAE.**

Stamens 2 to 6, as many as the petals or fewer; calyx lobes open or imbricate in bud; leaves alternate.....**OLACACEAE.**

Petals imbricate or contorted in bud.

Ovary 1-celled, the ovules suspended from the apex of the cell.

COMBRETACEAE.

Ovary 1-celled, with basal, central, or parietal ovules, or several-celled.

Ovary 4 or 5-celled.

Perfect stamens 10; leaves opposite.....**MYRTACEAE.**

Perfect stamens 5; leaves alternate...**PTEROSTEMONACEAE.**

Ovary 1-celled, or incompletely several-celled.

Anthers dehiscent by terminal pores; leaves usually with longitudinal ribs, opposite.....**MELASTOMATAACEAE.**

Anthers dehiscent by longitudinal slits; leaves without longitudinal ribs.

Seeds with endosperm; petals imbricate or open in bud; fruit baccate; leaves alternate...**GROSSULARIACEAE.**

Seeds without endosperm; petals contorted; fruit capsular; leaves alternate or opposite.....**ONAGRACEAE.**

BB. Perfect stamens more than 10.

Style 1, simple or cleft only at the apex, or stigma 1 and sessile.

Leaves stipulate. Leaves opposite, entire.....**RHIZOPHORACEAE.**

Leaves estipulate.

Plants very succulent and spiny, the leaves usually absent.

CACTACEAE.

Plants neither succulent nor spiny; leaves well developed.

Stamens usually twice as many as the petals; leaves usually with longitudinal ribs.....**MELASTOMATAACEAE.**

Stamens more than twice as many as the petals; leaves without longitudinal ribs.

Sepals 2 to 4, or more and imbricate; leaves usually punctate.

MYRTACEAE.

Sepals 5 to 8, valvate; leaves not punctate.....**PUNICACEAE.**

Styles 2 or more, free or united only at the base, or the stigmas 2 or more and sessile.

Leaves estipulate, opposite.

Flowers borne upon the leaves; petals valvate in bud.

ESCALLONIACEAE.

Flowers not borne upon the leaves; petals valvate or imbricate.

HYDRANGEACEAE.

Leaves stipulate, alternate. Petals imbricate in bud.

Ovary 1-celled; petals usually 6 to 8.....**FLACOURTIACEAE.**

Ovary several-celled; petals 5.....**MALACEAE.**

AA. Ovary superior or nearly so.

C. Ovary 1, 1-celled or incompletely several-celled.

Sepals 2, distinct or rarely connate and forming a cap. Leaves estipulate.

Leaves entire; plants with colorless juice.....**PORTULACACEAE.**

Leaves dentate or lobate; plants with colored juice...**PAPAVERACEAE.**

Sepals 3 or more.

D. Perfect stamens 1 to 10.

E. Style 1, simple, with 1 stigma or with several connected stigmas, or stigma 1 and sessile.

F. Ovules 1 or 2 in each cell.

Leaves stipulate, alternate.

Style basal.....ROSACEAE.

Style terminal or nearly so.

Flowers papilionaceous (like that of the bean or pea), the upper petal outside.....FABACEAE.

Flower not papilionaceous, the upper petal innermost.

CAESALPINIACEAE.

Leaves estipulate.

Leaves simple.

Flowers regular.

Sepals and petals 3; anthers dehiscent by valves. Leaves alternate, aromatic.....LAURACEAE.

Sepals and petals 4 to 6; anthers dehiscent by longitudinal slits.

Petals valvate in bud; endosperm copious.....OLACACEAE.

Petals imbricate in bud; endosperm scant or none.

Ovule 1; leaves usually compound.

ANACARDIACEAE.

Ovules 2; leaves simple.....ICACINACEAE.

Flowers distinctly irregular.

Fruit covered with barbed spines. Leaves entire.

KRAMERIACEAE.

Fruit without barbed spines.

Stamens 4 to 8, hypogynous; anthers dehiscent by pores.

Leaves entire; flowers racemose.....POLYGALACEAE.

Stamens 9 or 10, usually perigynous; anthers dehiscent by longitudinal slits.....FABACEAE.

Leaves compound.

Ovule 1.....ANACARDIACEAE.

Ovules 2.

Ovules ascending; stamens 10, perigynous, 5 of them often sterile.....CONNARACEAE.

Ovules descending; stamens 3 to 8, hypogynous, all perfect.

Stamens 3 to 5; seeds with endosperm; leaves with transparent glands.....RUTACEAE.

Stamens 8; seeds without endosperm; leaves without transparent glands.....BURSERACEAE.

FF. Ovules more than 2 in each cell.

Ovules attached to a basal or free central placenta. Leaves alternate.

Stamens alternate with the petals. Leaves simple.

OLACACEAE.

Stamens opposite the petals.

Petals valvate in bud; plants climbing, with tendrils.

VITACEAE.

Petals imbricate; plants erect.

Sepals and petals 4 or 5; leaves simple; fruit 1-seeded.

MYRSINACEAE.

Sepals 9; petals 6; leaves compound; fruit 3-seeded.

BERBERIDACEAE.

Ovules attached to a sutural placenta or to 2 or more parietal placentae.

Ovules attached to the ventral suture of the ovary. Leaves usually compound, alternate; fruit a legume.

Corolla regular or nearly so.....**CAESALPINIACEAE.**

Corolla very irregular, papilionaceous.....**FABACEAE.**

Ovules attached to 2 or more parietal placentae.

Calyx segments united. Leaves entire, small.

FRANKENIACEAE.

Calyx segments distinct.

Petals 4. Ovary stipitate.....**CAPPARIDACEAE.**

Petals 5.

Leaves pinnate.....**MORINGACEAE.**

Leaves simple.....**VIOLACEAE.**

EE. Styles 2 or more, free or partially united, with separate stigmas, or stigmas 2 or more and sessile.

Ovule 1.

Sepals and petals each 3. Leaves entire, stipulate, the stipules sheathing.....**POLYGONACEAE.**

Sepals and petals each 4 to 6.

Stamens opposite the petals and of the same number; style 5-parted. Leaves simple.....**PLUMBAGINACEAE.**

Stamens alternate with the petals, or more numerous; styles usually 3. Leaves usually compound.....**ANACARDIACEAE.**

Ovules 2 or more. Leaves alternate.

Plants with tendrils; ovary stipitate.....**PASSIFLORACEAE.**

Plants without tendrils; ovary sessile.

Leaves not scalelike.....**TURNERACEAE.**

Leaves scalelike.....**TAMARICACEAE.**

DD. Perfect stamens more than 10

Ovule 1.

Leaves opposite.....**CLUSIACEAE.**

Leaves alternate.....**AMYGDALACEAE.**

Ovules 2 or more.

Ovules basal, apical, central, or sutural.

Petals and stamens hypogynous; sepals imbricate in bud. Leaves simple, alternate.....**DILLENACEAE.**

Petals and stamens perigynous, rarely almost hypogynous but the sepals then valvate.

Leaves estipulate, entire.....**LYTHRACEAE.**

Leaves usually stipulate, dentate to pinnate.

Ovules 2; leaves simple.....**ROSACEAE.**

Ovules usually more than 2; leaves pinnate.

CAESALPINIACEAE.

Ovules on several parietal placentae.

Filaments wholly connate. Leaves alternate, estipulate, transparent-dotted; fruit berry-like.....**CANELLACEAE.**

Filaments free or connate only at the base.

Leaves, at least the lowest, opposite, simple. Fruit a capsule; low shrubs.

Plants not gland-dotted.....**CISTACEAE.**

Plants gland-dotted.....**HYPERICACEAE.**

Leaves alternate.

Style usually wanting; endosperm scant or none. Petals 4;
ovary stipitate.....**CAPPARIDACEAE.**

Style evident; endosperm copious. Leaves simple.

Petals similar to the sepals, perigynous; stamens perigynous.
FLACOURTIACEAE.

Petals unlike the sepals, hypogynous; stamens hypogynous.

Ovary 1-celled; fruit spiny; seeds glabrous, arillate;
flowers pinkish white.....**BIXACEAE.**

Ovary incompletely 3 to 5-celled, smooth; seeds woolly;
flowers yellow.....**COCHLOSPERMACEAE.**

CC. Ovary 1, completely or almost completely several-celled, or the ovaries several and distinct.

D. Ovaries several, distinct or connate only at the base, with wholly distinct styles and stigmas.

Petals and stamens perigynous.

Leaves stipulate, alternate.

Seeds not arillate.....**ROSACEAE.**

Seeds arillate. Leaves entire.....**CROSSOSOMATACEAE.**

Leaves estipulate.

Leaves compound, not fleshy; ovules 2.....**CONNARACEAE.**

Leaves simple, fleshy; ovules numerous.....**CRASSULACEAE.**

Petals and stamens hypogynous. Leaves estipulate.

Stamens twice as many as the sepals or fewer.

Ovule 1 in each carpel. Leaves simple.

Leaves opposite or verticillate; flowers perfect or polygamous;
petals 5; carpels 5 to 10; plants not scandent.

CORIARIACEAE.

Leaves alternate; flowers dioecious; petals 6 or rarely 3; plants
scandent.....**MENISPERMACEAE.**

Ovules 2 or more in each carpel.

Petals 6, twice as many as the sepals. Leaves entire.

ANNONACEAE.

Petals as many as the sepals, 3 or more, usually 5.

Plants leafless or nearly so.....**KOEBERLINIACEAE.**

Plants with well-developed leaves. Leaves compound.

Stamens and staminodia together 3 to 8; ovules descending;
leaves with translucent glands.....**RUTACEAE.**

Stamens and staminodia together 10; ovules ascending; leaves
without glands.....**CONNARACEAE.**

Stamens more than twice as many as the petals.

Perianth usually composed of 4 or more sepals and an equal or lesser
number of petals. Seeds arillate; leaves entire, alternate.

DILLENACEAE.

Perianth composed of 3 sepals and 6 or more (rarely 3) petals.
Leaves entire.

Sepals valvate in bud; leaves estipulate.....**ANNONACEAE.**

Sepals imbricate in bud; leaves usually stipulate.

MAGNOLIACEAE.

DD. Ovaries several, with connate styles or stigmas, or ovary 1.

E. Ovule 1 in each cell.

Stamens distinctly perigynous.

Stamens 10 or more. Leaves alternate, stipulate.....**ROSACEAE.**

- Stamens 4 or 5. Leaves simple, entire or dentate.
 Calyx valvate in bud; stamens opposite the petals and often adnate to them.....**RHAMNACEAE.**
- Calyx imbricate; stamens alternate or opposite, but very rarely adnate to the petals.....**CELASTRACEAE.**
- Stamens hypogynous.
 Flowers unisexual.
 Ovary 4 to 6-parted; leaves usually pinnate, alternate, estipulate.
SIMAROUBACEAE.
- Ovary entire or slightly lobed; leaves simple or digitate.
 Ovules pendulous or descending; ovary usually 3-celled.
 Cells of the ovary 3; fruit usually a capsule.
EUPHORBIACEAE.
- Cells of the ovary 4 or more; fruit a drupe.
AQUIFOLIACEAE.
- Ovules ascending; ovary usually 4 or 5-celled. Fruit drupaceous.
CLUSIACEAE.
- Flowers perfect or polygamous.
 Flowers polygamous.
 Leaves opposite or verticillate, entire. Stamens numerous.
CLUSIACEAE.
- Leaves alternate, usually compound.
 Stamens inserted within a disk; ovules ascending or horizontal; radicle inferior.....**SAPINDACEAE.**
- Stamens inserted outside a disk; ovules pendulous or horizontal; radicle superior. Leaves pinnate.
 Ovary entire or slightly lobed; styles several and distinct, or stigma 1 and sessile.....**ANACARDIACEAE.**
- Ovary deeply divided; styles connate...**SIMAROUBACEAE.**
- Flowers perfect.
 Stamens more than 10. Leaves stipulate, simple.
 Sepals valvate or open in bud, more or less united; anthers 1-celled.....**MALVACEAE.**
- Sepals imbricate, free or nearly so; anthers 2-celled. Flowers yellow.....**OCHNACEAE.**
- Stamens 10 or fewer.
 Leaves simple and entire, toothed, or lobed.
 Stamens 8; ovary 2-celled. Leaves entire; flowers racemose.
POLYGALACEAE.
- Stamens 2 to 6, or 10; ovary 3 to 6-celled.
 Ovary 5 or 6-celled. Leaves alternate, stipulate; petals imbricate, yellow.....**OCHNACEAE.**
- Ovary 2 to 4-celled. Leaves entire; plants often scandent.
MALPIGHIACEAE.
- Leaves compound.
 Filaments united. Leaves pinnate; ovary entire.
MELIACEAE.
- Filaments free.
 Leaves gland-dotted; filaments without scales; ovary entire.....**RUTACEAE.**
- Leaves not gland-dotted; filaments usually with a basal scale; ovary usually divided...**SIMAROUBACEAE.**

EE. Ovules 2 or more in each cell.

F. Stamens hypogynous; disk none, but separate glands or a gynophore sometimes present.

Leaves opposite or verticillate, entire.

Flowers unisexual, regular-----**CLUSIACEAE.**

Flowers perfect, irregular-----**VOCHYSIACEAE.**

Leaves alternate.

Leaves stipulate.

Calyx segments imbricate in bud.

Stamens more than 10. Petals 4; ovary borne on a long gynophore; stigma sessile-----**CAPPARIDACEAE.**

Stamens 10. Leaves entire-----**ERYTHROXYLACEAE.**

Calyx segments valvate or open in bud.

Petals valvate in bud. Stamens 4 or 5, free; ovary sessile, 2 or rarely 3 or 4-celled; vines with tendrils---**VITACEAE.**

Petals imbricate or convolute.

Ovary stipitate; petals (4) imbricate--**CAPPARIDACEAE.**

Ovary sessile or nearly so; petals usually convolute in bud.

Anthers 1-celled, dehiscent by a pore or a longitudinal slit.

Filaments adnate; petals 5; seeds sometimes covered with long hairs.

Leaves simple; flowers usually calyculate; filaments united to the apex or nearly so----**MALVACEAE.**

Leaves digitate or simple; flowers not calyculate; filaments united only at the base or in the lower half.

BOMBACACEAE.

Anthers 2-celled, dehiscent by 2 pores or longitudinal slits.

Filaments more or less united; staminodia present.

STERCULIACEAE.

Filaments free, or slightly united at the base, but staminodia then absent -----**TILIACEAE.**

Leaves estipulate.

Stamens more than twice as many as the petals.

Ovary long-stipitate; ovules numerous---**CAPPARIDACEAE.**

Ovary sessile; ovules 3 or few.

Style distinct; petals free or nearly so-----**THEACEAE.**

Style none; petals united at the apex.

MARCGRAVIACEAE.

Stamens as many or twice as many as the petals.

Leaves compound.

Filaments free; leaves gland-dotted-----**RUTACEAE.**

Filaments united; leaves not gland-dotted.

Leaflets 3, entire-----**OXALIDACEAE.**

Leaflets 5 or more-----**MELIACEAE.**

Leaves simple.

Ovary 1-celled. Leaves entire---**ERYTHROXYLACEAE.**

Ovary 2 to 7-celled.

Calyx lobes valvate in bud-----**STERCULIACEAE.**

Calyx lobes imbricate in bud.

Stamens 5-----**MARCGRAVIACEAE.**

Stamens 10 to 14-----**CLETHRACEAE.**

FF. Stamens hypogynous, but inserted at the base or on the surface of a disk, or perigynous.

G. Leaves stipulate.

Stamens twice as many as the petals or more.

Styles 2 to 5.

Styles 2; stamens 8 to 12; leaves compound, usually opposite.

CUNONIACEAE.

Styles 5; stamens usually numerous; leaves simple or compound, alternate.....

ROSACEAE.

Style 1, simple or bilobulate.

Leaves compound; stamens 8 to 10.....

ZYGOPHYLLACEAE.

Leaves simple; stamens usually numerous.

Stamens inserted on a disk; ovules numerous; leaves opposite or alternate.....

ELAEOCARPACEAE.

Stamens inserted on the calyx tube; ovules 2 in each cell; leaves opposite, entire.....

RHIZOPHORACEAE.

Stamens as many as the petals or fewer.

Stamens as many as the petals and opposite them. Vines with tendrils; leaves alternate.....

VITACEAE.

Stamens as many as the petals and alternate with them, or fewer.

Leaves compound. Flowers perfect.

Ovary 2 to 4-lobate; seeds without endosperm.

SAPINDACEAE.

Ovary 3-celled; seeds with endosperm.....

STAPHYLEACEAE.

Leaves simple.

Style 1, simple; ovules erect or ascending; flowers usually perfect.....

CELASTRACEAE.

Style 1 and divided, or styles 3; ovules pendulous or inverted; flowers unisexual.....

EUPHORBIACEAE.

G. Leaves estipulate.

Leaves simple; disk present or absent.

Leaves alternate. Stamens 2 to 10, twice as many as the petals or fewer.

Stamens 5, opposite the petals, only 2 of them fertile. Ovary 2-celled, each cell with 2 ovules.....

SABIACEAE.

Stamens 3 to 10, alternate with the petals, or less or more numerous.

Leaves with translucent glands.....

RUTACEAE.

Leaves without glands.....

CELASTRACEAE.

Leaves opposite or whorled.

Stamens 3, less numerous than the petals. Leaves entire.

HIPPOCRATEACEAE.

Stamens as many as the petals or more numerous.

Ovules 2 in each cell.

Ovary 2-celled; leaves without translucent glands. Fruit a double samara.....

ACERACEAE.

Ovary 3 to 5-celled; leaves with translucent glands.

RUTACEAE.

Ovules more than 2 in each cell.

Styles or stigmas 5 to 10; leaves entire.....

CLUSIACEAE.

Style 1, simple.

Calyx lobes imbricate or open in bud; leaves with longitudinal ribs.....

MELASTOMATACEAE.

Calyx lobes valvate; leaves not ribbed.....

LYTHRACEAE.

Leaves compound; disk always present.

Stamens inserted within the disk. Flowers usually polygamious.

Petals usually 5; plants often scandent.....**SAPINDACEAE.**

Petals 4; plants erect. Leaves digitate.....**AESCUACEAE.**

Stamens inserted outside the disk.

Fertile stamens 2; petals 5, 1 or 2 of them much reduced.

SABIACEAE.

Fertile stamens as many as the petals, rarely fewer, but the

4 or 5 petals then subequal.

Stamens as many as the petals and opposite them; flowers dioecious. Leaves alternate**SIMAROUACEAE.**

Stamens as many as the petals and alternate with them, or more or less numerous; flowers usually perfect or polygamious.

Filaments united**MELIACEAE.**

Filaments free.

Leaves with translucent glands.....**RUTACEAE.**

Leaves without glands.....**BURSERACEAE.**

Series 3. **GAMOPETALAE.**

Ovary inferior or semi-inferior.

Stamens numerous.

Ovary 1-celled; plants succulent, usually armed with spines; leaves usually absent**CACTACEAE.**

Ovary several-celled; plants not succulent, unarmed; leaves well developed.
SYMPLOCACEAE.

Stamens 10 or fewer.

Stamens twice as many as the corolla lobes. Fruit fleshy; anthers opening by terminal pores; leaves alternate, simple.....**VACCINIACEAE.**

Stamens as many as the corolla lobes or fewer.

Stamens as many as the corolla lobes and opposite them. Corolla lobes valvate in bud.

Plants parasitic; stigma entire; leaves opposite or verticillate, entire.
LORANTHACEAE.

Plants not parasitic; stigma bilobate; leaves alternate, estipulate.
OLACACEAE.

Stamens as many as the corolla lobes and alternate with them, or less numerous.

Ovary 1-ovulate.

Anthers coherent; flowers in an involucrate head. Fruit an achene.
ASTERACEAE.

Anthers not coherent; flowers not in an involucrate head. Leaves opposite.

Stipules present, free from the petiole. Leaves always entire.
RUBIACEAE.

Stipules none, or if present united with the petiole.
CAPRIFOLIACEAE.

Ovary containing 2 or more ovules.

Perfect stamens fewer than the corolla lobes. Leaves simple.
GESNERIACEAE.

Perfect stamens as many as the corolla lobes.

Ovaries 2, distinct. Leaves simple, entire.....**APOCYNACEAE.**

Ovary 1, entire.

Leaves alternate, often lobed or compound-----**ARALIACEAE.**

Leaves opposite or verticillate.

Leaves estipulate-----**CAPRIFOLIACEAE.**

Leaves stipulate, entire-----**RUBIACEAE.**

Ovary superior or nearly superior.

A. Perfect stamens as many as the corolla lobes and opposite them, or more numerous.

Ovary 1-celled.

Ovule 1. Leaves simple.

Styles 3, or style 1 but with 3 stigmas; flowers dioecious. Plants scandent-----**MENISPERMACEAE.**

Style 1, with 5 stigmas; flowers perfect-----**PLUMBAGINACEAE.**

Ovules 2 or more.

Fruit a legume; leaves compound, alternate-----**MIMOSACEAE.**

Fruit a drupe or capsule; leaves simple.

Plants armed with spines-----**FOUQUIERIACEAE.**

Plants unarmed.

Staminodia none in the staminate flowers; seeds small, black or dark brown-----**MYRSINACEAE.**

Staminodia always present; seeds large, yellow or orange.

THEOPHRASTACEAE.

Ovary perfectly, or sometimes imperfectly, 2 or more-celled.

Leaves stipulate (stipules sometimes minute or deciduous).

Flowers unisexual. Ovary 3-celled-----**EUPHORBIACEAE.**

Flowers perfect. Leaves alternate.

Anthers 2-celled; staminodia present-----**STERCULIACEAE.**

Anthers 1-celled; staminodia absent.

Leaves simple; flowers calyculate; filaments united almost throughout-----**MALVACEAE.**

Leaves digitate or simple; flowers not calyculate; filaments united only at the base or in the lower half-----**BOMBACACEAE.**

Leaves estipulate.

Flowers unisexual, rarely polygamous. Styles several, free or partially united.

Ovules 1 or 2 in each cell. Leaves entire-----**DIOSPYRACEAE.**

Ovules more than 2 in each cell.

Stamens 10; ovules parietal; juice milky; leaves compound or lobed-----**CARICACEAE.**

Stamens more than 10; ovules axial; juice not milky; leaves simple-----**THEACEAE.**

Flowers perfect.

Calyx segments free or united only at the base. Leaves simple.

Stamens more than twice as many as the corolla lobes, 9 or more.
THEACEAE.

Stamens as many or twice as many as the corolla lobes, 8 or fewer.

Flowers irregular. Leaves entire-----**POLYGALACEAE.**

Flowers irregular.

Stamens as many as the corolla lobes; juice milky.

SAPOTACEAE.

Stamens more numerous than the corolla lobes; juice not milky-----**ERICACEAE.**

Calyx segments united to the middle or higher.

Leaves with translucent glands; ovary deeply lobate, the cells
2-ovulate.....**RUTACEAE.**

Leaves without translucent glands; ovary entire or scarcely lobate.
Leaves pinnate.....**MELIACEAE.**

Leaves simple.

Ovary 3-celled; anthers longitudinally dehiscent. Flowers
white, showy; pubescence of branched hairs.

STYRACACEAE.

Ovary with 4 or more cells; anthers dehiscent by apical pores.

ERICACEAE.

AA. Perfect stamens as many as the corolla lobes and alternate with them,
or less numerous.

B. Perfect stamens 3 or more, as many as the corolla lobes; corolla usually
regular.

C. Ovary simple and of 1 or 2 cells, or the ovaries 2 and distinct.

D. Ovules 2 to 4 in the whole ovary.

Leaves opposite or verticillate.

Style stigmatose only below the apex; corolla lobes contorted in
bud. Ovary 2-celled or the ovaries 2 and distinct; leaves
entire; juice usually milky.....**APOCYNACEAE.**

Style stigmatose at the apex or between the lobes; corolla lobes
imbricate or valvate.

Leaves stipulate; style simple.....**LOGANIACEAE.**

Leaves estipulate; style with 1 or 2 stigmas.....**VERBENACEAE.**

Leaves alternate.

Corolla valvate or plicate in bud.

Ovules erect; stigmas usually 2. Fruit a capsule.

CONVOLVULACEAE.

Ovules pendent; stigma 1.

Leaves compound; fruit a legume; plants often armed with
spines.....**MIMOSACEAE.**

Leaves simple; fruit not a legume; plants unarmed.

ICACINACEAE.

Corolla imbricate in bud.

Style stigmatose only below the apex; stigma 1. Leaves entire;
juice usually milky.....**APOCYNACEAE.**

Style stigmatose at the apex; stigmas 2. Leaves simple.

Ovary 1-celled.....**HYDROPHYLLACEAE.**

Ovary 2-celled.....**BORAGINACEAE.**

DD. Ovules more than 4 in the whole ovary.

Fruit a legume; leaves compound. Plants often armed with spines.
MIMOSACEAE.

Fruit not a legume; leaves simple.

Ovaries usually 2 and distinct; juice milky. Plants often
scandent; leaves entire.

Styles separate almost to the apex.....**ASCLEPIADACEAE.**

Styles separate only at the base, or completely united.

APOCYNACEAE.

Ovary 1, entire or slightly lobate; juice not milky. Leaves simple.

Leaves all opposite.....**LOGANIACEAE.**

Leaves alternate, or only the lowest opposite.

Style bifid.....**HYDROPHYLLACEAE.**

Style undivided.

Ovary 1-celled-----**GESNERIACEAE.**

Ovary 2-celled.

Corolla valvate or plicate in bud; fruit often baccate;
plants often armed with spines-----**SOLANACEAE.**

Corolla imbricate in bud; fruit a capsule with longitudinal
dehiscence; plants unarmed.

SCROPHULARIACEAE.

CC. Ovary simple and of 3 or more cells, or the ovaries 3 or more and
distinct.

Ovules 1 or 2 in each cell.

Leaves opposite or verticillate.

Cells of the ovary 3; stigmas 3; fruit a capsule.

POLEMONIACEAE.

Cells of the ovary 4 or 5; stigmas 1, 2, 4, or 5; fruit indehiscent
or divided into nutlets. Leaves simple.

Ovary entire. Stigmas 3, rarely 5-----**VERBENACEAE.**

Ovary 4-parted.

Stamens 4; stigmas 2 or rarely 1; corolla bilabiate.

MENTHACEAE.

Stamens 5; stigma 1; corolla regular-----**BORAGINACEAE.**

Leaves alternate.

Anthers basifixed, opening laterally or apically. Leaves entire.

DIOSPYRACEAE.

Anthers dorsifixed, or basifixed and opening internally.

Corolla united only at the base-----**AQUIFOLIACEAE.**

Corolla with a conspicuous tube.

Flowers mostly in 1-sided cymes; fruit not a capsule.

BORAGINACEAE.

Flowers not in 1-sided cymes; fruit a capsule.

CONVOLVULACEAE.

Ovules 3 or more in each cell.

Corolla valvate or plicate in bud; stamens inserted on the corolla;
calyx more or less united; plants often armed with spines.

SOLANACEAE.

Corolla imbricate or contorted; stamens often free from the corolla;
calyx segments often distinct or nearly so; plants unarmed.

Anthers dehiscent by longitudinal slits; ovary 3-celled.

POLEMONIACEAE.

Anthers dehiscent by terminal pores; ovary with 2 or 4 or more
cells-----**ERICACEAE.**

BB. Perfect stamens 2 to 4, fewer than the corolla lobes, or if of the same
number the stamens and lobes each 2; corolla nearly always irregular.

Ovules 1 or 2, rarely 3 or 4, in each cell.

Ovules 1 in each cell.

Ovary entire or obscurely 4-lobate-----**VERBENACEAE.**

Ovary 4-parted or deeply 4-lobate-----**MENTHACEAE.**

Ovules 2 to 4 in each cell.

Ovary 4 or 5-celled; leaves with translucent glands----**RUTACEAE.**

Ovary 2-celled; leaves without translucent glands.

Stamens 2, regularly alternate with the cells of the ovary. Flowers
regular; leaves opposite-----**OLEACEAE.**

Stamens 4, or if 2 not alternate with the cells of the ovary.

Ovules 2 and collateral; fruit indehiscent or septicidal.

VERBENACEAE

Ovules 4, or 2 and superimposed; fruit loculicidal.

Seeds with endosperm, sessile or nearly so; stigma 1.

SCROPHULARIACEAE.

Seeds without endosperm, on conspicuous thick funicles; stigmas usually 2.....ACANTHACEAE.

Ovules more than 4 in each cell.

Ovary 1-celled; placentae central.

Seeds large; stamens 4; leaves compound. Plants often scandent.

BIGNONIACEAE.

Seeds small; fertile stamens 2; leaves simple.....GESNERIACEAE.

Ovary 2-celled; placentae axillary.

Leaves compound.....BIGNONIACEAE.

Leaves simple.

Corolla induplicate-valvate or plicate-imbricate...SOLANACEAE.

Corolla plicate (but not imbricate) in bud.

Seeds inserted on large thick funicles.....ACANTHACEAE.

Seeds sessile or nearly soSCROPHULARIACEAE.

ANNOTATED CATALOGUE.

1. GLEICHENIACEAE. Vine-fern Family.

(Contributed by Mr. William R. Maxon.)

REFERENCES: Sturm, Gleicheniaceae, in Mart. Fl. Bras. 1²: 217-238. pl. 17. 1859; Underwood, A preliminary review of the North American Gleicheniaceae, Bull. Torrey Club 34: 243-262. f. 1, 2. 1907; Maxon, Gleicheniaceae, N. Amer. Fl. 16: 53-63. 1909.

Xerophilous ferns, mostly with branched creeping rhizomes; fronds usually ascending or reclining, numerous, somewhat vinelike, of indefinite growth, entangled, often forming dense impenetrable low thickets; primary axis naked; primary branches 1 to many pairs, opposite, determinate or (in most species) once to several times dichotomous, the included bud dormant or producing secondary and tertiary axes like the primary one; ultimate branches (pinnae) usually in pairs, bipinnate, pinnate, or deeply pinnatifid, the segments mostly elongate in our species (minute and rounded in the Old World *Gleichenia*); veins free, forked; sori dorsal or (in *Gleichenia*) terminal upon the veinlets, nonindusiate; sporangia sessile, short, 2 to many, opening by a vertical fissure.

1. DICRANOPTERIS Bernh. Neues Journ. Bot.

Schrad. 1²: 38. 1806.

Widely distributed in tropical and subtropical regions of both hemispheres. In tropical America many of the species grow rankly in the greatest profusion, often occupying wide areas of open or thinly shaded mountain slopes to the exclusion of other vegetation. A mass of the wiry interlacing fronds, with a blanket thrown over it, makes an excellent bed for the collector.

Primary branches bipinnate, the rachis not forked.....1. *D. bancroftii*.

Primary branches once or several times forked.

Internodes of primary branches normally naked; veins 2 to 5-forked; sori multisporangiate; rhizomes with spreading articulate hairs.

Accessory pinnae (a pair) borne at all but the ultimate nodes.

2. *D. flexuosa*.

Accessory pinnae wanting.....3. *D. pectinata*.

Internodes of primary branches at least partially pectinate; veins once forked; sori 3 to 5-sporangiate; rhizomes with ciliate scales.

Segments closely tomentose beneath, rarely glabrate with age—4. *D. bifida*.
Segments not tomentose beneath.

Pinnae 2.5 to 3.2 cm. broad; segments narrowly oblong; veins 12 to 15 pairs, fibrillose with rusty scales; leaf tissues glabrous.

5. *D. underwoodiana*.

Pinnae 3 to 5.5 cm. broad; segments linear; veins 20 to 28 pairs, these and the leaf tissues sparsely pilose with whitish stellate hairs.

6. *D. palmata*.

1. *Dicranopteris bancroftii* (Hook.) Underw. Bull. Torrey Club 34: 252. 1907.

Gleichenia bancroftii Hook. Sp. Fil. 1: 5. 1844.

Mertensia bancroftii Kunze, Linnaea 18: 307. 1844.

Gleichenia brunei Christ, Bull. Herb. Boiss. II. 5: 13. 1905.

Dicranopteris brunei Underw. Bull. Torrey Club 34: 253. 1907.

Mountains of Veracruz and Chiapas, southward to the Andes of South America; also in the Lesser Antilles and Jamaica (the type locality), mainly at 1,000 to 1,800 meters elevation.

Primary pinnae 1 to 3 pairs, oblong, 1 to 1.5 meters long, 30 to 50 cm. broad, bipinnate; pinnules very numerous; segments narrowly linear, 1.5 to 2.2 cm. long, herbaceous, glabrous or nearly so, glaucous beneath; sori 3 to 5-sporangiate.

2. *Dicranopteris flexuosa* (Schrad.) Underw. Bull. Torrey Club 34: 254. 1907.

Mertensia flexuosa Schrad. Gött. Anz. Ges. Wiss. 1824: 863. 1824.

Mertensia rigida Kunze, Linnaea 9: 16. 1834.

Gleichenia flexuosa Mett. Ann. Lugd. Bat. 1: 50. 1863.

Gleichenia rigida Bomm. & Christ, Bull. Soc. Bot. Belg. 35¹: 174. 1896. Not

G. rigida J. Smith, 1841.

Mountains of Veracruz, at about 1,300 meters altitude. Guatemala to Brazil; widely distributed in the West Indies, mainly at low elevations; near Mobile, Alabama; type from Brazil.

Leaf axis 2 to 4 mm. in diameter; primary branches several pairs, repeatedly dichotomous, never developing a secondary axis, the internodes unequal, naked; pinnae glabrous; segments glaucous beneath, linear, retuse, narrowly connected at the dilatate base, revolute.

3. *Dicranopteris pectinata* (Willd.) Underw. Bull. Torrey Club 34: 260. 1907.

Mertensia pectinata Willd. Svensk. Vet. Akad. Handl. II. 25: 168. 1804.

Gleichenia nitida Presl, Rel. Haenk. 1: 70. 1825.

Mertensia elata Desv. Mém. Soc. Linn. Paris 6: 201. 1827.

Mertensia nitida Presl, Tent. Pter. 51. 1836.

Mountains of Veracruz. General throughout tropical America, the type from near Caracas, Venezuela.

Leaf axis 3 to 6 mm. in diameter; primary branches several pairs, stipulate, repeatedly and unequally dichotomous, a false flexuous secondary axis formed by the alternate production of the unequal secondary branches, the included bud of each dichotomy always abortive; segments oblong to linear-oblong, pruinose beneath, glabrous, or the costa and veins sparsely rusty-paleaceous.

A variable species.

4. *Dicranopteris bifida* (Willd.) Maxon, N. Amer. Fl. 16: 60. 1909.

Mertensia bifida Willd. Svensk. Vet. Akad. Handl. II. 25: 168. 1804.

Gleichenia bifida Spreng. Syst. Veg. 4: 27. 1827.

Mertensia fulva Desv. Mém. Soc. Linn. Paris 6: 201. 1827.

Dicranopteris fulva Underw. Bull. Torrey Club 34: 255. 1907.

Mountains of Veracruz. Common and generally distributed throughout the

West Indies and Central America, southward into South America; type from Caracas, Venezuela.

Leaf axis stout, light greenish brown; primary branches 2 or several pairs, these once or twice dichotomous (rarely developing a secondary axis), the internodes at least partially naked; segments mostly linear, dilatate (the sinuses obtuse), entire, revolute.

5. *Dicranopteris underwoodiana* Maxon, N. Amer. Fl. 16: 59. 1909.

Temperate region of Chiapas, the type locality. Also in the high mountains of Quiché, Guatemala.

Leaf axis reddish brown, 2 to 3 mm. in diameter; primary branches usually 2 pairs, twice dichotomous (not developing a secondary axis), the primary internode nearly naked, the secondary ones fully pectinate; pinnae linear, 18 to 30 cm. long, the rachises closely invested with short rusty scales.

6. *Dicranopteris palmata* (Schaffn.) Underw. Bull. Torrey Club 34: 259. 1907.

Mertensia palmata Schaffn.; Fée, Mém. Foug. 9: 40 (32). 1857, name only.

Gleichenia palmata Moore, Ind. Fil. 380. 1862, name only.

Mountains of Veracruz, the type from Orizaba. Also in Guatemala (Alta Verapaz), eastern Cuba, and the Blue Mountains of Jamaica, at altitudes of 900 to 1,650 meters.

Leaf axis olivaceous, opaque; primary branches 2 or 3 pairs, divergent, usually 2 to 4 times dichotomous (rarely developing a secondary axis), the first and second internodes usually naked; pinnae 20 to 25 cm. long.

2. CYATHEACEAE. Tree-fern Family.

(Contributed by Mr. William R. Maxon.)

REFERENCES: Cyatheaceae, Diels in Engl. & Prantl. Pflanzenfam. 1⁴: 113-139. 1899; Maxon, The tree ferns of North America, Ann. Rep. Smiths. Inst. 1911: 463-491. *pl.* 1-15. 1912.

Mainly treelike plants of moist tropical regions, the rhizome stout and woody, decumbent, oblique, or usually erect, and 1 to 15 meters high or more, naked, with smoothish, usually tessellate leaf scars, or rough and partially sheathed by the imperfectly deciduous stipe bases of the fronds of previous years; fronds borne in a terminal scaly crown, several or many, ascending to recurved, the blades 1 to 4-pinnate, up to 4 meters long, usually broad; sori indusiate or nonindusiate, nearly globose, borne dorsally upon the veins on the under surface of the blade or at the margin, the receptacle elongate, of various form and vestiture; sporangia numerous, crowded radially in several ranks, opening horizontally, the annulus oblique, with or without a stomium of thin-walled cells; spores triplanate.

The Cyatheaceae, or tree-fern family—the latter name given because, in contradistinction to all other families of ferns, the species are nearly all arborescent in habit of growth—are practically confined to tropical and subtropical regions and attain their best development, both as to luxuriant growth and as to number of species and individuals, in mountainous regions which have a nearly uniform, moist climate. Except in a very few cases they apparently can not endure extremes of either drought or cold. Thus in Mexico, as in Central America, they are practically confined to the Atlantic slopes and to the higher mountain regions that are constantly swept by the moisture-laden trade winds from the Gulf of Mexico. This territory embraces Veracruz and Tabasco and most of Oaxaca and Chiapas. From the arid interior plateau regions they are altogether lacking. Comparatively little material having been collected in extreme southeastern Mexico in recent years, our knowl-

edge, both of the species actually occurring there and of their geographic distribution, is very incomplete. Tree ferns are, as a rule, of restricted range, yet many of the Mexican species are known from Alta Verapaz, Guatemala, and of the remainder most, at least, may be expected to occur there. With a very few exceptions, the Mexican species are exclusively continental, and only a few extend as far south as Panama.

Aside from the attention attracted by their beauty and stately habit of growth, tree ferns are decidedly interesting because of their marked diversity in structural characters and, unfortunately, their difficult classification. Locally, at least, they serve varied economic uses also, the most important being the use of the trunks as building timbers. These are composed largely of a branched network of hard fibrovascular elements, resistant to decay and the attacks of termites alike, permitting the use of the trunks over and over again in the supporting framework of native houses. Occasionally they are made to serve as telegraph poles. Small pieces of the fibrovascular elements are employed in inlay work. In Costa Rica the succulent unrolling young fronds or "crosiers" of a *Cyathea* called "rabo de mico" are eaten as a salad. The scales of a related species (probably *Cyathea mexicana*), known in Veracruz as "ocopetate" or "cola de mono," are applied topically as a hemostatic. A like use of the matted capillary scales or "pulu" of Hawaiian species of *Cibotium* is, of course, well known. Several species of *Hemitelia* and *Alsophila* are known as "tatahueso" in Oaxaca, according to Reko.

Sori borne upon the back of the veins, commonly near the costule or at least not marginal; indusium (if present) not formed in part of the modified leaf margin.

Sori distinctly indusiate, the indusium attached at the base of the receptacle.

Indusia either (1) cup-shaped or saucer-shaped, never wholly inclosing the sporangia, persistent, or (2) globose, at first wholly containing the sporangia, rupturing at maturity, the divisions persistent to fugacious.

1. CYATHEA.

Indusia inferior, more or less semicircular in outline, often lobed and scale-like or sometimes cleft or lacerate, never inclosing all the sporangia.

2. HEMITELIA.

Sori usually nonindusiate, a very minute basal scale present in a few species.

3. ALSOPHILA.

Sori terminal upon the veins at or near the margin; indusium bilobate or bivalvate, the outer portion a more or less modified, concave lobule of the leaf margin.

Outer lip of the indusium formed of slightly modified leaf tissue, unlike the rigid brownish inner one.....**4. DICKSONIA.**

Outer lip of the indusium formed of highly differentiated cartilaginous tissue, similar to the inner one.....**5. CIBOTIUM.**

1. CYATHEA J. E. Smith, Mem. Accad. Sci. Torino 5: 416. 1793.

Caudex erect in most species, arboreous, bearing numerous adventitious roots in the basal part, in mature individuals usually smoothish above, with close-set to distant scars; fronds borne in a terminal crown, oblique, spreading, or rarely drooping, the stout stipes strongly aculeate to muricate, tuberculate, or nearly smooth, paleaceous toward the base; blades 2 or 3-pinnate, usually 1 to 3 meters long, lanceolate to oblong or ovate, the rachises variously pubescent, furfuraceous, or minutely paleaceous, glabrescent with age; pinnules subentire to pinnate, sessile to long-petiolate, deciduous or not; veins free, usually branched; sori dorsal, apart from the margin; indusium either (1) inferior and saucer-shaped, never wholly inclosing the sporangia, persistent,

with even margins, or (2) globose, at first wholly inclosing the sporangia, bursting irregularly at maturity, the divisions persistent or often disappearing. Indusia saucer-shaped, never inclosing the sporangia, with low even margins.

1. *C. arborea*.

Indusia at first globose and inclosing the sporangia, at length rupturing, the divisions persistent to fugacious.

Pinnules (secondary pinnae) distinctly petiolate, the lower ones with stalks 4 to 9 mm. long; leaf tissue coriaceous.....2. *C. tuerckheimii*

Pinnules mostly sessile or nearly so, membranous or herbaceous.

Rachises of the pinnae densely clothed with spreading or retrorse, linear, spinulose scales, sharply muricate from their persistent bases; pinnules cut to the costa nearly throughout.....3. *C. princeps*.

Rachises of the pinnae bearing a few deciduous scales, smooth or nearly so; pinnae very deeply pinnatifid, but the segments distinctly though narrowly joined.

Costae of the pinnules glabrous beneath; leaf tissue bright green beneath; sori large, apart from the costule.....4. *C. jurgensenii*.

Costae pilose or minutely squamulose beneath; leaf tissue much paler beneath than above; sori small, borne near or against the costule.

Pinnae long-petiolate (4 cm. or more); pinnules about 20 pairs; segments obtuse; veins 6 to 8 pairs, glabrous.....5. *C. trejoi*.

Pinnae subsessile or short-petiolate; pinnules 30 to 40 pairs; segments acute or acuminate; veins 8 to 12 pairs, usually minutely glandular-pubescent.....6. *C. mexicana*

1. *Cyathea arborea* (L.) J. E. Smith, Mem. Accad. Sci. Torino 5: 417. 1793.

Polypodium arboreum L. Sp. Pl. 1092. 1753.

Disphenia arborea Presl, Tent. Pter. 56. 1836.

Hemitelia arborea Fée, Mém. Foug. 5: 350. 1852.

Lowlands of eastern Mexico; rare. Generally distributed and common in the West Indies, the type from Martinique; variously reported from Central America and northern South America, probably in error.

Caudex erect, 4 to 12 meters high, usually with close-set, oval to broadly subhexagonal scars in 8 to 10 ranks, the apex clothed with large, lance-attenuate, dirty white scales; fronds 2.5 to 4 meters long; stipes stout, pale, low-tuberculate; blades 2 to 3 meters long, ovate, tripinnate, the rachises pale, glabrate; pinnae oblong, 40 to 80 cm. long, petiolate, or the shorter basal ones ovate and long-petiolate; pinnules numerous, mostly sessile, spreading, oblong-lanceolate, long-attenuate; segments linear-oblong, dilatate, sharply serrate, often revolute, the costule invariably with 1 or 2 white bullate scales at the base beneath; veins 1 to 3-forked.

This is one of the few species of Cyatheaceae which grow naturally in open sunny situations. It occurs often in colonies.

2. *Cyathea tuerckheimii* Maxon, Contr. U. S. Nat. Herb. 13: 4. 1909.

Region of Orizaba, Veracruz, at an altitude of about 1,300 meters. Also near Cobán, Alta Verapaz, Guatemala (the type locality), at 1,350 to 2,000 meters elevation.

Caudex erect, 3 to 4 meters high; fronds ample, at least 130 cm. broad, bipinnate-pinnatifid, the stout primary rachis deciduously furfuraceous, minutely spiny; pinnae oblong-lanceolate, acuminate, up to 65 cm. long, the rachis strongly muricate; pinnules 28 to 30 pairs, contiguous, short-petiolate, oblong-lanceolate, attenuate, up to 13 cm. long, pinnately cut nearly to the minutely and deciduously scaly costa; segments about 22 pairs, 10 to 12 mm. long, oblong, falcate, subacute, coriaceous, the crenate-serrate margins revo-

lute; sori large, 6 to 9 pairs, seated at the fork of the once-branched veins, the irregular divisions of the membranous indusium subsistent.

3. *Cyathea princeps* (Linden) E. Mayer, *Gartenflora* 17: 10. 1868.

Cibotium princeps Linden; E. Mayer, *Gartenflora* 17: 10. 1868, as synonym.

Cyathea bourgaei Fourn. *Mex. Pl. Crypt.* 135. 1872.

Cyathea munchii Christ, *Bull. Herb. Boiss.* II. 7: 413. 1907.

Veracruz and Chiapas, the type from the Volcano Tuxetla, Veracruz. Also in the mountains of Alta Verapaz, Guatemala; ascribed also to Costa Rica, but probably erroneously.

Caudex erect, stout, said to reach a height of nearly 20 meters; fronds at least 4 meters long; stipes 1 to 1.5 meters long, together with the yellowish primary and secondary rachises densely clothed with narrow, yellowish, spinulose, spreading or retrorse scales; blades broadly ovate, 2 to 2.5 meters long, tripinnate; pinnae oblong-lanceolate, acuminate, up to 1 meter long and 35 cm. broad, long-stalked; pinnules very numerous, approximate, linear-oblong, up to 18 cm. long, narrowly long-acuminate, the costa minutely and deciduously scaly beneath; segments 25 to 32 pairs, linear-oblong, dilatate, falcate, subentire, acutish, pruinose beneath, the costa with a few minute, simple or cleft scales; sori large, 6 to 9 pairs, the coriaceous indusium splitting into 2 to 4 persistent saccate lobes.

4. *Cyathea jurgensenii* Fourn. *Mex. Pl. Crypt.* 135. 1872.

Mountains of Oaxaca and Veracruz, the type from Oaxaca; rare.

Caudex presumably erect and several meters high; fronds ample, the blades bipinnate-pinnatifid, 1 meter broad or more, the primary rachis pale, minutely spinose; pinnae oblong, abruptly acuminate, mostly petiolate, up to 65 cm. long, the rachis smooth or nearly so, glabrate beneath; pinnules about 25 pairs, articulate, petiolate, deltoid-lanceolate, long-acuminate, 10 to 12 cm. long, very deeply pinnatifid, the costa nearly or quite glabrous beneath; segments 18 to 20 pairs, close, oblong, falcate, acute, obscurely crenate-serrate, bright green and nearly or quite glabrous on both surfaces; sori 4 to 8 pairs, apart from the costule, only the flat lobate basal portion of the pale yellowish membranous indusium persistent.

5. *Cyathea trejoi* Christ, *Bull. Herb. Boiss.* II. 5: 733. 1905.

Known only from San Pablo, Chiapas, altitude 1,500 meters, the type locality.

Caudex erect, long and slender, very spiny; fronds rather small, the primary rachis stout, smooth, stramineous or reddish, shining; pinnae articulate, easily deciduous, narrowly ovate, acuminate, 30 cm. long or more, long-petiolate; pinnules about 20 pairs, approximate, readily separable, lanceolate, 5 to 6 cm. long, cut nearly to the scantily pilose costa; segments about 15 pairs, oblong, subfalcate, obtuse, slightly dilatate, crowded, light green beneath, lightly crenate; sori 2 or 3 pairs, very small, basal, close to the costule, the delicate indusium grayish.

6. *Cyathea mexicana* Schlecht. & Cham. *Linnaea* 5: 616. 1830.

Cyathea hexagona Fée & Schaffn.; Fée, *Mém. Foug.* 8: 111. 1857.

Cyathea articulata Fée, *Mém. Foug.* 8: 111. 1857.

Cyathea glauca Fourn. *Mex. Pl. Crypt.* 135. 1872. Not *C. glauca* Bory, 1804.

Alsophila mucronata Christ, *Bull. Soc. Bot. Belg.* 35: 178. 1896.

Cyathea arida Christ, *Bull. Herb. Boiss.* II. 6: 180. 1906.

Veracruz to Chiapas, the type from Jalapa. Also in Guatemala (Alta Verapaz), Costa Rica, and western Panama, at 120 to 1,300 meters.

Caudex 3 to 10 meters high, unarmed; fronds 2 to 3 meters long, the stipe clothed at the base with brown acicular scales about 1 cm. long and armed with a few sharp conical shining black spines; blade 1.5 to 2.5 meters long,

oblong, bipinnate-pinnatifid; primary rachis stout, usually castaneous, deciduously puberulo-furfuraceous; pinnae oblong-lanceolate, acuminate, up to 85 cm. long, short-petiolate, deciduous; pinnules articulate, readily separable, 30 to 40 pairs, often distant, oblong-lanceolate, up to 10 cm. long (usually smaller), sessile or short-stalked, the costa beneath bearing a few antrorse hairs and deciduously squamulose toward the base; segments narrowly oblong, oblique, subfalcate, obscurely serrulate, connected by a wing 1 to 1.5 mm. broad on each side of the costa; sori 4 to 7 pairs, close to the costule, the divisions of the pale membranous indusium mostly fugacious.

A variable species.

2. HEMITELIA R. Br. Prodr. Fl. Nov. Holl. 158. 1810.

REFERENCES: Maxon, The North American species of *Hemitelia*, subgenus *Cnemidaria*, Contr. U. S. Nat. Herb. 16: 25-49. pl. 18-26. 1912; Maxon, The North American species of *Hemitelia*, section *Euhemitelia*, Contr. U. S. Nat. Herb. 17: 414-420. pl. 17-22. 1914.

Similar in general to *Cyathea*, but having the indusium inferior, more or less hemispherical, and varying from lobed to lacerate; or, in the American subgenus *Cnemidaria*, the plants mostly with short ascending trunks, coarse, succulent, pinnate or rarely bipinnate fronds, free-veined or not, the indusium hemispheric, concave, often lobed.

Blades fully bipinnate, the pinnules sessile and very deeply pinnatifid; indusium deeply lacerate, the divisions with long filamentous apices.

1. *H. costaricensis*.

Blades pinnate, the pinnae lightly crenate to pinnatifid; indusia entire or merely lobed.

Veins all free; pinnae pinnatifid at least two-thirds the distance to the costa, the segments oblong, acuminate, aristate.....2. *H. apiculata*.

Veins (basal) united by a transverse veinlet, a single row of costal areoles thus formed; lobes or crenations low or short, not acuminate.

Pinnae lightly crenate-serrate, decurrent.....3. *H. decurrens*.

Pinnae deeply crenate to crenately lobed, not decurrent.

Larger crenations 5 to 7 mm. broad, acute distally; pinnae 2.5 to 3 cm. broad.....4. *H. mexicana*.

Larger crenations 9 to 12 mm. broad, rounded; pinnae 3.5 to 4.2 mm. broad.....5. *H. lucida*.

1. *Hemitelia costaricensis* (Klotzsch) Mett.; Kuhn, *Linnaea* 36: 159. 1869.

Cyathea costaricensis Klotzsch; Kuhn, *Linnaea* 36: 159. 1869, as synonym.

Mountains of Veracruz and Chiapas. Also in western Guatemala and in Costa Rica (the type locality), ascending to 1,000 meters.

Caudex erect, 1 to 2 meters high, or more; pinnae narrowly oblong, acuminate, mostly 50 to 70 cm. long; pinnules 23 to 27 pairs, mostly sessile, linear-oblong, long-acuminate or attenuate; segments 20 to 23 pairs, narrowly oblong, subfalcate, acute, connected by a narrow costal wing.

2. *Hemitelia apiculata* Hook. in Hook. & Baker, *Syn. Fil.* 29. 1868.

Mountains of Oaxaca, the type locality.

Blades 35 to 50 cm. broad; pinnae narrowly oblong-lanceolate, 18 to 30 cm. long, 2.5 to 4.5 cm. broad below the narrowly long-acuminate apex, pinnatifid at least two-thirds the distance to the costa, the sinuses linear and very acute.

3. *Hemitelia decurrens* Liebm. *Dansk. Vid. Selsk. Skrivt.* V. 1: 285. 1849.

Hemistegia decurrens Fourn. *Mex. Pl. Crypt.* 135. 1872.

Mountain forests near Lobani, District of Chinantla, Oaxaca, at 900 to 1,050 meters; known only from the type collection.

Caudex about 30 cm. high; blades ovate-lanceolate, about 75 cm. long; pinnae narrowly oblong-lanceolate, 12 to 15 cm. long, 2.5 to 3 cm. broad, the upper ones adnate and confluent, those below semiadnate, constricted, narrowly long-decurrent.

4. *Hemitelia mexicana* Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 287. 1849.

Hemistegia mexicana Fourn. Mex. Pl. Crypt. 135. 1872.

Oaxaca, in mountain forests near Cacolá, District of Chinantla, at 750 to 900 meters altitude; known only from the original collection.

Caudex about 30 cm. high; blades broadly lanceolate, 1.5 to 1.8 meters long; pinnae linear, about 30 cm. long; main veins 50 pairs, spreading, 4 to 7 mm. apart.

5. *Hemitelia lucida* (Fée) Maxon, Contr. U. S. Nat. Herb. 16: 39. 1912.

Hemistegia lucida Fée, Gen. Fil. 351. 1852.

District of Chinantla, Oaxaca, at 2,000 meters altitude; known only from the type collection.

Blades ovate-oblong, 2 meters long or less; pinnae numerous, linear-lanceolate, up to 45 cm. long; main crenations or lobes 28 to 34 pairs.

3. **ALSOPHILA** R. Br. Prodr. Fl. Nov. Holl. 158. 1810.

Similar to *Cyathea*, but having the indusia wholly lacking or, in a few species, represented by a very minute, concealed, vestigial, basal scale; receptacles often copiously long-paraphysate.

Two subgenera, *Lophosoria* and *Amphidesmium*, are unique in their silky capillary scales, which are similar to those of *Cibotium* and *Dicksonia*. They differ notably from typical *Alsophila* in other morphological characters also and possibly should be regarded as distinct genera. *Amphidesmium* is not known to occur in Mexico, though it occupies a wide range southward. *Lophosoria* is represented by the variable and widely distributed *A. quadripinnata*, the first-mentioned species below.

Blades waxy-pruinose beneath, the rachises, costae, and veins lanate with lax, tortuous, pale rusty, septate hairs; sori with low hemispheric receptacles; caudex and stipe bases densely clothed with silky capillary scales 1 cell broad.....1. **A. quadripinnata.**

Blades not waxy-pruinose beneath, the rachises and costae paleaceous or furfuraceous, with or without spreading hairs; sori with capitate or spheric receptacles; caudex and stipe bases bearing flat scales many cells broad.

Primary and secondary rachises blackish; blades fully tripinnate, the segments stalked.....2. **A. salvinii.**

Primary and secondary rachises stramineous to yellowish or light brown; blades simply bipinnate or bipinnate-pinnatifid.

Blades bipinnate only, the pinnules sinuate to crenate...3. **A. marginalis.**

Blades bipinnate-pinnatifid, the segments connected by a narrow wing.

Segments rounded-obtuse, shallowly and broadly crenate.

4. **A. schiedeana.**

Segments acute or acutish, sharply incised to pinnatifid.

Costae of pinnules thinly squamulose, nearly devoid of long spreading septate hairs beneath; primary rachis with pungent, spreading or retrorse, scattered spines throughout, the secondary rachises similarly armed.....5. **A. microdonta.**

Costae with numerous spreading hairs beneath, these extending to the costules and often to the veins; primary rachis unarmed, or plainly aculeate only toward the base, the secondary rachises merely muricate.

Pinnae and pinnules petiolate; costae and costules devoid of bullate scales-----6. **A. myosuroides.**

Pinnae and pinnules sessile; costules bearing small, subsistent, white or yellowish, bullate scales beneath.

Segments pinnatifid; primary and secondary rachises with occasional large flat persistent white scales-----7. **A. mexicana.**

Segments deeply incised to deeply crenate-serrate; rachises devoid of large whitish scales.

Bullate scales deciduous, few, confined to the base of the costules; segments sparsely hirsute above along the costules and veins-----8. **A. scabriuscula.**

Bullate scales persistent, numerous; segments glabrous above.

9. **A. bicrenata.**

1. **Alsophila quadripinnata** (Gmel.) C. Chr. Ind. Fil. 47. 1905.

Polypodium quadripinnatum Gmel. Syst. Nat. 2²: 1314. 1791.

Polypodium pruinaum Swartz, Journ. Bot. Schrad. 1800²: 29. 1801.

Alsophila pruinata Kaulf.; Kunze, Linnaea 9: 99. 1834.

Lophosoria pruinata Presl, Abh. Böhm. Ges. V. 5: 345. 1848.

Trichosorus glaucescens Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 283. 1849.

Trichosorus densus Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 284. 1849.

Trichosorus frigidus Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 284. 1849.

?*Alsophila schaffneriana* Fée, Mém. Foug. 8: 109. 1857.

Mountains of Veracruz, Puebla, Oaxaca, and Chiapas, ascending to 3,000 meters. Central America to Chile and Argentina; Greater Antilles, the type from Jamaica.

Rhizomes stout, up to 3 meters high (usually less than 1 meter), often multipital, densely lanate with lax, tortuous, pale rusty, capillary scales; fronds 2 to 4.5 meters long, long-stalked, the blades subtriangular, tripinnate-pinnatifid.

2. **Alsophila salvinii** Hook. in Hook. & Baker, Syn. Fil. 36. 1866.

Alsophila munchii Christ, Bull. Herb. Boiss. II. 5: 734. 1905.

Region of San Pablo, Chiapas, at 2,200 meters altitude. Also in the mountains of Alta Verapaz, Guatemala, at 1,400 to 1,600 meters elevation, the type from Chilasco.

Trunk 1 to 1.5 meters high; blades very ample, at least 1.5 meters broad, the primary and secondary rachises blackish, polished, woody, nearly or quite smooth; pinnae 60 to 80 cm. long, 20 to 30 cm. broad; pinnules 22 to 25 pairs, close, spreading; segments 1 to 2 cm. long, 3 to 4 mm. broad, obtusely pinnatifid or crenately lobed; costae and costules deciduously paleaceous beneath, the scales minute, many of them substellate, with blackish spinous processes.

3. **Alsophila marginalis** Klotzsch, Linnaea 18: 542. 1844.

Hemitelia marginalis Jenman, Ferns Brit. W. Ind. Guian. 43. 1898.

Sierra San Nolasco, Oaxaca. Also in British Guiana, the type locality. Very rare.

Stipe sparsely short-aculeate, paleaceous above; blades 1.5 to 1.8 meters long, deciduously paleaceous; pinnae alternate, elongate-oblong, 20 to 38 cm. long, gibbose-articulate; pinnules sessile or short-petiolate, spreading, hastate-lanceolate, or ligulate from a cordate base, 2 to 8 cm. long, 8 to 15 mm. broad, sinuate to deeply crenate; sori in a continuous line 1 to 1.5 mm. from the margin.

4. *Alsophila schiedeana* Presl; Kunze, *Linnaea* 13: 149. 1839.

Mountains of Veracruz and Chiapas, the type from Veracruz. Also in eastern Guatemala, apparently common, at 275 to 1,000 meters altitude.

Arborescent; stipe dull brown, angulate, freely armed with stout straight spines up to 5 mm. long; blades ample, the rachis pale brown, aculeolate; pinnae spreading, linear-oblong to oblong, acuminate, up to 70 cm. long and 25 cm. broad, the secondary rachis deciduously squamulose-puberulous beneath; pinnules linear-oblong, acute or acuminate, spreading, with minute hairs and brown bullate scales beneath, the latter extending to the costules; veins simple or once forked, glabrous; sori nearly medial. "Malque" (Chiapas).

5. *Alsophila microdonta* Desv. *Mém. Soc. Linn. Paris* 6: 319. 1827.

Polypodium microdonton Desv. *Ges. Naturf. Freund. Berlin Mag.* 5: 319. 1811.

Polypodium aculeatum Raddi, *Opusc. Sci. Bologna* 3: 288. 1819. Not *P. aculeatum* L. 1753.

Alsophila armata Mart. *Icon. Pl. Crypt.* 72. *pl.* 28, 48. 1834. Not *A. armata* Presl, 1836.

Veracruz and Tabasco. Guatemala to Brazil, mainly at low elevations near the coast; known in the West Indies only from the Isle of Pines; type doubtfully South American.

Caudex 1 to 5 meters high; fronds arcuate-spreading, 2 to 2.5 meters long, the long brown stipes freely armed with very short, narrowly conical spines up to 1 cm. long, similar but smaller ones occurring sparsely on the primary and secondary rachises throughout; pinnae narrowly oblong, abruptly acuminate, 30 to 60 cm. long, 10 to 25 cm. broad; pinnules spreading, linear-oblong, attenuate; segments linear, falcate, obliquely incised except at the dilatate base, membranous, the costule bearing a few long septate hairs beneath and, with the veins, also thinly and laxly puberulous with minute tortuous hairs; sori numerous, nearly medial, often confluent.

6. *Alsophila myosuroides* Liebm. *Dansk. Vid. Selsk. Skrivt.* V. 1: 236. 1849.

Veracruz to Chiapas, at low elevations, the type from the region of Chinantla. British Honduras, eastern Guatemala, and Honduras, at 180 meters altitude or less; abundant in the province of Pinar del Río, Cuba, and the Isle of Pines, herbarium material having been widely distributed under the manuscript name *Alsophila wrightii* Underw.

Caudex $\frac{3}{4}$ to 5 meters high; fronds ample, the stout brown stipes thickly aculeolate and clothed with copious stiff, acicular, bright brown scales at the base, muricate above; pinnae petiolate, narrowly oblong, long-acuminate, 40 to 65 cm. long, 15 to 22 cm. broad; pinnules stalked, linear-attenuate or oblong-linear and abruptly long-caudate, the costae sparsely hirsute beneath; segments linear, falcate, acutish, serrate, herbaceous, dull green; costules sparsely hirsute beneath; sori very numerous, usually confluent.

7. *Alsophila mexicana* Mart. *Icon. Pl. Crypt.* 70. *pl.* 45. 1834.

Alsophila godmani Hook. in Hook. & Baker, *Syn. Fil.* 36. 1866.

Mountains of Oaxaca and Chiapas, the type from San Pablo de Teoxomulco, Oaxaca. Also in Alta Verapaz, Guatemala, at 900 to 1,550 meters altitude.

Caudex arborescent, presumably several meters high; blades ample; primary rachis stout, apparently unarmed, subpersistently furfuraceous, bearing scattered large whitish scales, and hirsute with long inflated tawny septate hairs, their bases persistent, the rachis thus invariably scabrous in age; pinnae narrowly oblong, acuminate, 50 to 60 cm. long, 16 to 22 cm. broad, the rachis similar to the primary one; pinnules close or subimbricate, sessile, linear-oblong, rather abruptly long-acuminate; segments herbaceous, pinnatifid, sparsely hirsute along the costules and veins on both surfaces.

8. *Alsophila scabriuscula* Maxon, Proc. Biol. Soc. Washington 32: 125. 1919.

Region of Córdoba, Veracruz. Also in Alta Verapaz, Guatemala, the type from Cubilquitz, altitude 350 meters.

Caudex arborescent, presumably stout and several meters high; fronds very ample, the stout stipe bearing numerous slender conical spines about 4 mm. long; blades ample, the primary rachis sparsely aculeate toward the base, hirsute, scabrous from the persistent bases of the pale spreading septate hairs; pinnae narrowly oblong, acuminate, 50 to 75 cm. long, 18 to 30 cm. broad, the secondary rachis hirsute, scabrous with age; pinnules approximate, spreading, sessile, oblong-linear, long-acuminate; segments herbaceous, deeply incised, the lobes usually bidentate; costules and veins sparsely hirsute beneath and with a thin covering of minute, closely appressed, septate hairs.

9. *Alsophila bicrenata* (Liebm.) Fourn. Mex. Pl. Crypt. 134. 1872.

Cyathea bicrenata Liebm. Dansk. Vid. Selsk. Skrivt. V. 1: 289. 1849.

Mountains of Veracruz, Puebla, Oaxaca, and Chiapas, at 1,200 to 2,100 meters elevation, the type from Puebla.

Caudex 5 to 10 meters high, up to 15 cm. thick; stipe short, yellowish brown, short-aculeate; blades 2 to 4 meters long, elongate-lanceolate, the primary rachis sparingly hirsute with gland-tipped, laxly unciform, septate hairs, scabrous from their persistent inflated bases; pinnae oblong-lanceolate, acuminate, 45 to 60 cm. long, 14 to 20 cm. broad; pinnules 25 to 30 pairs, linear, attenuate, 10 to 15 mm. broad, sessile; segments narrowly oblong, subfalcate, herbaceous, deeply crenate-serrate, the teeth bidentate.

4. *DICKSONIA* L'Hér. Sert. Angl. 30. 1788.

REFERENCE: Maxon, The North American tree ferns of the genus *Dicksonia*, Contr. U. S. Nat. Herb. 17: 153-156. 1913.

Caudex erect, 1 to 10 meters high or more, stout, often with a thick growth of adventitious roots toward the base, greatly thickened above by the long-persistent stipe bases of old fronds; fronds numerous, rigidly ascending in a terminal crown, the short stout stipes and the summit of the caudex with a copious covering of bright brown to ferruginous silky capillary scales, these straight or matted, several cm. long, one cell broad; lamina ovate to oblanceolate, 2 to 3-pinnate; pinnae mostly equilateral, the pinnules elongate; segments coriaceous or rigidly herbaceous, dimorphous or (in our species) uniform; veins simple or several times forked; sori terminal; indusium bivalvate, the outer lip consisting of a deeply concave, rounded, greenish, scarcely modified lobule of the leaf margin, the inner lip dark or yellowish brown, deeply concave, usually coriaceous and equaling the outer lip.

1. *Dicksonia ghiesbreghtii* Maxon, Contr. U. S. Nat. Herb. 17: 155. 1913.

Temperate mountain region of Chiapas, the type collected by Ghiesbreght.

Caudex 4 to 5 meters high; blades essentially tripinnate; primary pinnae linear-oblong, acuminate, 60 to 70 cm. long, about 20 cm. broad, the rachis slightly rough from the abrasion of the articulate, turgid, dirty yellow, capillary scales; pinnules numerous, contiguous, alternate, sessile, linear-oblong, long-acuminate, the costa with a few capillary scales beneath; segments 20 pairs or more, linear-oblong, straight or subfalcate, 10 to 15 mm. long, the sterile ones serrate to obliquely incised, the fertile ones pinnatifid two-thirds the distance to the elevated costule; veins 7 or 8 pairs, those of the fertile segments usually once forked; sori mostly 4 or 5 pairs, 1 mm. broad.

5. **CIBOTIUM** Kaulf. Berlin, Jahrb. Pharm. 21: 53. 1820.

REFERENCE: Maxon, The American species of Cibotium, Contr. U. S. Nat. Herb. 16: 54-58. pl. 30-32. 1912.

Caudex stout, 1 to 8 meters high, sometimes from its covering of adventitious roots and old stipe bases attaining a diameter of nearly one meter; fronds erect-arching, the stout stipes and upper caudex clothed with capillary scales as in *Dicksonia*; blades ample, of an ovate-deltoid type, bipinnate to tripinnate-pinnatifid, the rachises smooth or nearly so, glabrescent; pinnae mostly inequilateral, the distal pinnules much longer than the proximal ones; pinnules similarly inequilateral, deltoid-oblong to linear, asymmetrical; under surfaces pruinose to ceraceo-papillate, glabrous, hairy, or rarely subfurfuraceous; veins oblique, the fertile ones usually simple; sori terminal, essentially marginal; indusium deeply bivalvate, the outer lip consisting of a highly differentiated saccate portion of the leaf margin, the inner of an orbicular to linguiform cartilaginous operculum affixed at its base, somewhat reflexed at maturity.

Larger pinnae 40 to 50 cm. long; sori mostly distant, usually extending outward in the plane of the segment, the inner lip of the indusium as large as the outer one; leaf tissue chartaceous-membranous-----1. **C. schiedei**.

Larger pinnae 60 to 80 cm. long; sori contiguous, erect, or the narrower and slightly longer inner lip strongly reflexed at maturity and overlying the costule; leaf tissue rigidly herbaceous-----2. **C. regale**.

1. **Cibotium schiedei** Schlecht. & Cham. Linnaea 5: 616. 1830.

Dicksonia schiedei Baker in Hook. & Baker, Syn. Fil. 50. 1868.

Humid mountain forests of Oaxaca and Veracruz, at 600 to 1,200 meters altitude, the type from Hacienda de la Laguna, Veracruz.

Caudex 1 meter high or less or (according to Galeotti) attaining a height of 4.5 meters; fronds 1.2 to 1.8 meters long, the blade at least 80 cm. broad, pinnae ascending, deltoid-oblong to deltoid-lanceolate, abruptly acuminate; pinnules 28 to 30 pairs, pinnatifid nearly to the costa, the larger distal ones 11 to 16 cm. long; segments 25 to 30 pairs, conspicuously pruinose and ceraceo-papillate beneath.

2. **Cibotium regale** Versch. & Lem. Ill. Hort. 15: under pl. 548. 1868.

Dicksonia regalis Baker in Hook. & Baker, Syn. Fil. ed. 2. 461. 1874.

Mountains of Chiapas, whence it was introduced into cultivation by Ghiesbreght.

Caudex erect, up to 10 meters high, 40 to 50 cm. in diameter, fronds 10 to 12, widely recurved-spreading, up to 4 meters long; blades about 3 meters long, up to 1.5 meters broad; pinnae mostly spreading, deltoid-lanceolate acuminate; pinnules about 35 pairs, pinnatifid nearly to the costa; segments 30 to 35 pairs, conspicuously ceraceo-pruinose beneath.

3. **CYCADACEAE. Cycad Family.**

REFERENCE: A. De Candolle in DC. Prodr. 16²: 522-547. 1864.

Palmlike plants, the leaves pinnate, basal or clustered at the end of a trunk; flowers dioecious, in large thick cones; seeds nutlike.

Many of the species are important as food plants because of their edible fruits or of the starch obtained from the stems. They are often grown for ornament.

Cone scales imbricate in alternate series. Trunk covered by the persistent petioles -----1. **DIOON**.

Cone scales in vertical series.

Cone scales with 2 transverse appendages at the apex; caudex covered with persistent petioles-----2. **CERATUZAMIA.**

Cone scales naked; caudex naked-----3. **ZAMIA.**

1. **DIOON** Lindl. Bot. Reg. 1843: Misc. 59. 1843.

Pinnae entire-----1. **D. edule.**

Pinnae spinulose-denticulate.

Pinnae with numerous teeth on both margins; trunk 2 to 15 meters high.

2. **D. spinulosum.**

Pinnae entire on the lower margin, with few teeth on the upper margin; trunk short-----3. **D. purpusii.**

1. **Dioon edule** Lindl. Bot. Reg. 1843: Misc. 59. 1843.

Zamia maeleni Miquel, Linnaea 18: 97. 1844.

Platyzamia rigida Zucc. Abh. Wiss. Akad. München 4: 23. 1845.

Dioon imbricatum Miquel, Wiss. Tijdschr. 1: 36. 1848.

Dioon angustifolium Miquel, Wiss. Tijdschr. 1: 37. 1848.

Dioon aculeatum Lem. Ill. Hort. Lem. 2: Misc. 91. 1855.

Dioon edule latipinna Dyer in Hemsl. Biol. Centr. Amer. Bot. 3: 191. 1883.

Nuevo León, Tamaulipas, San Luis Potosí, and Veracruz; described from cultivated plants.

Plants with a trunk 1 to 2 meters high; leaves 1 to 1.5 meters long, woolly when young, with about 200 pinnae, these linear-lanceolate, sharp-pointed; staminate cones cylindrical, 20 to 30 cm. long; pistillate cones ovoid, 20 to 30 cm. long. "Chamal" (Nuevo León, Tamaulipas, San Luis Potosí); "sotol" (Tamaulipas); "palma de la virgen" (Sinaloa; in market); "palma de macetas" (Durango; cultivated).

The large chestnut-like seeds contain much starch, and are roasted or boiled and eaten. They are a favorite food of bears, peccaries, and domestic swine. A decoction of the seeds is said to be used for neuralgia. The staminate inflorescences are claimed to be poisonous to cattle, causing emaciation and partial paralysis. The plant is often seen in cultivation.

2. **Dioon spinulosum** Dyer; Eichl. Gart. Zeit. 1883: 411. 1883.

Reported from Veracruz and Yucatán.

Said to attain a height of 15 meters, although often much lower; leaves numerous, spreading, 1 to 2 meters long, with very numerous pinnae.

3. **Dioon purpusii**¹ Rose, Contr. U. S. Nat. Herb. 12: 260. 1909.

In shaded canyons, Puebla and Oaxaca; type from Tomellín Canyon, Oaxaca.

Trunk short; leaves numerous, a meter long or larger, stiff, ascending; pinnae 5 to 9 cm. long; staminate cones 15 to 20 cm. long; fertile cones about 45 cm. long and 20 cm. thick. "Chamal" (Oaxaca).

A plant with similar leaves, probably of the same species, has been collected in Tepic. Another similar plant, with glaucous leaves, is in cultivation in Sonora.

¹ Named for C. A. Purpus, who has made extensive collections in Mexico in recent years, especially in Baja California, San Luis Potosí, Veracruz, Puebla, and Chiapas. His collections have included many plants previously unknown, most of which have been described by Brandegee. Sets of his collections are in the U. S. National Herbarium.

2. CERATUZAMIA Brongn. Ann. Sci. Nat. III. 5: 7. 1846.

The plants of this genus are very imperfectly known and are rarely collected. Some of them are seen occasionally in cultivation.

Petioles unarmed; pinnae about 1.3 cm. wide.....1. *C. kusteriana*.

Petioles aculeate; pinnae 1.8 to 7.5 cm. wide.

Pinnae few (about 5 pairs), semiobovate.....2. *C. miqueliana*.

Pinnae numerous (15 to 20 pairs), narrowly lanceolate.

Pinnae 10 to 12.5 cm. long, 1.8 to 3.5 cm. wide.....3. *C. latifolia*.

Pinnae 30 to 32 cm. long, about 2.5 cm. wide.....4. *C. mexicana*.

1. *Ceratozamia kusteriana* Regel, Bull. Soc. Nat. Moscou 1857: 187. 1857.

Introduced into cultivation from Mexico, the locality not stated.

Trunk short; leaves about 1.5 meters long, tomentose at first, with about 40 pinnae; staminate cones about 8 cm. long, short-pedunculate.

2. *Ceratozamia miqueliana* Wendl. Ind. Palm. 68. 1854.

Mexico, the locality not stated.

Leaves about a meter long, glaucous when young; pinnae 20 to 22.5 cm. long, about 7 cm. wide.

3. *Ceratozamia latifolia* Miquel, Wiss. Tijdschr. 1: 206. 1848.

Described from Mirador, Veracruz.

4. *Ceratozamia mexicana* Brongn. Ann. Sci. Nat. III. 5: 7. 1846.

?*Zamia galeottii* Vriese, Tijdschr. Nat. Gesch. 1845: 23. 1845.

Ceratozamia longifolia Miquel, Wiss. Tijdschr. 1: 40. 1848.

Ceratozamia intermedia Miquel, Wiss. Tijdschr. 1: 40. 1848.

Ceratozamia robusta Miquel, Wiss. Tijdschr. 1: 42. 1848.

Veracruz.

Trunk short, ovoid; leaves about a meter long; staminate cones about 10 cm. long and 4 cm. thick. "Palma" (*Ramírez*).

3. ZAMIA L. Sp. Pl. 165. 1753.

Several other species besides those listed here have been reported from Mexico, but their status is altogether doubtful. The species of the genus are known very imperfectly. The Indians of Florida used the starch extracted from the stems of the species of that region as a food known as coontie.

Pinnae oblanceolate or obovate-oblong.....1. *Z. furfuracea*.

Pinnae linear to lanceolate.

Nerves of the pinnae few (7 to 10).....2. *Z. spartea*.

Nerves of the pinnae numerous (18 to 30 or more).

Pinnae few (about 16), usually entire.....3. *Z. cycadifolia*.

Pinnae numerous (28 to 50 or more), more or less serrulate.

Pinnae obtuse or truncate at the apex.....4. *Z. leiboldii*.

Pinnae acute or attenuate.

Pinnae about 0.8 cm. wide.....5. *Z. lawsoniana*.

Pinnae 1.5 to 3 cm. wide.....6. *Z. loddigesii*.

1. *Zamia furfuracea* L. f.; Ait. Hort. Kew. 3: 477. 1789.

Veracruz; introduced into cultivation in England as early as 1691.

Trunk 30 to 60 cm. long or obsolete; pinnae 20 to 26; pistillate cones 5 to 10 cm. long, yellow.

2. *Zamia spartea* A. DC. in DC. Prodr. 16²: 539. 1864.

Type from Acayucan, Veracruz. Guatemala.

Leaves about 30 cm. long, the petioles aculeolate; pinnae about 40, 25 to 30 cm. long, 4 to 5 mm. wide.

Reported (A. DC., loc. cit.) to be used as a remedy for snake bites.

3. *Zamia cycadifolia* Dyer in Hemsl. Biol. Centr. Amer. Bot. 3: 195. 1883.

Described from Mexico, probably from Veracruz.

Leaves bright green; pinnae linear, 12.5 to 20 cm. long, 6 to 12 mm. wide.

4. *Zamia leiboldii* Miquel, Linnaea 19: 427. 1845.

Described from Colipa, Veracruz.

Trunk very short; petioles 20 to 30 cm. long, the pinnae 28 to 44, 15 to 28 cm. long, 10 to 12 mm. wide; pistillate cone 5.5 cm. long.

5. *Zamia lawsoniana* Dyer in Hemsl. Biol. Centr. Amer. Bot. 3: 195. 1883.

Oaxaca.

Pinnae 50 or more, 22 cm. long or shorter, 8 mm. wide; staminate cone 6.5 cm. long, 2.5 cm. thick.

6. *Zamia loddigesii* Miquel, Tijdsch. Nat. Gesch. 10: 73. 1843.

Zamia mexicana Miquel, Prodr. Cycad. 13. 1861.

Southern Mexico, the locality not indicated. Guatemala.

Pinnae about 19 cm. long.

4. TAXACEAE. Yew Family.

1. TAXUS L. Sp. Pl. 1040. 1753.

1. *Taxus globosa* Schlecht. Linnaea 12: 496. 1838.

Forests of Veracruz, Hidalgo, Mexico, and Oaxaca; type from Real del Monte, Hidalgo.

Tree, 6 meters high or probably larger; leaves linear, cuspidate, 2 to 3.5 cm. long; seed nutlike, seated in a fleshy red cup-shaped disk.

The other North American species of yew have hard strong elastic close-grained reddish wood, with a specific gravity of about 0.64. The leaves and seeds of the various species contain a poisonous alkaloid, taxine; the bark is rich in tannin.

5. PINACEAE. Pine Family.

Trees or shrubs; leaves usually evergreen, alternate, opposite, verticillate, or fasciculate; flowers monoecious or dioecious; fruit a dry or somewhat fleshy cone, composed of few or numerous scales.

Leaves fasciculate (rarely solitary), with a sheath at the base.....1. **PINUS.**

Leaves solitary, without a sheath.

Leaves linear, 1 cm. long or larger.

Cones globose, with few thick scales; leaves deciduous...4. **TAXODIUM.**

Cones elongate, with numerous thin scales; leaves persistent.

Cones pendulous, the scales persistent.....2. **PSEUDOTSUGA.**

Cones erect, the scales deciduous.....3. **ABIES.**

Leaves scalelike, mostly 3 mm. long or shorter.

Fruit baccate, indehiscent.....5. **JUNIPERUS.**

Fruit a dry cone, dehiscent.

Leaves opposite; cone scales peltate.....6. **CUPRESSUS.**

Leaves in whorls of 4; cone scales oblong, not peltate.

7. **LIBOCEDRUS.**

1. PINUS L. Sp. Pl. 1000. 1753.

REFERENCE: G. R. Shaw, The pines of Mexico, pp. 1-29. *pl.* 1-22. 1909.

The pines are perhaps the most important genus of North American trees. They are certainly the most important group of lumber trees, the wood, varying

in quality in different species, being used for almost every purpose for which wood is commonly employed. In the mountains of Mexico large quantities of pine lumber are sawed and much is exported.

The resinous juice is of great economic importance, being the source of turpentine, resin, tar, and other products. When the juice, which is obtained by tapping the trees, is distilled, oil or spirits of turpentine is produced. This has many well-known uses in the arts and in medicine. The residue left from the distillation is the resin of commerce. By crude distillation of the wood, pine tar is obtained, with a residue of charcoal. Tar subjected to distillation yields oil of tar and a thick residue known as naval pitch.

Pine wood is used extensively in Mexico for fuel. Bundles of splinters of pitch pine to be used in starting fires are seen commonly in the markets. Some of the North American Indians in times of famine have used the sapwood and inner bark for food, and they have also employed strips of the inner bark for making baskets. Some tribes still use resin to waterproof baskets and jars of wickerwork.

Pine leaves are sometimes mixed in adobe bricks in place of straw. The leaves are very tough, and the longer ones occasionally serve as a substitute for twine. The branches are employed in some localities for thatching. A volatile oil obtained from the leaves is used in medicine, and pine tar also is employed medicinally. The cones are used in place of combs by some of the Indian tribes.

The pines are often planted for ornamental purposes, and some of the Mexican species have been cultivated in Europe, although few of them thrive there. *Pinus halepensis* Mill. and *P. pinea* L., European species, are said to be cultivated in Mexican parks.

In Mexico pines are most generally known under the names "pino" (Spanish) and "ocote," the latter a corruption of the Nahuatl "ocotl." Besides the vernacular names listed under the various species, the following names are applied to Mexican pines, although it is uncertain to which species they belong: "Pino barbón" (Durango); "pino triste" (Durango); "pino de azúcar" (Durango; "perhaps *P. ayacahuite*"); "pino prieto" (Durango, Sinaloa); "guiri-biche" (Oaxaca, Zapotec, *Reko*).

In 1857 there was published in the City of Mexico a "Catalogue de Graines de Conifères Méxicains" by B. Roezl & Cia. In this 82 new species of Mexican pines were described, nearly all from the Valley of Mexico. The most competent students of the genus have concluded that all these new names are properly referable to earlier published species. It does not seem necessary to list the numerous names in synonymy here, but those who wish to refer to them will find them tabulated in Shaw's monograph referred to above.

Leaves 1 or 2 in a fascicle.

Leaves solitary-----1. *P. monophylla*.

Leaves 2 in a fascicle.

Leaf sheaths deciduous; leaves 2 to 4 cm. long-----2. *P. edulis*.

Leaf sheaths persistent; leaves 3 to 8 cm. long-----26. *P. contorta*.

Leaves 3 or more in a fascicle.

Leaves 4 to 5 cm. long or shorter.

Leaves 3 in a fascicle-----3. *P. cembroides*.

Leaves 4 in a fascicle-----4. *P. quadrifolia*.

Leaves 6 cm. long or longer.

Leaves 15 to 40 cm. long.

Sheaths of the leaves deciduous.

Leaves in fascicles of 5; cones 20 to 45 cm. long-----7. *P. ayacahuite*.

Leaves in fascicles 3; cones 5 to 7 cm. long-----13. *P. lumholtzii*.

Sheaths of the leaves persistent.

Cones usually deciduous, dull or sublustrous.

Cones 4 to 5 cm. long.

Leaves bright green-----14. *P. teocote*.

Leaves glaucous-----15. *P. lawsoni*.

Cones mostly 8 to 30 cm. long.

Leaves in fascicles of 3 or 4; cones 6 to 12 cm. long.

Sheaths deciduous-----12. *P. chihuahuana*.

Sheaths persistent.

Cones deciduous, dull.

Cones 7 cm. long or shorter-----14. *P. teocote*.

Cones 6 to 12 cm. long-----18. *P. hartwegii*.

Cones persistent, sublustrous.

Leaves 8 to 13 cm. long; cones 4 to 8 cm. long; resin ducts uniting hypoderm and endoderm of the leaves.

23. *P. oocarpa*.

Leaves 7 to 10 cm. long; cones 6 to 12 cm. long; resin ducts medial-----24. *P. greggii*.

Leaves in fascicles of 5.

Cones 4 to 12 cm. long.

Sheaths deciduous-----11. *P. leiophylla*.

Sheaths persistent.

Leaves 18 to 28 cm. long. Cones persistent, lustrous.

23. *P. oocarpa*.

Leaves 7 to 18 cm. long.

Cones deciduous, dull-----18. *P. hartwegii*.

Cones persistent, lustrous-----20. *P. arizonica*.

Cones 10 to 45 cm. long.

Leaves 10 to 20 cm. long-----7. *P. ayacahuite*.

Leaves less than 10 cm. long.

Leaves entire. Seed wings rudimentary-----8. *P. flexilis*.

Leaves serrulate.

Prickles of the cone scales weak and deciduous.

Bark of young trees smooth-----16. *P. pseudostrobus*.

Bark of young trees rough-----17. *P. montezumae*.

Prickles of the cone scales stout and persistent.

19. *P. ponderosa*.

Cones persistent, very lustrous.

Resin ducts of the leaves uniting the hypoderm and endoderm.

23. *P. oocarpa*.

Resin ducts of the leaves internal or medial.

Resin ducts of the leaves internal.

Cone scales without upcurved spines-----21. *P. pringlei*.

Cone scales with strongly upcurved spines-----22. *P. coulteri*.

Resin ducts medial-----25. *P. patula*.

Leaves up to 15 cm. long, usually shorter.

Seeds not winged. Leaves in fascicles of 3.

Sheaths of the leaves deciduous; leaves entire-----5. *P. pinceana*.

Sheaths persistent; leaves serrulate-----6. *P. nelsoni*.

Seeds winged.

Seed wing well developed; cones 25 to 45 cm. long.

9. *P. lambertiana*.

Seed wing rudimentary; cones 10 to 25 cm. long-----10. *P. reflexa*.

1. *Pinus monophylla* Torr. in Frém. Rep. Exped. Rocky Mount. 319. *pl.* 4. 1845.

Pinus cembroides monophylla Voss, Mitt. Deutsch. Dendr. Ges. 16: 95. 1907.

Mountains of Northern Baja California. Southern California (type locality) to Utah.

Tree, usually 7 meters high or less, but sometimes attaining a height of 15 meters and a trunk diameter of 30 cm.; trunk short, often branched near the base, the bark deeply and irregularly fissured, dark reddish brown; leaves about 4 cm. long, pale green; cones 4 to 6.5 cm. long, light reddish brown, shining, the scales few, thick; seeds about 1.5 cm. long; wood soft, brittle, weak, close-grained, yellow to light brown, its specific gravity about 0.56. "Piñón" (California, Arizona).

The wood is used for fuel and for charcoal for smelters. The seeds are edible, either raw or roasted, and they are sometimes ground into meal.

2. *Pinus edulis* Engelm. in Wislitz. Mem. North. Mex. 88. 1848.

Pinus cembroides edulis Voss, Mitt. Deutsch. Dendr. Ges. 16: 95. 1907.

Dry mountain sides, Baja California, at an altitude of about 1,800 meters; perhaps also in northern Chihuahua. Western Texas to Arizona and Wyoming; type from New Mexico.

Sometimes reaching a height of 12 meters and a trunk diameter of 75 cm., but usually smaller; trunk short, often divided to the base, the bark brown, irregular fissured; leaves 1.8 to 4 cm. long, green; cones about 4 cm. long, the few scales very thick; seeds brown, about 1.2 cm. long; wood soft, weak, brittle, close-grained, pale brown, the specific gravity about 0.64. "Piñón" (New Mexico, Arizona, etc.).

In the United States the wood is used for fencing, fuel, and charcoal, and is sometimes sawed into boards, although it is only rarely suitable for lumber. Pinyon seeds are an important article of food in New Mexico and Arizona, largely taking the place filled by peanuts in other parts of the United States. They were a staple food, also, of the Indians. In New Mexico they are sometimes gathered in such large quantities as to be used for horse feed. The nuts are sometimes exported to other regions, and have been used in making confectionery.

3. *Pinus cembroides* Zucc. Abh. Akad. Wiss. Muenchen 1: 392. 1832.

Pinus llaveana Schiede, Linnaea 12: 488. 1838.

Pinus osteosperma Engelm. in Wislitz. Mem. North. Mex. 89. 1848.

Low mountains, Chihuahua to Baja California, southward to Hidalgo. Southern Arizona and New Mexico.

Bushy tree, usually about 6 meters high, with a trunk diameter of 30 cm., but sometimes much larger; bark reddish brown, irregularly fissured; leaves 2.5 to 5 cm. long, dark green; cones 3 to 5 cm. in diameter, reddish brown; seeds 8 to 10 mm. long; wood soft, close-grained, yellow, its specific gravity about 0.65. Known generally as "piñón" or "pino piñón," the seeds as "piñones."

The seeds are eaten in all regions where the nut pine grows, and are highly esteemed. They are very palatable raw, but are improved by roasting, after which they possess a flavor unexcelled, perhaps, by that of any kind of nut. The seeds are placed in the mouth and the thin shells are cracked with the teeth and ejected without being touched by the fingers, an operation in which one may become very proficient by a little practice. The nuts are often added to candies.

4. *Pinus quadrifolia* Parry; Parl. in DC. Prodr. 16²: 402. 1868.

Pinus parryana Engelm. Amer. Journ. Sci. II. 34: 332. 1862. Not *P. parryana* Gord. 1858.

Mountains of Baja California, at low elevations. Southern California; type from mountains east of San Diego.

Tree, sometimes 12 meters high, with a trunk 45 cm. in diameter, the lower branches often touching the ground; bark dark reddish brown, shallowly fissured; leaves 3.5 to 4.5 cm. long, pale green; cones 4 to 6 cm. long, brown and shining; seeds about 1.5 cm. long; wood soft, close-grained, yellow or pale brown, its specific gravity about 0.57. "Piñón" (California).

The seeds are eaten like those of the other nut pines.

5. *Pinus pinceana* Gord.; Gord. & Glend. Pinet. 204. 1858.

Pinus latisquama Engelm. Gard. Chron II. 18: 712. 1882.

Coahuila to Hidalgo; type said to have come from Cuernavaca, but if so it was probably taken from a cultivated tree.

Low tree with short trunk, the branchlets long, slender, pendent; leaves 12 to 16 cm. long, grayish green; cones 6 to 9 cm. long, pendent, early deciduous.

In the original description the tree is said to reach a height of 18 meters, but it is usually much lower.

6. *Pinus nelsoni*¹ Shaw, Gard. Chron. III. 36: 122. f. 49. 1904.

Nuevo León, on lower slopes of the mountains; type from Miquihuana.

Low tree, 8 to 10 meters high, with long slender branches, these clothing the trunk to the ground; leaves 6 to 9 cm. long, grayish green.

Shaw reports that the nuts are eaten greedily by macaws, and are sometimes found in the markets for human food.

7. *Pinus ayacahuite* K. Ehrenb. Linnaea 12: 492. 1838.

Pinus strobiformis Engelm. in Wislitz. Mem. North. Mex. 102. 1848.

Pinus veitchii Roezl, Cat. Conif. Mex. 32. 1857.

Pinus bonaparteae Roezl, Gard. Chron. 1858: 358. 1858.

Pinus loudoniana Gord.; Gord. & Glend. Pinet. 230. 1858.

Chihuahua to Mexico, Guerrero, and Chiapas; type from Omitlán, Hidalgo. Guatemala.

Large tree; leaves 10 to 20 cm. long; cones 20 to 45 cm. long, pendent, pale yellowish or reddish brown, usually dull; seeds with a large wing, or this rarely almost obsolete. "Acanita" (Coahuila); "acalocahuite" (Veracruz, Ramírez); "ayacahuite" (Valley of Mexico, Oaxaca, etc.); "ocote blanco" (Oaxaca); "ayacahuite colorado" (Hidalgo, Mexico, Ramírez); "sacalacahuite" (various localities, Ramírez); "pino real" (Oaxaca, Reko); "pino acahuite" or "pino cahuite" (Durango, Patoni).

8. *Pinus flexilis* James in Long, Exped. 2: 34. 1823.

Mountains of Coahuila. Northward along the Rocky Mountains to Alberta; type from the Rocky Mountains.

Tree, sometimes 15 meters high, with a trunk 1.5 meters thick, the crown conic or in age rounded; bark dark brown or nearly black, deeply fissured into broad ridges and scaly plates; leaves about 5 cm. long (rarely 9 cm.); cones 7.5 to 25 cm. long, light brown, with thin scales; seeds 8 to 12 mm. long, winged; wood soft, close-grained, pale yellow or reddish. its specific gravity about 0.43.

The wood of the limber pine is used to some extent in the United States for construction purposes. The seeds are edible.

¹ Named for E. W. Nelson (1855-), Chief of the Bureau of Biological Survey, U. S. Department of Agriculture. Mr. Nelson has traveled very extensively in Mexico, while engaged in investigations of the biological features of the country. He has obtained a very large series of botanical specimens, which are in the U. S. National Herbarium.

9. *Pinus lambertiana* Dougl. Trans. Linn. Soc. Bot. 15: 500. 1827.

San Pedro Mártir Mountains of Baja California, at elevations of 2,250 meters or more. Northward to Oregon; type from the Umpqua River.

The largest of North American pines (probably of all pines), in the northern part of its range sometimes attaining a height of 70 meters and a trunk diameter of 4 meters, trees of still larger dimensions having been reported; bark brown or red-brown, fissured into long plates, on young trees smooth; cones pendulous; seeds broadly winged; wood light brown, soft, its specific gravity about 0.37.

In the United States (where the tree is known as sugar pine) the wood is used for shingles, barrels, general construction, etc.

10. *Pinus reflexa* Engelm. Bot. Gaz. 7: 4. 1882.

Pinus flexilis reflexa Engelm.; Rothr. in Wheeler, Rep. U. S. Surv. 100th Merid. 6: 258. 1878.

Mountains of northern Chihuahua. Arizona (type from Santa Rita Mountains) and New Mexico.

Tree, sometimes 30 meters high and with a trunk diameter of 60 cm., the branches slender and somewhat drooping; bark brown or reddish brown, deeply fissured; leaves light green; wood hard, strong, reddish white, its specific gravity about 0.49.

11. *Pinus leiophylla* Schlecht. & Cham. Linnaea 6: 354. 1831.

Zacatecas to Veracruz and Oaxaca; type from Michoacán.

Tree, 15 to 27 meters high; bark thin, at first, red, soon becoming very coarse and rough; leaves 10 to 14 cm. long, grayish green; cones maturing the third year, 7 cm. long or shorter, persistent. The names "ocote blanco" and "ocote chino" are said to be applied to this species.

12. *Pinus chihuahuana* Engelm. in Wislitz. Mem. North. Mex. 103. 1848.

Chihuahua to Zacatecas and Tepic; type from mountains of Chihuahua. Southern Arizona and New Mexico.

Tree, sometimes 20 meters high, with a trunk 90 cm. in diameter; bark thick, dark reddish or nearly black, deeply fissured into broad flat ridges; leaves 6 to 10 cm. long, pale green; cones 4 to 6 cm. long, ripening the third year, brown and shining; wood soft and brittle but durable, close-grained, orange, its specific gravity about 0.54.

13. *Pinus lumholtzii*¹ Robins. & Fern. Proc. Amer. Acad. 30: 122. 1894.

In the mountains, Chihuahua to Zacatecas and Tepic; type from Coloradas, Chihuahua.

Tree with broad rounded crown and slender, somewhat pendent branches; bark at first thin, separating into deciduous scales, in age coarse and thick; leaves 20 to 30 cm. long, bright green, pendent; cones pendent, dull pale brown. "Pino triste."

A decoction of the leaves is employed by the Indians for stomach troubles. The wood is used for musical instruments, and for other purposes.

14. *Pinus teocote* Schlecht. & Cham. Linnaea 5: 76. 1830.

Pinus teocote macrocarpa Shaw, Pines Mex. 17. 1909.

Nuevo León to Tepic and Chiapas; type from Mount Orizaba.

Tree, 20 to 35 meters high; bark at first thin, red, deciduous, in age thick and rough; leaves 10 to 20 cm. long; cones spreading or reflexed, brown or

¹Named for Carl Lumholtz (1851-), a native of Norway, who has conducted extensive investigations of the ethnological features of Mexico, especially in the northern ranges of the Sierra Madre. Upon some of his expeditions botanical collections were obtained.

sublustrous. The following names are said to be applied to the tree in various localities: "Jalocote," "xalócotl" (Nahuatl), "ocote," "ocotl," "pino real."

The tree produces turpentine ("ocotzol," "trementina de pino," "trementina de ocote") which is used in medicine as a balsamic stimulant, and for other purposes for which turpentine is generally employed. The tar ("brea") remaining after the distillation of turpentine is used for making torches, in soap, etc.

15. *Pinus lawsoni* Roehl; Gord. & Glend. Pinet. App. 64. 1862.

Pinus altamirani Shaw; Sarg. Trees & Shrubs 1: 209. 1905.

Michoacán and Morelos to Oaxaca, growing at subtropical levels.

Tree, 20 to 25 meters high, the branchlets with a white bloom; leaves 24 cm. long or shorter, glaucous; cones usually 5 to 6 cm. long, reflexed, deciduous, dull yellowish brown. "Ocote" (Oaxaca).

16. *Pinus pseudostrobus* Lindl. Bot. Reg. 25: Misc. 63. 1839.

Pinus apulcensis Lindl. Bot. Reg. 25: Misc. 63. 1839.

Pinus tenuifolia Benth. Pl. Hartw. 92. 1842.

Pinus orizabae Gord. Journ. Hort. Soc. Lond. 1: 237. 1846.

Durango and Sinaloa to Veracruz and Chiapas, chiefly at subtropical levels; type from Orizaba. Guatemala and Nicaragua.

Large tree, the trunk sometimes nearly 2 meters in diameter; bark smooth at first, becoming very rough in old age, the branches slender, verticillate; leaves 15 to 30 cm. long, pendent; cones 7 to 14 cm. long, early deciduous. "Pino real" (Durango, *Patoni*).

17. *Pinus montezumae* Lambert, Descr. Pinus ed. 3. 1: 39. 1839.

Pinus devoniana Lindl. Bot. Reg. 25: Misc. 62. 1839.

Pinus russelliana Lindl. Bot. Reg. 25: Misc. 63. 1839.

Pinus macrophylla Lindl. Bot. Reg. 25: Misc. 63. 1839.

Pinus filifolia Lindl. Bot. Reg. 26: Misc. 61. 1840.

Pinus grenvilleae Gord. Journ. Hort. Soc. Lond. 2: 77. 1847.

Pinus gordoniana Hartw. Journ. Hort. Soc. Lond. 2: 79. 1847.

Pinus winchesteriana Gord. Journ. Hort. Soc. Lond. 2: 158. 1847.

Pinus lindleyana Gord.; Gord. & Glend. Pinet. 229. 1858.

In the mountains, Durango and Zacatecas to Chiapas. Guatemala.

Tree, 15 to 20 or even 30 meters high; leaves 10 to 45 cm. long; cones sub-cylindric, 6 to 25 cm. long, deciduous, brown or nearly black, dull. Reko states that the following names are applied in Oaxaca: "Ocote blanco," "pino de Montezuma," "yutnusatnu" (Mixtec). The following names are said to be applied in various regions: "Ocote," "ocotl," "pino real," "pino blanco," "ocote hembro," "ocote macho."

18. *Pinus hartwegii*¹ Lindl. Bot. Reg. 25: Misc. 62. 1839.

Pinus rudis Endl. Syn. Conif. 151. 1847.

Pinus ehrenbergii Endl. Syn. Conif. 151. 1847.

¹Karl Theodor Hartweg (1812-1871) was born at Karlsruhe, Germany. In 1836 he was sent by the Horticultural Society of London to Mexico to collect living plants and seeds for introduction into England. He reached Veracruz in December, 1836, and made collections about Santa Fé and Zacuapan. Later he visited Guanajuato, Aguascalientes, Jalisco, Hidalgo, and San Luis Potosí. In 1838 he spent two months at Morelia, and in 1839 he botanized in Oaxaca. Later he visited California, Guatemala, and the Andes of South America. His collections, which included many new species, were described by Bentham in a work entitled "Plantae Hartwegianae" (1839-42).

Durango to Nuevo León and Chiapas, growing on the mountains up to timber line; type from mountains of Campanario, at 2,700 meters.

Tree, 13 to 45 meters high; leaves 7 to 15 cm. long, glaucous; young cones blue or sooty black, the mature ones 6 to 12 cm. long, brown or nearly black, dull or lustrous. "Ocote" (Chiapas).

19. *Pinus ponderosa* Dougl.; P. Laws. Agr. Man. 354. 1836.

Pinus macrophylla Engelm. in Wislitz. Mem. North. Mex. 103. 1848.

Pinus jeffreyi Murray, Bot. Exped. Oreg. 2. pl. 1. 1853.

Pinus engelmanni Carr. Rev. Hort. 227. 1854.

In the mountains at middle elevations, Chihuahua to Durango and Baja California. Widely distributed in the western United States and Canada; type from Washington.

Large tree, sometimes 70 meters high, with a trunk diameter of 2.4 meters, but usually smaller, the trunk tall and naked, the bark pale reddish brown, broken into large plates; leaves 7.5 to 40 cm. long, yellowish green; cones 6 to 19 cm. long, early deciduous, reddish brown, lustrous; wood hard and strong but brittle, close-grained, pale and reddish brown or yellow, very resinous, its specific gravity 0.48 to 0.52. "Pino real" (Durango); "pinabete" (New Mexico).

The western yellow pine is an important source of lumber in northern Mexico and the southern Rocky Mountains. The wood is used for railroad ties, fencing, and all kinds of construction purposes.

20. *Pinus arizonica* Engelm.; Rothr. in Wheeler, Rep. U. S. Surv. 100th Merid. 6: 260. 1878.

Mountains of Chihuahua and Nuevo León. Southern Arizona (type from the Santa Rita Mountains) and New Mexico.

Tree, sometimes 30 meters high, with a trunk 1.2 meters in diameter; branches stout, spreading; bark reddish brown, broken into large irregular plates; leaves dark green; wood soft, weak, rather brittle, close-grained, light red or yellowish, very resinous, its specific gravity about 0.50.

An important source of lumber in the mountains of northern Mexico.

21. *Pinus pringlei* Shaw; Sarg. Trees & Shrubs 1: 211. 1905.

Michoacán, Guerrero, and Morelos, at subtropical levels; type from Uruapan, Michoacán.

Large tree with long sinuous branches; leaves 15 to 25 cm. long, bright green; cones 5 to 10 cm. long, pendent or spreading, ocher-yellow, lustrous.

22. *Pinus coulteri*¹ Lambert; Don, Trans. Linn. Soc. Bot. 17: 440. 1837.

On mountain tops, Baja California. California; type from Santa Lucia Mountains.

Tree, sometimes 21 meters high, with a trunk 1.2 meters in diameter; bark dark brown or nearly black, deeply fissured; leaves 15 to 35 cm. long, dark bluish green; cones 25 to 35 cm. long, 10 to 13 cm. thick, pendent, light yellowish brown; wood soft, weak, brittle, coarse-grained, light red, resinous, its specific gravity about 0.41.

¹Thomas Coulter (1793–1843) came to Mexico in 1825 as physician for a mining company in Hidalgo. He remained there for a number of years and made collections of plants. From 1831 to 1833 he explored Alta California (now chiefly included in the State of California) and later Sonora, being the first collector who forwarded to Europe collections from the latter region. His collections were sent to Trinity College, Dublin, from which institution they were distributed to various herbaria. A few of his plants are in the U. S. National Herbarium.

23. *Pinus oocarpa* Schiede, Linnaea 12: 491. 1838.

Sinaloa to Zacatecas and Chiapas; type collected between Ario and Volcán de Jorullo, Michoacán. Guatemala.

Tree, 12 to 15 meters high, with round compact head and stout branches; leaves 18 to 28 cm. long, bright green; cones 4 to 8 or sometimes 10 cm. long, persistent, pendent or spreading, ocher-yellow, often tinged with gray or green. "Ocote" (Oaxaca); "pino real" (Tepic); said to be known also as "ocote macho."

Pinus oocarpa microphylla Shaw¹ is a form from Sinaloa and Tepec with leaves only 8 to 13 cm. long.

24. *Pinus greggii*² Engelm.; Parl. in DC. Prodr. 16²: 396. 1868.

Mountains of Coahuila; type collected near Saltillo.

Tree, 10 to 15 meters high, with smooth gray bark when young; leaves bright green, erect; cones reflexed, ocher-yellow, lustrous.

25. *Pinus patula* Schlecht. & Cham. Linnaea 6: 354. 1831.

Querétaro to Veracruz and Puebla; type collected between Lerma and Toluca, Mexico.

Tree, 12 to 25 meters high, with long slender branches, the upper part of the trunk red; leaves 15 to 30 cm. long, slender, drooping; cones 6 to 9 cm. long, reflexed, persistent, dark brown.

26. *Pinus contorta* Dougl.; Loud. Arb. Frut. 4: 2292. 1830.

San Pedro Mártir Mountains of Baja California, at an altitude of about 2,400 meters. Northward to Alaska.

In the Mexican locality 22 to 30 meters high or larger, with straight trunk and narrow tapering crown; bark very thin, smooth, orange-brown; leaves 3 to 8 cm. long, stiff, yellowish green; cones 5 to 6 cm. long, ocher-brown, lustrous; wood soft, weak, close-grained, light yellow or whitish, with little resin, its specific gravity about 0.41.

2. PSEUDOTSUGA Carr. Trait. Conif. ed. 2. 256. 1867.

REFERENCES: Britton, N. Amer. Trees 69-73. f. 55, 56. 1908; Sudworth, For. Trees Pacif. Slope 99-106. f. 36, 37. 1908.

Trees with linear leaves 2 to 3 cm. long; cones ovoid-oblong, drooping, the bracts lobed, exserted beyond the rounded cone scales.

Cones 5 to 10 cm. long; bracts of the cones much exserted_____1. *P. mucronata*.

Cones 10 to 17 cm. long; bracts only slightly exserted_____2. *P. macrocarpa*.

1. *Pseudotsuga mucronata* (Raf.) Sudw. Contr. U. S. Nat. Herb. 3: 266. 1895.

Abies mucronata Raf. Atl. Journ. 120. 1832.

Abies douglasii Lindl. Penny Cycl. 1: 32. 1833.

Pseudotsuga douglasii Carr. Trait. Conif. ed. 2. 256. 1867.

Mountains, at high altitudes, Chihuahua and Sonora to Hidalgo. Northward to southern Canada; type from the mouth of the Columbia River.

¹ Pines Mex. 27. 1909.

² Little is known concerning Josiah Gregg, who was a trader under the patronage of Thomas G. Rockhill, a Philadelphia merchant. He published in 1844 "The Commerce of the Prairies," in which he tells of his travels in the West, and of his residence of nearly nine years in northern Mexico. He made botanical collections in Mexico, and his specimens are chiefly in the herbarium of the Missouri Botanical Garden. He is believed to have died in California in 1850. The genus *Greggia*, of the family Brassicaceae, was named in his honor by Gray.

Tree, in Oregon and Washington sometimes reaching a height of 90 meters, with a trunk diameter of 4.5 meters, but usually smaller; bark thick, deeply fissured; cones purplish at first, yellowish brown when mature; wood hard, light red and coarse-grained or yellowish brown and fine-grained, the specific gravity about 0.51. "Hallarín" (Coahuila); "abeto," "pino de corcho" (Hidalgo); "pinabete," "cahuite," or "acahuite" (Durango); "pino real" (New Mexico).

This tree (known in the United States as Douglas fir) is of the greatest commercial importance in the United States, especially on the Pacific coast, as well as in those portions of Mexico where it is abundant. It furnishes the largest saw timber of any of the North American trees, if not of any trees in the world. The wood is used for all kinds of construction purposes, especially those which require large timbers, such as shipbuilding. It is used also for railroad ties. Large quantities of the lumber are exported from the United States. The bark is sometimes employed for tanning leather. The smaller roots are very uniform in diameter for a length of 2 to 3 meters and have been a favorite material of the California Indians for the manufacture of baskets. It is said that in the same State a decoction of the green leaves has been used by both Indians and white people as a beverage in place of coffee; and a decoction of the spring buds has been employed as a remedy for venereal diseases.

2. *Pseudotsuga macrocarpa* (Torr.) Mayr, Wald. Nordam. 278. 1890.

Abies douglasii macrocarpa Torr. in Ives, Rep. Colo. Riv. 28. 1861.

San Pedro Mártir Mountains, Baja California, at altitudes of 1,500 to 2,100 meters. Southern California, the type from San Diego County.

Similar to preceding species except for the larger cones; tree, sometimes 30 meters high, with a trunk diameter of 1.2 meters; wood hard, strong, close-grained, brown, durable, the specific gravity about 0.45.

3. **ABIES** Hill, Brit. Herb. 509. 1756.

Large conical trees with linear sessile leaves 2 to 6 cm. long; flowers monoecious; cones cylindrical or ovoid, the thin scales falling away from the axis at maturity.

Leaves green and sulcate on the upper surface, slender-----1. *A. religiosa*.

Leaves glaucous and carinate on the upper surface, stout-----2. *A. concolor*.

1. *Abies religiosa* (H. B. K.) Schlecht. & Cham. Linnaea 5: 77. 1830.

Pinus religiosa H. B. K. Nov. Gen. & Sp. 2: 5. 1817.

Abies hirtella Lindl. Penny Cycl. 1: 31. 1833.

In the mountains, up to 3,600 meters, San Luis Potosí to Jalisco and southward; type collected between Mazatlán and Chilpancingo, Guerrero. Guatemala.

Large tree, sometimes 45 meters high (on Orizaba said to be as much as 60 meters high and 6 meters in circumference), occurring mostly at altitudes of 1,200 to 3,450 meters; branchlets hirtellous or glabrate; leaves mostly 2 to 3 cm. long; cones 6 to 15 cm. long. "Abeto" (Valley of Mexico, Oaxaca); "acxoyatl" (Valley of Mexico, Nahuatl); "bansú" (Otomí); "jalocote" (Valley of Mexico); "oyamel" or "oyametl" (Valley of Mexico, Durango, Oaxaca, Nahuatl); "huallame" (Coahuila); "pinabete" (Durango and elsewhere); "guayame" (Nuevo León, *González*); "cipreso" (Guatemala); known also in various localities as "pino," "pino oyamel," or "xalócotl" (Nahuatl).

This fir tree furnishes considerable lumber which is used for various construction purposes, as well as for making paper. The trees are tapped in winter

for the oleoresin which they yield abundantly. This, known as "aceite de palo" or "aceite de abeto," is used in medicine for its balsamic properties, and as an ingredient of paints. The specific name "*religiosa*" was applied to the tree because of the fact that its branches are often used as decorations in churches.

2. *Abies concolor* Lindl. Journ. Hort. Soc. Lond. 5: 210. 1850.

San Pedro Mártir Mountains of Baja California, at altitudes of 2,250 meters or more. New Mexico (type locality) to California and Oregon.

Large tree, sometimes attaining a height of 75 meters and a trunk diameter of 2 meters, but usually smaller; bark very thick, reddish brown or light gray, deeply furrowed; leaves 3 to 6 cm. long; cones 7 to 15 cm. long, green or purplish; wood very soft, of medium strength, coarse-grained, inodorous, its specific gravity about 0.36.

The balsam fir is valuable for lumber when it occurs in sufficient abundance.

4. **TAXODIUM** L. Rich. Ann. Mus. Hist. Nat. 16: 298. 1810.

Only 2 other species are known, natives of the southeastern United States.

1. *Taxodium mucronatum* Ten. Ann. Sci. Nat. III. 19: 355. 1853.

Taxodium montezumae Decaisne, Bull. Soc. Bot. France 1: 71. 1854.

Taxodium mexicanum Carr. Trait. Conif. 147. 1855.

Sinaloa to Coahuila and southward, chiefly in wet soil; often planted as a shade tree. Guatemala.

Large tree, 20 to 30 meters high; trunk straight, enlarged near the base, covered with brownish red, rather smooth but shredded bark; roots of trees growing in water often sending up conical projections or "knees;" leaves (and many of the young branches) deciduous, 6 to 12 mm. long; staminate flowers in long slender spikes; cones subglobose, 1.5 to 2.5 cm. in diameter. The Nahuatl name is "ahuehuatl," in modern Mexican "ahuehuate"; the Tarascan name is "pentamu" or "pentamón;" "ciprés" (Tamaulipas); "cipreso" (Chiapas); "sabino" (Durango, San Luis Potosí, Oaxaca, and in other states); "ciprés de Montezuma" (Oaxaca, Valley of Mexico); "tnuyucu" or "yucu-ndatura" (Oaxaca, Mixtec, *Reko*); "yaga-chichicino" or "yaga-guichi xiña" (Oaxaca, Zapotec, *Reko*).

This bald cypress is one of the best-known trees of Mexico, being noted especially for its size. The largest individual reported is the famous tree at Santa María del Tule, Oaxaca, near the city of Oaxaca, which has a height of 38.6 meters and a trunk circumference of 51.8 meters;¹ the greatest diameter of its trunk is 12 meters, and the spread of its branches about 42 meters. The Cypress of Montezuma, in the gardens of Chapultepec, has a height of 51 meters and a trunk circumference of 15 meters. It was a noted tree four centuries ago, and has been estimated to be about 700 years old. Other trees have been estimated to have attained a much greater age. A third famous tree is the "Árbol de la Noche Triste," in the village of Popatela, near the City of Mexico, which is noted for its association with Cortés.

The wood is soft and rather weak, light or dark brown or yellowish, and is often obtained in very large planks. It is susceptible of a good polish and is used in Mexico for fine furniture, as well as for general construction. The tree furnishes an acrid resin which was used in pre-Conquest times for the cure of wounds, ulcers, cutaneous diseases, toothache, gout, etc., and which is still used extensively in popular practice. The bark is employed as an emmena-

¹ M. O. Reyes. El gigante de la flora Mexicana ó sea el sabino de Santa María del Tule del Estado de Oaxaca. Naturaleza 6: 110-114. pl. 6. 1884.

gogue and diuretic, and the leaves are applied as a resolutive and as a cure for itch. Chips of the wood are placed in an excavation in the ground, covered with earth, and fired, and as a result there is obtained a kind of pitch which is used commonly as a cure for bronchitis and other chest affections.¹

5. JUNIPERUS L. Sp. Pl. 1038. 1753.

Trees or shrubs with small scalelike leaves, these opposite or verticillate; fruit a small globose cone, often berry-like.

Cedar wood is of much economic importance, being useful for many purposes, one of the most common of which is the manufacture of lead pencils. The bark is rich in tannin and is used for tanning leather. The volatile oil obtained from the fruit of some species is aromatic, stimulant, and diuretic. Spirits distilled with the berries of common juniper (*J. communis* L., of North America, Europe, and Asia) constitutes the gin of commerce. The leaves, or their decoction, of *J. sabina* L. (of Europe) and *J. virginiana* L. (of the United States) have been used as a teniafuge and abortifacient, although their use is dangerous. The trees are very commonly planted for ornamental purposes.

Reko gives the Mixtec name (in Oaxaca) as "yutnu-itne."

Leaves of the branchlets ternate, obtuse. Fruit 1.2 to 1.8 cm. in diameter, 1 or 2-seeded.....1. *J. californica*.

Leaves of the branchlets opposite.

Bark checkered. Leaves obtuse; fruit dry, usually 4-seeded.

2. *J. pachyphloea*.

Bark shredded.

Fruit brownish, dry, fibrous, with 4 or more seeds; leaves very acute.

3. *J. flaccida*.

Fruit blue, fleshy, resinous, with 1 or sometimes 2 seeds; leaves obtuse.

4. *J. mexicana*.

1. *Juniperus californica* Carr. Rev. Hort. 1854: 352. 1854.

Juniperus cerrosianus Kellogg, Proc. Calif. Acad. 2: 37. 1863.

Baja California, at altitudes of 150 to 1,000 meters. California (type locality).

Usually a shrub but sometimes a tree 12 meters high, with a trunk diameter of 60 cm.; bark thin, peeling off in long gray shreds, the inner bark reddish brown; fruit reddish brown, maturing the second year; wood soft, close-grained, light reddish brown, its specific gravity about 0.63. "Cedro" (Baja California).

The wood is very durable and is used for fencing and for fuel. The Indians employed the fruit, either fresh or dried, ground and made into cakes, for food.

2. *Juniperus pachyphloea* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 142. 1857.

Low dry hillsides, Chihuahua and Sonora to Zacatecas and Puebla. Arizona to western Texas; type from New Mexico.

Shrub or tree, sometimes 18 meters high, with a trunk diameter of 1.8 meters; trunk usually short, covered with thick, reddish brown bark, this divided into coarse 4-sided plates; fruit about 1.2 cm. in diameter, with dry sweet flesh; wood soft, weak, brittle, close-grained, light red, with a specific gravity of about 0.58. "Tascate" (Chihuahua, Durango).

The bark is very different from that of any other species. The fruit is often used as food. Palmer reports that in Chihuahua the plant (presumably the leaves) is used as a remedy for rheumatism and neuralgia. Because of its

¹ Tomás Noriega. El Ahuehuete. Naturaleza 4: 35-40. 1877.

rough checkered bark, this species is known in the United States as alligator juniper.

3. *Juniperus flaccida* Schlecht. *Linnaea* 12: 495. 1838.

Chihuahua and Sonora, southward; type from Atotonilco El Chico. Guatemala; western Texas.

Shrub or tree, sometimes 12 meters high, with slender, spreading or drooping branches; fruit subglobose, reddish brown, 1.2 to 1.6 cm. in diameter, with dry flesh. "Cedro colorado" (Veracruz); "cedro" (Durango).

4. *Juniperus mexicana* Spreng. *Syst. Veg.* 3: 909. 1826.

Cupressus sabinoides H. B. K. *Nov. Gen. & Sp.* 2: 3. 1817. Not *Juniperus sabinoides* Griseb. 1844.

Juniperus tetragona Schlecht. *Linnaea* 12: 495. 1838.

Juniperus deppeana Steud. *Nom. Bot.* ed. 2. 835. 1840.

Nearly throughout Mexico, except along the northern part of the Pacific coast. Guatemala; western Texas.

Shrub or tree, sometimes 30 meters high, with a trunk diameter of a meter or more; in Mexico sometimes ascending to an altitude of 4,500 meters, and then a low shrub; trunk short or tall, the thin bark separating into fibrous, reddish brown scales; twigs 4-sided; fruit 6 to 8 mm. in diameter, dark blue, glaucous, with thin sweet resinous flesh; wood hard, weak, close-grained, brown, its specific gravity about 0.59. "Sabino" (Chihuahua, Hidalgo, Mexico, etc.); "enebro" (Oaxaca, *Reko*); "tascate" or "taxate" (Durango, Chihuahua).

The wood is used for general construction, fence posts, telegraph poles, railroad ties, etc., and for fuel. Palmer states that the ashes of the bark are used in the preparation of corn for tortillas.

Some of the specimens placed here may be referable to *J. monosperma* (Engelm.) Sarg., but in the herbarium material examined it is impossible to distinguish more than a single species.

6. **CUPRESSUS** L. *Sp. Pl.* 1002. 1753.

Tree or shrubs, closely resembling the species of *Juniperus*, but with larger cones, these opening when ripe and shedding the seeds; leaves opposite, small and scalelike.

The species of cypress are often cultivated for ornament. *C. sempervirens* L., of the Old World, is said to be cultivated in Mexico.

Seeds not winged, 2 or 3 to each scale; leaves not appressed. Cones about 2.5 cm. in diameter.....1. *C. thurifera*.

Seeds narrowly winged, 5 to 8 to each scale; leaves appressed. Cones 2.5 to 3.5 cm. in diameter.....2. *C. guadalupensis*.

Cones 1.2 to 2.5 cm. in diameter. Branchlets stout, stiff; leaves glaucous.....3. *C. arizonica*.

Branchlets slender; leaves green.....4. *C. benthamii*.

1. *Cupressus thurifera* H. B. K. *Nov. Gen. & Sp.* 2: 3. 1817.

Veracruz and Oaxaca; type from Tasco and Tehuilotepec, at 1,750 meters.

Shrub or large tree. "Cedro" (Veracruz); "cedro de la sierra" (Durango, Veracruz, etc.); "ciprés" (Veracruz); "cedro amarillo," "gretado amarillo" (Oaxaca, *Reko*); "tlatzcán" (*Herrera*).

2. *Cupressus guadalupensis* S. Wats. *Proc. Amer. Acad.* 14: 300. 1879.

Guadalupe Island, Baja California.

Widely spreading tree, averaging about 12 meters in height, but sometimes larger and with a trunk 7.5 meters in circumference; bark brown, curling into thin plates; wood whitish.

One tree measured by Palmer had a trunk 2 meters in circumference, with 236 annual rings.

3. *Cupressus arizonica* Greene, Bull. Torrey Club 9: 64. 1882.

Coahuila to San Luis Potosí, Zacatecas, and Baja California. Arizona (type locality) and New Mexico.

Shrub or tree, sometimes 21 meters high, with a trunk diameter of 1.2 meters; old bark thin, dark red or brown, separating into long shreds; cones reddish brown, glaucous; wood soft, close-grained, grayish, streaked with yellow, its specific gravity about 0.48. "Cedro," "cedro de la sierra," "pinabete" (Durango).

The wood is used for fuel and for general construction purposes.

4. *Cupressus benthamii*¹ Endl. Syn. Conif. 59. 1847.

? *Cupressus coulteri* J. Forbes, Pinet. Woburn. 190. 1839.

Cupressus lindleyi Klotzsch; Endl. Syn. Conif. 59. 1847.

Cupressus ehrenbergii Kunze, Linnaea 20: 16. 1847.

Cupressus karwinskiana Regel, Gartenflora 1857: 346. 1857.

Cupressus knightiana Perry; Gord. & Glend. Pinet. 61. 1858.

Tepic to Veracruz and southward; ascending to 3,000 meters; type from Banco. Guatemala to Costa Rica.

Tree, often 18 to 30 meters high. "Cedro blanco" (Oaxaca, etc.); "ciprés" (Veracruz); "cedro" (Jalisco); "ciprés de México" (Veracruz, etc.); "gretado galán" (Oaxaca, Reko); "tlascal," "tlascale" (Veracruz Michoacán, Mexico, etc.); "tlazzcán" (Guerrero, Hidalgo, Veracruz); "teatlale" (various localities, Ramírez).

The wood is undoubtedly of importance for lumber, although no details concerning it are available. The bark is said to be used in medicine as an astringent.

7. **LIBOCEDRUS** Endl. Syn. Conif. 42. 1847.

1. *Libocedrus decurrens* Torr. in Frém. Rep. Exped. Rocky Mount. 7. pl. 3. 1854.

Mountains of Baja California, at altitudes of 2,100 to 2,400 meters. California and Oregon; type from the Sacramento River.

Tree, sometimes 45 meters high, with irregularly furrowed, reddish brown bark; leaves in whorls of 4, scalelike, decurrent; cones oblong, 1.8 to 2.5 cm. long, reddish brown; wood soft, weak, close-grained, light reddish brown, the specific gravity about 0.40.

Known in the United States as incense cedar, a name applied because of the fact that all parts of the tree contain a volatile oil with a characteristic incense-like odor. The wood is very durable and is used for general construction, laths, shingles, interior finish, etc. The bark is rich in tannin.

6. **GNETACEAE.** Joint-fir Family.

1. **EPHEDRA** L. Sp. Pl. 1040. 1753.

Shrubs, erect or rarely subscandent or trailing over other shrubs; stems slender, jointed; leaves reduced to opposite or verticillate scales; flowers dioecious, the staminate in short aments, the fertile inflorescence conelike; fruit nutlike, angled, sometimes fleshy.

¹ Named in honor of George Bentham (1800–1884), one of the most noted of British botanists. He was the author of many important botanical works, one of which was a report upon the Mexican collections obtained by Hartweg.

In their general appearance these leafless plants are very unlike any others found in North America. The stems have an astringent taste and contain tannin, but they are much eaten by stock. A decoction of the stems is used widely as a cure for venereal and renal diseases. *E. distachya* L., of the Mediterranean Region, contains an alkaloid, ephedrine, which produces paralysis of the heart.

Leaf scales ternate.

Leaf scales 8 to 10 mm. long, the apex aristate.....1. *E. trifurca*.

Leaf scales 5 mm. long or shorter, acute.....2. *E. californica*.

Leaf scales opposite.

Stems very scabrous3. *E. aspera*.

Stems smooth.

Fruit not fleshy; stems yellowish green, stiff, erect...4. *E. antisiphilitica*.

Fruit fleshy; stems glaucous or glaucescent.

Stems erect, with short stiff branches; fruit sessile or nearly so.

5. *E. compacta*.

Stems reclining, slender, flexuous; fruit conspicuously pedunculate.

6. *E. pedunculata*.

1. *Ephedra trifurca* Torr. in Emory, Mil. Recon. 152. 1848.

Dry mesas and hillsides, Chihuahua, Sonora, and Baja California. Western Texas to Utah; type from New Mexico.

About a meter high, with numerous erect branches. "Popotillo" (Chihuahua, Texas, New Mexico); "tepopote" (Chihuahua, Texas).

2. *Ephedra californica* S. Wats. Proc. Amer. Acad. 14: 300. 1879.

Dry plains and low mountain slopes, Baja California. Southern California; type from San Diego County.

Erect shrub.

3. *Ephedra aspera* Engelm.; S. Wats. Proc. Amer. Acad. 18: 157. 1883.

Dry plains and hillsides, Chihuahua to Zacatecas and Baja California; type from mountains near Saltillo, Coahuila.

Erect shrub, 0.3 to 1 meter high. "Pitamoreal" (Coahuila); "tepopote," "cañatilla," "popotillo" (Durango); "itamo real" (Coahuila); "hintimoreal" (Coahuila, *Palmer*).

Used for the same purposes as the other species. *Palmer* states, also, that the plant is sometimes sold in the markets as a remedy for pneumonia.

4. *Ephedra antisiphilitica* Meyer, Monogr. Ephedra 101. 1846.

In dry soil at low altitudes, Coahuila (type locality); doubtless also in Chihuahua. Western Texas to Colorado.

Shrub, a meter high or lower. "Cañatilla" (Chihuahua, Texas, New Mexico); "tepopote" (Chihuahua, Texas); "popotillo" (New Mexico).

5. *Ephedra compacta* Rose, Contr. U. S. Nat. Herb. 12: 261. 1909.

Dry plains and hillsides, Puebla and Oaxaca; type from Tehuacán, Puebla.

Shrub, 30 to 50 cm. high, very densely branched, pale green; fruit red and fleshy.

6. *Ephedra pedunculata* Engelm.; S. Wats. Proc. Amer. Acad. 18: 157. 1883.

Dry plains and hillsides, Chihuahua to San Luis Potosí and Zacatecas. Western Texas, the type from Uvalde.

Slender shrub with long reclining stems; fruit fleshy, red or salmon-colored. "Cañatilla," "tepopote," "popotillo" (Durango); "itamo real" (Zacatecas, San Luis Potosí); "retama real" (Durango, *Palmer*); "sanguinaria" (the stems, San Luis Potosí, *Safford*).

Besides its other uses, *Palmer* states that in Zacatecas the plant is esteemed as a remedy for pleurisy and pneumonia.

7. POACEAE. Grass Family.

(Contributed by Prof. A. S. Hitchcock.)

REFERENCE: Hitchcock, Mexican grasses in the U. S. National Herbarium, Contr. U. S. Nat. Herb. 17: 181-389. 1913.

Herbs or rarely shrubs or trees; leaves usually long and narrow, but in the woody species usually lanceolate or elliptic, often petiolate; flowers small, greenish, or purplish, arranged in small spikelets, the spikelets in narrow or open panicles; fruit a caryopsis or grain.

Most of the woody grasses belong to the tribe Bamboseae, usually known in English-speaking countries as bamboos. In tropical America there are few grasses, aside from bamboos, that have woody stems, and nearly all of these belong to the genus *Lasiacis* of the tribe Paniceae.

It is impracticable to draw a sharp distinction between woody and herbaceous grasses. In the following account only those species have been included which possess culms that persist from year to year. Some excluded species have woody crowns or have the base of the culms woody; others, such as the sugar cane and reed (*Phragmites communis* Trin.), have large firm culms that appear woody during the season of growth, but do not persist.

Leaves many times longer than broad; panicle a large terminal plume; spikelets 2 to several-flowered, more or less silky.

Spikelets unisexual, the pistillate long-silky, the staminate glabrous; plants dioecious.....1. **GYNERIUM.**

Spikelets perfect, the lemmas silky.....2. **ARUNDO.**

Leaves lanceolate or elliptic, usually not more than 20 cm. long; panicles narrow or open but scarcely a large plume; spikelets 1 to several-flowered.

Spikelets unisexual; pistillate spikelets borne on the upper branches and on the ends of the lower branches of a loose terminal panicle, the smaller staminate spikelets pedicellate along the lower branches; leaves asymmetrically lanceolate-oblong, the larger 20 cm. long and 5 cm. wide.

3. **OLYRA.**

Spikelets perfect (often with sterile florets above or below); leaves usually less than 5 cm. wide.

Spikelets globose or ovoid, obtuse, with one perfect terminal floret and a sterile floret below; blades sessile.....4. **LASIACIS.**

Spikelets 1 to several-flowered, the florets acute or acuminate; blades usually contracted into a short petiole and jointed with the sheath. (BAMBOOS.)

Stamens 6. Spikelets several-flowered.....5. **BAMBOS.**

Stamens 3.

Spikelets 1-flowered.....6. **CHUSQUEA.**

Spikelets 2 to many-flowered.

Glumes 1 or 2; sterile lemmas none; spikelets loose, many-flowered, elongate, paniculate or racemose.....7. **ARUNDINARIA.**

Glumes 2; sterile lemmas 1 or 2; spikelets in racemes or 1-sided spikes, these arranged in tufts at the culm nodes.

8. **ARTHROSTYLIDIUM.**

1. **GYNERIUM** Humb. & Bonpl. Pl. Aequin. 2: 112. pl. 115. 1809.

1. **Gynerium sagittatum** (Aubl.) Beauv. Ess. Agrost. 138. pl. 24. f. 6. 1812.

Saccharum sagittatum Aubl. Pl. Guian. 1: 50. 1775.

Gynerium saccharoides Humb. & Bonpl. Pl. Aequin. 2: 112. pl. 115. 1809.

River banks and low ground, forming dense colonies, Veracruz and Oaxaca. West Indies to South America, the type from French Guiana.

Stout reed, often 10 meters tall, with culms clothed below with old sheaths (the blades having fallen), sharply serrulate blades, commonly 2 meters long and 4 to 6 cm. wide (forming a great fan-shaped summit to the sterile culms), and pale, plummy, densely flowered panicles 1 meter long or more, the main axis erect, the branches drooping. "Caña brava" (Tabasco, *Rovirosa*); "caña de casa" (Guatemala); "caña boba," "suza" (Colombia); "caña de Castilla" (El Salvador, Cuba).

2. ARUNDO L. Sp. Pl. 81. 1753.

1. *Arundo donax* L. Sp. Pl. 81. 1753.

Along rivers and ditches throughout Mexico. Warmer parts of the Old World; cultivated in America for ornament and occurring from Texas to California and southward to South America as an escape.

A tall reed with strong, sparingly branching culms, elongate scabrous-margined flat blades, and densely flowered, slightly drooping panicles 30 to 60 cm. long, the spikelets about 1 cm. long. "Carrizo" (Durango, etc.); "caña hueca," "cañaverl" (*Ramírez*); "carricillo" (Tamaulipas); "güín" (Cuba).

Tender stems eaten by animals; canes used for fishing rods, arrows, and flutes.

3. OLYRA L. Syst. Nat. ed. 10. 2: 1261. 1759.

1. *Olyra latifolia* L. Syst. Nat. ed. 10. 2: 1261. 1759.

Copses and shady banks, San Luis Potosí to Michoacán and southward. Mexico and West Indies to South America, the type from Jamaica.

Glabrous perennial, bamboo-like in aspect, commonly 5 meters tall, the strong hollow culms sometimes 1 cm. thick, erect and unsupported, the summit only arching (or weaker culms leaning among brush), the lower half to two-thirds simple and naked, the short sheaths bladeless or nearly so, the elongate internodes blotched with dull purple, branching from the upper nodes, the branches commonly fasciated, divaricate, often 1 meter long, sometimes again branching; blades convolute in the bud, spreading, flat, firm, asymmetrically lanceolate-oblong, abruptly acuminate, commonly 20 cm. long and 5 cm. wide, those of the ultimate branches smaller, the lowermost on both primary culm and branches rudimentary; panicles 10 to 15 cm. long, about two-thirds as wide, those of the secondary branches reduced, the branches stiffly ascending or spreading, each bearing a single large long-acuminate pistillate spikelet at the thickened summit and several small slender-pedicelled staminate spikelets along the rachis. "Tibisí" (Cuba).

4. LASIACIS (Griseb.) Hitchc. Contr. U. S. Nat. Herb. 15: 16. 1910.

The clambering species are known in Cuba as "tibisí."

Main stem prostrate, the fertile shoots prostrate, ascending, or erect.

Blades lanceolate, mostly less than 5 cm. long; fertile shoots strongly dorsiventral, mostly prostrate.....1. *L. rugelii*.

Blades linear-lanceolate, about 10 to 12 cm. long; fertile shoots ascending or erect from a decumbent base, not dorsiventral.....2. *L. grisebachii*.

Main stem clambering, or much branched and forming a tangled mass.

Ligule noticeable, brownish, about 2 mm. long. Blades scabrous on both surfaces, elongate, more than 10 times as long as wide; plants not forming a strong central clambering cane.....3. *L. oaxacensis*.

Ligule inconspicuous, hidden within the mouth of the sheath, rarely as much as 1 mm. long.

Culms not high-climbing, decumbent and rooting at base, forming a tangled mass, with no strong central cane; spikelets clustered toward the ends of the branches.....4. *L. rhizophora*.

Culms high-climbing, forming a strong central cane; spikelets not clustered toward the ends of the branches.

Blades glabrous on both surfaces, often more or less scabrous (see *L. ruscifolia*, rarely with glabrous ovate-lanceolate blades).

Panicle few-flowered, 5 to 10 cm. long; branches strongly zigzag, the branchlets strongly divaricate or reflexed; blades narrowly lanceolate, firm, mostly less than 1 cm. wide (sometimes wider on vigorous shoots)5. *L. divaricata*.

Panicle many-flowered, usually 15 to 25 cm. long or more on the primary branches; branches straight or arcuate, not zigzag; blades mostly over 1.5 cm. wide.

Spikelets globose, about 3 mm. long.....6. *L. globosa*.

Spikelets lanceolate-ellipsoidal, 3.5 to 5 mm. long.....7. *L. sloanei*.

Blades pubescent on one or both surfaces (sometimes glabrous in *L. ruscifolia*).

Blades narrowly lanceolate, averaging 8 to 10 times as long as wide; panicle large and open; spikelets 4 to 5 mm. long.

8. *L. sorghoidea*.

Blades ovate-lanceolate or elliptic, sometimes lanceolate, often more or less cordate-clasping; panicle often compact or at least the branches commonly compactly flowered; spikelets 3 to 4 mm. long.

9. *L. ruscifolia*.

1. *Lasiacis rugelii* (Griseb.) Hitchc. Bot. Gaz. 51: 302. 1911.

Panicum rugelii Griseb. Cat. Pl. Cub. 233. 1866.

Rich woods, San Luis Potosí and Yucatán. Cuba (the type locality).

Prostrate, the main canes slender; branches commonly fascicled, very leafy, the pubescent sheaths overlapping, the small, lanceolate, firm, puberulent, somewhat cinereous blades oblique at base; panicles short-exserted, few-flowered.

2. *Lasiacis grisebachii*¹ (Nash) Hitchc. Bot. Gaz. 51: 302. 1911.

Panicum grisebachii Nash, Bull. Torrey Club 35: 301. 1908.

Rich woods and shady banks, carpeting the floor of dark thickets, Veracruz, Honduras; Cuba (type locality).

Stems more slender, freely producing rootlets, the long narrow blades not crowded; panicle branches ascending.

3. *Lasiacis oaxacensis* (Steud.) Hitchc. Proc. Biol. Soc. Washington 24: 145. 1911.

Panicum oaxacense Steud. Syn. Pl. Glum. 1: 73. 1854.

Edges of woods, Veracruz, Michoacán, and Oaxaca (type locality). Guatemala and Jamaica to South America.

Slender, straggling, decumbent and geniculate at base, with numerous aerial rootlets, the long branches ascending and arcuate, with narrow scabrous blades commonly 20 cm. long, and large open few-flowered panicles, the spikelets borne at the ends of the branchlets.

¹ Heinrich Rudolph August Grisebach (1814–1879), a native of Hanover, published in 1864 a "Flora of the British West Indies," one of the most important works upon the plants of tropical North America. He is known, too, for his "Vegetation der Erde," published in 1872, a classic work upon plant geography, and for numerous other botanical publications.

4. *Lasiacis rhizophora* (Fourn.) Hitchc. Proc. Biol. Soc. Washington **24**: 145. 1911.

Panicum rhizophorum Fourn. Mex. Pl. **2**: 31. 1886.

Copses and edges of woods, Veracruz, the type from Orizaba. Guatemala to Costa Rica.

Culms branching and straggling, not forming a strong central cane, decumbent at base and rooting at the lower nodes, the fertile culms ascending, 30 to 100 cm. long; blades 7 to 14 cm. long, 1.5 to 3 cm. wide; panicles 8 to 15 cm. long.

5. *Lasiacis divaricata* (L.) Hitchc. Contr. U. S. Nat. Herb. **15**: 16. 1910.

Panicum divaricatum L. Syst. Nat. ed. 10. **2**: 871. 1759.

Copses and edges of woods, chiefly at low altitudes and especially in the vicinity of the seacoast, Baja California to Veracruz and southward. Southern Florida and the West Indies to South America, the type from Jamaica.

Shrubby, with strong central canes, clambering to a height of 3 or 4 meters, the main branches often fascicled, the vigorous secondary foliage shoots mostly strongly divaricate or zigzag, usually glabrous throughout except on the margin of the sheaths; blades commonly less than 1 cm. wide, only on vigorous shoots as much as 1.5 cm. wide; panicles usually less than 10 cm. long, the branches deflexed at maturity. "Pito de bejuco" (Cuba).

6. *Lasiacis globosa* Hitchc. Contr. U. S. Nat. Herb. **17**: 251. 1913.

Copses near the sea, Guerrero; type from Acapulco. Panama.

Blades smooth, elliptic-lanceolate; panicle loosely flowered, 8 to 12 cm. long, the spikelets globose, 3 mm. long.

7. *Lasiacis sloanei* (Griseb.) Hitchc. Bot. Gaz. **57**: 302. 1911.

Panicum sloanei Griseb. Fl. Brit. W. Ind. 551. 1864.

Climbing among bushes and small trees, San Luis Potosí and Veracruz. West Indies and Mexico, south to Colombia, the type from Jamaica.

Climbing to the height of 3 to 4 meters, forming a strong central cane; branches solitary or 2 or 3 together, elongate; blades parchment-like in texture at maturity, commonly 12 to 15 cm. long and 2 to 3 cm. wide, narrowed into a very short pubescent petiole; panicles commonly as much as 20 cm. long, nearly as wide, the branches rather rigid.

The spikelets are larger in this species than in any other of the genus in the region.

8. *Lasiacis sorghoidea* (Desv.) Hitchc. & Chase, Contr. U. S. Nat. Herb. **18**: 338. 1917.

Panicum lanatum Swartz, Prodr. Veg. Ind. Occ. **24**. 1788. Not *P. lanatum* Rottb. 1776.

Panicum sorghoideum Desv.; Hamilt. Prodr. Pl. Ind. Occ. **10**. 1825.

Ravines, wood borders, and hedges, San Luis Potosí and Jalisco, southward. West Indies and Mexico to Argentina, the type from Hispaniola.

Erect or clambering to a height of 5 to 7 meters, with a strong central cane as much as 1 cm. thick, the main branches 1 meter long or more, arcuate, bearing slender branchlets toward the pendent ends; sheaths and both surfaces of the blades velvety, or the sheaths glabrescent, the blades of the main branches commonly 20 cm. long and 2.5 cm. wide, those of the branchlets much smaller, often less velvety; panicles usually about 10 to 20 cm. long, at maturity as wide or wider, the spikelets more or less clustered on the long distant branches.

9. *Lasiacis ruscifolia* (H. B. K.) Hitchc. Proc. Biol. Soc. Washington **24**: 145. 1911.

Panicum ruscifolium H. B. K. Nov. Gen. & Sp. **1**: 101. 1816.

Panicum compactum Swartz, Adnot. Bot. 14. 1829. Not *P. compactum* Kit. 1814.

Panicum liebmannianum Fourn. Mex. Pl. 2: 33. 1886.

Climbing over bushes, Sonora to Veracruz and southward; type from the Volcán Jorullo. Mexico and the West Indies to Venezuela.

More robust than any other species, freely branching, with numerous leafy dorsiventral shoots with broad blades, these velvety or glabrous beneath, glabrous or scabrous above, the sheaths glabrous or nearly so, the scarcely exerted, oblong or club-shaped panicles usually compactly flowered.

5. BAMBOS Retz. Obs. Bot. 5: 24. 1789.

Robust arboreous grasses with culms several centimeters in diameter and rising to the height of 10 to 20 meters.

Branches spiny-----1. *B. aculeata*.
Branches unarmed-----2. *B. vulgaris*.

1. *Bambos aculeata* (Rupr.) Hitchc. Contr. U. S. Nat. Herb. 17: 387. 1913.
Guadua aculeata Rupr.; Fourn. Mex. Pl. 2: 130. 1886.

Veracruz, the type from Colipa.

2. *Bambos vulgaris* Schrad.; Wendl. Coll. Pl. 2: 26. *pl.* 47. 1810.

Commonly cultivated in tropical America; native of the Old World.

Arborescent, freely branching; flowering branches fascicled, elongate, leafless, the sessile spikelets radiate in clusters. "Caña brava" (Cuba).

The common bamboo of cultivation.

6. CHUSQUEA Kunth, Syn. Pl. Aequin. 1: 254. 1822.

Branchlets pubescent; base of sheath tumid-----1. *C. nelsoni*.
Branchlets glabrous; base of sheath not tumid-----2. *C. bilimeki*.

1. *Chusquea nelsoni* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 16. 1897.

Only known from the type, which was collected between Chilapa and Tuxtla, Guerrero.

2. *Chusquea bilimeki*¹ Fourn. Mex. Pl. 2: 132. 1886.

Only known from the type locality, in the Valley of Mexico.

Described as having a culm a centimeter in diameter.

7. ARUNDINARIA Michx. Fl. Bor. Amer. 1: 73. 1803.

Blades 2 mm. wide; lemmas 1 to 1.5 mm. wide-----1. *A. acuminata*.
Blades 5 to 8 mm. wide; lemmas 2 mm. wide-----2. *A. longifolia*.

1. *Arundinaria acuminata* Munro, Trans. Linn. Soc. Bot. 26: 25. 1868.

Veracruz, the type locality.

Panicles diffuse, the spikelets narrow, acuminate, the lemmas awned.

2. *Arundinaria longifolia* Fourn. Mex. Pl. 2: 131. 1886.

Durango, Tepic, San Luis Potosí, Veracruz, and Oaxaca; type from Jicaltepec, Veracruz.

Panicles less diffuse than in the preceding, the spikelets wider; blades long and narrow, 15 to 20 cm. long, 5 to 8 mm. wide; culms as much as 4 cm. thick.

¹ Named for Bilimek, who was chief gardener of the Emperor Maximilian. He made a small collection of plants, some of which are in the U. S. National Herbarium.

8. **ARTHROSTYLIDIUM** Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3¹: 117. 1839.

1. **Arthrostylidium racemiflorum** Steud. Syn. Pl. Glum. 1: 336. 1854.

Veracruz; the type from Mexico, but the definite locality unknown. Costa Rica.

Several other species of bamboos have been described from Mexico, but their validity and identity are uncertain.

8. **PHOENICACEAE.** Palm Family.

REFERENCE: Oersted, Nat. For. Kjöbenhavn Vid. Medd. 1858: 1-54. 1859.

The palms are one of the most interesting and important groups of Mexican plants. Although the number of species represented is not nearly as large as in Central America, or farther southward in South America, those which are found in Mexico are of great economic importance. The plants attract attention because of their curious and beautiful forms, and they are favorite ornamental plants in Mexican parks and gardens. Besides the native species, some exotic ones are cultivated. The species are widely distributed in Mexico and often form extensive forests.

The trunks are used for making the walls and roofs of houses, and the leaves are the usual material employed for thatch. The juice of the stems usually contains sugar, and may be fermented to obtain intoxicating drinks. The tough leaves are made into hats, mats, raincoats, and other articles, and their fiber furnishes cordage. The fruits of many of the species are edible, and the seeds contain large quantities of oil.

The writer is under special obligations to Mr. O. F. Cook for assistance in the preparation of the account of this family.

Leaves flabellate.

Calyx and corolla united and forming a 6-dentate cup; ovary of a single 1-ovulate carpel. Petioles unarmed.....1. **THRINAX.**

Calyx and corolla distinct; ovary of 3 distinct or more or less united carpels. Style or stigma basilar in fruit. Petioles unarmed.....2. **INODES.**

Style or stigma terminal in fruit.

Trunk armed with long spines.....4. **ACANTHORRIZA.**

Trunk unarmed.

Petioles smooth. Fruit globose, about 12 mm. in diameter.

5. **CRYOSOPHILA.**

Petioles with dentate or denticulate margins.

Branches of the inflorescence, at least the primary ones, subtended by spathes.

Leaf sheaths split at base.....3. **WASHINGTONIA.**

Leaf sheaths not split at base.....6. **ERYTHEA.**

Branches of the inflorescence not subtended by spathes.

7. **BRAHEA.**

Leaves pinnate or pinnatifid, or sometimes simple and bifid at the apex.

Ovary of 3 distinct carpels, only one normally developed.....8. **PHOENIX.**

Ovary of united carpels.

Fruit baccate, without a bony endocarp.

Flowers sunk in the fleshy rachis of the inflorescence.

Style lateral, beside the one fertile cell of the ovary...9. **GEONOMA.**

Style rising from between the 3 fertile cells of the ovary.

10. **CALYPTROGYNE.**

Flowers not sunk in the rachis of the inflorescence.

Spathes 2 ----- 11. REINHARDTIA.

Spathes 3 or more ----- 12. CHAMAEDOREA.

Fruit nutlike, with a bony endocarp.

Trunk and leaf bases unarmed.

Stamens 6; fruit 1-seeded ----- 13. COCOS.

Stamens 10 to 24; fruit 2 to 6-seeded ----- 14. ATTALEA.

Trunk or leaf bases armed with spines, these sometimes black and needle-like.

Petals of the pistillate flowers connate only at the base.

15. ACROCOMIA.

Petals of the pistillate flowers united.

Staminate flowers immersed in the rachis of the inflorescence; fruit spiny ----- 16. ASTROCARYUM.

Staminate flowers not immersed in the rachis; fruit not spiny.

Trunk erect; seeds with large subapical foramina.

17. BACTRIS.

Trunk trailing or scandent; seeds with small peripheral foramina.

18. DESMONCUS.

1. **THRINAX** L. f.; Swartz, Prodr. Veg. Ind. Occ. 57. 1788.

1. *Thrinax wendlandiana* Becc. Webbia 2: 265. 1907.

Yucatán. Cuba (type locality); Honduras.

Leaves flabellate, about a meter long, green above, slightly paler beneath; spadix paniculate-branched; fruit globose, 5 mm. or more in diameter. Known in Cuba as "miraguano de lana," "guano de lana," or "guano de costa."

2. **INODES** Cook, Bull. Torrey Club 28: 529. 1901.

REFERENCE: Beccari, Webbia 2: 10-86. 1907 (as *Sabal*).

Plants with tall trunks; leaves flabelliform, the margins of the segments with numerous long threads; fruit small, globose, usually black.

Seeds small, 5 to 8 mm. broad. Branches of the inflorescence slender.

Fruit globose, not at all asymmetric ----- 1. *I. mexicana*.

Fruit more or less asymmetric at the base ----- 2. *I. japa*.

Seeds large, 10 to 13 mm. broad.

Branches of the pistillate inflorescence strongly thickened, fusiform. Embryo lateral ----- 3. *I. uresana*.

Branches of the pistillate inflorescence slender.

Embryo lateral ----- 4. *I. rosei*.

Embryo subdorsal ----- 5. *I. texana*.

1. *Inodes mexicana* (Mart.) Standl.

Sabal mexicana Mart. Hist. Nat. Palm. 3: 246. pl. S, f. 1-7, pl. V, f. 4. 1836-50.

Tepic to Zacatecas and Oaxaca (type locality), and perhaps farther eastward. Guatemala.

Trunk 10 to 20 meters high, when young clothed with the persistent petioles, but in age naked; leaf blades somewhat recurved; inflorescence short and dense, recurved; fruit depressed-globose, about 8 mm. in diameter. "Palma real" (Oaxaca); "palma redonda" (Michoacán, Guerrero).

2. *Inodes japa* (Wright) Standl.

Sabal japa Wright; Sauv. Anal. Acad. Ci. Habana 7: 562. 1870.

Yucatán. Cuba (type locality).

Trunk tall, sometimes 24 meters high; leaves large, the blades about 1.2 to 1.3 meters long; inflorescence 30 to 70 cm. long, composed of several short panicles; fruit globose, 8 to 10 mm. in diameter. "Huano," "xaan" (Yucatán). Known in Cuba as "palma de guano," "cana," "japa," or "miraguano."

3. *Inodes uresana* (Trel.) Cook, Bull. Torrey Club 28: 534. 1901.

Sabal uresana Trel. Rep. Mo. Bot. Gard. 12: 79. pl. 35-37. 1901.

Vicinity of Ures, Sonora.

Trunk 5 to 10 meters high, about 30 cm. in diameter, naked; leaves very glaucous, on long unarmed petioles, the blades about 1 meter long; fruit depressed-globose, 15 to 20 mm. in diameter, green or dirty brown and somewhat lustrous.

4. *Inodes rosei*¹ Cook, Bull. Torrey Club 28: 534. 1901.

Sabal rosei Becc. Webbia 2: 83. 1907.

In the coastal plain, Tepic and southern Sinaloa; type from Acaponeta, Tepic.

Six to 12 or even 18 meters high, the trunk slender, naked, 15 to 20 cm. thick; leaves numerous, the blades pale green, 80 cm. wide or larger; inflorescence 60 cm. long or longer; fruit globose, about 1.8 cm. in diameter, blackish or dark blue.

5. *Inodes texana* Cook, Bull. Torrey Club 28: 534. 1901.

Sabal texana Becc. Webbia 2: 78. 1907.

Tamaulipas. Southwestern Texas (type locality).

Trunk tall, naked; spadices about 75 cm. long, copiously branched; flowers white, with a honey-like odor; fruit globose, 1.5 to 2 cm. in diameter. "Palma real," "palma de micheros" (Tamaulipas).

The leaves are used for thatching and for chair seats. The flowers are much frequented by bees. The fruits, known as "micheros," are said to be edible.

3. WASHINGTONIA Wendl. Bot. Zeit. 37: 68. 1879.

REFERENCES: Parish, Bot. Gaz. 44: 408-434. f. 1-12. 1907; Goldman, Contr. U. S. Nat. Herb. 16: 316. 1916; Parish, Bot. Gaz. 46: 144-147. f. 1-5. 1908; Parish, Bot. Gaz. 48: 462-463. 1909.

Plants usually with tall trunks; leaves flabelliform, deeply divided, the margins of the leaves usually separating into drooping fibers; fruit drupaceous.

Petiole obtuse at the junction with the blade.....1. *W. sonorae*.

Petiole acuminate prolonged into the blade.

Leaf blades nearly or quite without filaments.....2. *W. gracilis*.

Leaf blades copiously filiferous.....3. *W. filifera*.

1. *Washingtonia sonorae* S. Wats. Proc. Amer. Acad. 24: 79. 1889.

Dry plains and canyons, Sonora and southern Baja California; type from canyons near Guaymas, Sonora.

Trunk reaching a height of 7.5 meters or more; leaves about a meter broad, somewhat glaucous, copiously filiferous; petioles armed with stout curved spines; inflorescence 1.5 to 1.8 meters long; fruit about 6 mm. in diameter, said to be used for food. In Baja California three distinct forms, known as "palma blanca," "palma colorada," and "palma negra," are recognized by the natives.

¹ Named for Dr. J. N. Rose (1862-), Associate Curator of the U. S. National Herbarium. Dr. Rose has collected extensively in nearly all parts of Mexico, and has obtained a very large series of specimens, which are in the National Herbarium. He has published many papers dealing with Mexican plants.

2. *Washingtonia gracilis* Parish, Bot. Gaz. 44: 420. f. 8-10. 1907.

Described from trees cultivated in southern California; believed to be a native of Baja California.

Trunk slender, at least 20 meters high; blades 80 to 100 cm. broad; petioles armed throughout with short curved yellow spines; fruit 6 to 7 mm. in diameter.

3. *Washingtonia filifera* (Linden) Wendl. Bot. Zeit. 37: 68. 1879.

Pritchardia filifera Linden, Ill. Hort. Lem. 24. 1877.

Neowashingtonia filamentosa Sudw. U. S. Dept. Agr. Div. For. Bull. 14: 105. 1897.

Neowashingtonia filifera Sudw. For. Trees Pac. Slope 199. 1908.

Dry plains, Baja California. Southern California.

Trunk up to 27 meters high, often a meter in diameter; leaves a meter broad or larger; inflorescence 2.5 to 3 meters long; fruit about 8 mm. long, black, with thin sweet flesh. In the typical form the petioles are unarmed near the blade; in *W. filifera robusta* (Wendl.) Parish¹ they are armed throughout; in *W. filifera microsperma* Becc.² they are armed only near the base.

This species is one of the commonest palms cultivated in hothouses. It is grown in parks in Sonora, where it is known as "palma de Castilla." The desert Indians of southern California utilized the leaves for building huts and strands from the leaves for tying and in basketry. The fruit was eaten fresh or dried, the seeds were ground into meal, and the terminal bud or "cabbage" was roasted and eaten.

4. **ACANTHORRHIZA** Wendl. in Kerchove, Palmiers 230. 1878.

REFERENCE: Beccari, Webbia 2: 230-243. 1907.

1. *Acanthorrhiza mocinni* (H. B. K.) Benth. & Hook.; Hemsl. Biol. Centr. Amer. Bot. 3: 411. 1885.

Chamaerops mocinni H. B. K. Nov. Gen. & Sp. 1: 300. 1815.

Trithrinax aculeata Liebm.; Mart. Hist. Nat. Palm. 3: 320. 1836-50.

Acanthorrhiza aculeata Wendl. in Kerchove, Palmiers 230. 1878.

Sinaloa to Oaxaca and Campeche; type from Acapulco, Guerrero. Guatemala.

Trunk of medium height, tapering upward, covered above with long spines; leaves flabelliform, green, slightly paler beneath, the petioles smooth; inflorescence short, recurved; fruit whitish, about 1.2 cm. in diameter. "Palma de escoba" (Campeche); "zoyamiche," "zoyaviche" (Oaxaca); "soyamiche" (Michoacán, Guerrero).

5. **CRYOSOPHILA** Blume, Rumphia 2: 53. 1836.1. *Cryosophila nana* (H. B. K.) Blume, Rumphia 2: 53. 1836.

Corypha nana H. B. K. Nov. Gen. & Sp. 1: 299. 1815.

Copernicia nana Liebm.; Hemsl. Biol. Centr. Amer. Bot. 3: 411. 1885.

Known only from the type locality, summit of Cuesta de los Pozuelos, between Acapulco and Mazatlán, Guerrero.

Trunk 2 to 4 meters high, slender, unarmed; leaves flabellate, green above, whitish beneath; flowers densely spicate; fruit globose, about 12 mm. in diameter, green. "Palmillo."

¹ Bot. Gaz. 44: 420. 1907. *Washingtonia robusta* Wendl. Gart. Zeit. 2: 198. 1883.

² Parish, Bot. Gaz. 44: 420. 1907.

6. **ERYTHEA** S. Wats. Bot. Calif. 2: 211. 1880.

REFERENCE: Beccari, Webbia 2: 118-140. 1907.

Plants with tall trunks; leaves flabelliform, deeply divided, the divisions lacerate at the apex; flowers perfect; fruit baccate.

Fruit obpyriform, distinctly attenuate to the base; petioles unarmed.

1. *E. elegans*.

Fruit globose, rounded at the base; petioles usually armed with spinelike teeth.

Leaves glaucous ----- 2. *E. armata*.

Leaves green.

Fruit 1.5 to 2 cm. in diameter; trunk sometimes 30 meters high.

3. *E. brandegeei*.

Fruit 2.5 to 3 cm. in diameter; trunk usually 6 to 9 meters high.

Petioles armed with short hooked spines ----- 4. *E. aculeata*.

Petioles unarmed or nearly so ----- 5. *E. edulis*.

1. *Erythea elegans* Franceschi; Becc. Webbia 2: 138. 1907.

-Sonora, in the region about Hermosillo.

Leaves glaucescent; fruit 18 to 20 mm. long, 15 to 17 mm. thick.

2. *Erythea armata* S. Wats. Bot. Calif. 2: 212. 1880.

Brahea armata S. Wats. Proc. Amer. Acad. 11: 146. 1876.

Glaucosphaera armata Cook, Journ. Washington Acad. Sci. 5: 237. 1915.

Along canyons and arroyos, northern Baja California; type from Tantillas Mountains.

Trunk sometimes 12 meters high and a meter in diameter, but usually about 6 meters high; leaves very numerous, the blades glaucous, the petioles armed with curved teeth; inflorescence slender, exceeding the leaves, the flowers dull purplish. "Palma blanca" (Sonora).

This species is cultivated in southern California and in Sonora. It has been made the type of a new genus, *Glaucosphaera*, by Cook. While this genus is apparently well founded, it seems impracticable to recognize it in the present work, since the position of some of the other species, especially *E. elegans*, is doubtful.

3. *Erythea brandegeei*¹ Purpus, Gartenflora 1903: 12. f. 1, 2. 1903.

Mountains of the Cape Region of Baja California.

Trunk 30 meters high or higher, about 60 cm. in diameter or less, smooth; leaves 10 to 12, the blades subtomentose, sparsely filiferous, green above, pale beneath, about 1 meter long; petioles glabrous, 1 to 1.5 meters long, spine-toothed; inflorescence tomentose; fruit 10 to 15 mm. in diameter. "Palmilla," "palma negra," "palma de Tlaco."

The tender buds are eaten.

4. *Erythea aculeata* T. S. Brandeg. Zoe 5: 196. 1905.

Sinaloa; type from Cofradía.

Trunk 6 to 7 meters high; leaf blades 40 to 60 cm. long, with about 40 segments, slightly filiferous; petioles slender, 50 cm. long or longer, the margins armed with short teeth; fruit globose, 2.5 cm. in diameter.

¹ Named for T. S. Brandege (1843-) who has made large collections of Mexican plants, chiefly in Baja California, but also in Sinaloa. He has published several papers upon the plants of Baja California, which are our most important sources of information upon the botanical features of that region. He has published, also, papers dealing with plants from other parts of Mexico, especially the recent collections obtained by C. A. Purpus. The Brandege Herbarium is at the University of California, but large numbers of the plants of Mr. Brandege's collections are in the U. S. National Herbarium.

5. *Erythea edulis* (Wendl.) S. Wats. Bot. Calif. 2: 212. 1880.*Brahea edulis* Wendl.; S. Wats. Proc. Amer. Acad. 11: 146. 1876.

Known only from Guadalupe Island, Baja California. Cultivated in southern California.

Trunk sometimes 9 meters high and 37 cm. in diameter, covered with thick corky cracked bark; petioles stout, unarmed; leaf blades about a meter long, with 70 to 80 folds, tomentose at first; inflorescence 1.2 meters long, tomentose; fruit about 2.5 cm. in diameter, with thick pulp.

The fruit clusters are said to weigh 40 to 50 pounds. The pulp of the fruit is sweet and edible. The buds also are eaten.

7. **BRAHEA** Mart. Hist. Nat. Palm. 3: 243. 1836-50.

REFERENCE: Beccari, Webbia 2: 92-107. 1907.

Plants with tall unarmed trunks; leaves flabelliform, cleft into numerous segments; fruit of 1 to 3 1-seeded carpels.

Flowers glomerate-ternate.....1. *B. pimo*.
Flowers solitary.

Branches of the inflorescence terete, stout, densely tomentose-velutinous, the flowers partly immersed; leaves filiferous.....2. *B. calcarea*.

Branches of the inflorescence filiform, puberulent, the flowers sessile; leaves not filiferous.....3. *B. dulcis*.

1. *Brahea pimo* Becc. Webbia 2: 103. 1907.

Type from Monte de la Ventana, Michoacán or Guerrero.

Trunk 3 to 4 meters high; spadices about 40 cm. long, thrice branched. "Pimo."

2. *Brahea calcarea* Liebm.; Mart. Hist. Nat. Palm. 3: 319. 1836-50.

Described from mountains near Jalcomulco, Veracruz, altitude about 600 meters.

Trunk about 6 meters high, naked; petioles smooth; inflorescence about 25 cm. long, the branches flexuous, pendulous.

3. *Brahea dulcis* (H. B. K.) Mart. Nat. Hist. Palm. 3: 244. *pl. 137, 162*. 1836-50.*Corypha dulcis* H. B. K. Nov. Gen. & Sp. 1: 300. 1815.

Nuevo León to Sinaloa and Oaxaca; type from "La Moxonera et Alto de las Caxas."

Trunk 2.5 to 6 meters high, or sometimes nearly obsolete, 15 to 20 cm. thick, unarmed; leaves green or pale green, sparsely filiferous, the margins of the petioles coarsely spine-toothed; inflorescence 1.5 to 2.5 meters long, pendulous, the branchlets very thick, tomentose; fruit globose, yellow, succulent; seed white, ovate, very hard. "Palmito" (Durango, Nuevo León); "cochaiste" (Michoacán, Guerrero); "palma apache" (Hidalgo, Puebla, *Urbina*); "palma dulce" (Puebla, Guerrero, *Ramírez*); "palma de sombrero," "palma soyal" (Guerrero, Hidalgo); "soyale" (various localities, *Ramírez*); "zoyate," "soyate" (Hidalgo, Jalisco, Oaxaca); "palma de abanico" (Oaxaca); "yaga-xiña" (Oaxaca, Zapotec, *Reko*); "yucu-teyeye," "yutnu-ñun" (Oaxaca, Mixtec, *Reko*).

Wood very hard and heavy, used for frames of houses. Leaves used for thatching. The fruit (known in Durango as "michire" or "miche") is sweet and edible.

8. PHOENIX L. Sp. Pl. 1188. 1753.

1. *Phoenix dactylifera* L. Sp. Pl. 1188. 1753.

Widely cultivated in Mexico and in some places, as in Baja California, growing without cultivation, perhaps on the sites of abandoned ranches. Native of the Old World.

Trunk often 15 meters high or taller; leaves large, pinnate; fruit borne in large panicles. Commonly known as "datil;" the name "zoyacapulín" is said to be applied also.

One of the best-known palms, grown for its fruit in most tropical regions. The date palm was introduced into Mexico at an early period and is now cultivated in many localities, chiefly in the more arid regions. Dates were exported from Baja California in the early part of the nineteenth century, but the amount now produced in Mexico is not very large. They could doubtless be grown on a large scale in Sonora and Sinaloa, for the trees thrive in that part of Mexico.

9. GEONOMA Willd. Mém. Acad. Sci. Berlin 1804: 37. 1807.

Trunk very short, covered by the sheaths of the petioles.....1. *G. mexicana*.
Trunk 4 to 8 meters high, naked.....2. *G. magnifica*.

1. *Geonoma mexicana* Liebm.; Mart. Hist. Nat. Palm. 3: 316. 1836-50.

Oaxaca, at about 900 meters; material from Veracruz perhaps belongs here.

Trunk very short; leaves interrupted-pinnatifid, bifid at the apex, the pinnae subopposite, broadly lanceolate, long-acuminate; spadix pubescent, with cernuous branches; fruit oblique-ellipsoid.

2. *Geonoma magnifica* Lind. & Wendl. Linnaea 28: 335. 1856.

Described from material collected between San Carlos and Macuspana, Tabasco.

Trunk 4 to 8 meters high and 5 to 6 cm. thick, annulate; leaves pinnatisect, the blade 2.5 meters long, 70 to 80 cm. wide, with 7 or 8 pairs of pinnae, these broadly lanceolate, long-acuminate. "Pujai."

Hemsley reports¹ a third species from Oaxaca as *Geonoma galeottiana* Wendl., but this name is unpublished.

10. CALYPTROGYNE Wendl. Bot. Zeit. 17: 72. 1859.

1. *Calyptrogyne ghiesbreghtiana*² (Lind. & Wendl.) Wendl. Bot. Zeit. 17: 72. 1859.

Geonoma ghiesbreghtiana Lind. & Wendl. Linnaea 28: 343. 1856.

Chiapas.

¹ Biol. Centr. Amer. Bot. 3: 408. 1885.

² August Ghiesbreght was born in Brussels in 1810. In 1836 he and Linden were appointed by Leopold I to explore Brazil. In 1837, together with Linden and Funck, he started for Mexico and reached Veracruz in January, 1838. He accompanied Galeotti in his ascent of Orizaba, and also collected elsewhere. He went to Europe in 1839, but returned to Mexico in the same year, and with Linden visited Tabasco. In March, 1840, he accompanied his collections to Europe, but returned soon after, and botanized in various states, ascending the volcanoes of Colima, Jorullo, and Zempoaltepec. He took up his residence in Tabasco, and explored that State as well as Chiapas. In 1857 he again accompanied his collections to Europe, to return once more, however, and establish himself in the city of Chiapas. His collections are found in many of the herbaria of Europe and America.

Trunk short or almost none; rachis of the leaf 80 to 85 cm. long, with 6 pairs of pinnae, these 50 to 65 cm. long; inflorescence 1.2 to 1.5 meters long. "Guanito talis."

Leaves used for covering huts.

11. **REINHARDTIA** Liebm.; Mart. Hist. Nat. Palm. 3: 311. 1836-50.

1. **Reinhardtia elegans** Liebm.; Mart. Hist. Nat. Palm. 3: 311. 1836-50.

Oaxaca; type collected between Chuapan and Tiutalcingo.

Trunk slender, 6 meters high; leaves 1.5 to 1.8 meters long, horizontal, the pinnae 30 to 45 cm. long, 1.2 cm. wide; inflorescence erect, a meter long, branched; fruit oval, about 1.5 cm. long.

12. **CHAMAEDOREA** Willd. Sp. Pl. 4²: 638. 1806.

Plants unarmed, erect or procumbent, with stout or very slender stems; leaves pinnatisect, or simple and bifid at the apex; fruit small, of 1 to 3 carpels, dry or fleshy.

The Mexican species of this genus, as of most others of the family, are very imperfectly known. Some of them were described from cultivated plants, and all are poorly represented in herbaria. The following key, consequently, is very imperfect.

The unopened flower spathes of various species are often cooked and eaten. The following vernacular names are reported for some of the species: "Tepejilote" or "tepexilotl" (Nahuatl; Oaxaca, Morelos, Guerrero); "hom cabalsáh" (Oaxaca, Veracruz, *Ramírez*); "guaya de bajo," "guaya de cerro," "guayita" (Tabasco).

Interior perianth of the staminate flowers usually not stipitate; anthers obliquely incumbent.

Caudex repent, short, dichotomous; pinnae linear.....1. *C. martiana*.

Caudex erect, elongate, simple; pinnae lanceolate.

Pinnae few, about 8 on each side.....2. *C. alternans*.

Pinnae numerous, 18 or more on each side.

Segments of the inner perianth acutish; branches of the staminate inflorescence few.....3. *C. tepejilote*.

Segments of the inner perianth very obtuse; branches of the staminate inflorescence numerous.....4. *C. wendlandiana*.

Interior perianth of the staminate flowers connate at the base with the filaments and rudimentary ovary to form a short stipe; anthers erect.

Perianth segments of both staminate and pistillate flowers valvate.

Interior perianth of the pistillate flowers of 3 distinct segments.

Leaves simple, bilobate or irregularly pinnatifid; pistillate spadix simple.

.....5. *C. ernesti-augusti*.

Leaves pinnate; pistillate spadix branched.....6. *C. sartorii*.

Interior perianth of both staminate and pistillate flowers gamophyllous, tridentate.

Leaves simple, bifid.....7. *C. stolonifera*.

Leaves pinnate.

Caudex very short or obsolete.....8. *C. humilis*.

Caudex 2 to 3.5 meters high.

Pinnae 1 to 1.5 cm. wide, about 15 cm. long.....9. *C. elegans*.

Pinnae about 2.5 cm. wide and 30 cm. long.....10. *C. liebmanni*.

Perianth segments of the staminate flowers valvate, those of the pistillate flowers imbricate.

Fruit 3-celled. Pistillate spadices simple.

Caudex procumbent; leaves about 40 cm. long----11. *C. pygmaea*.
 Caudex erect; leaves more than 40 cm. long.
 Pinnae 12.5 to 17 cm. long, 6 to 8 mm. wide.

12. *C. cataractarum*.

Pinnae 30 cm. long, 2.5 to 3.3 cm. wide-----13. *C. oreophila*.

Fruit 1-celled.

Leaves simple, bifid; spadices simple-----14. *C. tenella*.

Leaves pinnate; spadices usually branched.

Caudex very long, flexuous, subcandent.

Pinnae partly hooked at the apex, some of them opposite.

15. *C. elatior*.

Pinnae not hooked at the apex, all alternate----16. *C. affinis*.

Caudex erect.

Pinnae few (5 to 12 on each side), trapezoid or oblong.

Staminate flowers oblong; segments of the inner perianth
 free at the apex-----17. *C. lunata*.

Staminate flowers subglobose; segments of the inner peri-
 anth adnate at the apex.

Pinnae about 5 on each side-----18. *C. lindeniana*.

Pinnae 10 to 12 on each side-----19. *C. schiedeana*.

Pinnae numerous, elongate-lanceolate or linear-lanceolate.

Pinnae approximate in clusters along the rachis.

20. *C. klotzschiana*.

Pinnae evenly distributed along the rachis.

Leaf blades short, 45 to 60 cm. long-----21. *C. radicalis*.

Leaf blades large, 1 to 2 meters long.

Pinnae 45 to 50 cm. long, about 2.5 cm. wide; caudex
 very short-----22. *C. montana*.

Pinnae about 30 cm. long, 2 to 3.5 cm. wide; caudex
 elongate.

Pinnae 3 to 3.7 wide-----23. *C. karwinskiana*.

Pinnae 0.8 to 2 cm. wide.

Pinnae about 2 cm. wide-----24. *C. pochutlensis*.

Pinnae about 1 cm. wide-----25. *C. graminifolia*.

1. *Chamaedorea martiana* Wendl. Allg. Gartenz. 21: 137. 1853.

Native of Mexico, the locality not known.

Caudex short, repent, dichotomous; leaves long-petiolate, pinnate, the pinnae
 numerous, small, linear; spadices short-pedunculate, simply branched.

2. *Chamaedorea alternans* Wendl. Gartenflora 29: 104. 1880.

Chiapas.

Caudex up to 3 meters high, 3 cm. thick, the nodes 4 to 8 cm. apart; leaves
 4 or 5, 1.75 meters long, the petiole 35 cm. long, the blades pinnate, the pinnae
 about 8 on each side, elliptic-lanceolate, acuminate, the middle ones 40 to 50
 cm. long, 11 to 14 cm. wide; pistillate spadix 40 to 50 cm. long, with 9 to 13
 branches.

3. *Chamaedorea tepejilote* Liebm.; Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Described from "Matlaluca, S. Maria, Orizaba."

Caudex 1.2 to 1.8 meters high, thick, closely annulate; leaf blades 1.2 meters
 long, the pinnae 32 to 37 cm. long, 3.5 cm. wide, numerous, alternate, narrowly
 lanceolate, subfalcate, acute; spadices simply branched, borne among the
 younger leaves; fruit oblong-ovoid, 16 mm. long, 6 mm. thick, black. "Tepe-
 jilote."

The unopened spathes are cooked and eaten like asparagus.

4. *Chamaedorea wendlandiana* (Oerst.) Hemsl. Biol. Centr. Amer. Bot. 3: 407. 1885.

Stephanostachys wendlandiana Oerst. Nat. For. Kjöbenhavn Vid. Medd. 1858: 28. 1859.

Oaxaca.

Leaves 1.2 meters long, the petiole 30 cm. long, the pinnae 18 to 20 on each side, narrowly lanceolate, slightly falcate, long-acuminate, the middle ones 50 cm. long, 3.7 cm. wide or more; staminate spadix 45 cm. long, the peduncle 30 cm. long, the spathes 7, chartaceous, greenish, the branches numerous, 15 cm. long; pistillate spadix 25 cm. long, the few branches erect or ascending, 7.5 cm. long.

5. *Chamaedorea ernesti-augusti* Wendl. Allg. Gartenz. 20: 73. 1852.

Eleutheropetalum ernesti-augusti Oerst. Nat. For. Kjöbenhavn Vid. Medd. 1858: 7. 1859.

Tabasco (type locality). Guatemala and Honduras.

Caudex elongate, erect, remotely annulate; leaves simple, ovate-oblong, bifid or irregularly pinnatifid, coarsely serrate; pistillate spadix simple, strict, equaling or longer than the leaves, the rachis thick and fleshy.

6. *Chamaedorea sartorii*¹ Liebm.; Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Veracruz; type from Barranca de San Francisco, near Mirador, altitude 600 to 750 meters.

Caudex 2.5 to 4.2 meters high, annulate, covered above by the petiole bases; leaf blades 90 to 105 cm. long, the pinnae 30 cm. long, 4 to 5 cm. wide, alternate, elongate-lanceolate, acuminate, falcate; spathes soon deciduous; spadices borne between and below the fronds, simply branched, the branches of the staminate inflorescence very long and pendulous; fruit oval, black, 12 mm. long, 8 mm. thick.

7. *Chamaedorea stolonifera* Wendl.; Hook. f. in Curtis's Bot. Mag. 118: pl. 7265. 1892.

Described from southern Mexico, the locality not known.

Caudices very slender, a meter high, very stoloniferous, forming dense tufts, closely annulate; leaves terminal, 25 cm. long, short-petiolate, the blades cleft to below the middle into 2 oblong acute segments; spadices borne below the leaves, the staminate with 5 or 6 spreading flexuous branches, these 7.5 to 12.5 cm. long.

8. *Chamaedorea humilis* (Liebm.) Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Collinia humilis Liebm. Overs. Dansk. Vid. Selsk. Forh. 1846: 8. 1846.

Veracruz and Oaxaca; type from Colipa, Veracruz.

Dwarf, the caudex very short or obsolete, covered by the petiole sheaths; leaves about 45 cm. long, the pinnae 15 cm. long, 1 cm. wide, linear-lanceolate; spadices 20 to 30 cm. long, borne between and below the leaves simply branched; fruit globose, black.

9. *Chamaedorea elegans* Mart. Linnaea 5: 204. 1830.

Veracruz and Oaxaca; type from Barranca de Tioselo.

Caudex erect, 1.8 meters high, with numerous nodes; pinnae narrowly lanceolate, acuminate, straight; spadix paniculate-branched; fruit globose.

¹ Carl Sartorius, a native of Darmstadt, Germany, was obliged by political conditions to leave his native country in 1826, and in 1830 he took refuge in Mexico. He purchased land at Mirador, at the base of Mount Orizaba, and engaged in agricultural pursuits. He made large collections of plants which are deposited in various herbaria of Europe and the United States. His death occurred in 1872.

10. *Chamaedorea liebmanni*¹ Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Type from Chinantla, Oaxaca.

Caudex 3 to 3.5 meters high, erect, annulate; leaf blades 1 to 1.2 meters long, the petioles 22 cm. long, the pinnae elongate-lanceolate, 30 cm. long, 2.5 cm. wide, acuminate; spadices 45 cm. long, twice-branched; fruit globose, minute, black.

11. *Chamaedorea pygmaea* Wendl. Allg. Gartenz. 20: 217. 1852.

Chiapas.

Caudex very short, procumbent; leaves short-petiolate, 40 to 42.5 cm. long, the pinnae 9 to 12 on each side, elongate-lanceolate; pistillate spadices 25 to 30 cm. long.

12. *Chamaedorea cataractarum* (Liebm.) Mart. Hist. Nat. Palm. 3: 309. 1836-50.

Stachyphorbe cataractarum Liebm. Overs. Dansk. Vid. Selsk. Forh. 1846: 8. 1846.

Oaxaca; type from Chinantla.

Thirty to 60 cm. high, the caudex very short, included in the sheaths; terminal leaves erect, the pinnae linear-lanceolate, acute, straight, alternate, 12.5 to 17 cm. long, 6 to 8 mm. wide; spadices basal, shorter than the leaves; fruit oval, black, the size of a pea.

13. *Chamaedorea oreophila* Mart. Hist. Nat. Palm. 3: 309. 1836-50.

Type from mountains of Tepitonga, Oaxaca.

Caudex 7.5 to 10 cm. long, densely annulate; leaves erect-patent, 75 cm. long, the pinnae 30 cm. long, 2.5 to 3.3 cm. wide, alternate, elongate-lanceolate, acute, straight; spadix 8 cm. long, erect, borne among the leaves; fruit olive-like, orange.

14. *Chamaedorea tenella* Wendl. Gartenflora 29: 102. 1880.

Nunnezharia tenella Hook. f. in Curtis's Bot. Mag. 107: pl. 6584. 1881.

Described from cultivated plants of Mexican origin.

Plants very small, flowering when 17 to 23 cm. high but sometimes 1 meter high, the caudex slender, rooting from the lower nodes; leaves short-petiolate, 10 to 20 cm. long, 6 to 10 cm. wide, obovate-oblong, bifid for a third their length, the lobes acute; spadices about as long as the whole plant, slender, drooping, simple; fruit globose, 8 mm. in diameter, dark green or bluish black.

Hooker (loc. cit.) remarks that this is perhaps the smallest palm known.

15. *Chamaedorea elatior* Mart. Linnaea 5: 205. 1830.

Chamaedorea scandens Liebm.; Mart. Hist. Nat. Palm. 3: 308. 1836-50.

San Luis Potosí, Veracruz, and Oaxaca; type from Barranca de Tioselo.

Stem sometimes 3.5 meters high, 2.5 cm. thick, flexuous and subscandent, covered with petiole sheaths; basal leaves 2, persistent, flabellate-bifid, the

¹ Frederick Michael Liebmann (1813-1856), a Dane, was sent by the Danish Government to Mexico in 1840, in company with a gardener, Rath sack, to make scientific collections, especially of living plants and seeds for the botanical garden of Copenhagen. He landed at Veracruz in February, and with Karwinsky he explored that State, making his headquarters at Mirador. Later he visited Puebla and Oaxaca, and in 1843 he returned to Copenhagen with his collections, which consisted of 40,000 botanical specimens. He was appointed professor of botany at Copenhagen in 1845 and director of the botanical garden in 1849. He published numerous papers based upon his collections, and after his death Oersted also published descriptions of some of the new species discovered. His plants were distributed to many of the herbaria of Europe and the United States.

cauline ones remote, 1.8 to 2.5 meters long, the pinnae numerous, 45 cm. long, 2.5 cm. wide, alternate, elongate-lanceolate, long-acuminate; spadices lateral, subappressed, pedunculate, simply branched; fruit globose, black.

16. *Chamaedorea affinis* Liebm.; Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Oaxaca; type from Chinantla.

Pinnae all alternate, the uppermost confluent; spathes 4, persistent.

17. *Chamaedorea lunata* Liebm.; Mart. Hist. Nat. Palm. 3: 307. 1836-50.

Type from Jicaltepec, Veracruz. Guatemala.

Caudex erect, 1.8 to 3.5 meters high, annulate, covered above with the leaf sheaths; leaves 75 to 100 cm. long, the pinnae 30 cm. long and 7.5 cm. wide or smaller, alternate, remote, broadly lanceolate, falcate, acuminate; spadices simply branched, borne below the leaves, the branches very long, flexuous; fruit elongate, curved, attenuate at each end, 12 to 14 mm. long.

18. *Chamaedorea lindeniana* Wendl. Allg. Gartenz. 21: 139. 1853.

Native of Mexico, the locality not known; specimens from Veracruz are perhaps referable here.

Pinnae 5 on each side, oblong-trapezoid, the middle ones 25 to 28 cm. long, 10 to 11.5 cm. wide, the lowest ones approximate, reflexed-patent, the upper confluent; peduncle of the pistillate inflorescence 35 to 38 cm. long, the rachis 7.5 to 10 cm. long, the branches slender, subflexuous.

19. *Chamaedorea schiedeana*¹ Mart. Linnaea 5: 204. 1830.

Veracruz; type from Jalapa. Guatemala.

Caudex about 1.8 meters high; petioles half as long as the blades, the pinnae broadly lanceolate, falcate-cuspidate; spadices simply branched; fruit globose, bluish black.

20. *Chamaedorea klotzschiana* Wendl. Ind. Palm. 63. 1854.

Native of Mexico, the locality not known.

Pinnae 15 to 18 on each side, elongate-lanceolate, acuminate, the middle ones 30 cm. long, 3.7 cm. wide.

21. *Chamaedorea radicalis* Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Type from the Sierra Madre, lat. 21° to 22° (Tepic or Jalisco).

Plant small, the caudex short, stoloniferous, covered with the petiole sheaths; petioles shorter than the pinnae, the blades 45 to 60 cm. long, the pinnae thickish, linear-acuminate; spathes 6; spadices subbasal, erect, few-branched; fruit globose, black, the size of a pea.

22. *Chamaedorea montana* Liebm.; Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Type from Trapiche de la Concepción, Oaxaca.

Caudex 30 cm. high or less, erect, closely annulate; petioles 45 to 60 cm. long, the blades 1.5 to 2 meters long, the pinnae 45 to 50 cm. long, 2.5 cm. wide or

¹ Christian Julius Wilhelm Schiede (1798-1836), a German, studied natural science, especially botany, at Berlin and Göttingen, and, as a means of assistance in his proposed botanical explorations, medicine. Accompanied by another botanist, Deppe, he reached Mexico in 1828. The two spent about a year in exploring the State of Veracruz, and obtained large collections of plants and other objects. Schiede then took up the practice of medicine, which gave him means to explore other regions of Mexico. His collections were studied chiefly by Schlechtendal and Chamisso, who published numerous papers dealing with them in Linnaea. Schiede himself published descriptions of some of the new plants he discovered, as well as letters dealing with the general aspects of Mexican vegetation. He died in the City of Mexico in 1836. His plants were widely distributed, the most complete series being at Berlin; a few are in the U. S. National Herbarium.

more, numerous, alternate or subopposite, rigid, narrowly lanceolate, acute, cuspidate; spadices simply branched, erect, borne among the leaves, the branches flexuous; fruit globose, small, thin-fleshed, black.

23. *Chamaedorea karwinskiana* Wendl. Allg. Gartenz. 21: 179. 1853.

Native of Mexico, the locality not known.

Caudex 50 cm. high or more, stoloniferous; leaves pinnate, the pinnae 27 to 33 on each side, linear-lanceolate, 30 cm. long, 3 to 3.7 cm. wide; staminate spadix 35 to 50 cm. long, the branches pendulous, the pistillate spadix 40 to 50 cm. long, branched; fruit oblong, black.

24. *Chamaedorea pochutlensis* Liebm.; Mart. Hist. Nat. Palm. 3: 308. 1836-50.

Type from Pochutla, Oaxaca.

Caudex 3 to 3.5 meters high, slender, closely annulate; fronds 1 to 1.2 meters long, the pinnae 20 to 28 cm. long, scarcely 2.5 cm. wide, elongate-lanceolate, straight, acute, spadices 45 cm. long, erect between the leaves, simply branched, the branches very long, slender, pendulous.

25. *Chamaedorea graminifolia* Wendl. Ind. Palm. 62. 1854.

Specimens from Yucatán are referred here with doubt. Guatemala.

Pinnae 36 to 42 on each side, linear, about 25 to 30 cm. long and 1 cm. wide, straight; staminate spadix 30 cm. long or more, the branches very long, flexuous, pendulous. "Xiat" (Yucatán).

13. COCOS L. Sp. Pl. 1188. 1753.

REFERENCES: Cook, The origin and distribution of the cocoa palm, Contr. U. S. Nat. Herb. 7: 257-293. 1901; Cook, History of the coconut palm in America, Contr. U. S. Nat. Herb. 14: 271-342. 1910; Beccari, The origin and dispersal of *Cocos nucifera*, Philippine Journ. Sci. Bot. 12: 27-43. 1911.

1. *Cocos nucifera* L. Sp. Pl. 1188. 1753.

Common along both coasts of Mexico, often cultivated. Widely distributed in tropical regions.

Trunk slender, sometimes 30 meters high with a diameter of 60 to 70 cm., usually enlarged at the base, normally erect but often bent over by wind; leaves pinnate, 3 to 6 meters long; flowers white, borne in large panicles. Known commonly in Mexico as "coco," "cocotero," "palma de coco," and "coco de agua;" also as "coco de castillo."

The best known and most important of all palms, of frequent occurrence along the coasts of Mexico, growing normally in the immediate vicinity of salt water. The trunks are used for building dwellings and for rafts and the leaves for thatching. The meat of the nut is a favorite article of food and large amounts are used for making "dulces" or sweetmeats. The milk of the fresh fruits is a refreshing drink and is said to have diuretic properties. The fruit has the reputation, in Cuba and Yucatán, of expelling intestinal parasites.

On the west coast of Mexico, particularly in Colima, an intoxicating drink called "tuba" is made from the sap obtained from the trunk or from the inflorescences. This is sometimes flavored with pineapple, lemon, onion, chile, or cinnamon, when it is known as "tuba compostura." The "tuba" is distilled to obtain alcohol, and also furnishes vinegar.

The shells of the nuts are made into cups and other articles. Oil is expressed from the meat, and small quantities of it have been exported from Mexico.

In other regions of the world the different parts of the coco palm are employed for an infinite variety of purposes which it seems unnecessary to enumerate here.¹

¹ See Safford, Contr. U. S. Nat. Herb. 9: 233-243. 1905.

14. **ATTALEA** H. B. K. Nov. Gen. & Sp. 1: 309. 1815.1. *Attalea cohune* Mart. Hist. Nat. Palm. 3: 300. *pl.* 167. 1836-50.

Jalisco to Oaxaca and Yucatán, chiefly in the littoral regions. Central America; type from Honduras.

Trunk often 50 to 60 meters high, when short usually covered with persistent leaf bases; leaves very large, sometimes 7.5 meters long (said to be even 18 meters long and 2.5 meters wide), gracefully recurved, pinnate, with very numerous segments; inflorescence 1.5 to 2 meters long; fruit resembling a small coconut, about 7 cm. long, mamillate at the apex, subtended by the accrescent perianth; seeds large, very oily. "Corozo" (Yucatán, Oaxaca, Guatemala, Costa Rica); "palma de coquito de aceite," "coquino," "coco de aceite," "coquito" (Colima); "palma real," "corozo gallinazo" (Panama); "cohune" (Honduras, Guatemala); "monaco," "manaca" (Guatemala); "coco de Guadalajara" (Chihuahua, in market).

The tallest and most showy of Mexican palms and one of the most important ones economically. The trunks are used for building purposes and the leaves for thatching. From the trunk a liquor similar to that of the coco palm is obtained. The flowers have a heavy, unpleasant odor, and attract bees and wasps. The young bud or "cabbage" is cooked and eaten, and in Costa Rica, at least, the young leaves are used for making hats. The fruits, however, are the most important part of the plant. They are much eaten by cattle, and the seeds are used for human food, especially for the preparation of sweetmeats. The seeds contain about 50 per cent of oil, which is extracted by pressure, and is used chiefly for making soap, but also for candles, machine oil, etc. One soap factory at Guaymas is said to have used 100,000 pounds of the oil a year.

Two species of *Cocos* described from Mexico by Liebmann probably belong to this genus. They may be synonyms of *Attalea cohune*, or they may represent distinct species, for there is reason to believe that more than one species of *Attalea* occurs in Mexico. *Cocos regia* Liebm. (Mart. Hist. Nat. Palm. 3: 323. 1836-50) was based upon material from the mountains of eastern Mexico. *C. guacuyule* Liebm. (Mart. loc. cit.) was collected near Guatulco, at an altitude of 360 meters. The latter name has been much used in Mexican literature for the plant here listed as *Attalea cohune*. The following vernacular names have been reported: "Coyol," "coyole," "guacoyul," "huiscoyul," "quacoyul."

15. **ACROCOMIA** Mart. Hist. Nat. Palm. 2: 66. 1823 (?).1. *Acrocomia mexicana* Karw.; Mart. Hist. Nat. Palm. 3: 285. *pl.* 138. 1836-50.

Sinaloa and southward along the Pacific coast; Yucatán; type from Teoxomulco. Guatemala.

Trunk of medium height, very spiny; leaves pinnate, with numerous thin narrow segments, these pale and more or less hispid beneath; rachis and petiole of the leaf armed with very numerous long compressed blackish lustrous spines; fruit globose, about 4 cm. in diameter: "Coyol" (Guerrero); "co-coyol" (Yucatán); "cocoyul" (Sinaloa, Guerrero); "guacoyul" (Oaxaca; from the Nahuatl, "cuau-coyotli"); "coquito baboso" (Oaxaca).

The fruit is edible and is often found in the markets. It is said that an intoxicating liquor is made from it.

16. **ASTROCARYUM** Meyer, Prim. Fl. Esseq. 265. 1818.1. *Astrocaryum mexicanum* Liebm.; Mart. Hist. Nat. Palm. 3: 323. 1836-50. Veracruz and Oaxaca (type locality).

Trunk 1.2 to 1.8 meters high, densely covered with black spines; petiole and rachis densely spiny, the blades pinnate, the pinnae broadly linear; spathes densely spiny; inflorescence spicate; fruit fusiform, beaked, densely spiny. "Chocón" (Veracruz).

17. **BACTRIS** Jacq. Stirp. Amer. 271. 1763.

Plants usually low, the stems unarmed or often covered with long spines; leaves pinnatisect, the petioles usually spiny; flowers monoecious; fruit 1-celled, 1-seeded, the pericarp fleshy.

Petiole and rachis of the leaf unarmed.....1. **B. acuminata.**

Petiole and rachis armed with long spines.

Fruit globose, unarmed.....2. **B. baculifera.**

Fruit obovoid, ovoid, or turbinate.

Fruit densely prickly.....3. **B. cohune.**

Fruit unarmed.....4. **B. mexicana.**

1. **Bactris acuminata** Liebm.; Mart. Hist. Nat. Palm. 3: 321. 1836-50.

Described from Chinantla, Oaxaca.

Petiole and rachis unarmed, the pinnae elongate-lanceolate or the upper ones elongate-obovate, linear-acuminate, black-aculeate beneath.

2. **Bactris baculifera** Karw.; Mart. Hist. Nat. Palm. 3: 322. 1836-50.

Type from Jicaltepec, Veracruz.

Cespitose; trunk 2.5 to 2.7 meters high, the internodes about 20 cm. long, armed with numerous compressed spines 7 to 13 cm. long; petiole and rachis spiny; fruit globose, unarmed.

Wood very hard; said to be used for canes, etc.

3. **Bactris cohune** S. Wats. Proc. Amer. Acad. 21: 467. 1886.

Material from Tabasco probably belongs to this species. Originally described from Guatemala.

Trunk 1.8 to 4.5 meters high, straight, slender, densely spiny, covered with the persistent sheaths of old leaves; leaves pale beneath, the petiole and rachis very spiny, the pinnae linear, often a meter long, aculeolate on the margin; spathes tomentose and spiny; fruit obovoid, nearly 5 cm. long, prickly. "Cocoyol de jauacte" (Tabasco).

Fruit edible.

4. **Bactris mexicana** Mart. Palm. Orbign. 65. 1847.

Veracruz and Oaxaca; type from Jicaltepec, Veracruz.

Trunk of medium height, very spiny; petiole and rachis armed with numerous long slender black spines, the pinnae lance-linear, aculeate-ciliate, paler beneath; spathe very prickly; fruit shaped like an acorn, about 2.5 cm. long, surrounded at the base by the cuplike perianth. "Palma de garroche" (Oaxaca); the "quauhcoyolli" of Hernández, according to Martius.

18. **DESMONCUS** Mart. Hist. Nat. Palm. 2: 84. 1824(?).

1. **Desmoncus chinantlensis** Mart. Hist. Nat. Palm. 3: 321. 1836-50.

Forests of Chinantla, Oaxaca.

Trunk stout, flexuous, subscandent, very densely setose-aculeate; leaves remote, the petioles sheathing, spiny, the blades pinnate, with elliptic pinnae; peduncles densely retrose-spiny; fruit obovoid-globose.

Plants of this genus are said to be known in Tabasco as "ballí" and "matambilla," but perhaps these names apply rather to species of *Bactris*.

9. ARACEAE. Arum Family.

REFERENCES: Engler in DC. Monogr. Phan. 2. 1879; Engler, Pflanzenreich IV. 23. 1905-1913.

Plants glabrous; leaves alternate, distichous, or spirally arranged, entire or lobate; flowers small, perfect or monoecious, crowded on a simple spadix, this usually surrounded by a spathe, the whole inflorescence resembling a single flower; fruit baccate.

A large family, with numerous species in Mexico. Most of the plants, however, are wholly herbaceous, and often acaulescent. The species taken up here scarcely deserve to rank as shrubs, but they have long, coarse, epiphytic, scandent stems, which give them the general appearance, at least, of shrubs. The leaves in this family usually contain crystals of calcium oxalate, which penetrate the tongue when a piece is chewed, causing pain and swelling.

Flowers all fertile, or a few at the base of the spike unisexual; leaves often perforated or pinnatifid-----1. **MONSTERA**.

Flowers monoecious, the upper ones staminate, the lower pistillate; leaves not perforated.

Ovaries distinct, 2 to 10-celled; seeds with endosperm--2. **PHILODENDRON**.

Ovaries coherent, 1 or 2-celled; seeds without endosperm--3. **SYNGONIUM**.

1. **MONSTERA** Adans. Fam. Pl. 2: 470. 1763.

Scandent branched shrubs, the branches rooting; leaves distichous, entire or pinnatifid, often with large perforations; flowers perfect.

Leaf blades regularly pinnatifid-----1. **M. deliciosa**.

Leaf blades never regularly pinnatifid, with large openings.

Openings biseriate or triseriate along the costa-----2. **M. punctulata**.

Openings irregularly scattered or uniseriate.

Spadix oblong, about half as long as the spathe---3. **M. pertusa jacquinii**.

Spadix broadly ovoid, only slightly shorter than the spathe.

4. **M. karwinskyi**.

1. **Monstera deliciosa** Liebm. Nat. For. Kjöbenhavn Vid. Medd. 1849: 19. 1849.

Monstera lennae C. Koch, Bot. Zeit. 1852: 277. 1852.

Forests of Oaxaca (type locality) and Veracruz. Guatemala.

Stems terete, 6 meters long and 6 cm. thick or larger, sending out long roots from the nodes; leaf blades 40 to 60 cm. broad, with numerous narrow lobes; spadix 17 to 20 cm. long; berries pale yellow, spotted with violet. "Piñanona" (Oaxaca).

The fruiting spadices are edible.

2. **Monstera punctulata** Schott; Engl. in DC. Monogr. Phan. 2: 259. 1879.

Anadendron punctulatum Schott, Prodr. Syst. Aroid. 393. 1860.

Reported from Mexico, the locality not stated. Type locality uncertain but probably somewhere in Central America.

Leaf blades ovate, 60 to 70 cm. long, with numerous perforations.

3. **Monstera pertusa jacquinii** (Schott) Engl. in Mart. Fl. Bras. 3^o: 113. 1878.

Monstera jacquinii Schott, Oesterr. Bot. Wochenbl. 1854: 66. 1854.

Forests of Veracruz. West Indies, Central America, and northern South America.

Stems high-climbing, 1 to 3 cm. thick; leaf blades ovate, 30 to 40 cm. long, with few large perforations.

4. *Monstera karwinskyi* Schott, Oesterr. Bot. Zeitschr. 9: 99. 1859.
Monstera egregia Schott; Engl. in DC. Monogr. Phan. 2: 260. 1879.
 Forests of Veracruz; type collected between Colipa and Papantla.
 Stems high-climbing, 2 to 3 cm. thick; leaf blades obliquely oblong, 40 to 50 cm. long.

2. **PHILODENDRON** Schott; Schott & Endl. Melet. Bot. 1: 19. 1832.

Plants scandent, the leafy stems rooting at the nodes; leaves entire or lobate, thick, with persistent sheaths; flowers monoecious.

Leaves acute at the base, entire.

Leaf sheath arising slightly below the blade, long-produced---1. *P. seguine*.

Leaf sheath arising far below the blade-----2. *P. inaequilaterum*.

Leaves either sagittate or cordate or lobate.

Leaves parted or lobed.

Leaves 3-parted.

Ovules several in each cell-----9. *P. anisotomum*.

Ovules solitary-----10. *P. fenzlii*.

Leaves incised or pinnatifid.

Leaves ovate in outline-----11. *P. radiatum*.

Leaves rounded-----12. *P. polytomum*.

Leaves neither parted nor lobed.

Ovules solitary.

Petiole terete-----7. *P. subovatum*.

Petiole flattened above-----8. *P. advena*.

Ovules 2 to 5 in each cell.

Leaves thin, usually pellucid-striolate-----6. *P. mexicanum*.

Leaves subcoriaceous, not pellucid-striolate.

Petioles terete-----5. *P. sanguineum*.

Petioles flattened or sulcate on the anterior side.

Petioles flattened on the anterior side-----3. *P. sagittifolium*.

Petioles sulcate on the anterior side-----4. *P. daemonum*.

1. *Philodendron seguine* Schott, Bonplandia 1859: 164. 1859.

Forests of Oaxaca.

Branches 6 to 8 mm. thick; leaf blades narrowly oblong, 15 to 20 cm. long, 4 to 4.5 cm. wide.

2. *Philodendron inaequilaterum* Liebm. Nat. For. Kjöbenhavn Vid. Medd. 1850: 16. 1850.

Pital, Veracruz, the type locality.

Leaf blades oblong-ovate, 20 to 32 cm. long, 10 to 13 cm. wide.

3. *Philodendron sagittifolium* Liebm. Nat. For. Kjöbenhavn Vid. Medd. 1850: 17. 1850.

Philodendron tanyphyllum Schott, Prodr. Syst. Aroid. 273. 1860.

Veracruz to Morelos.

Stems high-climbing, 2.5 to 3 cm. thick; leaf blades sagittate, 30 to 50 cm. long; spathe green outside, purplish within; berries dull yellow.

4. *Philodendron daemonum* Liebm. Nat. For. Kjöbenhavn Vid. Medd. 1850: 17. 1850.

Veracruz, the type from Colipa.

Leaf blades cordate-hastate, 28 to 35 cm. long.

5. *Philodendron sanguineum* Regel, Gartenflora 1869: 197. pl. 621. 1869.

Forests of Veracruz, the type from the Valley of Córdoba.

Leaf blades elongate-sagittate, 20 to 30 cm. long; spathes green, 13 to 15 cm. long.

6. *Philodendron mexicanum* Engl. in Mart. Fl. Bras. 3²: 143. 1878.
Valley of Córdoba, Veracruz.
Leaf blades elongate-hastate, 30 to 36 cm. long.
7. *Philodendron subovatum* Schott, Oesterr. Bot. Wochenbl. 1855: 289. 1855.
Southern Mexico, the locality not indicated.
Stems scandent; leaf blades cordate-ovate, 25 to 35 cm. long, 24 to 30 cm. wide.
8. *Philodendron advena* Schott, Oesterr. Bot. Wochenbl. 1855: 289. 1855.
Southern Mexico, the locality not indicated.
Stems scandent; leaf blades broadly cordate-ovate, 35 cm. long, 20 to 26 cm. wide; spathes green outside, purple within; berries stramineous.
9. *Philodendron anisotomum* Schott, Oesterr. Bot. Zeitschr. 1858: 179. 1858.
Philodendron affine Hemsl. Diag. Pl. Mex. 37. 1878.
Morelos to Chiapas. Guatemala.
Stems repent or scandent, rooting at the nodes; leaf blades 3-parted.
10. *Philodendron fenzlii* Engl. in Mart. Fl. Bras. 3²: 144. 1878.
Morelos and probably elsewhere in Mexico.
Caudex scandent, 1 to 1.2 cm. thick; leaves 3-parted.
11. *Philodendron radiatum* Schott, Oesterr. Bot. Wochenbl. 3: 378. 1853.
Forests of Veracruz and Oaxaca. Guatemala.
Stems stout, scandent; leaf blades deeply pinnatifid; spathes green or purplish outside, pale purple within.
12. *Philodendron polytomum* Schott, Bonplandia 7: 164. 1859.
Forests of Veracruz; type from Colipa.
Leaf blades deeply pinnatifid, 60 to 70 cm. long, 60 to 65 cm. wide.

3. SYNGONIUM Schott, Wien. Zeitschr. 3: 780. 1829.

Scandent shrubs, the stems rooting at the nodes; leaves petiolate, the primary ones sagittate, the adult ones 3 to 9-lobate, the petiole elongate, with an accrescent persistent sheath; flowers monoecious, the peduncles short, solitary or fasciculate, the spadix much shorter than the spathe.

Tube of the spathe narrowly cylindrical; lateral nerves of the leaves ascending at an angle of about 60° ----- 1. *S. auritum*.

Tube of the spathe oblong-ovoid; lateral nerves ascending at an angle of 30 to 45° ----- 2. *S. podophyllum*.

1. *Syngonium auritum* (L.) Schott; Schott & Endl. Melet. Bot. 1: 19. 1832.
Arum auritum L. Sp. Pl. ed. 2. 1371. 1763.

Syngonium neglectum Schott, Bonplandia 1859: 163. 1859.

Veracruz to Morelos. Jamaica.

2. *Syngonium podophyllum* Schott, Prodr. Syst. Aroid. 68. 1856.

Veracruz. El Salvador.

10. LILIACEAE. Lily Family.¹

The Mexican species treated here are trees or shrubs, sometimes acaulescent but often with thick, simple or branched trunks; the leaves are either linear or dagger-shaped, usually stiff and rigid, sometimes with spiny margins; the flowers are either small or large and showy.

¹The writer is under obligations to Dr. William Trelease for generous assistance in the preparation of the account of this family.

Ovules numerous in each cell; flowers large, perfect.

Flowers scarcely 1.5 cm. wide, greenish; anthers oblong—1. **HESPERALOE**.

Flowers 5 to 10 cm. wide, white or yellow; anthers short-sagittate.

Style filiform; stigma papillate-----2. **HESPEROYUCCA**.

Style stout; stigma not papillate.

Perianth gamophyllous, tubular below, the stamens inserted in the throat.

3. **SAMUELA**.

Perianth polyphyllous or nearly so, campanulate, the stamens inserted at the base-----4. **YUCCA**.

Ovules 2 or 3 in each cell; flowers small, unisexual.

Ovary 3-celled; fruit exalate.

Fruit deeply 3-lobate, often inflated-----5. **NOLINA**.

Fruit not lobed or inflated-----6. **CALIBANUS**.

Ovary 1-celled; fruit 3-winged.

Perianth segments entire; leaves somewhat ribbed, the margins not prickly.

7. **BEAUCARNEA**.

Perianth segments denticulate; leaves not ribbed, the margins usually prickly-----8. **DASYLIRION**.

1. **HESPERALOE** Engelm.; S. Wats. in King, Geol. Expl. 40th Par. 5: 497. 1871.

REFERENCE: Trelease, Rep. Mo. Bot. Gard. 13: 29-38. pl. 1-4. 1902.

Plants acaulescent or nearly so; leaves linear, with filiferous margins; inflorescence paniculate, with few branches.

Flowers green, tinged with purple-----1. **H. funifera**.

Flowers rosy red or salmon-colored-----2. **H. parviflora**.

1. **Hesperaloe funifera** (Koch) Trel. Rep. Mo. Bot. Gard. 14: 36. 1902.

Yucca funifera Koch, Belg. Hort. 12: 132. 1862.

Hesperaloe davayi Baker, Kew Bull. 1898: 226. 1898.

Coahuila, Nuevo León, and San Luis Potosí; described from cultivated plants.

Leaves sometimes nearly 2 meters long and 4 cm. wide; inflorescence 2 to 2.5 meters high, the flowers campanulate, about 2.5 cm. long; capsule 2.5 to 5 cm. long, with large flat black seeds. "Samandoque."

The plant is said to be planted in Nuevo León for the fiber obtained from the leaves. The fiber is long and of excellent quality. It is exported as "ixtli" or "Tampico fiber."

2. **Hesperaloe parviflora** (Torr.) Coulter, Contr. U. S. Nat. Herb. 2: 436. 1894.

Yucca parviflora Torr. U. S. & Mex. Bound. Bot. 221. 1859.

Aloe yuccaefolia A. Gray, Proc. Amer. Acad. 7: 390. 1867.

Hesperaloe yuccaefolia Engelm.; S. Wats. in King, Geol. Expl. 40th Par. 5: 497. 1871.

Southwestern Texas, the type collected between the mouth of the Pecos and the Nueces. There is little doubt that the species occurs also on the Mexican side of the Rio Grande, in Coahuila.

Leaves 1 to 1.25 meters long, about 2.5 cm. wide; inflorescence 1 to 1.25 meters high; flowers about 3.5 cm. long; capsule 2.5 cm. long or larger.

2. **HESPEROYUCCA** (Engelm.) Baker, Kew Bull. 1892: 8. 1892.

REFERENCE: Trelease, Rep. Mo. Bot. Gard. 13: 38-41. pl. 4, 5. 1902.

1. **Hesperoyucca whipplei** (Torr.) Baker, Kew Bull. 1892: 8. 1892.

Yucca whipplei Torr. U. S. & Mex. Bound. Bot. 222. 1859.

Mountain slopes, Baja California. California; type from Pasqual.

Plants acaulescent or nearly so; leaves linear, stiff, 0.3 to 1 meter long, 1.5 cm. wide, sharp-pointed, glaucous; inflorescence 2 to 5 meters high, dense, the flowers white, pendent, fragrant; capsule about 5 cm. long.

The leaves are said to give a fine, strong fiber. The flowers were eaten formerly by the California Indians, and Palmer states that the seeds, also, were ground and eaten, either raw or in the form of porridge.

3. SAMUELA Trel. Rep. Mo. Bot. Gard. 13: 116. 1902.

Trees with thick, simple or branched trunks; leaves dagger-shaped, sharp-pointed, coarsely filiferous; flowers white, in large dense panicles.

Perianth tube conic, less than 1 cm. long-----1. *S. faxoniana*.

Perianth tube cylindric, 1.2 to 1.5 cm. long-----2. *S. carnerosana*.

1. Samuela faxoniana Trel. Rep. Mo. Bot. Gard. 13: 117. 1902.

Western Texas (type from Sierra Blanca), and doubtless extending into Chihuahua.

Trunk 1.5 to 5 meters high, 30 to 60 cm. thick, simple or with a few branches at the top; leaves 1 to 1.25 meters long, 5 to 7.5 cm. wide; fruit baccate, 2.5 to 7.5 cm. long.

2. Samuela carnerosana Trel. Rep. Mo. Bot. Gard. 13: 118. 1902.

Dry plains and mountain sides, Coahuila, Nuevo León, San Luis Potosí, and Zacatecas; type from Carneros Pass.

Trunk 1.5 to 6 meters high, simple or rarely branched, 70 cm. or less in diameter; fruit 5 to 7.5 cm. long, 4 cm. thick. "Palma samandoca" (Coahuila, Zacatecas).

The large trunks are used for fences or for the walls of houses, and sometimes they are split open so that the soft interior may be eaten by stock. The large flower panicles are eaten greedily by cattle and are sometimes gathered for this purpose. The immature inflorescences are used also for human food, boiled or roasted. The leaves yield a fiber (known in Zacatecas as "palma ixtle" fiber) useful for cordage. The pulpy, sweet but somewhat bitter fruits are eaten by people as well as by wild and domestic animals.

4. YUCCA L. Sp. Pl. 319. 1753.

REFERENCES: Trelease, Rep. Mo. Bot. Gard. 13: 27-133. *pl.* 1-99. 1902; *op. cit.* 18: 225-230. *pl.* 12-17. 1907.

The plants of this genus are distributed nearly throughout Mexico, but are most abundant in the more arid regions east of the western Sierra Madre, where they are often the dominant feature of the landscape. Yuccas are of importance from an economic standpoint, although much less so than the genus *Agave*.

The most important product is the fiber obtained from the leaves, which, however, is usually coarse and shorter than is desirable in commercial fiber. It is extracted usually in a crude fashion, and is an article of export. It may be that in time its extraction will be of considerable importance commercially. During the war-shortage of raw materials this fiber has acquired considerable value in the southwestern United States, especially that of *Yucca elata*. The fiber is much used locally for cordage, and it has been woven into mats and cloth by the Indians of Mexico and the United States. It is said that the cloth ("ayate") bearing the famous likeness of Our Lady of Guadalupe is made of *Yucca* fiber, but this may be incorrect.

The trunks of the arborescent species are often used for stockades and for walls of houses, and the leaves are used for thatching. Paper can be made from the fiber of the trunks and leaves.

The plants possess the saponifying properties of the genus *Agave*. The roots (under the name "amole") are used widely for washing clothing, the hair, etc., and they have been used in the United States in the manufacture of fine

toilet soap. An extract of the roots has been employed to produce foam in beverages.

The plants are of some importance as forage, chiefly in times of severe drought, when cattle often eat the stiff leaves. The flower panicles are much eaten by cattle. The flowers, either in bud or just after they have opened, have long been an article of human food in Mexico and they are frequently found in the markets at the present time. They are eaten raw as a salad, or are cooked in various ways, and are sometimes made into a conserve. They are slightly bitter and are reputed to have tonic properties.

The fruits of those species with baccate fruit, usually known as "datiles," are eaten by birds and mammals and by man. They contain much sugar but are more or less bitter. They are eaten either raw or cooked, and some of the Indians, of the United States at least, dried them for use in winter. The fruits are also fermented and sometimes distilled to produce an alcoholic beverage.

Various statements are made concerning the seeds. Palmer reports that the Indians used them for food. Others state that they are purgative, while Cervantes says that they are useful for the treatment of dysentery.

Many of the species of *Yucca* are used as ornamental plants, especially in arid regions. They are admirably suited for this purpose because of their showy flowers and striking palmlike appearance.

Fruit dehiscent, erect.

Leaves filiferous along the white margins. Plants with a tall trunk.

1. *Y. elata*.

Leaves minutely denticulate on the margins, not filiferous.

Capsule beaked, the valves rounded on the back.

Leaves about 60 cm. long; trunk about 3 meters tall.....4. *Y. rostrata*.

Leaves 20 to rarely 35 cm. long; trunk 1 meter high or less.

5. *Y. thompsoniana*.

Capsule mucronate, the valves flat on the back.

Plants with a tall trunk.....2. *Y. rigida*.

Plants acaulescent.....3. *Y. rupicola*.

Fruit indehiscent, baccate, pendent.

Fruit without a core, the pulp purple; ovary stalked. Leaves sharply denticulate but not filiferous.....6. *Y. aloifolia*.

Fruit with a papery core, the pulp greenish or whitish; ovary sessile.

Leaves not filiferous.....7. *Y. elephantipes*.

Leaves filiferous.

Margins of the leaves denticulate at first. Leaves thick and firm, often rough.....8. *Y. treculeana*.

Margins of the leaves not denticulate.

Leaves thin, flexible, smooth, the filaments slender.

Leaves 2 to 4 cm. wide; trunk nearly simple.....9. *Y. schottii*.

Leaves 7.5 cm. wide; trunk much branched.....10. *Y. jaliscensis*.

Leaves thick, rigid, the filaments usually coarse.

Leaves usually less than 2.5 cm. wide, smooth; trunk usually less than 2 meters high.....11. *Y. treleasei*.

Leaves 2.5 cm. wide or wider, often rough; trunk usually more than 2 meters high.

Leaves usually 2 to 4 cm. wide, smooth.

Plants acaulescent.....12. *Y. endlichiana*.

Plants with an elongate trunk.

Panicles narrow, pendent.....13. *Y. australis*.

Panicles broad, not pendent.

Leaves 15 to 23 cm. long-----14. *Y. valida*.

Leaves 30 to 60 cm. long.

Panicles glabrous or the pedicels puberulent.

15. *Y. decipiens*.

Panicles tomentose-----16. *Y. periculosa*.

Leaves 4 to 5 cm. wide, rough.

Style elongate-----17. *Y. macrocarpa*.

Style very short-----18. *Y. mohavensis*.

1. *Yucca elata* Engelm. Bot. Gaz. 7: 17. 1882.

Yucca angustifolia radiosa Engelm. in King, Geol. Expl. 40th Par. 5: 496. 1871.

Yucca radiosa Trel. Rep. Mo. Bot. Gard. 3: 163. 1892.

Dry plains, Chihuahua. Western Texas to Arizona.

Trunk simple or branched, sometimes 7 meters high; leaves very numerous, usually 3 to 10 mm. wide, long and very slender, with white margins; inflorescence glabrous; flowers white, campanulate. "Palmilla" (New Mexico).

2. *Yucca rigida* (Engelm.) Trel. Rep. Mo. Bot. Gard. 13: 65. 1902.

Yucca rupicola rigida Engelm. Trans. Acad. St. Louis 3: 49. 1873.

Chihuahua, Durango, and Zacatecas; perhaps also in Coahuila; type from between Mapimi and Guajuquilla.

Trunk simple or branched, sometimes 5 meters high; leaves thin, flat, glaucous, 30 to 60 cm. long, 2 to 3 cm. wide, rather stiff, sharp-pointed, with yellow margins; inflorescence glabrous; capsule about 5 cm. long. "Palma San José (Zacatecas); "palmita" (Durango); "palmilla."

A form with smooth, entire-margined leaves is var. *inermis* Trel. (Rep. Mo. Bot. Gard. 22: 102. 1911).

3. *Yucca rupicola* Scheele, Linnaea 23: 143. 1850.

Western Texas and doubtless in adjacent Mexico.

Plants acaulescent; leaves 30 to 50 cm. long, 2.5 to 3 cm. wide, glaucous, with brown or yellowish margins; inflorescence glabrous; flowers white or greenish.

A form with smooth-edged leaves is var. *edentata* Trel. (Rep. Mo. Bot. Gard. 22: 102. 1911).

4. *Yucca rostrata* Engelm.; Trel. Rep. Mo. Bot. Gard. 13: 68. 1902.

Chihuahua and Coahuila; type from Monclova, Coahuila.

Trunk simple or branched 3 meters high or less, 15 to 20 cm. in diameter, the wood very soft and spongy; leaves about 1 cm. wide, somewhat glaucous, striate, rather stiff, very pungent, with yellow margins; inflorescence glabrous, 0.5 to 1 meter long, the flowers large, pendent, white, rarely tinged with purple; capsule about 5 cm. long. "Soyate" (Coahuila); "palmita."

5. *Yucca thompsoniana* Trel. Rep. Mo. Bot. Gard. 22: 101. pl. 104-107. 1911.

Coahuila; type from Bufatello. Western Texas.

Flowering while stemless, but in age with a trunk a meter high; leaves 35 cm. long and 1 cm. wide or smaller, nearly flat, rigid, bluish or somewhat glaucous, pungent, usually roughened on the back; flowers about 4 cm. long; fruit 4 cm. long.

6. *Yucca aloifolia* L. Sp. Pl. 319. 1753.

Yucca serrulata Haw. Suppl. Pl. Succ. 32. 1819.

Veracruz, Morelos, and Yucatán; sometimes cultivated for ornament. West Indies; Gulf coast of the United States.

Trunk slender, branched or nearly simple, short; leaves distributed along the stem, flat, rigid, brown-pointed; flowers creamy white, tinged with green or purple near the base; fruit baccate, nearly black, with purplish black pulp. Ramírez gives the common names as "ic Zotli" and "izote."

A form with clustered trunks sometimes 7 meters high, and with tomentose inflorescence, is var. *yucatanana* (Engelm.) Trel. (Rep. Mo. Bot. Gard. 13: 93. 1902; *Y. yucatanana* Engelm. Trans. Acad. St. Louis 3: 37. 1873). It is known only from Yucatán.

7. *Yucca elephantipes* Regel, Gartenflora 8: 35. 1859.

Yucca guatemalensis Baker, Ref. Bot. 5: pl. 313. 1872.

Veracruz, Morelos, etc., the type apparently from Veracruz. Extensively cultivated in Guatemala.

Often 8 to 10 meters high, compactly branched above, the trunk from a swollen base, the bark rough; leaves 50 to 100 cm. long, 5 to 7 cm. wide, green, lustrous, not at all pungent, with very slightly scabrid margin; flowers white or creamy white. "Palmita," "datiles" (fruits), "palma" (Veracruz); "itabo" (Costa Rica); "izote" (Veracruz, Guatemala, Honduras).

Extensively cultivated, especially in Central America, as a hedge plant. The flowers are prized as an article of food, and are often found in the markets. They are usually fried with eggs.

8. *Yucca treculeana* Carr. Rev. Hort. 1858: 580. 1858.

Yucca aspera Regel, Ind. Sem. Hort. Petrop. 1858: 24. 1858.

Coahuila and Durango to Tamaulipas. Texas.

Trunk usually less than 5 meters high, simple or sparsely branched; leaves 0.9 to 1.25 meters long, 2.5 to 5 cm. wide, bluish green, thick, rough, concave, pungent, brown-margined; flowers white, sometimes tinged with purple. "Palma pita" or "palma de datiles" (Tamaulipas); "palma loca" (Nuevo León and elsewhere).

The leaves yield a coarse fiber which is used extensively. Palmer reports that the seeds are reputed purgative. The broader-leaved, larger-flowered form is var. *canaliculata* Trel. (*Y. canaliculata* Hook. in Curtis's Bot. Mag. III. 16: pl. 5201. 1860).

9. *Yucca schottii*¹ Engelm. Trans. Acad. St. Louis 3: 46. 1873.

Dry plains and hillsides, northern Chihuahua and Sonora. Southern Arizona and Sonora; type from Santa Cruz River, Arizona.

Trunk 2 meters high or rarely larger, simple or nearly so; leaves 2 to 4 cm. wide, bluish green, smooth, thin, concave, pungent, very finely filiferous; inflorescence usually tomentose; fruit sometimes 10 cm. long.

10. *Yucca jaliscensis* Trel., sp. nov.

Yucca schottii jaliscensis Trel. Rep. Mo. Bot. Gard. 13: 99. 1902.

Jalisco; type from Zapotlán.

¹Arthur Carl Victor Schott (1814-1875), a native of Germany, came to the United States in 1850. He was appointed a member of the scientific corps of the commission to establish the boundary between the United States and Mexico, and in the course of his work made large botanical collections. In 1864 he was commissioned by the governor of Yucatán to make a geological survey of that State, and here, also, he secured botanical collections. The most complete representation of his Yucatán plants is in the herbarium of the Field Museum of Natural History, but many of his specimens are in the U. S. National Herbarium.

About 8 meters high, freely branched; leaves about 75 cm. long and 7.5 cm. wide, thin, blue-green. "Isote."

The fiber extracted from the leaves is fine and of good quality.

11. *Yucca treleasei* Macbride, Contr. Gray Herb. n. ser. 56: 15. 1918.

Yucca brevifolia Schott; Torr. U. S. & Mex. Bound. Bot. 221. 1859, as synonym.

Not *Y. brevifolia* Engelm. 1871.

Region of Nogales, Arizona (the type locality), and doubtless in adjacent Sonora.

Trunk 2.5 meters high or less, or often wanting; leaves about 75 cm. long, usually 2 to 3 cm. wide, green, smooth, thick and stiff, falcate, the margins freely filiferous.

12. *Yucca endlichiana* Trel. Rep. Mo. Bot. Gard. 18: 229. 1907.

Coahuila; type from Marte.

Acaulescent; leaves about 50 cm. long and 1.5 cm. wide, erect, fleshy, V-shaped, smooth, pungent, bluish green, finely filiferous; flowers creamy white or purplish, about 1.5 cm. long; fruit pendent, 2.5 to 3 cm. long, with thin flesh. "Pitilla."

The leaves furnish fiber of excellent quality; it is considered superior to that of "lechuguilla."

13. *Yucca australis* (Engelm.) Trel. Rep. Mo. Bot. Gard. 3: 162. 1892.

Yucca baccata australis Engelm. Trans. Acad. St. Louis 3: 44. 1873.

Coahuila (type locality) to Tamaulipas and Querétaro, perhaps extending to the Distrito Federal; often forming forests.

Large, much branched tree, sometimes 10 meters high or more; leaves about 30 cm. long and 2.5 cm. wide, or sometimes larger, green, stiff, coarsely filiferous; inflorescence pendent, glabrous; flowers creamy white. "Palma" (San Luis Potosí and elsewhere); "palma corriente" (Querétaro); "izote" (Valley of Mexico, perhaps only cultivated there). Known also in various localities as "palma de San Pedro" and "palma samandoca" or "palma samondoca."

The hollowed trunks are used sometimes for beehives. The leaves give a fiber useful for cordage, and the fiber is sometimes dipped in pitch to make torches for use in mines. The young stems and leaves have been distilled to obtain alcohol. The spongy interior of the trunk is cut into long strips, beaten flat, washed in running water, and made into mats which are used as pads ("sudaderos") for pack animals. The fiber forms a part of the exported "ixtle" or "Tampico fiber."

14. *Yucca valida* T. S. Brandeg. Proc. Calif. Acad. II. 2: 208. pl. 11. 1889.

Southern Baja California.

Usually 4.5 to 6 meters high, branched, the trunks 20 to 60 cm. or more in diameter; leaves distributed along the stem, 15 to 23 cm. long, 1 to 2 cm. wide, thin, smooth, with whitish threads; panicle somewhat pubescent, not pendent; flowers creamy white.

15. *Yucca decipiens* Trel. Rep. Mo. Bot. Gard. 18: 228. 1907.

Durango to San Luis Potosí; type from Gutiérrez, Zacatecas.

Arborescent, 8 to 10 meters high, much branched above, the trunk sometimes 2 meters thick, covered with very rough bark; leaves 30 to 60 cm. long, 1 to 4 cm. wide, heavily pointed, finely or coarsely filiferous; panicles about 1.5 meters long, not pendent, glabrous or puberulent; flowers creamy white, 3 to 4 cm. long; fruit pendent, 6 to 8 cm. long. "Palma" (Durango); "palma china" (Zacatecas, etc.).

16. *Yucca periculosa* Baker, Gard. Chron. 1870: 1088. 1870.

Yucca circinata Baker, Gard. Chron. 1870: 1088. 1870.

Puebla and probably in Oaxaca and Veracruz; described from cultivated plants, from Tehuacán, Puebla.

Sometimes 6 meters high, with few branches, slender, with rather smooth bark; leaves 35 to 50 cm. long, 2 to 3.5 cm. wide, short-pointed, finely and abundantly filiferous, with brown threads; panicle about a meter long, tomentose, the flowers creamy white.

17. *Yucca macrocarpa* (Torr.) Coville, Contr. U. S. Nat. Herb. 4: 202. 1893.

Yucca baccata macrocarpa Torr. U. S. & Mex. Bound. Bot. 221. 1859.

Dry plains and hillsides, Chihuahua. Western Texas to southern Arizona; type from plains near the Limpio, Texas.

Usually 3 to 5 meters high, but often lower, simple, or with few short branches; leaves 50 to 100 cm. long, 4 to 5 cm. wide, usually rough, pungent, yellowish green, coarsely filiferous; panicle glabrous or somewhat pubescent, the flowers creamy white, 4 cm. long; fruit 7.5 to 10 cm. long. "Palma criolla" (Chihuahua, Texas); "palma" (New Mexico).

The leaves are used extensively by the Indians of southern New Mexico for making baskets.

18. *Yucca mohavensis* Sarg. Gard. & For. 9: 104. 1896.

? *Yucca schidigera* Roehl, Belg. Hort. 1880: 51. 1880.

Dry plains, Baja California. California to Arizona; type from the Mohave Desert.

Sometimes 4.5 meters high but usually lower, simple or with few short branches, the trunk 20 cm. or less in diameter; leaves 45 to 80 cm. long, about 4 cm. wide, smooth; panicles 30 to 45 cm. long, the flowers 2.5 to 4 cm. long, white, often tinged with purple; fruit 7.5 to 10 cm. long, yellowish, becoming purplish or black; wood porous, light brown, the specific gravity about 0.27.

5. *NOLINA* Michx. Fl. Bor. Amer. 1: 208. 1803.

REFERENCE: Trelease, Proc. Amer. Phil. Soc. 50: 412-426. 1911.

Plants acaulescent or with well-developed trunks; leaves linear, often rough on the margins; flowers very small, whitish, paniculate; fruit papery, containing 3 globose seeds.

It is said that the trunks are sometimes roasted and the interior portion eaten. The leaves are very tough and useful for thatching, brooms, baskets, coarse hats, mats, etc. Their fiber is used locally for cordage and enters somewhat into the cordage materials of the United States.

In Durango (and probably elsewhere) the various species are known as "zacate cortador," "zacate de armazón," "zacate de aparejo," and "palmilla." In the United States the name "bear-grass" is applied.

Leaves 15 to 40 mm. wide, usually not brushlike at the tip; bracts usually papery, often showy. Plants treelike.

Pedicels scarcely half as long as the fruit; leaves rather thick.

13. *N. bigelovii*.

Pedicels nearly or quite as long as the fruit; leaves rather thin.

Leaves 3 to 4 cm. wide.....14. *N. nelsoni*.

Leaves 1.5 to 3 cm. wide.

Primary divisions of the inflorescence about 50 cm. long; leaves glaucescent.....15. *N. beldingi*.

Primary division of the inflorescence 25 to 30 cm. long; leaves green.

Leaves spreading or erect.....16. *N. parviflora*.

Leaves drooping.....17. *N. longifolia*.

- Leaves 2 to 12 mm. wide, frequently brushlike at the tip; bracts not very showy.
 Leaves thin and grasslike, usually 3 to 5 mm. wide, rather flat, usually not brushlike at the tip.
 Pedicels slender, equaling or exceeding the fruit; bracts not imbricate.
 Inflorescence 30 cm. long, the branches short-----1. *N. pumila*.
 Inflorescence 25 to 30 cm. long, the branches stout, stiff--2. *N. juncea*.
 Pedicels stout, about half as long as the fruit; bracts imbricate.
 Leaves 2 to 3 mm. wide; inflorescence 15 cm. long-----3. *N. humilis*.
 Leaves 5 mm. wide; inflorescence 25 to 30 cm. long-----4. *N. watsoni*.
 Leaves thick, 2 to 12 mm. wide, concave, keeled on one or both surfaces, often brushlike at the tip.
 Fruit somewhat inflated, the seed not protruding.
 Leaves 4 to 5 mm. wide; lower branches of the panicle much longer than the bracts-----12. *N. rigida*.
 Leaves 6 to 12 mm. wide; lower branches of the panicle about as long as the bracts.
 Fruit shorter than the pedicels, 6 to 7 mm. wide--10. *N. durangensis*.
 Fruit about as long as the pedicels, 7 to 10 mm. wide.
 Divisions of the inflorescence 15 to 45 cm. long; leaves 6 to 12 mm. wide-----9. *N. microcarpa*.
 Divisions of the inflorescence 10 to 15 cm. long; leaves 12 mm. wide.
 11. *N. elegans*.
 Fruit not inflated, the seed early protruding.
 Inflorescence essentially smooth; pedicels slender-----8. *N. palmeri*.
 Inflorescence roughened in lines; pedicels stout in fruit.
 Lower panicle divisions as long as the bracts-----6. *N. erumpens*.
 Lower panicle divisions shorter than the bracts.
 Branchlets of the lower panicle divisions short, stiff, spreading.
 7. *N. cespitifera*.
 Branchlets of the lower panicle divisions weak, finally ascending.
 5. *N. affinis*.
1. *Nolina pumila* Rose, Contr. U. S. Nat. Herb. 10: 92. 1906.
 Known only from the type locality, in the Sierra Madre near Santa Teresa, Tepic.
 Plants acaulescent; leaves 20 to 30 cm. long, 2 to 4 mm. wide, with serrulate margins; inflorescence about 30 cm. long.
2. *Nolina juncea* (Zucc.) Macbride, Contr. Gray Herb. n. ser. 56: 16. 1918.
Dasylyrion junceum Zucc. Denkschr. Akad. Wiss. Muenchen 19: 19. 1845.
Dasylyrion hartwegianum Zucc. Denkschr. Akad. Wiss. Muenchen 19: 21. 1845, nomen nudum.
Nolina hartwegiana Hemsl. Biol. Centr. Amer. Bot. 3: 371. 1884.
 Known only from Zacatecas, the type locality.
 Leaves 3 to 4 mm. wide; inflorescence 25 to 50 cm. long.
3. *Nolina humilis* S. Wats. Proc. Amer. Acad. 14: 248. 1879.
 Known only from the original collection, from the region of San Luis Potosí.
 Acaulescent; leaves 60 cm. long, 2 to 3 mm. wide, with very rough margins; inflorescence 15 cm. long.
4. *Nolina watsoni* (Baker) Hemsl. Biol. Centr. Amer. Bot. 3: 372. 1884.
Beaucarnea watsoni Baker, Journ. Linn. Soc. Bot. 18: 236. 1880.
 San Luis Potosí.
 Leaves 5 mm. wide, with very rough margins; inflorescence 25 to 30 cm. long.
5. *Nolina affinis* Trel. Proc. Amer. Phil. Soc. 50: 417. 1911.
Nolina caudata Trel. Proc. Amer. Phil. Soc. 50: 417. 1911.

- Chihuahua and Sonora, on mesas and stony hills; type from near the city of Chihuahua. Southern Arizona.
- Leaves 3 to 4 mm. wide, sometimes with smooth margins. "Palmilla" (Chihuahua).
- Leaves used in Chihuahua for making hats. The young leaves are eaten by goats.
6. *Nolina erumpens* (Torr.) S. Wats. Proc. Amer. Acad. 14: 248. 1879.
Dasyilirion erumpens Torr. U. S. & Mex. Bound. Bot. 216. 1859.
Chihuahua. Western Texas (type locality).
Leaves usually 6 to 10 mm. wide, with rough or rarely smooth edges.
7. *Nolina cespitifera* Trel. Proc. Amer. Phil. Soc. 50: 419. 1911.
Coahuila; type from Buena Vista.
Leaves 6 to 10 mm. wide, rough-edged.
8. *Nolina palmeri* S. Wats. Proc. Amer. Acad. 14: 248. 1879.
In canyons, Baja California; type from Tantillas Mountains.
Acaulescent; leaves 8 to 10 mm. wide, rough-edged.
The roots ("amole") are said to be used as a substitute for soap.
Nolina palmeri brandegeei Trel. (Proc. Amer. Phil. Soc. 50: 420. 1911) is a form with the trunk up to 5 meters high.
9. *Nolina microcarpa* S. Wats. Proc. Amer. Acad. 14: 247. 1879.
Dry plains and hillsides, Chihuahua and Sonora. Arizona (type from Rock Canyon) and New Mexico.
Leaves 6 to 12 mm. wide, rough-edged.
10. *Nolina durangensis* Trel. Proc. Amer. Phil. Soc. 50: 421. 1911.
Chihuahua and Durango; type from the city of Durango.
About 2 meters high; leaves 7 to 11 or even 20 mm. wide, rough-margined.
"Soyate" (Durango).
11. *Nolina elegans* Rose, Contr. U. S. Nat. Herb. 10: 91. 1906.
Known only from the Sierra Madre of Zacatecas.
Leaves 50 to 60 cm. long, 12 mm. wide, rough-margined.
12. *Nolina rigida* (Brongn.) Trel. Proc. Amer. Phil. Soc. 50: 422. 1906.
Anatis rigida Brongn. Ann. Sci. Nat. II. 14: 320. 1840.
Known only from a drawing of Sessé and Mociño,¹ believed to represent a Mexican plant.
Leaves about 10 cm. long, 4 to 5 mm. wide.
13. *Nolina bigelovii* (Torr.) S. Wats. Proc. Amer. Acad. 14: 247. 1879.
Dasyilirion bigelovii Torr. U. S. Rep. Expl. Miss. Pacif. 4: 151. 1857.
Dry mesas and hillsides, Sonora and Baja California. California and Arizona; type from Bill Williams Fork, Arizona.
Trunk 1 to 2 meters high; leaves 1.5 to 2.5 cm. wide, the margin shredding into brown fibers.
14. *Nolina nelsoni* Rose, Contr. U. S. Nat. Herb. 10: 92. 1906.
Known only from the type locality, mountains near Miquihuana, Tamaulipas.
Trunk 1 to 3 meters high; leaves 50 to 70 cm. long, 3 to 4 cm. wide, rough-margined; inflorescence 2 to 3.5 meters high.
15. *Nolina beldingi* T. S. Brandeg. Zoe 1: 305. 1890.
Baja California; type from mountains of the Cape Region.
Trunk 3 to 7.5 meters high, branched; leaves 1.5 to 2 cm. wide.
Nolina beldingi deserticola Trel. (Proc. Amer. Phil. Soc. 50: 424. 1911) is a nearly acaulescent form.

¹ Proc. Amer. Phil. Soc. 50: pl. 17. 1911.

16. *Nolina parviflora* (H. B. K.) Hemsl. Biol. Centr. Amer. Bot. 3: 372. 1884.
Cordylina parviflora H. B. K. Nov. Gen. & Sp. 1: 268. 1815.
Roulinia humboldtiana Brongn. Ann. Sci. Nat. II. 14: 320. 1840.
Nolina altamiranoa Rose, Proc. U. S. Nat. Mus. 29: 438. 1905.
 Veracruz, Puebla, and Mexico; type from between Hauhtitlán and Tane-
 pantla.

Trunk 2 to 4 meters high; leaves 1.5 to 2.5 cm. wide.

17. *Nolina longifolia* (Schult.) Hemsl. Biol. Centr. Amer. Bot. 3: 372. 1884.
Yucca longifolia Schult. Syst. Veg. 7: 1715. 1830.
Roulinia karwinskiana Brongn. Ann. Sci. Nat. II. 14: 320. 1840.
 Oaxaca and Puebla; type from San José del Oro.
 Trunk 2 to 3 meters high, swollen at the base, sparsely branched at the top;
 leaves very long, recurved over the trunk, 2 to 3 cm. wide.

6. **CALIBANUS** Rose, Contr. U. S. Nat. Herb. 10: 90. 1906.

1. *Calibanus hookerii* (Lem.) Trel. Proc. Amer. Phil. Soc. 50: 426. 1911.
Dasyllirion hookerii Lem. Ill. Hort. Lem. 6: Misc. 24. 1859.
Dasyllirion caespitosum Scheidw. Wochenschr. Ver. Beförd. Gartenb. 4: 286.
 1861.

Calibanus caespitosus Rose, Contr. U. S. Nat. Herb. 10: 90. 1906.

Hidalgo and San Luis Potosí; type from Real del Monte, Hidalgo.

A very curious and remarkable plant, the trunk subglobose, 30 to 100 cm. in diameter, resembling a puffball, attached to the soil by small roots, the interior loosely spongy, the exterior covered with dark corky bark like that of some oaks; leaves 30 to 90 cm. long, 2 to 2.5 mm. wide, appearing in clusters here and there over the trunk, pale green, serrulate; flowers dioecious, purplish, very small, arranged in panicles 10 to 20 cm. long and 10 cm. broad.

7. **BEAUCARNEA** Lem. Ill. Hort. Lem. 8: Misc. 57. 1861.

REFERENCE: Trelease, Proc. Amer. Phil. Soc. 50: 427-431. 1911; Rose, Contr. U. S. Nat. Herb. 10: 87-89. pl. 23. 1906.

Treelike plants, the trunks sometimes 10 meters high, more or less swollen at the base; leaves long, linear; flowers small, whitish, paniced.

The leaves are used for the same purposes as those of *Dasyllirion* and *Nolina*.

Leaves with papillose grooves and rough margins, firm, more or less concave, keeled, pale or glaucous; fruit short-pedicellate.

Leaves 8 to 15 mm. wide; seeds 4 to 5 mm. long-----5. *B. stricta*.

Leaves 4 to 7 mm. wide; seeds 3 mm. long-----6. *B. gracilis*.

Leaves with smooth grooves and nearly smooth margins, thin, nearly flat, green; fruit long-pedicellate.

Leaves 1.5 to 2 meters long-----1. *B. recurvata*.

Leaves 1 meter long or shorter.

Fruit 18 to 20 mm. long-----4. *B. goldmanii*.

Fruit 10 to 15 mm. long.

Perianth segments scarcely 2 mm. long-----2. *B. inermis*.

Perianth segments 3 mm. long-----3. *B. pliabilis*.

1. *Beaucarnea recurvata* Lem. Ill. Hort. Lem. 8: Misc. 61. 1861.

Beaucarnea tuberculata Roezl, Belg. Hort. 33: 138. 1883.

Nolina recurvata Hemsl. Biol. Centr. Amer. Bot. 3: 372. 1884.

Dasyllirion recurvatum Macbride, Contr. Gray Herb. n. ser. 56: 17. 1918.

Veracruz.

Trunk openly branched; leaves 1.5 to 2 meters long, 1.5 to 2 cm. wide.

2. *Beaucarnea inermis* (S. Wats.) Rose, Contr. U. S. Nat. Herb. 10: 88. 1906.
Dasyllirion inerme S. Wats. Proc. Amer. Acad. 26: 157. 1891.
 San Luis Potosí and Veracruz; type from Las Palmas, San Luis Potosí.
 Tree, openly branched, sometimes 13 meters high, with a trunk 1.5 meters in diameter, this covered with hard scaly black bark; leaves 1.2 to 1.5 cm. wide. "Soyate" or "zoyate" (San Luis Potosí); "palma culona" (San Luis Potosí, Ramírez).
- The soft spongy wood is used for corks.
3. *Beaucarnea pliabilis* (Baker) Rose, Contr. U. S. Nat. Herb. 10: 89. 1906.
Dasyllirion pliabile Baker, Journ. Linn. Soc. Bot. 18: 240. 1880.
 Yucatán; type from Sisal.
 Leaves 1.5 cm. wide.
4. *Beaucarnea goldmanii*¹ Rose, Contr. U. S. Nat. Herb. 12: 261. 1909.
 Known only from the type locality, San Vicente, Chiapas.
 Tall slender tree with swollen base, the trunk covered with thick, deeply furrowed bark; leaves 80 to 90 cm. long, 1 to 1.5 cm. wide, erect or reflexed; panicles 30 to 50 cm. long.
5. *Beaucarnea stricta* Lem. Ill. Hort. Lem. 8: Misc. 61. 1861.
Beaucarnea glauca Roez, Belg. Hort. 33: 138. 1883.
Beaucarnea purpusi Rose, Contr. U. S. Nat. Herb. 10: 89. 1906.
Dasyllirion strictum Macbride, Contr. Gray Herb. n. ser. 56: 17. 1918.
 Puebla and Oaxaca; described from cultivated plants.
 Tree, 6 to 8 meters high, the trunk moderately swollen at the base, covered with the old leaves; leaves about 60 cm. long, 8 to 15 mm. wide, with yellowish margins. "Izote" (Oaxaca).
6. *Beaucarnea gracilis* Lem. Ill. Hort. Lem. 8: Misc. 61. 1861.
Beaucarnea oedipus Rose, Contr. U. S. Nat. Herb. 10: 88. pl. 23. 1906.
Dasyllirion gracile Macbride, Contr. Gray Herb. n. ser. 56: 17. 1918.
 Puebla; described from cultivated plants.
 Tree, 6 to 12 meters high, with stout branches, the trunk enormously swollen at the base and 2 to 7 meters in circumference; leaves 25 to 50 cm. long, 4 to 7 mm. wide, glaucous.

8. DASYLIRION Zucc. Allg. Gartenz. 6: 258. 1838.

REFERENCE: Trelease, Proc. Amer. Phil. Soc. 50: 431-441. 1911.

Acaulescent or arborescent plants; leaves linear, usually with very spiny margins, the bases much broadened; flowers small, whitish, paniculate.

The plants grow mostly on dry, rocky mesas or hillsides and are often very abundant and conspicuous. The trunks are used frequently for building houses and for fuel. When one of the plants, covered with the dead leaves, is set on fire it will burn for some time, and the burned stumps are a familiar sight in regions where the plants occur. The leaf bases remaining on such burned plants, when removed from the trunk, make very satisfactory beds upon camping expeditions, for they are elastic and not uncomfortably hard. The trunks are often split open to permit cattle to eat the spongy interior, for this, as well as the leaf bases, contains much sugar and has been found to be an excellent

¹ Named for E. A. Goldman (1873-), of the Bureau of Biological Survey, U. S. Department of Agriculture, who has engaged in biological exploration of nearly all parts of Mexico. He has obtained a large collection of botanical material, which is deposited in the U. S. National Herbarium. Mr. Goldman has published a valuable paper dealing with the plants of Baja California (Contr. U. S. Nat. Herb. 16: 309-371. pl. 104-133. 1916).

food for cattle, especially in time of drought. In New Mexico and western Texas the plants have been used on a large scale for this purpose, often after having been transported by railroad. The plants were formerly much used for food by the natives of the arid regions, and are still so used to some extent. The leaves are trimmed off and the remaining head is roasted or boiled and the sweet pith and leaf bases then eaten. The heads are often baked for about 24 hours in pits dug in the ground. The roasted trunks are also allowed to ferment and then distilled to obtain a highly esteemed intoxicating drink known as "sotol," which is a colorless liquor of penetrating odor and peculiar taste. Alcohol has been extracted from sotol plants upon a commercial scale.

The leaves are much used for thatching, baskets, rough hats, mats, etc., and their fiber for rough cordage. The fiber seems to be suitable for the manufacture of paper.

Most of the species are known generally under the name "sotol."

Leaves 4-sided, unarmed-----16. *D. longissimum*.

Leaves 2-edged, flattened or concave, with prickly margins.

Fruit large (8 to 9 mm. wide), the style longer than the wings.

15. *D. berlandieri*.

Fruit small or, if large, the style not exceeding the wings.

Fruit 3 to 5 mm. wide.

Fruit with a very shallow notch at the apex, broadly elliptic, the style equaling or slightly exceeding the wings. Prickles of the leaves antrorse.

Leaves 10 to 15 mm. wide. Inflorescence much branched.

6. *D. texanum*.

Leaves 5 to 10 mm. wide.

Leaves about 1 meter long-----7. *D. simplex*.

Leaves 40 to 50 cm. long-----8. *D. longistylum*.

Fruit with a rather deep notch, narrowly elliptic to obovate, the style not surpassing the wings. Leaves usually 15 to 20 cm. wide.

Prickles of the leaves mostly retrorse-----5. *D. leiophyllum*.

Prickles of the leaves mostly antrorse.

Leaves 25 mm. wide or more-----3. *D. palmeri*.

Leaves 10 to 20 mm. wide.

Leaves about 0.5 meters long, dull; style nearly equaling the wings.

4. *D. parryanum*.

Leaves about 1 meter long; style half as long as the wings.

Leaves dull, glaucous-----1. *D. cedrosanum*.

Leaves lustrous, not glaucous-----2. *D. lucidum*.

Fruit 6 to 8 mm. wide, the style not exceeding the wings. Prickles all or mostly antrorse.

Leaves not with brushy tips, glaucous-----9. *D. glaucophyllum*,

Leaves with more or less brushy tips.

Leaves 1 cm. wide or narrower-----10. *D. acrotriche*.

Leaves mostly 1.5 cm. wide or wider, rarely only 1.2 cm. wide.

Wings of the fruit truncate at the apex, with a very narrow notch; leaves rough-----13. *D. serratifolium*.

Wings of the fruit rounded or obtuse at the apex, with a broad notch; leaves smooth or nearly so.

Leaves about 1.2 cm. wide-----11. *D. graminifolium*.

Leaves 1.5 to 2 cm. wide.

Style scarcely half as long as the wings-----12. *D. durangense*.

Style about as long as the wings-----14. *D. wheeleri*.

1. *Dasyilirion cedrosanum* Trel. Proc. Amer. Phil. Soc. 50: 431. 1911.
Coahuila and Zacatecas; type from Cedros, Zacatecas.
Trunk 1 to 1.5 meters high; leaves 2 cm. wide, glaucous; inflorescence 5 meters high.
2. *Dasyilirion lucidum* Rose, Contr. U. S. Nat. Herb. 10: 90. 1906.
Puebla; type from Tehuacán.
Trunk 1 to 2 meters high; leaves 1 to 1.7 cm. wide, smooth and lustrous; inflorescence 2 to 3 meters high.
3. *Dasyilirion palmeri* Trel. Proc. Amer. Phil. Soc. 50: 432. 1911.
Known only from the type locality, San Lorenzo Canyon, Coahuila.
Plants 2.5 to 3 meters high; leaves about 1 meter long, green or slightly glaucous, smooth, dull. "Sotol."
The leaves, deprived of the spines, are used for making brooms.
4. *Dasyilirion parryanum*¹ Trel. Proc. Amer. Phil. Soc. 50: 432. 1911.
San Luis Potosí, the type from the vicinity of San Luis Potosí.
Leaves dull, minutely roughened.
5. *Dasyilirion leiophyllum* Engelm.; Trel. Proc. Amer. Phil. Soc. 50: 433. 1911.
Chihuahua. New Mexico and western Texas; type from Presidio, Texas.
Stem short; leaves about 1 meter long, green or glaucescent, smooth, rather lustrous.
6. *Dasyilirion texanum* Scheele, Linnaea 23: 140. 1850.
Dasyilirion texanum aberrans Trel. Proc. Amer. Phil. Soc. 50: 434. 1911.
Coahuila and Nuevo León. Texas; type from New Braunfels.
Trunk very short or subterranean; leaves 1 meter long or shorter, green, lustrous; inflorescence 3 to 5 meters high. "Sotol" (Texas).
7. *Dasyilirion simplex* Trel. Proc. Amer. Phil. Soc. 50: 434. 1911.
Durango; type from Tepehuanes.
Plants 1.5 meters high; leaves about a meter long, green, smooth, lustrous. "Sotol."
The leaves are employed for making baskets, and for the "sopladores" used to fan charcoal fires.
8. *Dasyilirion longistylum* Macbride, Contr. Gray Herb. n. ser. 56: 16. 1918.
Known only from the type locality, Minas de San Rafael, San Luis Potosí.
Leaves 5 to 7 mm. wide, glaucous-green, smooth, the margin with large remote teeth; fruit 5 mm. wide.
9. *Dasyilirion glaucophyllum* Hook. in Curtis's Bot. Mag. II. 14: pl. 5041. 1858.
Dasyilirion glaucum Carr. Rev. Hort. 44: 435. 1872.
Known in Mexico only from the type locality, Real del Monte, Hidalgo; also in cultivation in Europe.
Trunk short; leaves 1 meter long or longer, about 1.2 cm. wide, dull; inflorescence 4 to 6 meters high.
10. *Dasyilirion acrotriche* (Schiede) Zucc. Denkschr. Akad. Wiss. München 16: 226. 1840.

¹ Named for C. C. Parry (1823-1890), at one time botanist of the U. S. Department of Agriculture, who made extensive collections of plants in the United States, especially in the Rocky Mountains. In 1878, in company with Edward Palmer, he collected a large series of Mexican plants, chiefly in the State of San Luis Potosí.

Yucca acrotricha Schiede, Linnaea 4: 230. 1829.

Roulinia gracilis Brongn. Ann. Sci. Nat. II. 14: 320. 1840.

San Luis Potosí, Veracruz, Hidalgo, and Querétaro; type from Mount Orizaba.

Trunk 1 meter high or more; leaves less than 1 meter long, 6 to 10 or rarely 15 mm. wide, green or glaucescent; inflorescence 3 to 5 meters high or larger. "Cucharilla" (San Luis Potosí, Urbina).

11. *Dasyilirion graminifolium* Zucc. Allg. Gartenz. 6: 259. 1833.

San Luis Potosí; described from cultivated plants.

Leaves about 1 meter long, green, smooth, lustrous.

12. *Dasyilirion durangense* Trel. Proc. Amer. Phil. Soc. 50: 438. 1911.

Known only from Durango, the type locality.

Leaves 1 meter long or shorter, glaucescent.

13. *Dasyilirion serratifolium* (Schult.) Zucc. Allg. Gartenz. 6: 258. 1838.

Yucca serratifolia Schult. Syst. Veg. 7: 1716. 1830.

Dasyilirion laxiflorum Baker, Journ. Bot. Brit. & For. 10: 299. 1872.

Oaxaca; described from cultivated plants.

Plants subcaulescent; leaves 1 meter long or shorter, 1.5 to 3.5 cm. wide, whitish.

14. *Dasyilirion wheeleri* S. Wats.; Rothr. in Wheeler, Rep. U. S. Surv. 100th Merid. 6: 378. 1878.

Dasyilirion wheeleri wislizeni Trel. Proc. Amer. Phil. Soc. 50: 439. 1911.

Chihuahua. Western Texas to Arizona (type from Ash Creek).

Trunk 1 meter high or less; leaves 1 meter long or shorter, glaucous or green, nearly smooth; inflorescence 3 to 5 meters high.

15. *Dasyilirion berlandieri*¹ S. Wats. Proc. Amer. Acad. 14: 249. 1879.

Known only from the type locality, La Silla, Monterrey, Nuevo León.

The leaves of this species have not been collected.

16. *Dasyilirion longissimum* Lem. Ill. Hort. Lem. 3: Misc. 91. 1856.

Dasyilirion quadrangulatum S. Wats. Proc. Amer. Acad. 14: 250. 1879.

Dasyilirion juncifolium Rehnelt, Gartenwelt 11: 77. 1906.

Tamaulipas to Hidalgo; described from cultivated plants.

Trunk 1 to 2 meters high; leaves sometimes 2 meters long, 3 to 8 mm. wide, green, dull; inflorescence 2 to 6 meters high. "Junquillo" (Querétaro, Hidalgo).

11. SMILACACEAE. Smilax Family.

1. SMILAX L. Sp. Pl. 1028. 1753.

REFERENCE: A. De Candolle in DC. Monogr. Phan. 1: 1-213. 1878.

Scandent shrubs; rhizomes often tuberiferous; stems often armed with spines; leaves alternate, usually persistent, palmately nerved, the petiole often tendril-bearing; flowers small, dioecious, umbellate, the umbels axillary; fruit a small globose berry.

The species of catbrier, greenbrier, or horsebrier, because of their spiny stems, often form almost impenetrable thickets.

¹In honor of Jean Luis Berlandier, a Belgian, who made extensive collections between 1827 and 1830 in northeastern Mexico, especially in Tamaulipas, San Luis Potosí, Nuevo León, and Coahuila. The larger portion of his botanical collections was obtained in Texas. He died at Matamoros in 1851. His plants were widely distributed, and some of them are in the U. S. National Herbarium.

Leaves and branches copiously pilose; flowers usually tomentose.

Peduncles longer than the petioles.

Leaves copiously pilose, oval to ovate, deeply cordate at the base, obtuse or rounded and apiculate at the apex..... 1. *S. mollis*.

Leaves glabrate, deltoid, subcordate at the base, long-acuminate at the apex. 2. *S. purpusii*.

Peduncles equaling or usually shorter than the petioles.

Sheaths about one-fifth as long as the petioles or shorter.

3. *S. tomentosa*.

Sheaths one-fourth to half as long as the petioles..... 4. *S. subpubescens*.

Leaves and branches glabrous or nearly so; flowers glabrous.

Staminate flowers small, 1.5 to 2 or rarely 3 mm. long; anthers equaling or longer than the filaments..... 5. *S. mexicana*.

Staminate flowers large, 2.5 to 8 mm. long; anthers usually shorter than the filaments.

Peduncles at anthesis shorter than the petioles..... 6. *S. domingensis*.

Peduncles at anthesis longer than or equaling the petioles.

Leaves glaucous beneath..... 7. *S. glauca*.

Leaves green beneath.

Peduncles about 5.5 cm. long, 5 to 6 times as long as the petiole. Fruit red..... 8. *S. erythrocarpa*.

Peduncles rarely over 2 cm. long.

Pedicels half as long as the flowers..... 9. *S. densiflora*.

Pedicels equaling or much longer than the flowers.

Leaves denticulate..... 10. *S. moranensis*.

Leaves entire.

Fruit red..... 11. *S. medica*.

Fruit black.

Younger branches with numerous stout spines; leaf blades more or less triangular, nearly or quite as broad as long.

12. *S. bona-nox*.

Younger branches unarmed or with few slender spines; leaf blades not triangular, usually twice as broad as long.

13. *S. cordifolia*.

1. *Smilax mollis* Willd. Sp. Pl. 4: 785. 1806.

Smilax pringlei Greenm. Proc. Amer. Acad. 34: 567. 1899.

Morelos to Veracruz, Tabasco, and Chiapas; type from Jalapa, Veracruz. West Indies, Central America, and northern South America.

Leaves lanceolate to broadly cordate-oval, 8 to 15 cm. long, acute or abruptly short-pointed, 5 or 7-nerved; umbels long-pedunculate. "Bejuco de chiquihuite" (Tabasco); "zarzaparrilla" (Veracruz, *Ramírez*).

2. *Smilax purpusii* T. S. Brandeg. Univ. Calif. Publ. Bot. 6: 117. 1915.

Known only from the type locality, Cerro del Boquerón, Chiapas.

Leaves coriaceous, 5 to 10 cm. long, reticulate-veined, usually 7-nerved; umbels often racemose.

3. *Smilax tomentosa* H. B. K. Nov. Gen. & Sp. 1: 272. 1815.

Oaxaca. Central America and northern South America; type from Santa Fé, Colombia.

Leaves broadly ovate-cordate to lanceolate, sometimes as much as 25 cm. long and 20 cm. wide, acute or acuminate; umbels densely many-flowered.

4. *Smilax subpubescens* A. DC. in DC. Monogr. Phan. 1: 69. 1878.

Tamaulipas and Veracruz; type from Orizaba, Veracruz.

Scandent over shrubs and trees in woods; leaves ovate or ovate-oval, 7 to 13 cm. long, cordate at the base, short-pointed, lustrous. "Zarzón" (Tamaulipas). Specimens referred by De Candolle to *S. candelariae* A. DC.¹ belong here perhaps.

5. *Smilax mexicana* Griseb.; Kunth, Enum. Pl. 5: 167. 1850.

?*Smilax obtusa* Benth. Bot. Voy. Sulph. 175. 1844.

Smilax costaricae Vatke, Linnaea 40: 223. 1876.

Smilax gaumerii Millsp. Field Mus. Bot. 1: 357. 1898.

Sinaloa to Guerrero, Yucatán, and Tamaulipas. Central America.

Scandent shrub with angulate branches; leaves lanceolate to broadly ovate-oval, 5 to 17 cm. long, lustrous; umbels on long or short peduncles; fruit black. "Bejuco de chiquihuite" (Tabasco); "bejuco diente-de-perro," "zarza" (Guerrero); "xoché" (Yucatán, Maya); "zarzón" (Costa Rica).

The species has been reported from Mexico as *S. cumanensis* Willd. The leaves are very variable in shape, as in most species of the genus.

6. *Smilax domingensis* Willd. Sp. Pl. 4: 783. 1806.

Smilax schlechtendalii Kunth, Enum. Pl. 5: 224. 1850.

Smilax domingensis microscola Robinson, Proc. Amer. Acad. 35: 323. 1900.

Veracruz, Puebla, Tabasco, and Chiapas. West Indies; type from Santo Domingo.

Leaves lanceolate or ovate, 7 to 15 cm. long, thick, lustrous, acute to long-acuminate. "Alcacatza" (Puebla); "chiquihuite" (Tabasco); "bejuco de membrillo," "dunguey," "dunguez blanco" (Porto Rico).

7. *Smilax glauca* Walt. Fl. Carol. 245. 1788.

? *Smilax jalapensis* Schlecht. Linnaea 18: 451. 1844.

Smilax discolor Schlecht. Linnaea 18: 454. 1844.

Veracruz. Eastern United States; type from the Carolinas.

Stems terete, armed with stout scattered prickles; leaves broadly ovate, 6 to 10 cm. long, acute or rounded at the apex, usually truncate at the base; fruit bluish black.

8. *Smilax erythrocarpa* Kunth, Enum. Pl. 5: 234. 1850.

Described from Mexico; reported from the Valley of Mexico.

Branches terete, armed with short straight prickles or unarmed; leaves ovate-oblong, 8 to 10 cm. long, acutish at the apex, rounded or subcordate at the base.

9. *Smilax densiflora* A. DC. in DC. Monogr. Phan. 1: 88. 1878.

Described from Toluca, Mexico; reported also from "San Miguel."

Stems terete, unarmed; leaves ovate, 3 to 5 cm. long, 5 or 7-nerved, acuminate at the apex, obtuse or subcordate at the base.

10. *Smilax moranensis* Mart. & Gal. Bull. Acad. Brux. 9²: 389. 1842.

Veracruz and Hidalgo, and probably elsewhere; type from Morán, Hidalgo.

Stems terete, aculeate; leaves lanceolate or ovate, 5 to 9 cm. long, 5 or 7-nerved, acuminate; fruit 6 to 7 mm. in diameter.

According to De Candolle, this is the "mecapatli" of Hernández.

11. *Smilax medica* Schlecht. & Cham. Linnaea 6: 47. 1831.

Veracruz and San Luis Potosí; type from Papantla, Veracruz; reported from Tamaulipas.

Stems angulate, unarmed or sparsely prickly; rhizome slender, striate, covered with whitish or purplish bark; leaves ovate or oblong, 10 to 20 cm. long, often lobate, 7 or 9-nerved, entire, sometimes prickly beneath; fruit 8 to 10 mm. in diameter. "Zarzaparrilla," "nanahuapatle," "quauhmecapatli," "quaumeca-

¹ In DC. Monogr. Phan. 1: 70. 1878.

patli," "zarza," "zarzaparrilla de Tulancingo," "zarzaparrilla de la sierra," "mecapatli" (*Ramírez*).

The species of *Smilax* which furnish the sarsaparilla of commerce are very imperfectly known, but this species is believed to be one of the chief sources of the drug. The Nueva Farmacopea Mexicana states that this is the only species of Eastern Mexico whose rhizomes are employed medicinally, and *Smilax medica* is one of the official sources of sarsaparilla according to the U. S. Pharmacopoea. Not much dependence can be placed upon either of these statements, however, because the species are poorly known, and the rhizomes have not been associated with botanical specimens of the plants which produce them.

The rhizomes are dug at any time of the year and dried in the sun. They contain a crystalline principle, parillin, upon which their virtues depend. This has sudorific and stimulant properties. Sarsaparilla was introduced into Spain about 1540, and was widely used as a remedy for venereal diseases. It is still employed for the same purpose, and for rheumatism, scrofulous diseases, and some cutaneous affections. It is widely employed also for flavoring beverages. Large amounts of sarsaparilla have been and still are exported from Mexico. It is said that the rhizome of a fern, known as "zarzaparrilla de Tierra Caliente," is sometimes used as an adulterant.

12. *Smilax bona-nox* L. Sp. Pl. 1030. 1753.

Veracruz. Eastern United States; West Indies.

Stems angulate, prickly or unarmed; leaves lanceolate to broadly deltoid-ovate, 3 to 10 cm. long, sometimes lobate, 5 to 9-nerved, acute, often denticulate. "Mecapatli, zarzaparrilla" (*Ramírez*).

13. *Smilax cordifolia* Humb. & Bonpl.; Willd. Sp. Pl. 4: 778. 1806.

? *Smilax acutifolia* Schlecht. Linnaea 18: 449. 1844.

? *Smilax invenusta* Kunth, Enum. Pl. 5: 234. 1850.

Smilax schiedeana Kunth, Enum. Pl. 5: 236. 1850.

Veracruz and Tabasco to Oaxaca and Colima; type from Jalapa, Veracruz.

Stems subterete or angulate, unarmed or sparsely prickly; leaves ovate or rounded-ovate, 6 to 12 cm. long, acute or acuminate, 5 to 9-nerved, usually more or less cordate at the base. "Cocolmegan," "cozolmécatl," "olcacatzin" (Veracruz, *Ramírez*); "pacas" (Tarascan, *Herrera*); "cocolmeca," "raíz de china" (*Ramírez*); "móoga" (Otomí, *Ramírez*).

This species has been reported from Mexico as *S. pseudochina* L. It is said to be used in medicine like *S. medica*.

DOUBTFUL SPECIES.

SMILAX ARISTOLOCHIAEFOLIA Mill. Gard. Dict. ed. 8. *Smilax* no. 7. 1768. *Smilax milleri* Steud. Nom. Bot. ed. 2. 2: 599. 1841. Described from Veracruz.

SMILAX BOTTERI A. DC. in DC. Monogr. Phan. 1: 89. 1878. Described from Veracruz. Perhaps the same as *S. cordifolia*.

SMILAX COGNATA Kunth, Enum. Pl. 5: 175. 1850. Described from Mexico, but probably rather a native of Brazil.

SMILAX GLAUCOCARPOS Schlecht. Linnaea 18: 450. 1844. Described from Hacienda del Carmen and Mineral del Monte. Related, according to De Candolle, to *S. mexicana* or *S. moranensis*.

SMILAX HAVANENSIS Jacq. Enum. Pl. Carib. 33. 1760. Native of the West Indies; reported from Mexico by De Candolle, perhaps erroneously.

SMILAX MULTIFLORA Mart. & Gal. Bull. Acad. Brux. 9²: 390. 1842. Described from Chinantla, Oaxaca.

SMILAX SPINOSA Mill. Gard. Dict. ed. 8. *Smilax* no. 8. 1768. Described from Veracruz.

12. AMARYLLIDACEAE. Amaryllis Family.¹

(Contributed by Dr. William Trelease.)

Plants usually herbs, often from bulbs as in the Liliaceae, from which they differ chiefly in their inferior ovary; in the warmer parts of America represented by the following monocarpic genera, some species of which produce a trunk, while the flower clusters of all are borne on more or less woody stalks that are sometimes tall and much branched.

Perianth segments distinct; filaments swollen at base; style base dilated and 3-angled; seed not lifted from the soil in germination_____1. **FURCRAEA**.
Perianth more or less tubular at base; filaments and style not swollen; seed raised on the cotyledon in germination_____2. **AGAVE**.

1. **FURCRAEA** Vent. Bull. Soc. Philom. 1: 65. 1793.

REFERENCES: J. G. Baker, Handbook of the Amaryllideae 198-203. 1888; Trelease, Observations on *Furcraea*, Ann. Jard. Bot. Buitenzorg II. Suppl. 3: 905-916. pl. 35-48. 1910; Drummond, Rep. Mo. Bot. Gard. 18: 25-75. pl. 1-4. 1907. The name is often written *Fourcroya* (Spreng. 1817) or *Furcroea* (Haw. 1819).

The leaves contain an excellent fiber resembling Sisal hemp, and variously called "pita" or "cabulla," but this is little exploited except for the Mauritius hemp, derived from the Brazilian *F. gigantea*.

Leaves denticulate but never toothed, finely striate-ridged. Leaves over 1 meter long; panicle very large. **SERRULATAE**.

Trunk tall (15 meters). Leaves concave and rather stiff_____1. **F. longaeva**.

Trunk moderate (1 to 2 meters tall).

Leaves rather concave, long (2 meters), often recurved_____2. **F. roezlii**.

Leaves rather flat, short and stiff, very glaucous.

Leaves short, 50 to 60 cm. long; flowers 4 cm. long___3. **F. bedinghausi**.

Leaves twice as long; flowers 5 to 6 cm. long_____4. **F. quicheensis**.

Leaves neither denticulate nor striate, often horny-toothed. **EUFURCRAEA**.

Leaves 5 to 8 cm. wide.

Leaves narrow (5 to 6 cm. wide), straight between the short teeth.

5. **F. cahum**.

Leaves moderate (7 to 8 cm. wide), the margin concave between the teeth.

6. **F. melanodonta**.

Leaves broad (10 to 20 cm.).

Leaves with numerous marginal red-brown teeth.

Plants with a trunk sometimes 2 meters tall; leaves mostly entire above the middle_____7. **F. selloa**.

Plants mostly acaulescent; leaves usually toothed throughout.

Teeth rather short (3 mm. long) and close together (10 to 30 mm. apart); bulbils round-ovoid_____8. **F. guatemalensis**.

Teeth longer (5 to 7 mm. long) and more separated (30 to 60 mm. apart); bulbils elongate_____9. **F. cabuya**.

Leaves unarmed, otherwise as in no 9_____9a. **F. cabuya integra**.

¹ Fifteen Mexican species of *Agave*, not considered in this account, are characterized by Mr. Alwin Berger in "Die Agaven," published in 1915 but through the exigencies of the war not received until after the present account was in page proof.—WM. TRELEASE.

1. *Furcraea longaeva* Zucc. Act. Acad. Caes. Leop. Carol. 16²: 665. 1833.
Oaxaca; type from Mount Tanga. Also in adjacent Guatemala.
A tall unbranched monocarpic tree, finally surmounted by a gigantic panicle 5 meters long or more. "Yahuindayasi" (Oaxaca, Mixtec, *Reko*).
2. *Furcraea roezlii* Baker, Amaryll. 203. 1888.
Fourcroya roezlii André, Rev. Hort. 59: 353. 1887.
Furcraea longa Smith, Teysmannia. 7: 131. 1897.
Pachuca, Hidalgo; described from plants cultivated in Europe; type locality sometimes said to be near Juquila, Oaxaca, but this report probably refers to the preceding species.
A short-trunked plant, finally with panicle of equal length, the leaves characteristically sweeping the ground.
Much cultivated in warm regions under the garden names of *Agave argyrophylla*, *A. toneliana*, *Beschorneria floribunda*, *Lilia regia*, *Lilium regium*, *Roezlia bulbifera*, *R. regina*, *Yucca argyraea*, *Y. argyrophylla*, *Y. bulbifera*, *Y. parmentieri* and *Y. toneliana*.
3. *Furcraea bedinghausi* Koch, Wochenschr. Ver. Beförd. Gartenb. 6: 234. 1863.
Distrito Federal; described from plants cultivated in Europe, the type locality unrecorded.
A short-trunked smaller plant with shorter, stiffer, and flatter leaves.
Sometimes cultivated as *Beschorneria multiflora*. Specimens have been distributed as *Yucca pringlei* Greenm.
4. *Furcraea quicheensis* Trel. Trans. Acad. St. Louis 23: 148. 1915.
Guatemala; type collected near Quiché.
In size and habit intermediate between *F. longaeva* and *F. bedinghausi*. "Cheech."
5. *Furcraea cahum* Trel. Ann. Jard. Bot. Buitenzorg II. Suppl. 3: 908. pl. 39. 1910.
Yucatán; type collected near Sisal.
Subacaulescent, with narrow green flat leaves, these straight-margined between the finally blackish teeth. "Cajum" or "cajum-ci"; also "catana" (?).
6. *Furcraea melanodonta* Trel. Trans. Acad. St. Louis 23: 150. 1915.
Eastern Guatemala; type from Cruz.
Somewhat caulescent, with gray or bluish concave leaves, the margins hollowed between the black-chestnut teeth. "Maguey."
7. *Furcraea selloa* Koch, Wochenschr. Ver. Beförd. Gartenb. 3: 22. 1860.
Furcraea samalana Trel. Trans. Acad. St. Louis 23: 149. 1915.
Western Guatemala; type from the Samalá Valley.
Somewhat caulescent, with green broad long-channeled leaves, these usually toothed only below the middle, the margins hollowed between the red-brown teeth; bulbils elongate. "Maguey."
8. *Furcraea guatemalensis* Trel. Trans. Acad. St. Louis 23: 149. 1915.
Eastern Guatemala; type collected about Guatemala City.
Nearly acaulescent, the broad and long-channeled leaves grayish beneath and toothed throughout, the margin somewhat hollowed between the red-brown or chestnut teeth; bulbils ovoid. "Maguey."
9. *Furcraea cabuya* Trel. Ann. Jard. Bot. Buitenzorg II. Suppl. 3: 906. 1910.
Furcraea tuberosa Seem. Bot. Voy. Herald 216. 1854. Not *F. tuberosa* Ait. 1811.

Costa Rica (type from San Ramón) and Panama.

Nearly acaulescent, the leaves transiently somewhat glaucous, broad, long and openly concave, straight-margined between the rather long and distant yellowish teeth, these with brown or chestnut tips. "Cabuya," "cabuya con espina," or "Central American sisal."

9a. *Furcraea cabuya integra* Trel. Ann. Jard. Bot. Buitenzorg II. Suppl. 3: 907. 1910.

Furcraea gigantea Seem. Bot. Voy. Herald 216. 1854.

Costa Rica (type from San Ramón) and Panama; also (?) in Honduras and El Salvador.

Differs from the type only in having its leaves unarmed or with merely minute rudiments of teeth. "Cabuya Olancho," transmuted into "cabuya blanca."

2. AGAVE L. Sp. Pl. 323. 1753.

REFERENCES: J. G. Baker, Handbook of the Amaryllideae 163-198. 1888; Mulford, A study of the agaves of the United States, Rep. Mo. Bot. Gard. 7: 48-100. pl. 26-63. 1896; Trelease, *Agave macroacantha* and related euagaves, Rep. Mo. Bot. Gard. 18: 231-256. pl. 18-34. 1907; Trelease, The Mexican fiber agaves known as zapupe, Trans. Acad. St. Louis 18: 29-37. pl. 1-6. 1909; Trelease, The agaves of Lower California, Rep. Mo. Bot. Gard. 22: 37-65. pl. 18-72. 1912; Trelease, Revision of the agaves of the group *Applanatae*, Rep. Mo. Bot. Gard. 22: 85-97. pl. 73-99. 1912; Trelease & Ludwig, El Zapupe, pp. 1-29. ill. 1909; Trelease, Agave, in Bailey, Stand. Cycl. Hort. 1: 230-239. 1914.

The leaves contain an excellent fiber. That of *A. americana*, which is much planted and has escaped around the Mediterranean, is used in the dainty pita lacework of the Azores, etc. Much of the fiber of the *lechuguilla* type of plants is used for coarse sacking or enters into the complex of ixtle or Tampico fiber or Matamoros fiber. *Agave cantala* is grown extensively in tropical Asia for its fiber. Of recent years the zapupes have been exploited as equally worthy with the henequen or Sisal hemp, which forms the chief basis of Yucatecan commerce and is being extensively planted through tropical regions. The national drink of the Mexican Indians is fermented from the exuded sap of the large fleshy-leaved or maguey species when they are ready to bloom, and great plantations are maintained for this purpose on the table-land; and a great deal of distilled liquor, called mezcal, like the smaller-leaved species used for the purpose, is distilled from a fermented mash made from the roasted stems of many species, especially those of the group *Tequilanae*, which are grown in large numbers for this purpose, particularly about Tequila in the State of Jalisco. The glucoside saponin occurs in many species and is very abundant in the rootstocks of a few agaves and particularly in those of the related herbaceous genus *Manfreda*, and these are used for washing under the name "amole." The fiber of the leaves was used in preconquest days for making a kind of paper, upon which manuscripts were written.

The species of *Agave* are known in the United States as century plants. This name was given because of a belief that the plants flowered only when they had attained an age of a hundred years. This belief is, of course, incorrect. It is probably due to the fact that in cultivation the plants rarely bloom. In Europe the plants are often known as American aloes, because of a slight resemblance to Old World plants of the genus *Aloe*, of the family Liliaceae.

I. EUAGAVE. Flowers in a panicle.

- A. Leaves without a horny border, the spine at most decurrent for little more than its length.
- B. Leaves hard-fibrous, swordlike or dagger-like or else under 10 cm. wide.
- C. Marginal teeth numerous and strong.
Teeth close together (5 to 10 mm. apart) and very slender.
Leaves green-----1. *A. panamana*.
Leaves gray-green, purple-green, or very glaucous.
Leaves gray-green or purple-green-----2. *A. rubescens*.
Leaves very glaucous-----3. *A. stringens*.
- Teeth more separated or heavier.
- D. Spine elongate, biconvex-----4. *A. angustifolia*.
- DD. Spine elongate, half-round or very openly grooved.
Leaves rough-granular-----5. *A. bergeri*.
Leaves smooth.
Teeth slender-----6. *A. lespinassei*.
Teeth heavy.
Teeth scarcely raised-----7. *A. endlichiana*.
Teeth on fleshy bases-----36. *A. sicaefolia*.
- DDD. Spine needle-shaped, round-grooved.
Teeth heavy or raised-----8. *A. aboriginum*.
Teeth slender-----9. *A. deweyana*.
- DDDD. Spine short and thick or subulately tapered, biconvex or shallow-grooved at base.
- E. Spine subulately slender.
Spine chestnut. Teeth small-----10. *A. zapupe*.
Spine red-brown or graying.
Spine red-brown; teeth small-----20. *A. donnell-smithii*.
Spine graying; teeth larger-----11. *A. subtilis*.
- EE. Spine similar but larger and stouter.
Teeth separated (30 mm. apart or more).
Teeth heavy-based-----12. *A. longisepala*.
Teeth very slender-----13. *A. pedrosana*.
Teeth closer (scarcely 20 mm. apart), slender.
Leaves green-----14. *A. gutierreziana*.
Leaves gray or white.
Leaves gray-----15. *A. elongata*.
Leaves white-----16. *A. collina*.
- EEE. Spine not subulate, or else short.
Spine graying. Teeth large-----17. *A. palmaris*.
Spine red-brown.
Teeth large-----18. *A. rhodacantha*.
Teeth rather small.
Teeth close (10 mm. apart)-----19. *A. pes-mulae*.
Teeth distant-----20. *A. donnell-smithii*.
- DDDDD. Spine conical, often round-grooved at base.
- F. Leaves green.
Plants arborescent.
Teeth heavy-----21. *A. karwinskii*.
Teeth very slender-cusped-----22. *A. decipiens*.
Plants short-stemmed or acaulescent.
Teeth few or slender-----23. *A. sisalana*.
Teeth numerous, tapered-----24. *A. candelabrum*.

FF. Leaves gray or lightly blue-glaucous.

Leaves numerous.

Leaves somewhat rough-----25. *A. kirchneriana*.

Leaves smooth.

Plant subcaulescent.

Teeth gradually tapered.

Teeth short.

Leaves lax-----26. *A. pacifica*.

Leaves more rigidly ascending.

Teeth distant (2 to 3 cm. apart)----27. *A. cantala*.Teeth closer (1 to 1.5 cm. apart)---28. *A. tequilana*.

Teeth long and strong.

Teeth sharply flexed-----29. *A. pseudotequilana*.Teeth gently curved-----30. *A. sullivanii*.Teeth abruptly slender-cusped-----31. *A. ixtli*.Plant distinctly caulescent-----32. *A. fourcroydes*.

Leaves few.

Spine grooved only at base-----33. *A. datylio*.Spine grooved to middle-----34. *A. vexans*.

FFF. Leaves very white-glaucous.

Leaves very long and concave-----35. *A. nivea*.

Leaves shorter, rather dagger-like.

Leaves not falcate.

Teeth gradually pointed-----36. *A. collina*.Teeth deltoid at base-----37. *A. macroacantha*.Leaves falcate-----38. *A. yaquiana*.

CC. Marginal teeth few or minute.

Leaves oblong, green, transiently glaucous-----23. *A. sisalana*.Leaves oblanceolate, pale-----39. *A. desmetiana*.

BB. Leaves hard-fibrous, oblanceolate-oblong.

Teeth small and slender. Spine needle-shaped-----40. *A. thomasae*.

Teeth conspicuous and strong.

Leaves relatively long (nearly 1 meter).

Spine needle-shaped.

Spine involute-----41. *A. deamiana*.Spine round-grooved-----45. *A. kellermaniana*.Spine conical, flat-grooved-----42. *A. hurteri*.

Leaves short (scarcely 0.5 meter long).

G. Spine conical, flat-grooved or shallow-grooved.

Spine brown, much twisted-----43. *A. tortispina*.Spine gray, straight-----44. *A. pachycentra*.

GG. Spine round-grooved.

Teeth close together (10 to 15 mm. apart) chestnut.

Teeth slender-cusped-----45. *A. kellermaniana*.Teeth heavily triangular-----46. *A. samalana*.Teeth more separated, red-brown-----47. *A. lagunae*.

GGG. Spine involute at base.

Teeth easily detachable-----48. *A. minarum*.

Teeth firmly attached.

Teeth small-----49. *A. seemanniana*.

Teeth large, brown.

Spine needle-shaped; teeth almost hooked---50. *A. tenuispina*.Spine conical; teeth nearly straight-----51. *A. opacidens*.

- BBB. Leaves rather fibrous, oblong, over 1 mm. long.
 Leaves rather thin and straight-margined.....52. *A. lurida*.
 Leaves fleshier.
 Margin nearly straight.....53. *A. rasconensis*.
 Margin concave between the teeth.....54. *A. vera-cruz*.
- BBBB. Leaves fleshy, obovate, deeply repand, short.
 Spine flexuous; leaves scarcely 25 cm. long.
 Spine and teeth dull rusty brown.....55. *A. verchaffeltii*.
 Spine and teeth gray, gray-brown, or red-chestnut.
 Spine and teeth gray-brown or gray.....56. *A. megalacantha*.
 Spine and teeth red-chestnut.....57. *A. guadalajarana*.
 Spine straight; leaves twice as long.....58. *A. potatorum*.
- BBBBB. Leaves rather fleshy and long, oblanceolate, repand; teeth very unequal.
 Spine and teeth red-brown.
 Leaves green.....59. *A. mescal*.
 Leaves grayish.....60. *A. fenzliana*.
 Spine and teeth copper-colored.....61. *A. cupreata*.
- BBBBBB. Leaves fleshy, large, the teeth mostly subequal.
 Leaves green-and-gray-banded, rough.....111. *A. marmorata*.
 Leaves not markedly zoned.
 Spine conical, somewhat recurved.
 Leaves not sharply reflexed.
 Leaves abruptly acute, plicate.....112. *A. abrupta*.
 Leaves not plicate.
 Spine gradually tapered.....113. *A. wercklei*.
 Spine rapidly very acute.....114. *A. expansa*.
 Leaves reflexed toward the end.....115. *A. americana*.
 Spine needle-shaped.
 Leaves reflexed.....116. *A. picta*.
 Leaves not sharply reflexed.
 Leaves rough.....117. *A. asperrima*.
 Leaves smooth.
 Spine nearly straight.....118. *A. palmeri*.
 Spine flexuous.....119. *A. flexispina*.
- AA. Leaves with the teeth usually joined by a firmly attached horny border.
 Spine sinuous, rather slender.
 Filaments inserted in middle of tube.....62. *A. shawii*.
 Filaments inserted above the middle.....63. *A. orcuttiana*.
 Spine straight.
 Teeth gradually tapered.....64. *A. sebastiana*.
 Teeth abrupt from a broad base.
 Leaves abruptly acuminate.....65. *A. pachyacantha*.
 Leaves gradually acute.....66. *A. goldmaniana*.
- AAA. Leaves mostly with long-decurrent spine, but scarcely horny-margined between the teeth.
- H. Leaves oblong, long (over 1 meter).
 Leaves green or subglaucous; perianth segments long (3 cm.)
 12. *A. longisepala*.
 Leaves white-glaucous; segments much shorter.....67. *A. applanata*.
- HH. Leaves ovate or obovate, scarcely half as long.
 Leaves rather thin; spine slender.
 Leaves acute, dull gray.....68. *A. scabra*.
 Leaves acuminate, glaucous.....70. *A. parrasana*.

- Leaves thick and fleshier; spine rather stout.
- Spine flat-grooved.....71. *A. chihuahuana*.
- Spine round-grooved, sharp-edged.
- Leaves elongate; capsule about 4 cm. long.....72. *A. parryi*.
- Leaves broad; capsule 5.5 to 7.5 cm. long.
- Leaves acute.....69. *A. huachucensis*.
- Leaves acuminate.....73. *A. patonii*.
- HHH. Leaves triangular or lance-oblong, ascending.
- Leaves elongate (fully 1 meter long).
- Perianth segments twice as long as tube.....74. *A. aurea*.
- Perianth segments shorter than tube.....75. *A. promontorii*.
- Leaves scarcely half as long.
- Teeth close together (5 to 10 mm. apart), small.
- Teeth friable, almost cusplless.....76. *A. dentiens*.
- Teeth firm, with short sharp cusps.....77. *A. disjuncta*.
- Teeth more separated, sometimes very large.
- Spine nearly straight.
- Spine strong and rather stout.
- Leaf margin repand.
- Ovary flask-shaped.....78. *A. deserti*.
- Ovary fusiform.....79. *A. consociata*.
- Leaf margin nearly straight.....80. *A. pringlei*.
- Spine very slender.
- Leaves roughened.....81. *A. cerulata*.
- Leaves smooth.
- Perianth segments 15 mm. long.....82. *A. carminis*.
- Perianth segments 20 mm. long.....83. *A. sobria*.
- Spine somewhat tortuous. Leaves roughened.....84. *A. affinis*.
- HHHH. Leaves broadly lanceolate or oblanceolate.
- Teeth small, close together (10 mm.).....85. *A. brandegeei*.
- Teeth larger and more separated.
- Teeth gradually tapered.
- Teeth comparatively short and straight.....86. *A. margaritae*.
- Teeth long and often hooked.....87. *A. connochaetodon*.
- Teeth abruptly contracted from the base.
- Spine undulate; margin repand.....88. *A. roseana*.
- Spine and margin straight.....89. *A. avellanidens*.
- HHHHH. Leaves oblong or ovate-oblong; spine straight.
- Teeth long and firm.....90. *A. subsimplex*.
- Teeth short, detachable.....91. *A. nelsoni*.
- AAAA. Leaves horny-margined for the upper third or more, fleshy, large.
- Leaves broad (3 times, or rarely 4 or 5 times, as long as wide).
- Margin with few and rudimentary teeth or none.....92. *A. weberi*.
- Margin with numerous strong teeth.
- Teeth confluent on much of the margin.....93. *A. latissima*.
- Teeth joined by a horny margin only toward the end.
- Leaves undulate, very crenate, green.....94. *A. ferox*.
- Leaves not very crenate if green.
- Leaves deeply gutter-shaped.....96. *A. compluviata*.
- Leaves not gutter-like.
- Leaves scarcely twice as long as broad.....95. *A. mitraeformis*.

Leaves three or four times as long as broad.

Leaves gray or glaucous, scarcely 1.5 meters long.

Teeth close (1.5 to 2 cm. apart) ; margin incised 97. *A. felina*.

Teeth more separated or margin not incised.

Leaves gray-and-green-banded, often rough.

Teeth on fleshy hummocks 98. *A. subzonata*.

Teeth without such hummocks 99. *A. zonata*.

Leaves not conspicuously zoned.

Spine needle-shaped 100. *A. gracilispina*.

Spine stout-conical.

Leaves acuminate 101. *A. melliflua*.

Leaves acute.

Teeth on fleshy hummocks 102. *A. quotifera*.

Teeth without such hummocks 103. *A. crassispina*.

Leaves green or slightly gray, plicate, 2 meters long.

104. *A. tecta*.

Leaves elongate (10 times as long as wide or longer).

Leaves smooth.

Leaves green (or relatively broad if gray), extremely large.

105. *A. atrovirens*.

Leaves gray.

Leaves very long (over 2 meters) and narrow. Teeth small.

106. *A. mapisaga*.

Leaves moderate.

Leaves scarcely repand (Pacific) 107. *A. schlechtendalii*.

Leaves more repand (central) 108. *A. bourgaei*.

Leaves white and very large 109. *A. mirabilis*.

Leaves rough. Plants very glaucous except the green scape.

110. *A. franzosini*.

II. LITTAEA. Flowers in a spike or spikelike cluster.

A. Leaves not striate-ridged.

B. Leaves neither filiferous nor with a detachable margin.

C. Leaves elongate, at most minutely denticulate.

Leaves rather fleshy, tapered from the base.

Leaves with slender spine; flowers withering.

Margin denticulate.

Pedicels distinct 123. *A. yuccaefolia*.

Pedicels on a peduncle 124. *A. eduardi*.

Margin smooth 125. *A. houghii*.

Leaves without spine; flowers drying rotate 122. *A. bracteosa*.

Leaves rather stiff, oblong.

Leaves light green, narrow (scarcely 1 cm. wide)

120. *A. dasyliroides*.

Leaves gray, broader (2 cm. wide) 121. *A. intrepida*.

CC. Leaves relatively broad, at most minutely denticulate.

Leaves without spine.

Leaves without spine or denticles.

Plants with elongate trunk 126. *A. attenuata*.

Plants nearly or quite acaulescent 127. *A. ellemeetiana*.

Leaves without spine but denticulate 128. *A. pruinosa*.

- Leaves with pungent short spine.
 Leaves not denticulate.....129. *A. vilmoriniana*.
 Leaves minutely denticulate.....130. *A. pedunculifera*.
- CCC. Leaves with evident spine and teeth.
 Spine and teeth soft and weak or small.
 Leaves glaucous or green. Teeth more or less irregularly connate.
 131. *A. celsii*.
 Leaves gray-green. Teeth mostly distinct.....132. *A. micracantha*.
 Leaves green, with pale median stripe.....133. *A. pendula*.
 Spine and teeth firm and relatively large.
 Teeth close together; leaves green.....134. *A. polyacantha*.
 Teeth more separated (10 mm. apart); leaves commonly glaucous.
 Flowers yellowish white, moderate.....135. *A. xalapensis*.
 Flowers deep yellow, large (75 mm. long).....136. *A. macrantha*.
- BB. Leaves with soft dry border, spine, and teeth.....137. *A. pumila*.
- BBB. Leaves with detachable horny border and with pungent spine.
 D. Leaves falcately ascending, thin, not repand.
 Leaves green or bluish.....138. *A. lecheguilla*.
 Leaves gray-green, somewhat glaucous.....139. *A. funkiana*.
- DD. Leaves spreading, rather narrow and thin, repand.
 140. *A. lophantha*.
- DDD. Leaves spreading, rather broad and usually thick.
 Leaves relatively thin, without pale ventral stripe...141. *A. horrida*.
 Leaves thicker.
 Leaves usually with pale ventral stripe142. *A. roezliana*.
 Leaves without pale ventral stripe.
 Leaves fleshy, incurved.....143. *A. ghiesbreghtii*.
 Leaves fibrous, straight.....144. *A. obscura*.
- DDDD. Leaves often falcate, ascending, thick and stiff.
 Spine short (25 mm. long).
 Teeth long (5 to 15 mm.) if widely separated...145. *A. triangularis*.
 Teeth scarcely 5 mm. long, distant.....146. *A. potrerana*.
 Spine long (over 50 mm. long). Spike very dense...147. *A. kerchovei*.
- DDDDD. Leaves spreading, oblong, thin, or else fleshy rather than hard.
 Horny margin of the leaf continuous.
 Teeth not on green hummocks.
 Leaves gray-green or blue-green, rather few ..148. *A. inopinabilis*.
 Leaves light green or glaucous.
 Leaves light green, scarcely glaucous.
 Spike very compact.....149. *A. convallis*.
 Spike rather loose.....150. *A. expatriata*.
 Leaves glaucous.
 Leaves flaccidly recurved.....151. *A. dissimulans*.
 Leaves not recurved.....152. *A. angustiarum*.
- Teeth saddling fleshy hummocks.
 Leaves rough. Teeth very broad.....153. *A. xylonacantha*.
 Leaves smooth.
 Teeth mammaeform.....154. *A. washingtonensis*.
 Teeth triangular.....155. *A. splendens*.
 Horny margin interrupted in the middle.....156. *A. vittata*.
- DDDDDD. Leaves straight, 3-edged, very hard...157. *A. victoriae-reginae*.
- BBBB. Leaves with (characteristically) detachable marginal threads, and with pungent spine.

Leaves small (scarcely 1 cm. wide and 10 cm. long), denticulate at base.

Spine flat.

Marginal threads coarse.....158. *A. parviflora*.

Marginal threads fine.....159. *A. toumeyana*.

Spine and leaf tip involute.....160. *A. hartmani*.

Leaves elongate, or broader in dwarf forms.

Leaves not recurving.

E. Leaves narrow (scarcely 1 cm. wide).

Leaves denticulate at base.....161. *A. mulfordiana*.

Leaves not denticulate.....162. *A. schottii*.

EE. Leaves moderately broad (1 to 2 cm.), not denticulate.

Threads coarse, shaving-like.....163. *A. schidigera*.

Threads fine, coiling.....164. *A. angustissima*.

EEE. Leaves relatively broad (2.5-4 cm.), denticulate on suckers.

165. *A. filifera*.

Leaves recurving, very long and narrow.....166. *A. geminiflora*.

AA. Leaves striate-ridged, linear, without coarse teeth or marginal threads or horny margin.

Leaves long and narrow (0.5 cm. wide, 60 to 90 cm. long); spine very slender.

167. *A. striata*.

Leaves shorter and broader (1 cm. wide, 25 to 50 cm. long); spine stouter.

Leaves densely clustered, rhombic in section.....168. *A. echinoides*.

Leaves fewer or laxer, often 3-sided.

Leaves nearly smooth on the margin.....169. *A. stricta*.

Leaves scabrid on the margin.....170. *A. falcata*.

1. *Agave panamana* Trel., sp. nov.

Leaves thin, 5 cm. wide and 65 cm. long, with a blackish needle-shaped spine scarcely 2 mm. wide and 10 mm. long, and small upcurved teeth 15 mm. apart and 1 to 2 mm. long; inflorescence 1 to 3 meters tall; flowers 60 mm. long, with segments equaling the tube, the filaments inserted about the upper third; freely bulbiferous.

Panama (type, in the herbarium of the New York Botanical Garden, from Urava Island, *Howe*, in 1909).

Known as "vara de San José."

2. *Agave rubescens* Salm-Dyck, Hort. Dyck. 8, 306. 1834.

Agave flaccida Salm-Dyck, Hort. Dyck. 306. 1834.

Agave punctata Salm-Dyck, Hort. Dyck. 8, 306. 1834.

Agave densispina Cels, Cat. 1865.

? *Agave erubescens* Ellemeet, Belg. Hort. 1871: 119. 1871.

Puebla and Oaxaca; type cultivated in Europe from an unspecified locality.

Nearly acaulescent; leaves gray, tinged with purple, 5 cm. wide, 75 cm. long, with a brown spine 4 mm. wide and 25 mm. long, and very slender, upcurved, orange or brown teeth 10 to 20 mm. apart and 3 to 4 mm. long, the translucent margin straight between them.

3. *Agave stringens* Trel., sp. nov.

Leaves concave, thin and recurving, very glaucous, 1 to 2 cm. wide and 60 cm. long or more, with a dark brown conical spine about 2 mm. wide and 8 mm. long, and very sharp and slender, red or brown, curved teeth scarcely 5 mm. apart and 1 to 2 mm. long, the intervening cartilaginous margin nearly straight.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, from Río Blanco barranca, *Trelease*, in 1904.

4. *Agave angustifolia* Haw. Syn. Pl. Succ. 72. 1812.

Agave wrightii Drummond, Rep. Mo. Bot. Gard. 18: 27. 1907.

Yucatán or Honduras ?; what appears to be this, also, from Campeche (*v. Christman*), in the Berlin herbarium; type cultivated in Europe from the island of St. Helena, where, as everywhere in warm countries, it is planted.

Subcaulescent; leaves gray-green, 8 cm. wide, 40 to 65 cm. long, with red-brown ungrooved spine 4 mm. wide and 25 to 40 mm. long, and dark, variously bent, very slender teeth 20 to 25 mm. apart and 3 to 5 mm. long.

5. *Agave bergeri* Trel.; Berger, *Agaven* 250. 1915.

Leaves gray-green, granular-roughened, about 8 cm. wide and 100 cm. long, with red-chestnut or graying, half-round, rough spine 5 to 6 mm. wide and 20 to 25 mm. long, and red or black, hooked, very slender teeth 15 to 25 mm. apart and 5 mm. long; inflorescence 5 meters tall; flowers 60 mm. long, green-yellow, with segments twice as long as the tube; capsules 30 mm. broad and 60 mm. long, somewhat stipitate and beaked; seeds 8 mm. wide and 12 mm. long; bulbiferous.

Region ?; type, in the herbarium of the Missouri Botanical Garden, cultivated in Europe as *A. rigida*, Berger, in 1908.

6. *Agave lespinassei* Trel. *Trans. Acad. St. Louis* 18: 33. 1909.

Veracruz; type from Tuxpan.

Acaulescent; leaves yellow-green, 6 to 7 cm. wide, 150 cm. long, with red-brown spine 5 to 6 mm. wide and 30 to 35 mm. long, and very slender, mostly upcurved, red-brown teeth 15 to 20 mm. apart and 1 to 2 mm. long, the intervening cartilaginous margin somewhat hollowed. "Zapupe de Tepezintla," "zapupe de Vincent."

7. *Agave endlichiana* Trel. *Trans. Acad. St. Louis* 18: 34. 1909.

Veracruz; type from Huatusco.

Acaulescent; leaves green, transiently glaucous, 5 to 9 cm. wide, 80 to 125 cm. long, with a garnet or chestnut spine 4 to 5 mm. wide and 15 to 30 mm. long, and heavy, upcurved, garnet or chestnut teeth 10 to 30 mm. apart and 3 mm. long, the intervening translucent margin nearly straight. "Ixtle," "ixtle manso."

8. *Agave aboriginum* Trel. *Trans. Acad. St. Louis* 18: 34. 1909.

Veracruz; type from Tuxpan.

Acaulescent; leaves yellow-green, somewhat gray, 5 to 11 cm. wide, 70 to 150 cm. long, with brown, somewhat decurrent spine 4 mm. wide and 35 to 50 mm. long, and heavy upcurved teeth 20 to 35 mm. apart and 5 to 8 mm. long sometimes with intercalated smaller ones, the intervening margin nearly straight. "Zapupe silvestre," "zapupe cimarrón," "zapupe de Sierra Chontla"; "wild zapupe."

9. *Agave deweyana*¹ Trel. *Trans. Acad. St. Louis* 18: 35. 1909.

Tamaulipas and Veracruz; type from Victoria, Tamaulipas.

Acaulescent; leaves yellow-green, somewhat transiently glaucous, 5 to 10 cm. wide, 150 cm. long, with brown or purplish spine 3 to 4 mm. wide and 15 to 40 mm. long, and slender upcurved teeth 15 to 45 mm. apart and 2 to 3 mm. long. "Zapupe de Tantoyuca," "zapupe de Huatusco," "zapupe verde"; "green zapupe."

10. *Agave zapupe* Trel. *Trans. Acad. St. Louis* 18: 32. 1909.

Veracruz; type from Tuxpan.

Acaulescent; leaves dark green but glaucous, 8 to 10 cm. wide, 150 to 200 cm. long, with red-brown or blackening spine 4 mm. wide and 15 to 25 mm.

¹ Named for L. H. Dewey (1865-), of the U. S. Department of Agriculture, well known for his work upon the fiber plants of Mexico and other regions.

long, and slender upcurved teeth 15 to 30 mm. apart and 2 to 3 mm. long. "Zapupe azul," "zapupe de Estopier," "zapupe de San Bernardo"; "blue zapupe."

11. *Agave subtilis* Trel., sp. nov.

Leaves ascending, glaucous, 10 to 15 cm. wide, 150 cm. long, with an acuminate gray spine 5 mm. wide and 25 mm. long, this flattened to the middle, and with rather slender-cusped, mostly upcurved teeth 20 to 50 mm. apart and 4 to 5 mm. long.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, from Tequila, *Griffiths* H, in 1909.

"Chato"; a good mezcal species.

12. *Agave longisepala* Tod. Hort. Panorm. 2: 34. 1891.

Jalisco(?); type cultivated in Europe; cultivated for mezcal at Tequila as "mezcal grande."

Leaves spreading, gray-green, 15 to 20 cm. wide, 200 cm. long, with a large conical or acuminate, flat-based, chestnut spine often 10 mm. wide and 25 mm. long, and with deltoid teeth 30 to 50 mm. apart and 5 to 10 mm. long, the prevailingly upcurved cusps often suppressed; flowers 70 mm. long, with short tube, the segments 30 mm. long.

13. *Agave pedrosana* Trel., sp. nov.

Leaves green, lightly glaucous, 10 to 15 cm. wide, 100 to 150 cm. long, with flexuous heavy flat-based chestnut spine about 10 mm. wide and 30 mm. long, and with slender upcurved teeth 30 to 60 mm. apart and 2 to 4 mm. long.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, collected at San Pedro, near Guadalajara, *Trelease*, in 1903.

14. *Agave gutierreziana* Trel., sp. nov.

Leaves green, about 15 cm. wide and 200 cm. long, with a rather small subulate ungrooved graying spine scarcely 5 mm. wide and 20 mm. long, and with slender, sharply upcurved teeth 10 to 25 mm. apart and 5 to 6 mm. long.

Chiapas; type, in the herbarium of the Missouri Botanical Garden, from Tuxtla Gutiérrez, *Gutiérrez*, in 1908.

"Magueyón."

15. *Agave elongata* Jacobi, Hamb. Gart. Zeit. 20: 501. 1864.

Agave spectabilis Tod. Hort. Panorm. 2: 4. 1879.

Region ?; type cultivated in Europe.

Leaves spreading, gray-glaucous, 10 to 13 cm. wide, 200 cm. long, with rather attenuate, chestnut or graying, flat-based spine 5 to 6 mm. wide and 20 to 30 mm. long, and slender, mostly upcurved teeth 10 to 15 mm. apart and 5 mm. long.

16. *Agave collina* Greenm. Proc. Amer. Acad. 32: 296. 1897.

Morelos; type collected above Cuernavaca.

Acaulescent; leaves glaucous, somewhat green-banded across the back, 5 to 8 cm. wide, 75 cm. long, with red-brown or purplish brown spine 3 to 5 mm. wide and 20 to 30 mm. long, and rather heavy, upcurved, blackish teeth 10 to 25 mm. apart and 3 to 5 mm. long, the yellowish margin nearly straight between them.

17. *Agave palmaris* Trel., sp. nov.

Leaves ascending, gray, more or less glaucous, 10 to 15 cm. wide, 150 cm. long, with recurved, red or graying spine 4 mm. wide and 15 mm. long, and mostly upcurved, slender teeth 20 to 30 mm. apart and 5 mm. long.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, from Mazatepec, *Dewey* 657.

“Mano larga,” “chino bermejo.” A good mezcal species; apparently cultivated for fiber in Sinaloa. A form with open spoon-shaped blunt spine fully 10 mm. wide (var. *monstrosa*) is cultivated as “zapalote.”

18. *Agave rhodacantha* Trel., sp. nov.

Leaves green, lightly glaucous, 15 to 20 cm. wide, 250 cm. long or more, with black-chestnut flat-based spine 5 mm. wide and 20 mm. long, and large heavy upcurved teeth 20 to 60 or 70 mm. apart and 10 mm. long, from large lenticular bases.

Sinaloa; type, in the herbarium of the Missouri Botanical Garden, from Mocarito, *Lundstrom*, in 1909.

“Espinoza.”

19. *Agave pes-mulae* Trel., sp. nov.

Leaves ascending, blue-green, glaucous, 6 to 8 cm. wide, 100 to 150 cm. long, with red-brown spine about 3 mm. wide and 15 mm. long, and sharply upcurved slender triangular teeth about 10 mm. apart and 3 mm. long.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, from Tequila, *Griffiths* B, in 1909.

“Pato de mula,” “pié de mula.” A good mezcal species.

20. *Agave donnell-smithii*¹ Trel. Trans. Acad. St. Louis 23: 144. 1915.

Guatemala; type from Escuintla.

Acaulescent; leaves light green, glaucous beneath, 8 cm. wide, 75 to 100 cm. long or more, with garnet or chestnut spine 4 mm. wide and 12 to 15 mm. long, and rather slender upcurved teeth 15 to 25 mm. apart and 2 to 3 mm. long.

21. *Agave karwinskii* Zucc. Act. Acad. Caes. Leop. Carol. 16²: 677. 1833.

? *Agave laxa* Salm-Dyck, Hort. Dyck. 8. 1834.

? *Agave viridissima* Baker, Gard. Chron. n. ser. 8: 137. 1877.

Agave corderoyi Baker, Gard. Chron. n. ser. 8: 398. 1877.

Agave bakeri Ross, Boll. Soc. Sci. Nat. ed. Econom. Palermo. 1894³.

Puebla and Oaxaca; type cultivated in Europe, presumably from Tehuacán.

Trunk becoming 4 meters tall; leaves green or very transiently glaucous, concave, 2 to 4 cm. wide, 35 to 70 cm. long, with dark brown spine 3 to 6 mm. wide and 25 to 50 mm. long, and strong, upcurved, nearly black teeth 25 to 45 mm. apart and 3 to 5 mm. long, the margin nearly straight between them. “Candelillo.”

22. *Agave decipiens* Baker, Kew Bull. Misc. Inf. 1892: 183. 1892.

Agave laxifolia Baker in Curtis's Bot. Mag. 122: pl. 7477. 1896.

Southern Florida, around the coast (type cultivated in Europe without recorded locality); presumably native in Yucatán.

Trunk 2 to 3 meters tall; leaves green, outcurved, rather fleshy and concave, 4 to 10 cm. wide, 70 to 125 cm. long, with dark chestnut spine 3 to 5 mm. wide and 10 to 25 mm. long, and very slender flexuous teeth 10 to 25 mm. apart and 2 mm. long, these on fleshy prominences of the margin.

Cultivated (from a plant of Baja California) as *A. spiralis*. “False sisal.”

¹ Named for Capt. John Donnell Smith (1829–), of Baltimore, Maryland, well known for his extensive publications upon the botany of Central America. Capt. Smith has made collections in Central America, and has directed botanical explorations in many parts of that region. His large herbarium, which contains a wide representation of Mexican plants, and his library, have been presented to the Smithsonian Institution, and are incorporated in the U. S. National Herbarium.

23. *Agave sisalana* Perrine, U. S. Sen. 25th Congr. Sess. 2. Doc. 300. *pl.* 1, 2, 4. 1838.

Agave rigida sisalana Baker, Kew Bull. Misc. Inf. 1889: 254. 1889.

Yucatán; type cultivated in Florida from introduced plants.

Acaulescent; leaves at length bright glossy green, at first lightly glaucous, nearly flat, 10 cm. wide, 150 cm. long, with a chestnut spine 4 to 5 mm. wide and 20 to 25 mm. long, the straight margin typically unarmed or with a few very rudimentary teeth. "Yaxci," "yax-qui," "green agave," "Sisal hemp," or "Bahama hemp."

The species most extensively planted, as a source of fiber, outside of Yucatán. Called "maguey tuxtleco" in Chiapas.

Sometimes occurring in a form as prickly as the preceding species (*f. armata* Trel. Mem. Nat. Acad. Sci. 11: 49. 1913); and exceptionally with a trunk about 1 meter tall.

24. *Agave candelabrum* Tod. Hort. Panorm. 1: 66. 1876.

Agave rumphii and *Agave laxa* Hort.

Region ?; type cultivated in Europe.

Leaves uniformly spreading, green, 7 cm. wide, 100 to 150 cm. long, with conical brown spine 3 mm. wide and 15 to 20 mm. long, and sharply upcurved teeth 10 to 25 or 30 mm. apart and 4 mm. long, the intervening margin straight.

Perhaps a green extreme of *A. cantala*.

25. *Agave kirchneriana* Berger, Agaven 252. 1915.

Acaulescent; leaves dull gray-green, slightly roughened, 7 cm. wide, 125 cm. long, with polished chestnut spine 5 mm. wide and 20 mm. long, and slender upcurved blackish teeth 15 to 20 mm. apart and 3 to 5 mm. long; flowers green, 50 to 55 mm. long, the openly conical tube half as long as the segments.

Guerrero; type from Xochipila or Zumpango.

"Maguey delgado"; yielding superior fiber and mezcal.

26. *Agave pacifica* Trel., sp. nov.

Acaulescent; leaves yellow-green, very lightly glaucous and zoned, 3.5 to 5 cm. wide, 50 to 75 cm. long, the purplish red-brown spine 15 to 25 mm. long, often abruptly contracted and slender above the decurrent base, the teeth usually upcurved-triangular, 15 to 25 mm. apart and 3 to 5 mm. long, the intervening cartilaginous margin straight; flowers greenish yellow, 50 mm. long, the openly conical tube half as long as the segments; capsules shortly stipitate and beaked, 25 mm. broad and 45 mm. long.

Sonora, Sinaloa, and Tepic; type, in the herbarium of the Missouri Botanical Garden, from Creston Island, Mazatlán, Sinaloa, *Trelease*, in 1904.

27. *Agave cantala* Roxb. Hort. Beng. 25. 1814.

Agave vivipara of authors, not L.

Agave flaccida Haw. Syn. Pl. Succ. 72. 1812.

Furcraea cantala Haw. Suppl. Pl. Succ. 42. 1819.

Furcraea madagascariensis Haw. Suppl. Pl. Succ. 42. 1819.

Agave madagascariensis Spreng. Syst. Veg. 2: 79. 1825.

Agave cantula Roxb. Fl. Ind. 2: 167. 1832.

Region ?; type cultivated in India.

Acaulescent; leaves glaucous, slightly green-lined longitudinally, falcate or straight, ascending, 6 to 10 cm. wide, 150 cm. long, with slender-pointed conical brown spine 3 to 4 mm. wide and 15 to 20 mm. long, and red-chestnut, upcurved, gradually very sharp-pointed teeth 20 to 30 mm. apart and 5 to 6 mm. long.

A close ally of the "zapupe" and especially the "Tequila mezcal" species; cultivated for its fiber in the Philippines as "maguey" or "Manila aloe," and in India where it is the source of "Bombay hemp" or "Bombay aloe fiber."

Apparently one of the west-Mexican allies of *A. tequilana*, perhaps early taken for its fiber to the Philippines and thence to India, from the Acapulco region.

28. *Agave tequilana* Weber, Bull. Mus. Hist. Nat. 8: 220. 1902.

Jalisco; type from about Tequila.

Shortly caulescent; leaves rather light bluish green and persistently glaucous, thin and nearly flat, 8 to 10 cm. wide, 125 cm. long or more, with red-brown or purple-brown spine 3 to 4 mm. wide and 15 to 20 mm. long, and triangular upcurved reddish teeth 10 to 15 mm. apart and 3 to 4 mm. long, the intervening whitish margin slightly hollowed. "Mezcal azul" or "chino azul."

The common source of the distilled liquor, "mezcal de Tequila." A number of related forms are found in cultivation with this typical "azul." These, probably all specifically separable as with the "zapupe" complex, to which they are related, are known as "mano larga," "bermejo," "chato," "chino bermejo," "zapalote," "pié de mula" or "pato de mula," and "seguín" or "ziguín."

29. *Agave pseudotequilana* Trel., sp. nov.

Shortly caulescent; leaves yellow-green, glaucous, rather thick, openly concave, 15 cm. wide, 175 to 200 cm. long, with dark red-brown, conical or acuminate tapered spine 4 to 7 mm. wide and 10 to 15 or 20 mm. long, and sharply upcurved or flexed, triangular teeth on broad bases, 15 to 20 or 35 mm. apart and 5 to 10 mm. long, the intervening margin nearly straight; inflorescence ample, paniced; flowers unknown; capsules broadly oblong, 25 mm. broad and 45 mm. long, accompanied by bulbils.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, from Tuxpan.

"Mezcal blanco" or "mezcal cucharo."

30. *Agave sullivanii* Trel., sp. nov.

Leaves green, about 10 cm. wide and 100 cm. long, with a chestnut, very short-conical spine, this abruptly pointed, or less commonly conical, and round-grooved at base, 5 mm. wide and 10 to 15 mm. long, the teeth triangular, upcurved, 20 mm. apart and 4 to 6 mm. long.

Region ?; type, in the herbarium of the Missouri Botanical Garden, cultivated for mezcal at La Paz, Baja California, *Sullivan*, in 1910.

31. *Agave ixtli* Karw. in Salm-Dyck, Hort. Dyck. 8, 304. 1834.

Yucatán; type cultivated in Europe, from Yucatán.

Acaulescent; leaves grayish, somewhat concave, scarcely 50 cm. long, with spine and prickles much as in *A. fourcroydes*.

"Ixtle"; apparently including the plants known as "bab-ci," "chelem" (which is *A. silvestris* D'Utra, Bol. Agr. S. Paulo, 1909: 169. 1909, and *A. proliferata* Schott, in sched.), "chucum-ci," "citam-ci" (which is *A. minima* D'Utra, loc. cit.), "pita-ci," "xix-ci," and "xtuc-ci." The specific name is variously and often erroneously spelled.

32. *Agave fourcroydes* Lem. Ill. Hort. 11: Misc. 65. 1864.

Agave rigida elongata Baker, Kew Bull. Misc. Inf. 1892: 33. 1892.

Yucatán; type cultivated in Europe from an unrecorded locality.

Trunk becoming 2 meters tall; leaves gray, rather flat, 8 to 10 cm. wide, 150 to 250 cm. long, with black-brown spine 4 to 6 mm. wide and 20 to 30 mm. long, and moderately slender, somewhat upcurved, blackish teeth 10 to 20 mm.

apart and 1 to 4 mm. long, the margin nearly straight between their somewhat raised bases. "Sacqui," "sac-ci," "gray agave," or "henequén."

The source of the larger part of the "Sisal hemp" exported from Yucatán.

33. *Agave datylio* Weber, Bull. Mus. Hist. Nat. 8: 223. 1902.

Baja California; type from La Paz.

Acaulescent; leaves yellow-green or gray-green, 3 to 4 cm. wide, 30 to 75 cm. long, with purplish or blackish spine 4 to 6 mm. wide and 20 to 30 mm. long, and glossy, chestnut, heavily triangular or slender-cusped teeth 20 to 30 or 50 mm. apart and 3 to 5 mm. long, the intervening margin nearly straight.

34. *Agave vexans* Trel. Rep. Mo. Bot. Gard. 22: 62. 1911.

Baja California; type from Mulegé.

Acaulescent; leaves gray-green, 2 cm. wide, 20 to 45 cm. long, with gray-brown spine 3 to 5 mm. wide and 25 to 35 mm. long, and triangular or slender-cusped, detachable teeth 15 to 20 mm. apart and 3 to 4 mm. long.

35. *Agave nivea* Trel. Trans. Acad. St. Louis 23: 143. 1915.

Guatemala; type from El Rancho.

Acaulescent; leaves very glaucous, very concave, 15 cm. wide, 200 cm. long, with black-chestnut spine 3 mm. wide and 15 to 20 mm. long, and triangular slender-cusped teeth 30 to 50 mm. apart and 3 mm. long, their bases often fleshy, the intervening margin nearly straight.

36. *Agave sicaefolia* Trel. Trans. Acad. St. Louis 23: 141. 1915.

Guatemala; type from El Rancho.

Acaulescent; leaves gray, flat or concave, 7 to 8 cm. wide, 60 to 75 cm. long, with purplish chestnut spine 4 mm. wide and 30 to 40 mm. long, and mostly upcurved, slender teeth 15 to 35 mm. apart and 3 to 5 mm. long, the intervening margin sometimes with smaller straight teeth.

37. *Agave macroacantha* Zucc. Act. Acad. Caes. Leop. Carol. 16²: 676. 1833.

Agave pugioniformis Zucc. Act. Acad. Caes. Leop. Carol. 16²: 676. 1833.

Agave flavescens Salm-Dyck, Hort. Dyck. 8, 305. 1834.

Agave flavescens macroacantha Jacobi, Hamb. Gart. Zeit. 1864: 500. 1864.

Agave bessereriana Van Houtte, Cat. 1868: 32. 1868.

Agave subfalcata Jacobi, Wochenschr. Ver. Beförd. Gartenb. 1869: 179. 1869.

Agave linearis Jacobi, Wochenschr. Ver. Beförd. Gartenb. 1869: 179. 1869.

Agave concinna Baker, Gard. Chron. n. ser. 8: 137. 1877.

Agave sudburyensis Baker, Gard. Chron. n. ser. 8: 137. 1877.

Agave paucifolia Baker, Gard. Chron. n. ser. 9: 266. 1878.

Agave oligophylla Baker, Gard. Chron. n. ser. 10: 492. 1878.

? *Agave wiesenburgensis* Wittm. Gart. Zeit. 4: 13. 1885.

Agave baxteri Baker, Amaryll. 178. 1888.

? *Agave integrifolia* Baker, Amaryll. 185. 1888.

Puebla; type cultivated in Europe, probably from Tehuacán.

Acaulescent; leaves glaucous, 2 to 4 (or 7) cm. wide, 20 to 55 cm. long, with dark brown or blackish spine 4 to 6 mm. wide and 15 to 25 mm. long or more, and heavy-based, rather upcurved teeth 15 to 20 mm. apart and 2 to 3 mm. long. "Espadilla."

38. *Agave yaquiana* Trel., sp. nov.

Acaulescent; leaves falcately erect, glaucous and green-zoned, 5 cm. wide, 75 cm. long, with brown decurrent spine 4 mm. wide and 25 mm. long, and rather heavy, mostly upcurved, triangular teeth 15 to 20 or even 50 mm. apart and 36 mm. long, the intervening cartilaginous margin very slightly hollowed.

Sonora; type, in the herbarium of the Missouri Botanical Garden, from rocky hillsides between Hermosillo and Ures, *Trelease* 391.

"Mezcal."

39. *Agave desmettiana* Jacobi, Hamb. Gart. Zeit. 22: 217. 1866.

? *Agave pallida* Jacobi, Hamb. Gart. Zeit. 22: 112. 1866.

? *Agave regeliana* Jacobi, Hamb. Gart. Zeit. 22: 214. 1866.

? *Agave ananassoides* de Jonge & Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 147. 1868.

Agave miradorensis Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 156. 1868.

Veracruz; type cultivated in Europe, presumably from El Mirador, Huatusco, though said to be from Brazil.

Leaves glaucous, nearly straight, 3 to 7 or 10 cm. wide, 75 to 100 cm. long, with slender spine 4 to 5 mm. wide and 20 to 25 mm. long, entire above but with minute, nearly colorless teeth some 5 mm. apart toward the base.

40. *Agave thomasaе* Trel. Trans. Acad. St. Louis 23: 138. 1915.

Guatemala; type cultivated at Quezaltenango.

Leaves green, glaucous, 15 cm. wide, 60 cm. long, with chestnut needle-shaped spine 2 mm. wide and 25 mm. long, and minute, nearly straight teeth 5 to 10 mm. apart and 1 to 2 mm. long, the margin straight between them.

41. *Agave deamiana*¹ Trel. Trans. Acad. St. Louis 23: 139. 1915.

Guatemala; type from Fiscal.

Leaves grayish, 10 cm. wide and 100 cm. long, with purplish brown, needle-shaped spine 3 to 4 mm. wide and 40 mm. long, and slender teeth 10 to 20 mm. apart and 2 to 4 mm. long, the margin straight between them.

42. *Agave hurteri* Trel. Trans. Acad. St. Louis 23: 136. 1915.

Guatemala; type from Zunil.

Leaves somewhat glaucous, 10 cm. wide, 75 to 100 cm. long, with straight chestnut spine 8 mm. wide and 40 mm. long, and more or less hooked, relatively slender teeth 10 to 20 mm. apart and 5 to 10 mm. long, the intervening margin straight.

43. *Agave tortispina* Trel. Trans. Acad. St. Louis 23: 135. 1915.

Guatemala; type from Cruz.

Leaves yellow-green, white-glaucous, 10 cm. wide, 25 to 30 cm. long, with red or smoky brown, very flexuous spine 4 mm. wide and 30 mm. long, and heavy, nearly straight teeth 15 to 25 mm. apart and 3 to 5 mm. long on prominent fleshy hummocks.

44. *Agave pachycentra* Trel. Trans. Acad. St. Louis 23: 135. 1915.

Guatemala; type from Cruz.

Leaves green, blue-glaucous, 15 to 20 cm. wide, 35 to 60 cm. long, with large gray spine 8 mm. wide and 50 to 60 mm. long, and heavy recurved teeth 25 to 50 mm. apart and 5 to 10 mm. long, these on prominent fleshy hummocks.

45. *Agave kellermaniana*² Trel. Trans. Acad. St. Louis 23: 142. 1915.

Guatemala; type from Fiscal.

Leaves very glaucous, 8 to 10 cm. wide and 100 cm. long or larger, with purple-chestnut spine 4 to 5 mm. wide and 30 to 35 mm. long, and upcurved slender teeth 10 to 25 mm. apart and 3 to 5 mm. long, these sometimes on fleshy prominences.

¹ Named for Charles C. Deam, of Bluffton, Indiana, well known for his investigations of the flora of Indiana. Mr. Deam has also obtained an extensive collection of plants in Guatemala.

² Named for W. A. Kellerman (1850–1908), of Ohio, known especially for his investigations of parasitic fungi. He made large collections of plants in Guatemala.

46. *Agave samalana* Trel. Trans. Acad. St. Louis 23: 142. 1915.

Guatemala; type from Esperanza.

Leaves glaucous, 15 cm. wide, 60 cm. long, with reddish or chestnut needle-shaped spine 3 to 4 mm. wide and 35 to 55 mm. long, and rather straight triangular teeth 5 to 20 mm. apart and 1 to 3 or 5 mm. long, the nearly straight intervening margin denticulate.

47. *Agave lagunae* Trel. Trans. Acad. St. Louis 23: 143. 1915.

Guatemala; type from Amatitlán.

Leaves very glaucous, 8 to 10 cm. wide, 40 cm. long, with garnet spine 3 to 5 mm. wide and 20 to 30 mm. long, and variously curved teeth 20 to 40 mm. apart and 3 to 5 mm. long, these on rather prominent fleshy hummocks between which the margin is straight.

48. *Agave minarum* Trel. Trans. Acad. St. Louis 23: 139. 1915.

Guatemala; type collected near El Rancho.

Leaves yellow-green, 6 cm. wide, 60 cm. long, with brown spine 5 mm. wide and 45 mm. long, and detachable teeth 5 to 10 mm. apart, the intervening margin straight.

49. *Agave seemanniana*¹ Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 154. 1868.

Nicaragua (type from Segovia) and Guatemala.

Leaves glaucous, 8 cm. wide, 35 cm. long, with purplish brown spine 2 to 4 mm. wide and 20 to 30 mm. long, and triangular teeth 10 to 20 mm. apart and 2 to 3 mm. long, the margin hollowed between them.

50. *Agave tenuispina* Trel. Trans. Acad. St. Louis 23: 140. 1915.

Guatemala; type from Cruz.

Leaves glaucous, 20 cm. wide, 70 cm. long, with dull brown needle-like spine 3 mm. wide and 60 to 70 mm. long, and rather heavy curved teeth 20 to 40 mm. apart and 5 to 10 mm. long, the margin hollowed between them.

51. *Agave opacidens* Trel. Trans. Acad. St. Louis 23: 140. 1915.

Guatemala; type from Cruz.

Leaves glaucous, 8 to 10 cm. wide, 75 cm. long, with dull brown spine 6 mm. wide and 50 to 60 mm. long, and heavy, nearly straight teeth 20 to 50 mm. apart and 5 to 8 mm. long, these on rather fleshy prominences.

52. *Agave lurida* Ait. Hort. Kew. 1: 472. 1789.

Veracruz; type cultivated in Europe; scarcely known except in cultivation.

Leaves glaucous, rather thin and curved, with a slender spine 3 to 4 mm. wide and 25 to 30 mm. long, and small teeth about 10 mm. apart and 3 mm. long, these usually not on fleshy bases.

53. *Agave rasconensis* Trel., sp. nov.

Leaves rather thin and more or less outcurved, about 10 cm. wide and 75 cm. long, gradually acute, glaucous, with needle-shaped, somewhat round-grooved, glossy red-brown spine about 4 mm. wide and 30 mm. long, and broadly triangular teeth 20 to 50 mm. apart and 6 mm. long, these on somewhat raised prominences between which the margin is nearly straight; inflorescence about 8 meters tall, paniculate; flowers 90 to 95 mm. long, short-pedicel, somewhat stipitate, the tube 12 to 15 mm. deep, scarcely half as long as the segments,

¹Berthold Seemann (1825-1871) was a native of Hanover, who from 1847 to 1851 was naturalist of H. M. S. *Herald*. In Mexico he collected in the states of Sinaloa and Durango, and probably elsewhere. He collected also in Panama, and published an extended account of his botanical discoveries.

the filaments inserted in its throat; capsules 25 mm. broad and 50 mm. long, stipitate but scarcely beaked; seeds 7 mm. wide and 10 mm. long.

San Luis Potosí; type, in the herbarium of the Missouri Botanical Garden, from Rascón, *Trelease* 75.

54. *Agave vera-cruz* Mill. Gard. Dict. ed. 8. *Agave* no. 7. 1768.

Agave mexicana and *Agave theometel* of authors.

Veracruz (?); type cultivated in Europe, nominally from that region; also established in Peru. Extensively planted about the Mediterranean, and cultivated as "blue aloe" in Mauritius, Amoy, and India.

Leaves glaucous, rather fleshy and straight, 15 to 17 cm. wide, 150 cm. long, with short stout gray spine 5 to 6 mm. wide and 20 to 25 mm. long, and deltoid teeth on low fleshy prominences.

55. *Agave verschaffeltii* Lem. in Verschaffelt, Cat. 1866-7, f.; Ill. Hort. 15: pl. 564. 1868.

Puebla; type cultivated in Europe, pretty clearly from about Tehuacán.

Leaves glaucous, 7 cm. wide, 15 to 17 cm. long, obovate-oblong, acuminate, with twisted light brown spine and long rust-brown teeth on very high fleshy prominences. "Papalometl."

A beautiful polymorphic small species, at one time popular in European gardens under distinctive varietal names, of which over 30 have been listed—one of the introducers advertising as many varieties as there are plants. Among the names preoccupied by these as specific are *A. albida*, *A. amoena*, *A. auricantha*, *A. bedinghausii*, *A. bonneti*, *A. cochleata*, *A. crenata*, *A. croucheri*, *A. cucullata*, *A. elegans*, *A. imbricata*, *A. leopoldi*, *A. prolifera*, *A. pulverulenta*, *A. quadreta*, *A. rotundifolia*, *A. saundersii*, *A. serrata*, *A. serrulata*, *A. simsii*, *A. streptacantha*, and *A. tehuacanensis*.

56. *Agave megalacantha* Hemsl. Diag. Pl. Mex. 55. 1880.

Valley of Mexico; type from the lava fields.

Leaves gray, short-obovate, acuminate, 10 cm. wide, 15 to 20 cm. long, with brown or gray spine 5 mm. wide and 40 mm. long, and rather stout, mostly upcurved teeth about 20 mm. apart and 5 mm. long, these from very high fleshy prominences.

57. *Agave guadalajarana* Trel., sp. nov.

Leaves dull and pale but scarcely glaucous, cuneate-obovate, rather obtuse, 8 cm. wide and 12 cm. long, with red-chestnut curved spine 3 mm. wide and 25 mm. long, and triangular teeth, the upper ones 7 mm. long and from high fleshy prominences; inflorescence paniced, with short, more or less connate pedicels; flowers 60 mm. long, the perianth segments equaling or shorter than the tube; capsules stipitate and beaked, 15 to 20 mm. wide, 35 mm. long.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, from Guadalajara, *Pringle* 4473.

58. *Agave potatorum* Zucc. Act. Acad. Caes. Leop. Carol. 16²: 675. 1833.

Puebla; type cultivated in Europe (from about Tehuacán?).

Leaves oblanceolate, acute, 8 to 10 cm. wide, 30 to 40 cm. long, with straight, dull brown spine, and rather small teeth on low fleshy prominences, gray in the typical form, and green in that which has been called *A. scolymus* Karw. (in Salm-Dyck, Hort. Dyck. 307. 1834).

59. *Agave mescal* Koch, Wochenschr. Ver. Beförd. Gartenb. 8: 94. 1865.

Agave hookeri Jacobi, Hamb. Gart. Zeit. 22: 168. 1866.

Michoacán (type locality about Tejulpico on the Balsas River?), Sinaloa, and Sonora.

Leaves dark green, oblong-obovate, acute, 15 to 25 cm. wide, 100 to 150 cm. long, rather thin, with slender brown spine and rather long teeth from the tops of fleshy prominences between which other teeth occur on the hollowed margin. "Mezcal," "lechuguilla."

60. *Agave fenzliana* Jacobi, Hamb. Gart. Zeit. 22: 170. 1866.

Agave inaequidens Koch, Wochenschr. Ver. Beförd. Gartenb. 3: 28. 1860.

Michoacán (?); type cultivated in Europe.

Leaves dull light green, 15 to 20 cm. wide and 150 cm. long or more, with long brown spine and unequal, rather small teeth more or less raised on prominences.

61. *Agave cupreata* Trel. & Berger; Berger, Agaven 197. 1915.

Leaves gray, oblanceolate, acute, 20 cm. wide, 75 cm. long, with copper-colored, somewhat twisted spine 5 mm. wide and 45 mm. long, and large, variously curved, unequal, similarly colored, flat teeth 30 to 60 mm. apart and 10 to 15 mm. long, these clasping the tops of large fleshy prominences; panicle 10 meters tall; flowers yellow, 55 to 60 mm. long, the tube about 10 mm. long.

Michoacán and Guerrero; type from the Sierra Madre.

"Maguey de mezcal."

62. *Agave shawii* Engelm. Trans. Acad. St. Louis 3: 314. 1875.

Northwestern Baja California, near the coast. Southern California; type from Point Loma.

Trunk 1 meter tall; leaves green, glossy, acuminate, 6 to 12 cm. wide, 25 to 50 cm. long, with flexuous needle-shaped red spine 3 to 6 mm. wide and 20 to 40 mm. long, and large, garnet, variously curved teeth 10 to 25 mm. apart and 10 to 15 mm. long, connected by a horny band; filaments inserted about the middle of the perianth tube.

63. *Agave orcuttiana*¹ Trel. Rep. Mo. Bot. Gard. 22: 47. 1912.

Northwestern Baja California, near the coast; type from San Quintín.

Trunk reaching a height of 3 meters; leaves green, with gray spine 4 mm. wide and 20 to 25 mm. long, and large curved gray teeth with-horny connection; filaments inserted above the middle of the tube.

64. *Agave sebastiana* Greene, Bull. Calif. Acad. 1: 214. 1885.

Western coast region and islands of middle Baja California; type from Cedros Island.

Leaves glaucous, rather acute, 6 to 10 cm. wide, 15 to 30 cm. long, with red-brown or gray spine 5 to 6 cm. wide and 20 to 50 mm. long, and nearly straight teeth 15 mm. apart and 3 to 5 or even 10 to 15 mm. long, with horny connection; filaments inserted above the middle of the tube.

65. *Agave pachyacantha* Trel. Rep. Mo. Bot. Gard. 22: 48. 1912.

Northwestern coast region of Baja California; type from Todos Santos Bay.

Leaves rather gray, acuminate, 10 to 12 cm. wide, 25 to 40 or 75 cm. long, with straight heavy chestnut spine 6 to 9 mm. wide and 25 to 40 mm. long, and mostly recurved, heavy teeth 15 mm. apart and 10 mm. long (or sometimes almost suppressed), with connecting horny line; filaments inserted toward the top of the tube.

¹ Named for C. R. Orcutt (1864-), for many years a resident of California, who has collected plants in various parts of Mexico, but especially in Baja California. Many specimens of his collection are in the U. S. National Herbarium.

66. *Agave goldmaniana* Trel. Rep. Mo. Bot. Gard. 22: 49. 1911.

Eastern Baja California; type from Yubai.

Trunk short; leaves grayish, 10 cm. wide, 50 cm. long, with nearly straight blackish spine 7 mm. wide and 40 mm. long, and teeth 15 to 30 mm. apart and up to 10 mm. long, these very nearly triangular, often connected by a horny band, the intervening margin nearly straight.

67. *Agave applanata* Koch, Wochenschr. Ver. Beförd. Gartenb. 1862: 83. 1862.

Veracruz; on the lava fields about Limón; type cultivated in Europe, without recorded locality.

Leaves glaucous, 10 to 15 cm. wide, 100 to 150 cm. long, with purplish or gray, somewhat flexuous, long-decurrent spine 6 to 7 mm. wide and 35 to 45 mm. long, and more or less recurved, triangular teeth 25 to 50 mm. apart and 5 to 8 mm. long, the upper ones connected by a horny line.

68. *Agave scabra* Salm-Dyck, Bonplandia 7: 86. 1859.

Agave wislizeni Engelm. Trans. Acad. St. Louis 3: 320. 1875.

Agave noah Nickels, Cat. 26: 20.

Coahuila; type from San Sebastián, Sierra de Noa.

Leaves dull gray, smooth, acute, 10 to 15 cm. wide, 20 to 25 cm. long, with somewhat curved and decurrent, chestnut or gray spine 3 to 4 mm. wide and 15 to 20 mm. long, and more or less curved, narrowly triangular teeth 15 to 20 mm. apart and 3 to 8 mm. long, the margin between them slightly hollowed.

69. *Agave huachucensis* Baker, Amaryll. 172. 1888.

Southern Arizona (type locality, Huachuca Mountains), and perhaps adjacent Mexico.

Leaves in a globose cluster, dull gray, essentially smooth, acute, 10 to 15 cm. wide, 16 to 30 cm. long, with more or less flexuous and decurrent, red-chestnut or gray spine 5 to 6 mm. wide and 25 mm. long, and usually recurved, narrowly triangular teeth 15 mm. apart and 4 to 7 mm. long, the margin between these usually concave.

70. *Agave parrasana* Berger, Notizbl. Bot. Gart. Berlin 4: 250. 1906.

Coahuila; type from Sierra de Parrás.

Leaves green, lightly glaucous, obovate, long-acuminate, 6 to 8 cm. wide, 10 cm. long or more, with slender-tipped spine 3 to 4 mm. wide and 50 mm. long, and more or less recurved triangular teeth about 10 mm. apart and 5 mm. long, on fleshy prominences.

71. *Agave chihuahuana* Trel. Rep. Mo. Bot. Gard. 22: 90. 1911.

Chihuahua; type locality near Chihuahua.

Leaves grayish, somewhat acuminate, 10 to 15 cm. wide, 15 to 25 cm. long, with purplish chestnut spine 4 to 7 mm. wide and 25 to 35 mm. long, and triangular teeth 15 to 25 mm. apart and 6 mm. long, the margin between them nearly straight; filaments inserted far above the middle of the tube.

72. *Agave parryi* Engelm. Trans. Acad. St. Louis 3: 311. 1875.

Mountains of northern Chihuahua. Southern Arizona and New Mexico; type from Santa Rita, New Mexico.

Leaves gray, acute or somewhat acuminate, 6 to 10 cm. wide, 25 to 30 cm. long (exceptionally 15 cm. wide and 40 cm. long), the spines nearly straight, from chestnut becoming gray, 5 to 6 mm. broad and 20 to 25 mm. long, the teeth straightish or gently recurved, 15 to 20 mm. apart, 3 to 5 mm. long; filaments inserted nearly in the throat of the perianth tube.

73. *Agave patonii* Trel. Rep. Mo. Bot. Gard. 22: 92. 1911.

Durango; type locality, Chinacates.

Leaves grayish, more or less acuminate, 20 cm. wide, 30 cm. long, with nearly straight purplish spine 6 mm. wide and 30 to 35 mm. long, and relatively

slender recurved teeth 20 to 25 mm. apart and 6 to 7 mm. long, the intervening margin nearly straight; filaments inserted in the throat of the perianth tube.

74. *Agave aurea* T. S. Brandeg. Proc. Calif. Acad. II. 2: 207. 1889.

Eastern Baja California; type locality, Purísima.

Leaves gray-green, acuminate, 10 to 15 cm. wide, 75 to 100 cm. long, with conical or acuminate chestnut spine 3 to 5 mm. wide and 20 to 30 mm. long, and very unequal, triangular, often upcurved teeth 10 to 20 mm. apart and 4 to 8 mm. long, from fleshy prominences.

75. *Agave promontorii* Trel. Rep. Mo. Bot. Gard. 22: 50. 1911.

Cape region of Baja California; type locality, Sierra de la Laguna.

Leaves rather glaucous; spine more acuminate and curved.

76. *Agave dentiens* Trel. Rep. Mo. Bot. Gard. 22: 51. 1911.

Islands off the Sonora coast; type from San Esteban Island.

Leaves glaucous gray-green, 3 to 5 cm. wide, 30 to 50 cm. long, with ash-colored or brown-tipped spine 3 to 4 mm. wide and 20 to 30 mm. long, and minute whitish friable teeth 5 to 10 mm. apart and scarcely 1 mm. long, the margin nearly straight.

77. *Agave disjuncta* Trel. Rep. Mo. Bot. Gard. 22: 51. 1911.

Islands of Baja California; type locality, San Benito Island.

Differs from the preceding in its firmer browner teeth.

78. *Agave deserti* Engelm. Trans. Acad. St. Louis 3: 310, 370. 1875.

Colorado Desert of southern California (type locality east of San Felipe), and possibly adjacent Baja California.

Leaves gray, slightly granular, 5 cm. wide, 15 to 30 cm. long, with brown or fading, needle-shaped spine 3 mm. wide and 30 mm. long, and rather friable teeth 5 to 10 mm. apart and 3 to 4 mm. long, from rather prominent fleshy hummocks; ovary flask-shaped, 15 to 20 mm. long, equaling the perianth.

79. *Agave consociata* Trel. Rep. Mo. Bot. Gard. 22: 53. 1911.

Southern California and adjacent Baja California; type locality, San Felipe, California.

Leaves gray, 6 cm. wide, 20 to 30 cm. long, with brown spine 3 to 4 mm. wide and 25 to 30 mm. long, and triangular teeth 10 to 30 mm. apart and 4 to 8 mm. long, the intervening margin somewhat hollowed; ovary fusiform, 25 to 30 mm. long, exceeding the perianth.

80. *Agave pringlei* Engelm.; Trel. Rep. Mo. Bot. Gard. 22: 54. 1911.

Baja California; type from the central plateau.

Leaves gray, 5 cm. wide, 15 to 40 cm. long, with drab or brown-tipped spine 3 to 5 mm. wide and 25 to 35 mm. long, and easily detachable triangular teeth 15 to 25 mm. apart and 3 to 5 mm. long, the intervening margin nearly straight.

81. *Agave cerulata* Trel. Rep. Mo. Bot. Gard. 22: 55. 1911.

Central Baja California; type locality, Calmallí.

Leaves gray or glaucous, somewhat rough, 2 to 4 cm. wide, 30 cm. long, with gray-brown spine 2 to 4 mm. wide and 30 mm. long, and friable teeth 10 to 15 or 25 mm. apart and 3 mm. long, from fleshy marginal hummocks.

82. *Agave carminis* Trel. Rep. Mo. Bot. Gard. 22: 55. 1911.

Islands of eastern Baja California; type locality, Carmen Island.

Leaves grayish, smooth, 5 cm. wide, 30 to 40 cm. long, with needle-shaped, light brown spine 2 mm. wide and 35 mm. long, and firm, variously curved, narrowly triangular teeth 20 to 30 mm. apart and 5 mm. long, from low fleshy prominences between which the margin is nearly straight.

83. *Agave sobria* T. S. Brandeg. Proc. Calif. Acad. II. 2: 207. 1899.

East-central Baja California; type locality, mesas about Comondú.

Leaves glaucous, about 60 cm. long, with chestnut or glaucous, narrowly triangular, variously curved teeth 20 to 30 mm. apart and 8 to 10 mm. long, the intervening margin more or less hollowed.

84. *Agave affinis* Trel. Rep. Mo. Bot. Gard. 22: 56. 1911.

Eastern Baja California; type locality, Concepción Bay.

Leaves glaucous gray-green, rough, 5 cm. wide, 50 cm. long, with somewhat wavy, light brown or faded, nearly straight, narrowly triangular teeth 10 to 20 or 40 mm. apart and 5 to 7 mm. long, from low prominences between which the margin is somewhat concave.

85. *Agave brandegeei* Trel. Rep. Mo. Bot. Gard. 22: 57. 1911.

Cape region of Baja California; type from the mountains.

Leaves grayish yellow-green, 10 cm. wide, 60 cm. long, with stout, conical or acuminate, recurved, red-brown spine 4 mm. wide and 20 mm. long, and gently upcurved, broadly triangular teeth 10 mm. apart and 2 mm. long, the intervening margin straight.

86. *Agave margaritae* T. S. Brandeg. Proc. Calif. Acad. II. 2: 206. 1889.

Islands of southwestern Baja California; type locality, Magdalena Island.

Leaves green or transiently glaucous, acuminate, 6 to 10 cm. wide, 12 to 20 cm. long, with somewhat undulate, needle-shaped, chestnut or fading spine 3 mm. wide and 25 mm. long, and narrowly triangular, curved teeth 10 mm. apart and 6 to 8 mm. long, on low fleshy prominences.

87. *Agave connochaetodon* Trel. Rep. Mo. Bot. Gard. 22: 58. 1911.

Southwestern Baja California; type locality, Santa María Bay.

Leaves somewhat glaucous light green, 6 cm. wide, 25 cm. long, with red or drab, flexuous, needle-shaped spine 3 to 4 mm. wide and 40 to 50 mm. long, and triangular, often much hooked teeth 15 to 20 mm. apart and 10 to 15 mm. long, the intervening margin hollowed.

Perhaps a form of the preceding with larger and peculiarly curved marginal teeth.

88. *Agave roseana* Trel. Rep. Mo. Bot. Gard. 22: 59. 1911.

Southeastern Baja California; type locality, Espíritu Santo.

Leaves glaucous gray-green, 15 cm. wide, 50 cm. long, with glaucous, purplish brown or fading, tortuous, needle-shaped spine 3 to 4 mm. wide and 50 to 70 mm. long, and large, flat, broadly triangular, often much and diversely curved teeth 30 mm. apart and 10 to 25 mm. long, on large fleshy prominences.

89. *Agave avellanidens* Trel. Rep. Mo. Bot. Gard. 22: 60. 1911.

East-central Baja California; type locality, Paraíso.

Leaves long-acuminate, 11 cm. wide and 60 cm. long or more, with conical wavy drab spine 5 mm. wide and 50 mm. long, and similarly colored, variously curved, very broadly triangular teeth 25 to 50 mm. apart (sometimes with an intermediate smaller one) and 10 mm. long, the intervening margin slightly hollowed.

90. *Agave subsimplex* Trel. Rep. Mo. Bot. Gard. 22: 60. 1911.

Islands of Sonora; type locality, Seal Island, near Tiburón.

Leaves very glaucous, 5 cm. wide, 15 cm. long, with nearly straight, light gray, needle-shaped spine 3 mm. wide and 20 mm. long, and purplish black or red or fading, narrow triangular, variously curved teeth 10 to 20 mm. apart and 5 to 10 mm. long, on fleshy prominences between which the margin is nearly straight.

91. *Agave nelsoni* Trel. Rep. Mo. Bot. Gard. 22: 61. 1911.

North-central Baja California; type locality, San Fernando.

Leaves glaucous, 7 cm. wide, 18 to 35 cm. long, with blackish or fading spine 5 mm. wide and 30 cm. long, and fragile, brown or whitish, broadly triangular teeth 10 to 20 mm. apart and 5 mm. long, the intervening margin nearly straight.

92. *Agave weberi* Cels; Poisson, Bull. Mus. Hist. Nat. 7: 231. 1901.

Coahuila, Nuevo León, Durango, and San Luis Potosí; type cultivated in Europe, from Moctezuma, San Luis Potosí.

Leaves nearly straight, 15 cm. wide, 120 to 200 cm. long, green, somewhat glaucous, with straight brown spine 5 mm. wide and 40 to 50 mm. long, the margin typically without teeth but sometimes bearing a very few small rudimentary teeth; capsules 30 mm. broad and 55 mm. long, stipitate but scarcely beaked; bulbiferous.

"Maguey liso"; yielding aguamiel and containing a usable fiber.

93. *Agave latissima* Jacobi, Hamb. Gart. Zeit. 20: 499, 551. 1864.

Agave gracilis Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1870: 150. 1870.

Agave macroculmis Tod. Hort. Panorm. 2: 51. 1891.

Michoacán; type cultivated in Europe.

Leaves bright green or slightly glaucous, 20 to 30 cm. wide, 100 to 150 cm. long, with a stout conical spine as much as 25 mm. long, or a very heavy compressed spine base 20 mm. wide and 10 to 20 mm. long bearing a somewhat refracted tip 3 mm. wide and 5 mm. long, and short triangular teeth 20 to 30 mm. apart and 1 to 2 mm. long, or these commonly closer together or almost or quite confluent and from half-round graying horny bases.

Yielding "aguamiel" and fiber. Sometimes grown in gardens as *A. coccinea*.

94. *Agave ferox* Koch, Wochenschr. Ver. Beförd. Gartenb. 3: 23. 1860.

Valley of Mexico; type cultivated in Europe under a name suggesting confusion with the next.

Leaves acuminate, rather abruptly outcurved above the middle, undulate and very deeply crenate, green, 30 cm. wide, 120 cm. long, with long, sometimes flexed, gray spine 8 to 10 mm. wide and 60 mm. long, and rather recurved teeth 15 mm. long and 30 to 60 mm. apart on very high fleshy prominences.

95. *Agave mitraeformis* Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 145. 1868.

Agave coarctata Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 147. 1868.

Puebla and adjacent Veracruz; type cultivated in Europe; the name taken for the common "maguey cimarrón" of the vicinity of Tehuacán.

Leaves long-acuminate, concave, slightly gray-and-green-zoned, 30 cm. wide, 75 cm. long, with long, relatively slender spine and large triangular teeth between which the margin is concave.

Cultivated sometimes as *A. bonnettiana* and *A. selloum*.

96. *Agave compluviata* Trel. in Bailey, Stand. Cycl. Hort. 1: 234. 1914.

Durango; type locality, Pueblito.

Leaves gray, zoned with green, acute, deeply gutter-shaped, with upcurved sides, the back somewhat ridged, 40 cm. wide and 120 cm. long or more, with rather long conical gray spine and triangular, more or less recurved, rather large teeth between which the margin is somewhat hollowed. "Maguey verde."

Cultivated for aguamiel and a sort of pulque.

97. *Agave felina* Trel., sp. nov.

Leaves dull, glaucous, 20 cm. wide, 150 cm. long, with slightly flexuous spine 7 mm. wide and 45 mm. long, and clawlike teeth 15 to 20 mm. apart and 5 to 10 mm. long, the intervening margin repand or often incised.

Durango; type, in the herbarium of the Missouri Botanical Garden, from Pueblito, *Trelease*.

"Maguey chino."

98. *Agave subzonata* Trel., sp. nov.

Leaves gray, somewhat zoned with green, smooth or slightly rough, acute, 30 cm. wide, 120 cm. long, with stout gray spine 5 to 10 mm. wide and 30 mm. long, and rather heavy curved triangular teeth 40 to 50 mm. apart on very high fleshy prominences; panicle 5 meters tall, sparingly branched at top; filaments inserted about the middle of the rather long perianth tube; capsules stipitate and beaked, 2 cm. broad, 4.5 cm. long; seeds 5 mm. wide, 6 to 7 mm. long.

Nuevo León; type, in the herbarium of the Missouri Botanical Garden, collected at Monterrey, *Trelease*; common in hedges.

99. *Agave zonata* Trel. in Bailey, Stand. Cycl. Hort. 1: 234. 1914.

Nuevo León; type locality, Monterrey; common in hedges.

Leaves broadly and distinctly green-and-gray-banded, rough, acuminate, 25 cm. wide and 100 cm. long or more, with long, rather slender spine and rather distant triangular teeth between which the margin is very concave; capsules stipitate but scarcely beaked, 2.5 cm. broad, 4 to 4.5 cm. long; seeds about 5 mm. wide and 8 mm. long. "Maguey verde."

100. *Agave gracilispina* Engelm.; Leichtlin, Cat. 1882; Trel. in Bailey, Stand. Cycl. Hort. 1: 234. 1914.

Agave salmiana gracilispina Rol.-Goss. Rev. Hort. 68: 11. 1896.

San Luis Potosí; type locality, San Luis Potosí.

Aspect of the next, but the spine very long and needle-like. "Maguey blanco."

Planted for pulque. The leaf fiber of this and some of the following, as well as of the marginate species, is known as "ixtle."

101. *Agave melliflua* Trel. in Bailey, Stand. Cycl. Hort. 1: 234. 1914.

Nuevo León; type locality, Monterrey.

Leaves light gray, slightly roughened, long-acuminate, 30 cm. wide, 120 to 200 cm. long, with long, relatively slender, gray spine 4 to 6 mm. wide and 35 to 45 mm. long, and heavy-based, abruptly rather triangular-cusped teeth 20 to 50 mm. apart and 10 mm. long, on fleshy prominences; panicle 5 to 6 meters tall, rather narrow, sometimes bulbiferous; capsules stipitate and somewhat beaked, 2.5 cm. wide and 5 cm. long.

"Maguey serrano," "maguey manso," "maguey chino"; cultivated for aguamiel and the so-called pulque fermented from it there.

102. *Agave quotifera* Trel.; Ochoterena, Mem. Soc. Alzate 33: 102. 1913.

Durango; type locality, Pueblito.

Leaves light gray, acute, moderately concave, about 30 cm. wide and 120 cm. long or more, with conical gray spine 8 mm. wide and 150 mm. long, and triangularly recurved teeth 25 to 40 mm. apart and about 4 mm. long, on low fleshy or horny bases between which the margin is nearly straight; inflorescence 6 meters tall; flowers 70 to 80 mm. long, yellow, the tube and segments equal.

"Maguey ceniso"; cultivated in hedges; sometimes used for aguamiel, or the flower stalk allowed to develop and cut for "quite," which is sold on the streets and chewed like sugar cane.

103. *Agave crassispina* Trel. in Bailey, Stand. Cycl. Hort. 1: 234. 1914.

San Luis Potosí and Durango; type locality, about San Luis Potosí.

Aspect of the preceding, but the leaves 25 cm. wide and 100 cm. long, only slightly gray, the spine very stout, 15 to 18 mm. wide, 50 to 80 mm. long, and

the large teeth 25 to 50 or 70 mm. apart and 10 to 15 mm. long, from abruptly dilated bases, sometimes on very prominent fleshy hummocks. "Maguey cimarrón."

Agave crassisпина culta Trel., var. nov., differs from the type in its smaller spine and marginal teeth. San Luis Potosí; type locality, San Luis Potosí. "Maguey manso"; planted for pulque.

104. *Agave tecta* Trel. Trans. Acad. St. Louis 23: 145. 1915.

Guatemala; type cultivated in hedges at Quezaltenango.

Leaves gray-green, very thick and broad, spreading, plicate above the middle, 50 cm. wide, 200 cm. long, with purple-chestnut or gray spine 5 to 7 mm. wide and 45 to 65 mm. long, and recurved triangular teeth 40 to 70 mm. apart and 8 mm. long; scape densely covered by broad appressed imbricate bracts. "Maguey."

105. *Agave atrovirens* Karw. in Salm-Dyck, Hort. Dyck. 7, 302. 1834.

Oaxaca and Puebla; type locality, Mount Tanga, near Cajonos, Oaxaca.

Leaves dark green, very thick, ascending at the end, contracted at base, 30 to 40 cm. wide, 200 to 250 or even 400 cm. long, with elongate conical gray spine, and triangular teeth about 10 mm. long from low widened bases between which the margin is nearly straight. "Maguey verde grande."

Very extensively planted on the plains of Apam, in many forms, and the principal source of the pulque industry of Mexico, amounting to something like five million pesos annually. The most prized of the many forms planted are "maguey manso" and "maguey manso fino." Some mezcal called "mezcal de pulque" is distilled from pulque.

No fewer than 32 forms from about Apam are enumerated and their spines and marginal teeth pictured by P. and I. Blasquez in a "Tratado del Maguey," published at Puebla; and half as many more are listed for the District of Cholula. These lists contain the following Latin names—hardly employed according to botanical usage: *Agave acerva*, *A. aspera*, *A. blanda*, *A. cereus*, *A. cervus*, *A. cholulensis*, *A. cinerea*, *A. citrulacea*, *A. crispa*, *A. echidne*, *A. elegans*, *A. flava*, *A. foliosa*, *A. funis*, *A. glauca*, *A. insulsa*, *A. lutea*, *A. lutea mayor*, *A. maculata*, *A. maximiliana*, *A. miniata*, *A. nigra*, *A. pallida*, *A. praestans*, *A. procera*, *A. profusa*, *A. rubra*, *A. silvestris*, *A. smaragdina*, *A. spinaceum*, *A. spinosa*, *A. spinosissima*, *A. superba*, *A. torosa*, *A. variegata*, *A. vesca*, *A. violacea*, and *A. viridis*. Aztec names, based on the word metl and not maguey, are given frequently to the forms recognized by planters.

Quite as disconcerting as to differentiate these, is any effort to recognize a number of the nominal species of this group based on young plants cultivated in European gardens a generation ago. A gray-leafed form closely allied to the green *atrovirens* but with leaves less narrowed at base is var. *salmiana* (*A. salmiana* Otto in Salm-Dyck, Bonplandia 7: 88. 1859), the scape of which is densely covered by long, somewhat spreading bracts, and of which the most glaucous extreme is *A. salmiana glauca* Becker (Monatsschr. Kakteenk. 8: 150). An exceptionally broad-leafed form is var. *cochlearis* (*A. cochlearis* Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1871: 151. 1871), known in Sicilian gardens as *A. whitakeri*.

106. *Agave mapisaga* Trel., sp. nov.

Leaves green, slightly glaucous, narrow, rather straight but outcurving in age, 15 cm. wide, 175 to 250 cm. long, with rather short and recurved, chestnut or gray spine 4 to 8 mm. wide and 30 to 35 mm. long, and small but broad-based teeth 15 to 30 mm. apart and 1 to 2 mm. long, the intervening margin

nearly straight; inflorescence 8 meters tall or more; flowers green-yellow, 70 mm. long, the perianth segments equaling the tube.

Distrito Federal; type, in the herbarium of the Missouri Botanical Garden, from Tacubaya, *Trelease*.

“Maguey mapisaga”; planted for pulque.

107. *Agave schlechtendalii* Jacobi, Hamb. Gart. Zeit. 20: 555. 1864.

Region ?; type cultivated in Europe from seed said to have come from Sonora.

Known only from young plants rather closely comparable with those of *atrovirens*, but the gray leaves thinner and more outcurving.

108. *Agave bourgaei*¹ Trel., sp. nov.

Leaves gray, as much as 10 to 15 cm. wide and 150 cm. long, with conical gray spine 3 mm. wide and 30 mm. long, and triangular teeth some 10 mm. apart, the intervening margin more or less hollowed; panicle 3 meters tall or more; flowers 70 to 75 mm. long, the perianth segments nearly twice as long as the tube, the filaments inserted above the upper third of the tube.

Valley of Mexico; type, in the herbarium of the Museum of Natural History, Paris, collected on the lava fields, *Bourgeau* 1020; also *Bourgeau* 1399 and *Pringle* 6677.

109. *Agave mirabilis* Trel., sp. nov.

Leaves smooth, bright dark green when abraded, but densely white-pruinose, 40 cm. wide, 200 to 250 cm. long, often reflexed above the middle, with long gray spine 6 mm. wide and 80 mm. long, and triangular, more or less recurved teeth mostly 30 to 60 mm. apart and 10 to 15 mm. long, these abruptly dilated at base; inflorescence 8 to 10 meters tall, the thick (25 cm.) scape with very narrow reflexed bracts; flowers 70 to 80 mm. long, the tube and segments equal; capsules 25 mm. broad, 40 mm. long, not stipitate but shortly apiculate; seeds 6 to 7 mm. wide, 8 to 10 mm. long.

Puebla ?; type, in the herbarium of the Missouri Botanical Garden, from Las Vigas, *Trelease*.

“Maguey blanco”; planted in hedges.

110. *Agave franzosini* Baker, Kew Bull. Misc. Inf. 1892: 3. 1892.

Locality ?; type cultivated on the Riviera.

Leaves very rough, glaucous, often recurving, 20 to 30 cm. wide, 200 to 300 cm. long, with stout decurrent conical smoky-gray grooved spine 10 mm. wide and 55 mm. long, and abruptly broadly triangular teeth 30 to 70 mm. apart and 5 to 10 mm. long, these often from fleshy prominences; scape green.

111. *Agave marmorata* Roezl, Belg. Hort. 33: 238. 1883.

Agave todaroi Baker, Amaryll. 195. 1888.

Puebla; type locality unquestionably the Cerro Colorado near Tehuacán.

Leaves very rough, gray, green-zoned, 25 to 40 cm. wide, 100 to 150 cm. long, with short, stout, curved, dull red spine 5 to 15 mm. wide and 20 mm. long, and large, rough, rusty brown teeth 15 to 40 mm. apart and 5 to 10 mm. long, sometimes in pairs, from fleshy prominences. “Maguey curandero,” or “pitsomel.”

¹E. Bourgeau was a member of the French Scientific Commission of 1865–66. He had had previously wide experience as a botanical collector in the Old World, and his Mexican collection was an extensive one. It was gathered chiefly in the Valley of Mexico and in Veracruz. A large number of his specimens are in the U. S. National Herbarium. He died at Paris in 1877.

112. *Agave abrupta* Trel., sp. nov.

Leaves straight or somewhat upcurved, 15 to 30 cm. wide, 150 to 175 cm. long, very glaucous, very concave and deeply plicate toward the abrupt end, with heavy, conical, somewhat recurved spine 8 mm. wide and 25 mm. long, and small, variously curved, triangular teeth 15 to 30 or 40 mm. apart and only about 2 mm. long, but from conspicuous fleshy or horny prominences; inflorescence 7 to 8 meters tall.

Jalisco; type, in the herbarium of the Missouri Botanical Garden, from La Barca, *Trelease*, in 1901; cultivated in hedges.

113. *Agave wercklei* Weber, sp. nov.

Acaulescent; leaves glaucous, bluish or white, abruptly upcurved above the base, 15 cm. wide, 125 to 200 cm. long, with somewhat recurved, grooved, conical, brown or gray spine 4 to 6 mm. wide and 25 to 35 mm. long, and triangular straight brown teeth 15 to 25 mm. apart and 3 mm. long, these sometimes on fleshy prominences or with the intervening margin hollowed; inflorescence 8 meters tall; flowers chrome-yellow, pumpkin-scented, 60 mm. long, the perianth segments twice as long as the tube; capsules 15 mm. broad and 45 mm. long; seeds 4 mm. wide and 6 mm. long; bulbiferous.

Costa Rica; type, in the herbarium of the Missouri Botanical Garden, cultivated at San José, *Alfaro & Tonduz* 17553.

Sometimes cultivated under the name of *A. costaricensis*.

114. *Agave expansa* Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 151. 1868.

Region ?; type cultivated in Europe.

Leaves gray, oblong, uniformly spreading, straight, acute, concave, about 20 cm. wide and 200 cm. long, with brown or gray, straight or slightly recurved, grooved spine 8 to 10 mm. wide and 25 to 30 mm. long, this acutely pointed from the very base, and with heavily triangular teeth 30 to 60 mm. apart and 5 to 8 mm. long, these with dilated bases, often from fleshy hummocks.

Extensively planted in southern Arizona (Tucson) and California (Los Angeles) as *A. americana*, from which its unreflexed leaves and more acutely pointed, somewhat prismatic spine distinguish it.

115. *Agave americana* L. Sp. Pl. 323. 1753.

Native ?; type cultivated in Europe, probably originally from a Mexican hedge-row; established freely about the Mediterranean.

Leaves gray, acute, outcurved or reflexed at end, 15 to 20 cm. wide, 200 to 250 cm. long, with brown, somewhat curved, conical spine 5 mm. wide and 25 mm. long, and triangular, more or less recurved teeth 15 to 50 mm. apart and about 5 mm. long, on fleshy prominences.

It is this plant, cultivated in the Azores, etc., from which the "pita" used in the drawn work of those islands is procured. Early records of the economic uses of "*Agave americana*" and "*A. mexicana*" commonly refer to other species, such as *A. fourcroydes* and *A. atrovirens*.

116. *Agave picta* Salm-Dyck, Bonplandia 7: 88. 1859.

Native ?; type cultivated in Europe.

Equally large and very similar, the darker and clearer green leaves 17 to 18 cm. wide, 225 cm. long, with a marginal band of yellow (as in one form, var. *marginata*, of the preceding), the spine straight and needle-shaped. "Maguey pinto," "maguey listado."

Much planted. On the Mediterranean coast seedlings are said to be invariably green (var. *viridis* Trel. in Bailey, Stand. Cycl. Hort. 1: 235. 1914; *A. ingens* Berger, Hort. Mortolensis. 12, 360. 1912), and no doubt correspond to the normal type of foliage.

117. *Agave asperrima* Jacobi, Hamb. Gart. Zeit. 20: 561. 1864.

Texas, on the lower Rio Grande; and adjacent Coahuila, Zacatecas, and Durango; type cultivated in Europe, supposedly from Texas.

Leaves dull glaucous green, rough, 15 to 20 cm. wide, 120 cm. long, with decurrent brown spine 3 to 4 or 6 mm. wide and 30 to 55 mm. long, and variously curved triangular teeth 20 to 30 mm. apart and 7 to 10 mm. long, these saddling and sometimes confluent over high fleshy hummocks.

Seeds were distributed to gardens by Engelmann as *A. longispina*.

118. *Agave palmeri*¹ Engelm. Trans. Acad. St. Louis 3: 319. 1875.

New Mexico, Arizona, and adjacent Sonora; type locality, mountains of southern Arizona.

Leaves blue-green, smooth, varying much in shape and attenuation, ascending or outcurved or spreading, about 8 to 10 cm. wide and 45 to 70 cm. long, with nearly straight, needle-shaped, somewhat decurrent, garnet or purplish, finally fading spine 2 to 4 mm. wide and 20 to 40 mm. long, and variously straight or curved, very unequal, triangular teeth commonly 10 to 20 mm. apart and 3 to 5 mm. long, the intervening margin straight or much hollowed.

119. *Agave flexispina* Trel., sp. nov.

Leaves green or bluish, smooth, regularly spreading, deeply concave, 6 cm. wide and 12 cm. long (or much more?), with flexuous spine 5 mm. wide and 30 mm. long, this very openly flat-grooved, with acute margin at base, the slender unequal teeth scarcely 10 mm. apart and often nearly 10 mm. long, the margin between them sharply incised; flowers nearly sessile, agreeing with those of the last preceding species.

Durango; type, in the herbarium of the Missouri Botanical Garden, from Tepehuanes, *Palmer* 330, in 1906.

120. *Agave dasylirioides* Jacobi & Bouché, Hamb. Gart. Zeit. 21: 344. 1865.

Guatemala?; type cultivated in Europe; Berlin Herbarium material referring the collection to the igneous mountains near Quezaltenango, *Warscewicz*, or southern Mexico.

Leaves outcurved and then ascending, thin and flat, light green, 10 to 15 mm. wide, 25 to 30 cm. long, unarmed except for the small flattened brown spine; spike 1.5 to 2 meters tall, recurving.

121. *Agave intrepida* Greenm. Proc. Amer. Acad. 34: 567. 1899.

Morelos; type locality, El Parque, above Cuernavaca.

Leaves gray, spreading, 2 cm. wide, 50 cm. long, with somewhat flexuous needle-like brown spine 1 to 2 mm. wide and 10 mm. long, the margin almost microscopically denticulate; spike 1 to 1.5 meters tall, commonly recurving.

122. *Agave bracteosa* S. Wats. Gard. Chron. n. ser. 18: 776. 1882.

Nuevo León; type locality, near Monterrey.

Leaves gray, rather soft, openly ascending with recurved tips, 4 cm. wide, 45 cm. long, without spine, the margin minutely denticulate; inflorescence 1 to 2 meters tall, the scape densely covered with outcurved narrow bracts; flowers 30

¹The species is named in honor of Edward Palmer (1831–1911), an Englishman by birth, who was for most of his life a resident of the United States. He spent many years in Mexico in botanical exploration, and his collections are surpassed in extent, probably, by those of no other collector. His work in Mexico began about 1870 and was continued until 1910. He collected chiefly in the northern states, but some of his plants were obtained as far south as Guerrero and Veracruz. His earlier collections were the basis of special reports by Gray and Watson, and many new species have been based upon his specimens.

mm. long, the marcescent perianth segments about equaling the tube. "Amole de Castilla."

123. *Agave yuccaefolia* DC. in Red. Liliac. 6. pl. 328, 329. 1812.

Region ?; type cultivated in Europe; said to be from Real del Monte, Hidalgo.

Trunk short; leaves glaucous, rather soft, recurved, 2.5 cm. wide, 60 cm. long, long-tapering, with minute slender spine, the margin minutely denticulate; inflorescence 3 meters tall; flowers 35 mm. long, the perianth segments almost distinct.

124. *Agave eduardi* Trel., sp. nov.

Habit ?; leaves glaucous, 6 cm. wide, 100 cm. long, long-attenuate, with slender brown spine about 1 mm. wide and 10 mm. long, and entire margin; scape covered by long narrow bracts; pedicels connate into a peduncle some 15 mm. long; flowers yellow, 40 mm. long; ovary flask-shaped, 20 mm. long, the tube narrow, about one-third as long as the segments, the filaments inserted in its throat; capsules scarcely glaucous, 8 mm. broad, 20 mm. long.

Durango; type, in the herbarium of the Missouri Botanical Garden, from San Ramón, *Palmer* 135, in 1906.

125. *Agave houghii* Hort.

A similar, if separable, plant, of the barranca of the Río Blanco, near Guadalajara, Jalisco, with stronger spine and smooth margin.

126. *Agave attenuata* Salm-Dyck, Hort. Dyck. 7, 303. 1834.

Agave glaucescens Hook. in Curtis's Bot. Mag. III. 18: pl. 5333. 1862.

Hidalgo; type cultivated in Europe (from about Real del Monte ?).

Trunk 1 to 1.5 meters tall, sometimes prostrate; leaves 15 to 20 cm. wide, 60 to 100 cm. long, glaucous, without either spine or prickles; spike 1.5 to 3 meters tall, often recurving, sometimes very bulbiferous in age.

127. *Agave ellemeetiana* Jacobi, Hamb. Gart. Zeit. 21: 457. 1864.

Veracruz ?; type cultivated in Europe (from about Jalapa ?).

Nearly acaulescent; leaves 15 cm. wide and 60 cm. long or more, glaucous, without either spine or prickles; spike 1.5 to 3 meters tall, straight.

128. *Agave pruinosa* Lem. in Jacobi, Hamb. Gart. Zeit. 21: 449. 1864.

Agave debaryana Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1869: 164. 1869.

Agave kellockii Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1869: 165. 1869.

Michoacán ?; cultivated in Europe; the Volcán Jorullo is given as the source of *A. debaryana*.

Nearly acaulescent; very similar to the preceding, but the leaves with close-set minute denticles.

129. *Agave vilmoriniana* Berger, Repert. Nov. Sp. Fedde 12: 503. 1913.

Jalisco ?; cultivated in Europe, introduced by Diguët.

Leaves green or bluish or glaucous, softly fleshy, narrowly linear-lanceolate, acuminate, with slender, subulate, shortly decurrent spine 3 to 4 mm. long, the margin without teeth.

130. *Agave pedunculifera* Trel., sp. nov.

Habit ?; leaves 12 to 15 cm. wide, 65 cm. long, thin, glaucous, oblanceolate, acuminate, with dull red-brown needle-shaped spine 2 mm. wide and 15 mm. long, the margin with minute denticles about 2 mm. apart; inflorescence small, the pedicels aggregated on short slender forking peduncles 15 to 20 mm. long; capsules fusiform, 5 to 8 mm. broad, 20 mm. long; seeds dull, very small, 2 mm. wide, 2.5 mm. long.

Sinaloa; type, in the U. S. National Herbarium, from Colomas, *Rose* 1713.

131. *Agave celsii* Hook. in Curtis's Bot. Mag. III. 12: *pl.* 4934. 1856.? *Agave brauniana* Jacobi, Hamb. Gart. Zeit. 22: 216. 1866.? *Agave thompsoniana* Jacobi, Hamb. Gart. Zeit. 22: 262. 1866.? *Agave smithiana* Jacobi, Hamb. Gart. Zeit. 22: 263. 1866.? *Agave humboldtiana* Jacobi, Hamb. Gart. Zeit. 22: 264. 1866.

San Luis Potosí; type cultivated in Europe from an unrecorded locality.

Leaves glaucous, 10 cm. wide, 30 to 45 cm. long, with slender weak spine scarcely 1 mm. wide and 5 to 10 mm. long, and very irregular, close-set or confluent, green teeth 5 to 10 mm. apart and 2 to 3 mm. long, a little horny at the tip only.

The four synonyms, based on specimens cultivated from about San Luis Potosí, seem to refer to forms of this species with greener foliage; and *A. rupicola* Regel, *A. lamprochlora* Jacobi, and *A. perlucida* Jacobi differ little.

132. *Agave micracantha* Salm-Dyck, Bonplandia 7: 93. 1859.

Hidalgo or Veracruz?; type cultivated in Europe from an unrecorded locality.

Leaves gray-green, 8 to 12 cm. wide, 40 to 60 cm. long, with slender weak spine and small close-set dark teeth, these sometimes almost suppressed.

Nominal but closely related species cultivated in gardens from unrecorded localities and evidently of this alliance, are *A. albicans* Jacobi, *A. chloracantha* Salm-Dyck, *A. bernhardii* Jacobi, *A. bouchei* Jacobi, *A. haseloffii* Jacobi, ? *A. martiana* Koch, *A. mitis* Salm, *A. muilmanni* Jacobi, *A. oblongata* Jacobi; and *A. wallisii* Jacobi, said to be from Colombia.

133. *Agave pendula* Schnitts. Zeitschr. Gartenb. Ver. Darmstadt 6: 7. 1857.*Agave aloina* Koch, Wochenschr. Ver. Beförd. Gartenb. 3: 37. 1860.*Agave sartorii* Koch, Wochenschr. Ver. Beförd. Gartenb. 3: 37. 1860.*Agave noackii* Jacobi, Hamb. Gart. Zeit. 22: 261. 1866.*Agave rubrocincta* Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 153. 1868.*Agave caespitosa* Tod. Hort. Panorm. 1: 32. 1876.

Veracruz; type cultivated in Europe, but collected at El Mirador, Huatusco.

More or less caulescent, the trunk sometimes 60 cm. tall; leaves deep green with paler median stripe above, about 8 cm. wide and 100 cm. long, with scarcely pungent end and minute brown teeth 5 mm. apart and 1 mm. long; inflorescence nodding.

134. *Agave polyacantha* Haw. Rev. Pl. Succ. 35. 1821.*Agave densiflora* Hook. in Curtis's Bot. Mag. III. 13: *pl.* 5006. 1857.? *Agave chiapensis* Jacobi, Hamb. Gart. Zeit. 22: 213. 1865.*Agave ottonis* Jacobi, Hamb. Gart. Zeit. 22: 320. 1865.*Agave salmdyckii* Baker, Gard. Chron. n. ser. 8: 490. 1877.

Veracruz (type cultivated in Europe, from an unspecified source, about 1800) and Chiapas ?.

Leaves green though transiently glaucous, 5 to 15 cm. wide, 25 to 60 or 100 cm. long, with dark firm spine 2 to 3 mm. wide and 15 mm. long, and rather small close-set brown teeth 3 to 5 or 10 mm. apart and 2 to 3 mm. long; spike sometimes budding at tip and base.

Species evidently of this group, but of unrecorded habitat, are *A. botterii* Baker, *A. decaisneana* Jacobi, *A. engelmanni* Trel., *A. galeottei* Baker, *A. guedeneyri* Houll., and *A. warelliana* Baker.

Other less closely placed garden aloid species, supposedly from Mexico, are *A. ehrenbergii* Jacobi, *A. goeppertiana* Jacobi, *A. horizontalis* Jacobi, *A. kewensis* Jacobi, *A. lindleyi* Jacobi, *A. melanacantha* Lem., *A. regia* Baker, *A. rudis* Lem., and *A. rupicola* Regel.

135. *Agave xalapensis* Roezl in Jacobi, Hamb. Gart. Zeit. 21: 61. 1864.

Agave uncinata Jacobi, Hamb. Gart. Zeit. 21: 104. 1864.

Veracruz above Cruz Verde, Las Vigas; type cultivated in Europe, from unrecorded locality.

Leaves green or glaucous, 5 to 12 cm. wide, 25 to 75 cm. long, with dark firm brown spine 3 to 5 mm. wide and 5 to 30 mm. long, and red or blackish strong flat teeth 5 to 7 mm. apart and 5 mm. long; spike often budding at tip.

136. *Agave macrantha* Tod. Hort. Panorm. 2: 11. 1879.

Region ?; type cultivated in Europe.

Leaves spatulate-obovate, uncurved, glaucous, as much as 12 cm. wide and 30 to 50 cm. long, with chestnut spine 8 mm. wide and 20 to 30 mm. long, and firm brown teeth 6 to 15 mm. apart and 2 to 3 mm. long; flowers large for the group, about 80 mm. long, the yellow or bronzed perianth segments nearly 15 mm. wide and twice as long as the tube.

137. *Agave pumila* Baker, Amaryll. 172. 1888.

Region ?; type cultivated in Europe.

Very small (scarcely 5 cm. in diameter), with few round fleshy concave leaves, these dark-lined on the back and with soft whitish spine, and teeth somewhat connected by a similar margin.

The smallest of all agaves. Sometimes cultivated under the name *A. simoni* or *A. simonis*.

138. *Agave lecheguilla* Torr. U. S. & Mex. Bound. Bot. 213. 1859.

Agave poselgeri Salm-Dyck, Bonplandia 7: 92. 1859.

Agave multilineata Baker, Amaryll. 168. 1888.

? *Agave nissoni* Baker, Gard. Chron. 1874: 529. 1874.

Texas and Chihuahua to Tamaulipas and Zacatecas, in a variety of forms; type locality, western Texas.

Leaves falcately ascending, green or bluish, the upper face often with a paler stripe and the back with narrow green lines, 2 to 3 cm. wide, 40 to 60 cm. long, with brown or graying spine 4 mm. wide and 30 to 50 mm. long, and mostly gently recurved triangular teeth 20 to 40 mm. apart and 3 to 7 mm. long, joined by a nearly straight detachable horny border scarcely 1 mm. wide. With flowers in short compact glomerules it is f. *glomeruliflora* Engelm. (*A. glomeruliflora* Berger, Hort. Mortol. 12. 1911).

"Lecheguilla"; much used for cordage, brushes, bagging, etc., and exported as "ixtle."

139. *Agave funkiana* Koch & Bouché, Wochenschr. Ver. Beförd. Gartenb. 3: 47. 1860.

Nuevo León and Tamaulipas; type cultivated in Europe, without recorded locality.

Leaves scarcely falcate, ascending, light green or gray-green, slightly glaucous, with pale ventral stripe and dark-lined back, 3 to 5 cm. wide, 50 to 75 cm. long, with brown-tipped gray spine 3 mm. wide and 15 to 25 mm. long, and mostly gently recurved triangular teeth 20 to 50 mm. apart and 5 mm. long, joined by a nearly straight or slightly concave detachable border about 1 mm. wide.

"Ixtle de Jaumave"; of better quality than the last preceding species.

140. *Agave lophantha* Schiede, Linnaea 4: 581. 1829.

Agave heteracantha Zucc. Act. Acad. Caes. Leop. Carol. 16²: 675. 1833.

Veracruz; type locality, Malpais de Naulingo.

Leaves uniformly spreading, apple-green or dark blue-green, sometimes with pale ventral stripe and dark dorsal lines, 3 to 5 cm. wide, 30 to 60 cm. long,

with gray-brown spine 3 mm. wide and 20 mm. long, and conspicuously unequal and variously curved, narrowly triangular teeth 20 to 30 mm. apart and 3 to 7 mm. long.

When the median stripe is most pronounced it is var. *univittata* (*A. univittata* Haw. Phil. Mag. 10: 415. 1831); but the marking is not confined to this species.

141. *Agave horrida* Jacobi, Hamb. Gart. Zeit. 20: 546. 1864.

Morelos, abundant above Cuernavaca on the lava fields; type cultivated in Europe without indication of locality.

Leaves uniformly spreading, rather thin, green, without ventral stripe or dorsal lines, 6 to 7 cm. wide, 30 cm. long, with red-brown graying spine 3 mm. wide and 20 to 40 mm. long, and large flat hooked teeth 15 to 30 mm. apart and 5 to 15 mm. long, the connecting undulate horny border 2 to 3 mm. wide.

142. *Agave roezliana* Baker, Gard. Chron. n. ser. 7: 528. 1877.

Agave horrida laevior Jacobi, Wochenschr. Ver. Beförd. Gartenb. 1869: 178. 1869.

Puebla; type cultivated in Europe, but now known to have come from Tehuacán.

Leaves uniformly spreading, thick, green, sometimes with paler ventral stripe but not dark-lined on the back, 5 to 10 cm. wide, 30 to 40 cm. long, with brown or fading spine 3 mm. wide and 20 to 25 mm. long, and heavily triangular teeth 10 to 15 mm. apart and 6 to 20 mm. long, the nearly straight horny intervening margin 1 to 3 mm. wide.

Plants with very short and broad leaves and exceptionally large teeth constitute var. *nana* (*A. horrida nana* Laurentius, Cat. 1869: 12. 1869; *A. gilbeyi horrida* Baker, Gard. Chron. 1873: 1305. 1873); and a form with elongate, narrowly oblong leaves and often reduced teeth is var. *peacockii* (*A. peacockii* Croucher, Gard. Chron. 1873: 1400. 1873).

143. *Agave ghiesbrechtii* Koch, Wochenschr. Ver. Beförd. Gartenb. 5: 83. 1862.

Region ?; type cultivated in Europe.

Leaves upcurving, concave, fleshy, grayish green or bluish green, without distinct ventral stripe or dorsal lines, 5 to 7 cm. wide, 18 to 20 cm. long, with spine scarcely 15 mm. long, and gray, triangular, nearly straight teeth scarcely 10 mm. apart and 5 mm. long, the connecting horny border under 2 mm. wide.

The form with shorter, more heavily bordered leaves is *A. rohanii* Jacobi (Hamb. Gart. Zeit. 20: 545. 1864); and that with elongate, narrowly bordered leaves is *A. leguayiana* J. Verschaffelt (Pr. Cour. 1868: 2. 1868).

144. *Agave obscura* Schiede, Linnaea 18: 413. 1844.

Agave grandidentata Jacobi, Hamb. Gart. Zeit. 22: 114. 1866.

Agave horrida micracantha Baker, Gard. Chron. n. ser. 7: 621. 1877.

Veracruz; common on the lava beds about Limón; type locality, lava fields of La Joya.

Densely subglobose; leaves uniformly spreading, gray, 10 cm. wide, 30 cm. long, with gray spine 3 to 8 mm. wide and 25 to 30 mm. long, and triangular, straight or variously curved teeth 5 to 10 mm. apart and 3 to 5 mm. long, the intervening margin 1 to 2 mm. wide. "Lechuguilla."

145. *Agave triangularis* Jacobi, Wochenschr. Ver. Beförd. Gartenb. 1869: 178. 1869.

Puebla; type cultivated in Europe from near Tehuacán.

Leaves ascending, thick and very rigid, dull gray-green, without ventral stripe or dorsal lines, about 5 cm. wide and 25 cm. long, with gray spine 3 mm. wide and 20 to 25 mm. long, and large, gently curved teeth 15 to 25 mm. apart and 5 to 15 mm. long, the nearly straight intervening margin 1 to 2 mm. wide.

With numerous but small teeth it is var. *rigidissima* (*A. rigidissima* Jacobi, Wochenschr. Ver. Beförd. Gartenb. 1869: 179. 1869); and with few and

minute or no teeth it is var. *subintegra* (*A. kerchovei inermis* Baker, Gard. Chron. n. ser. 7: 527. 1877).

146. *Agave potrerana* Trel., sp. nov.

Leaves falcately ascending, triangular, rigid, transiently glaucous, without ventral stripe or dorsal lines, 5 to 6 cm. wide, 30 cm. long, with gray spine 3 mm. wide and 25 mm. long, and narrowly triangular, rather straight teeth commonly 10 to 15 mm. apart and 3 to 4 mm. long, the nearly straight connecting horny margin about 1 mm. wide; flowers about 50 mm. long, the perianth segments and tube about equal; capsules oblong-pyriform, 10 to 12 mm. broad, 30 to 35 mm. long; seeds 3 mm. wide, 4 mm. long.

Chihuahua; type, in herbarium of the Missouri Botanical Garden, from Potrero Peak, *Pringle* 302.

147. *Agave kerchovei* Lem. Ill. Hort. 11: 64. 1864.

Puebla?; type cultivated in Europe.

Leaves uniformly spreading or ascending, triangular, rigid, gray-green, 7 to 10 cm. wide, 40 to 50 cm. long, with gray spine about 5 mm. wide and 50 to 70 mm. long, and triangular teeth 30 to 50 or even 100 mm. apart and 10 to 20 mm. long, each sometimes with an adjoining denticle, the straight connecting margin 2 to 3 mm. wide; spike extremely compact.

148. *Agave inopinabilis* Trel., sp. nov.

Leaves falcately spreading or ascending, oblong or gradually narrowed from base to point, gray-green or bluish-green, somewhat glaucous when young, 4 to 6 cm. wide, 100 cm. long, with dull brown or fading spine 5 mm. wide and 50 mm. long, and large, flat, brown, hazel-colored, or dead-gray, triangular, often doubled teeth commonly 50 to 100 mm. apart and 10 to 30 mm. long, the connecting margin 2 to 4 mm. wide; capsules oblong, 8 to 12 mm. wide, 12 to 30 mm. long; inflorescence rather lax; flowers claret-colored, 35 mm. long, the perianth segments almost distinct; seeds 2 mm. wide, 4 mm. long.

Puebla; type, in the herbarium of the Missouri Botanical Garden, from Tehuacán, *Trelease*, in 1903.

149. *Agave convallis* Trel., sp. nov.

Leaves uniformly spreading, light green, 6 cm. wide, 50 cm. long, with gray spine 4 mm. wide and 25 mm. long, and heavily triangular, brown-tipped, somewhat recurved teeth 50 to 60 mm. apart and 6 to 10 mm. long, the nearly straight intervening border about 1 or 2 mm. wide but lenticularly widened beneath each tooth; inflorescence 3 to 4 meters tall; flowers creamy or bronzed, 35 to 40 mm. long, with very short tube.

Oaxaca; type, in herbarium of the Missouri Botanical Garden, from El Parián, *Trelease* 4, in 1905.

150. *Agave expatriata* Rose, Rep. Mo. Bot. Gard. 11: 82. 1900.

Region?; type cultivated at Washington.

Leaves uniformly spreading, light green, 6 to 9 cm. wide, 75 cm. long, with slender spine 15 to 25 mm. long, and triangular, unequal, variously curved teeth 10 to 20 mm. apart and 5 to 10 mm. long, the intervening straight border about 1 mm. wide.

151. *Agave dissimulans* Trel., sp. nov.

Leaves widely and flaccidly spreading or recurved, glaucous, more or less tinged with red, 7 cm. wide, 80 to 100 cm. long, with gray spine about 5 mm. wide and 50 mm. long, and heavily triangular, somewhat curved teeth 15 to 30 mm. apart and 6 to 15 mm. long, the intervening straight border 1 or 2 mm. wide; inflorescence 2 to 3 meters tall; flowers whitish, glaucous, 30 mm. long, with very short tube; capsules 12 mm. broad, 20 to 25 mm. long.

Oaxaca; type, in the herbarium of the Missouri Botanical Garden, from Mexia, *Trelease*.

152. *Agave angustiarum* Trel., sp. nov.

Leaves openly spreading, rather thin, glaucous, 5 to 13 cm. wide, 80 to 100 cm. long, with very slender spine 25 to 35 mm. long, and rather slender and curved teeth 15 to 40 mm. apart and 2 to 6 mm. long, the nearly straight intervening border scarcely over 1 mm. wide; inflorescence 1.5 to 4 meters tall; flowers glaucous greenish white, 35 to 40 mm. long, with very short tube; capsules 12 to 15 mm. broad, 25 mm. long; seeds 2 to 3 mm. wide, 3 to 5 mm. long.

Guerrero; type, in the herbarium of the Missouri Botanical Garden, from the canyon between Naranjo and Los Amates, *Trelease*.

153. *Agave xylonacantha* Salm-Dyck, Bonplandia 7: 92. 1859.

Agave amurensis Jacobi, Hamb. Gart. Zeit. 20: 548. 1864.

Agave kochii Jacobi, Hamb. Gart. Zeit. 22: 117. 1866.

Hidalgo and San Luis Potosí; type cultivated in Europe, said to be from San Luis Potosí, but later records include Ixmiquilpan and Real del Monte.

Leaves loosely spreading, rather thin, undulate or contorted, dull, mostly grayish green, rough, the back with darker lines, 5 to 12 cm. wide, 30 to 60 cm. long, with flexuous gray spine about 5 mm. wide and 40 to 50 mm. long, and large, triangular or confluent broad and very irregular teeth 15 to 40 mm. apart, these 10 to 15 mm. long, and nearly as broad over green prominences between which the nearly straight connecting horny margin is 1 to 2 mm. wide.

154. *Agave washingtonensis* Baker & Rose, Rep. Mo. Bot. Gard. 9: 121. 1898.

Region ?; type cultivated at Washington.

Leaves spreading, dark green, smooth, 7 to 10 cm. wide, 75 cm. long, with very short slender spine and small mammaeform teeth scarcely 10 mm. apart and 2 mm. long, these concave at base and connected by a very narrow horny border.

155. *Agave splendens* Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1870: 147. 1870.

Region ?; type cultivated in Europe.

Leaves uniformly spreading, often with axillary branches, dark blue-green, glaucous when young, smooth, somewhat pale-banded above and dark-lined beneath, 4 to 5 cm. wide, 35 to 60 cm. long or more, with slender, more or less flexuous, gray spine 30 mm. long, and unequal, often doubled, variously curved, triangular teeth 20 to 40 mm. apart and 6 to 12 mm. long, these concave at base and connected by a moderately heavy border.

156. *Agave vittata* Regel, Gartenflora 7: 313. 1858.

Agave haynaldi Tod. Hort. Panorm. 1: 88. 1876.

Agave toneliana Baker, Gard. Chron. 1881: 362. 1881.

Nuevo León; type cultivated in Europe, probably from the mountains about Monterrey.

Leaves spreading along a distinct short trunk, dark green, often with pale ventral stripe, 6 to 7 cm. wide, 70 cm. long, with slender brown-tipped spine 20 mm. long, and variously curved triangular teeth 25 to 50 mm. apart and 4 to 7 mm. long, these on more or less oblique fleshy prominences, the very narrow connecting horny border frequently absent from the middle of the leaf.

157. *Agave victoriae-reginae* Moore, Gard. Chron. n. ser. 4: 484. 1875.

Agave consideranti Carr. Rev. Hort. 1875: 429. 1875.

Nuevo León, Coahuila, and Durango; type locality near Monterrey, Nuevo León.

Leaves very many, very hard and crowded in a round cluster, dark green, 4 to 6 cm. wide, 15 to 20 cm. long, acutely 3-sided, with 1 or 3 black apical

spines 5 to 10 mm. long, these decurrent into marginal and usually dorsal detachable horny borders.

"Noa"; the short but strong fiber used for bundles.

With fewer leaves, and consequently forming a less compact plant, it is f. *nickelsi* (*A. nickelsi* Rol. Goss. Rev. Hort. 1895: 579. 1895). "Pintillo."

158. *Agave parviflora* Torr. U. S. & Mex. Bound. Bot. 214. 1859.

Sonora; type locality, Sierra del Pajarito. Also in adjacent Arizona.

Small and globose; leaves ascending, numerous, green, dotted with gray, scarcely 1 cm. wide and 4 to 6 cm. long, denticulate at the base, elsewhere bearing a few coarse outcurved marginal threads, the straight flattened spine 1 mm. wide and 5 mm. long.

159. *Agave toumeyana* Trel., sp. nov.

Rather larger, laxer, and fewer-leaved than the preceding; leaves 1 cm. wide, 5 to 10 cm. long, with flat brown spine scarcely 1 mm. wide and 5 mm. long, the margin minutely hyaline-denticulate below the middle, at length bearing numerous long slender white marginal threads; flowers 15 mm. long, with short tube; capsules 7 mm. broad, 12 mm. long; seeds 2 mm. wide, 3 mm. long.

Southern Arizona; type, in herbarium of the Missouri Botanical Garden, from Pinal Mountains, *Toumey* in 1892; also in adjacent Sonora?

160. *Agave hartmani*¹ S. Wats. Proc. Amer. Acad. 26: 156. 1891.

Eastern Sonora (type cultivated at Cambridge, Massachusetts) and adjacent Chihuahua.

Resembling *A. parviflora*; leaves falcate, with concave-based spine and finer marginal threads.

161. *Agave mulfordiana* Trel., sp. nov.

Agave schottii serrulata Mulford, Rep. Mo. Bot. Gard. 7: 73. 1896.

Dimensions and aspect of the following and with similar marginal threads, but the base denticulate.

Southern Arizona; type, in the herbarium of the Missouri Botanical Garden, from Rincon Mountains, *Toumey* in 1894; also adjacent Sonora?

162. *Agave schottii* Engelm. Trans. Acad. St. Louis 3: 305. 1875.

Agave geminiflora sonorae Torr. U. S. & Mex. Bound. Bot. 214. 1859.

Arizona (type locality, Sierra del Pajarito) and adjacent Sonora.

Leaves falcately ascending, rather few, green, scarcely 1 cm. wide and 15 to 30 cm. long, untoothed, with brown or golden spine 1 mm. wide and 5 mm. long, and a few very thin outcurving marginal threads.

"Amole"; the crown used as a substitute for soap.

Without marginal threads it is var. *atricha*, the type cultivated at St. Louis, without record.

163. *Agave schidigera* Lem. Ill. Hort. 9: pl. 330. 1860.

Agave filifera adornata Scheidw. Wochenschr. Ver. Beförd. Gartenb. 4: 287. 1861.

Littaea roezlii Fonville, Rev. Hort. 1862: 39. 1862.

Agave vestita S. Wats. Proc. Amer. Acad. 25: 163. 1890.

Michoacán (type cultivated, from about the Volcán Jorullo), Zacatecas, Mexico, and Jalisco (the type of *A. vestita*, with more prismatic threads, from about Guadalajara).

¹C. V. Hartman and F. E. Lloyd made an extensive collection of plants in Chihuahua and Sonora from 1890 to 1893, while accompanying Carl Lumholtz in his archaeological explorations. The collection was reported upon by Robinson and Fernald (Proc. Amer. Acad. 30: 114-123. 1894). A set of the plants is in the U. S. National Herbarium.

Leaves green or purplish, uniformly spreading, 1.5 to 2 cm. wide, mostly 30 cm. long, not toothed, with rather numerous coarse and shaving-like marginal threads sometimes 2 mm. wide, the spine 5 to 10 mm. long or almost suppressed.

164. *Agave angustissima* Engelm. Trans. Acad. St. Louis 3: 306. 1875.

Tepic (the type from "Ocotillo, direction of Tepic") and Sinaloa.

Leaves green or almost red, numerous, uniformly spreading or falcate, 1 to 1.5 cm. wide, 30 to 60 cm. long, not toothed, with numerous long, slender, mostly loosely coiled marginal threads and flattened spine 5 mm. long. "Palmilla."

With leaves scarcely 30 cm. long it is var. *ortgiesiana* (*A. schidigera ortgiesiana* Baker, Gard. Chron. n. ser. 7: 303. 1877; *A. ortgiesiana* Roehl, Belg. Hort. 1880: 52. 1880; *A. maritima* Hort.); common on the seaside rocks about Manzanillo, Colima.

165. *Agave filifera* Salm-Dyck, Hort. Dyck. 309. 1834.

Hidalgo and San Luis Potosí; type cultivated in Europe without locality.

Leaves clear green to dark green or purplish, rather numerous, uniformly spreading or somewhat upcurved, 2.5 to 4 cm. wide, 20 to 25 cm. long, not toothed, with numerous slender, recurved or coiled marginal threads, the openly grooved spine 15 to 20 mm. long. "Amole," "lechuguilla mansa."

With leaves twice as long, without increase in width, those of suckers commonly denticulate, it is var. *filamentosa* Baker (Gard. Chron. n. ser. 7: 303. 1877; *A. filamentosa* Salm-Dyck, Bonplandia 7: 94. 1859). A very compact form somewhat resembling *A. parviflora*, with leaves scarcely 10 cm. long, is var. *compacta* J. Verschaffelt (Cat. 9: 41. 1865-6; *A. perplexans* Trel. in Bailey, Stand. Cycl. Hort. 1: 238. 1914).

166. *Agave geminiflora* Gawl. Journ. Sci. 2: 88. 1817.

Bonaparteia juncea Haw. Syn. Pl. Succ. 68. 1812.

Yucca boscii Desf. Tabl. Écol. Bot. Mus. ed. 2. 28, 274. 1815, name only.

Littaea geminiflora Tagliabue, Bibl. Ital. 1: 100. 1816.

Bonaparteia flagelliformis Henckel, Flora 3: 45. 1820.

Dracaena filamentosa Scanagatta in Schult. Syst. Veg. 729. 1829.

Dracaena boscii Steud. Nom. Bot. ed. 2. 1: 528. 1840.

Agave geminiflora filamentosa Hook. in Curtis's Bot. Mag. 82: under pl. 4950. 1856.

Region ?; type cultivated in Europe; sometimes, but doubtless erroneously, thought to be South American.

Leaves of various shades of green, very numerous, gracefully spreading, recurved in age, 5 mm. wide, 60 to 90 cm. long, biconvex, entire, with flattened spine scarcely 5 mm. long and long, usually very slender marginal threads.

When the margin bears no threads it is var. *atricha* Trel. (in Bailey, Stand. Cycl. Hort. 1: 238. 1914; *A. geminiflora* Hook. in Curtis's Bot. Mag. 82: under pl. 4950; Lindl. Bot. Reg. pl. 1145; *A. knightiana* Drummond in Curtis's Bot. Mag. IV. 5: under pl. 8271. 1909).

167. *Agave striata* Zucc. Act. Acad. Caes. Leop. Carol. 16²: 678. 1833.

Hidalgo; type cultivated in Europe from Real del Monte.

Leaves numerous, uniformly spreading, grayish, rhombically biconvex, 4 to 6 mm. wide, 60 to 90 cm. long, somewhat scabrid on the margin, the surface with close round ribs separated by narrow whitened grooves, the needle-shaped spine 1 to 2 mm. wide and 15 to 20 mm. long; ovary stout, protruding into the perianth.

With fewer more laxly spreading or recurving leaves it is var. *recurva* Baker (Gard. Chron. n. ser. 8: 556. 1877; *A. recurva* Zucc. Abh. Akad. Wiss. Muenchen 4: 22. 1845). "Estoquillo," "espadín."

Agave paucifolia Tod. (Hort. Bot. Panorm. 1: 77. pl. 19. 1877) differs scarcely more than in its fewer leaves, these as wide as in the next species.

168. *Agave echinoides* Jacobi, Abh. Schles. Ges. Vaterl. Cult. 1868: 163. 1868.

Agave striata echinoides Baker, Gard. Chron. n. ser. 8: 556. 1877.

Region ?; type cultivated in Europe.

Leaves numerous, straight or slightly falcate, gray-green, rhombically biconvex, 1 cm. wide, 25 to 30 cm. long, slightly scabrid on the margin, the surface with close narrow ribs, the triangular spine 3 mm. wide and 25. mm. long; ovary slender, not protruding into the tube.

169. *Agave stricta* Salm-Dyck, Bonplandia 7: 94. 1859.

Agave hystrix Cels, Cat. 1861: 19. 1861.

Agave striata stricta Baker, Gard. Chron. n. ser. 8: 556. 1877.

Puebla, common about Tehuacán; type cultivated in Europe.

Often densely cespitose; leaves numerous, falcately upcurved, often in a globose cluster, gray-green or purplish to nearly white, triquetrously biconvex, 6 to 10 mm. wide, 25 to 35 cm. long, at most slightly scabrid, the surface with distinctly separated ribs, the red-brown or fading spine 3 to 4 mm. wide and 25 mm. long; ovary slender, scarcely protruding into the tube.

The purplish form is known in gardens as f. *purpurea*; the rosy form, as f. *rosea*; and the most glaucous form as var. *glaucua* (or *Agave* or *Littaea dealbata*), of which there is a dwarfer form, f. *nana*.

170. *Agave falcata* Engelm. Trans. Acad. St. Louis 3: 304, 370. 1875.

Agave californica Baker, Gard. Chron. n. ser. 8: 556. 1877.

Coahuila (type locality, Buenavista), Durango, Zacatecas, and Nuevo León.

Leaves rather numerous spreading, often falcate, gray or purplish, evanescently glaucous, from biconvex or half-round becoming 3-sided, 7 to 15 mm. wide, 15 or commonly 30 to 50 cm. long, finely striate-ridged, the margin minutely denticulate, the triquetrously needle-shaped spine 2 to 3 mm. wide, 15 or 35 to 40 mm. long.

"Guapilla," "palmita," "espadín," "soyate," "sotolito"; furnishing "ixtle" or "Tampico fiber."

13. DIOSCOREACEAE. Yam Family.

1. DIOSCOREA L. Sp. Pl. 1032. 1753.

REFERENCE: Uline, Bot. Jahrb. Engler 22: 421-431. 1896.

Scandent plants, usually with large fleshy roots; leaves mostly broad and cordate, palmately 3 to many-nerved and reticulate-veined, entire or lobed; flowers small, usually dioecious, racemose or spicate; fruit a 3-valved capsule.

It is difficult to determine which, if any, of the species should be included in the present treatment. Some of them certainly have large, more or less persistent stems, but this character is rarely shown in herbarium specimens. The writer has included most of the larger plants, although probably most of them should have been omitted. There have been excluded a number of species which are evidently wholly herbaceous.

Stems winged-----1. *D. alata*.

Stems not winged.

Leaves conspicuously lobed.

Uppermost leaves conspicuously lobate-----2. *D. lobata*.

Uppermost leaves entire-----5. *D. convolvulacea*.

Leaves entire.

Staminate flowers solitary along the rachis of the raceme.

Staminate flowers 3 mm. long or larger.

Stamens 6; flowers green.

Stamens all antheriferous.....3. *D. pallens*.

Stamens partly (3) reduced to staminodia.....4. *D. densiflora*.

Stamens 3; flowers purplish.....5. *D. convolvulacea*.

Staminate flowers about 2 mm. long. Stamens 3.

Leaves large, mostly 12 to 18 cm. wide, the basal sinus often closed.

6. *D. grandifolia*.

Leaves mostly 6 cm. wide or narrower, the basal sinus open.

7. *D. capillaris*.

Staminate flowers fasciculate or spicate in the racemes.

Staminate flowers pubescent. Stamens 6.

Flowers greenish white.....8. *D. laxiflora*.

Flowers purplish.....9. *D. dugesii*.

Staminate flowers glabrous.

Flowers in short dense spikes, these arranged in racemes.

10. *D. spiculiflora*.

Flowers fasciculate or in short loose racemes.

Stamens 3. Flowers 2 to 3 mm. long, greenish white.

Staminate flowers 3 mm. long.....11. *D. platycolpota*.

Staminate flowers scarcely more than 2 mm. long...12. *D. pringlei*.

Stamens 6.

Stamens subequal.....13. *D. macrostachya*.

Stamens unequal.

Flowers purplish, the racemes mostly solitary.

14. *D. composita*.

Flowers green, the racemes in loose panicles...15. *D. floribunda*.

1. *Dioscorea alata* L. Sp. Pl. 1033. 1753.

Cultivated in Mexico and in some places, as in Oaxaca, apparently naturalized. Native probably of Asia, but widely cultivated.

Leaves mostly orbicular-cordate, taper-pointed, glabrous, sometimes very large; flowers greenish. Known in Mexico as "igname," "iñame," or "ñame;" "ñangate" (Oaxaca).

The large roots of the yam are valuable for human food.

2. *Dioscorea lobata* Uline, Bot. Jahrb. Engler 22: 427. 1896.

Dioscorea lobata morelosana Uline, Proc. Amer. Acad. 35: 323. 1900.

Morelos, Mexico, and Veracruz; type collected near the City of Mexico.

Leaves puberulent, shallowly or deeply lobed.

3. *Dioscorea pallens* Schlecht. Linnaea 17: 610. 1843.

Veracruz, the type from Jalapa.

Plants glabrous; capsule 1.2 to 1.4 cm. long.

4. *Dioscorea densiflora* Hemsl. Biol. Centr. Amer. Bot. 3: 356. 1884.

Veracruz to Chiapas; type from Valley of Córdoba. Guatemala and Honduras.

Glabrous except upon the racemes; flowers in very long slender spikes.

5. *Dioscorea convolvulacea* Schlecht. & Cham. Linnaea 6: 49. 1831.

Dioscorea galeottiana Kunth, Enum. Pl. 5: 409. 1850.

Dioscorea convolvulacea viridis Uline, Bot. Jahrb. Engler 22: 427. 1896.

Mexico to Michoacán and Oaxaca.

Leaves usually puberulent; flowers long-pedicellate, purplish; capsules 1.5 to 2.5 cm. long.

D. convolvulacea viridis is a form with 3-lobed leaves.

6. *Dioscorea grandifolia* Schlecht. Linnaea 17: 602. 1843.

Jalisco to Morelos and Puebla; type from Acatlán, Puebla.

7. *Dioscorea capillaris* Hemsl. Biol. Centr. Amer. Bot. 3: 354. 1884.
Dioscorea hirsuta Mart. & Gal. Bull. Acad. Brux. 9²: 391. 1842. Not *D. hirsuta* Blume, 1827-28.
 Guerrero to Veracruz, Tabasco, and Oaxaca; type from Mirador, Veracruz. Central America.
 Glabrous or pubescent; leaves often very large.
8. *Dioscorea laxiflora* Schlecht. Linnaea 17: 606. 1843.
Dioscorea remotiflora Kunth, Enum. Pl. 5: 409. 1850.
Dioscorea sparsiflora Hemsl. Biol. Centr. Amer. Bot. 3: 360. 1884.
 Sinaloa to San Luis Potosí and Oaxaca; type from Atotonilco el Grande, Hidalgo.
 Glabrous or pubescent; leaves often very large; capsules about 2 cm. long. "Bejuco de visnaga," "falsa cocolmeca" (Oaxaca).
 Roots often very large, covered with irregular plates.
9. *Dioscorea dugesii*¹ Robinson, Proc. Amer. Acad. 29: 330. 1894.
Dioscorea violacea Uline, Bot. Jahrb. Engler 22: 423. 1896.
 Guanajuato (type locality) to Oaxaca.
 Plants puberulent.
10. *Dioscorea spiculiflora* Hemsl. Biol. Centr. Amer. Bot. 3: 361. pl. 92. 1884.
 Yucatán (type locality). Guatemala.
 Plants glabrous.
11. *Dioscorea platycolpota* Uline; Robinson, Proc. Amer. Acad. 36: 471. 1901.
 Known only from the type locality, near Iguala, Guerrero.
 Plants glabrous; leaves orbicular-cordate.
12. *Dioscorea pringlei* Robinson, Proc. Amer. Acad. 29: 323. 1894.
 Jalisco, the type from Guadalajara.
 Plants glabrous.
13. *Dioscorea macrostachya* Benth. Pl. Hartw. 73. 1841.
Dioscorea macrophylla Mart. & Gal. Bull. Acad. Brux. 9²: 392. 1842.
Dioscorea leiboldiana Kunth, Enum. Pl. 5: 355. 1850.
 ? *Testudinaria cocolmeca* Procopp, Bot. Centralbl. 49: 201. 1892.
 Veracruz and probably elsewhere; type from Panistlahuaca and Tepinistlahuaca. Central America.
 Plants glabrous; capsules 2 to 3 cm. long.
Testudinaria cocolmeca is referred here with doubt by Uline; it may be referable rather to *D. remotiflora*, or perhaps it is a distinct species. The plant so named is very imperfectly known.
14. *Dioscorea composita* Hemsl. Biol. Centr. Amer. Bot. 3: 354. 1884.
 Veracruz, Oaxaca, and Chiapas; type from Orizaba, Veracruz. Central America.
 Glabrous or nearly so; capsules about 3 cm. long.
15. *Dioscorea floribunda* Mart. & Gal. Bull. Acad. Brux. 9²: 391. 1842.
 Veracruz, Oaxaca, and Tabasco; type from Jalapa, Veracruz. Central America.

¹ Alfredo Duges, a native of France, came to Mexico in 1853. For many years he held the chair of natural history in the college of the State of Guanajuato. He was a diligent student of the plants and animals of Mexico, and published many papers upon natural history. He obtained extensive collections of plants, many of which are in the Gray Herbarium, and a few in the U. S. National Herbarium. He died in 1910. The genus *Dugesia*, of the family Asteraceae, was named in his honor by Gray.

Glabrous; leaves thick and firm, with prominent venation. "Corrimiento" (Tabasco).

14. CASUARINACEAE. Beefwood Family.

1. CASUARINA L. Amoen. Acad. 4: 143. 1759.

1. *Casuarina equisetifolia* L. Amoen. Acad. 4: 143. 1759.

Commonly cultivated in Mexico and often growing without cultivation. Native of tropical Asia and Australia; naturalized also in southern Florida.

Large pinelike tree, sometimes 20 meters high, with a trunk 1 meter in diameter, with slender verticillate spreading branches; bark gray; young branchlets drooping, pale, resembling the stems of *Equisetum*, the leaves reduced to whorled scales; staminate flowers in slender terminal spikes; fruit conelike, 1 to 2 cm. in diameter; wood very hard, strong, close-grained, flesh-colored or in age brown, its specific gravity about 0.93. "Pino" (Yucatán, Cuba); "ciprés" (Yucatán); "pino de Australia" (Cuba); "sauce" (Nicaragua). Known in English-speaking regions as beefwood.

A common and handsome tree in parks in Mexico. In regions where the tree is native the bark is used for tanning and dyeing, yielding a reddish or blue-black dye. The bark is used in medicine for its tonic and astringent properties.

15. PIPERACEAE. Pepper Family.

The genus *Peperomia* is the only other Mexican representative of the family. Its species are mostly low herbs. Some of them may be shrubs, but there is no satisfactory evidence that they are.

1. PIPER L. Sp. Pl. 28. 1753.

REFERENCE: C. De Candolle in DC. Prodr. 16¹: 240-388. 1869.

Shrubs or small trees; leaves alternate, entire, stipulate; flowers perfect or unisexual, small, greenish, sessile in very dense terete spikes, or sometimes racemose; fruit a small berry.

The species are widely distributed in the moist and tropical regions of Mexico, but they are more abundant farther south. They are separated by rather small differences, and, as so limited, most of them are of very limited distribution. In some localities the plants are used medicinally, for various purposes. The plants are more or less aromatic. The leaves are used for seasoning, and the fruit of some species is edible. *Piper nigrum* L., of the East Indies, furnishes the black pepper of commerce, which is widely used as a condiment. It is cultivated in the East Indies, Asia, Philippines, West Indies, and elsewhere. *P. cubeba* L., also of the East Indies, furnishes the cubeb berries of commerce, which are used in medicine for various catarrhal affections. *Piper betle* L. is the betel pepper, whose leaves are chewed by the natives of the Pacific Islands.¹ In South America some of the species have a wide reputation for the cure of snake bites.

The species of *Piper* are most commonly known in Mexico by the name of "cordoncillo."

Spikes of flowers congested at the ends of axillary branchlets.

Subgenus 1. *Heckeria*.

¹ See Safford, Contr. U. S. Nat. Herb. 9: 353-354. 1905.

Spikes solitary, opposite the leaves.

Flowers pedicellate.....Subgenus 2. *Ottonia*.

Flowers sessile.

Stamens 2 or 3.

Stamens 2.....Subgenus 3. *Cocobryon*.

Stamens 3.....Subgenus 4. *Carpunya*.

Stamens 4 to 6.

Stamens 4.....Subgenus 5. *Steffensia*.

Stamens 5 or 6.....Subgenus 6. *Enckea*.

Subgenus 1. HECKERIA.

Leaves peltate.....1. *P. cuernavacanam*.

Leaves not peltate.

Petioles as long as the blades or longer.....2. *P. cordillerianum*.

Petioles scarcely more than half as long as the blades.....3. *P. umbellatum*.

Subgenus 2. OTTONIA.

Leaves pubescent beneath on the nerves.....4. *P. muelleri*.

Leaves glabrous.

Leaves 7-nerved, about 6.5 cm. wide.....5. *P. yucatanense*.

Leaves 5-nerved, 2.5 to 4 cm. wide.

Stamens 4.....6. *P. neesianum*.

Stamens 5 or 6.....7. *P. disjunctum*.

Subgenus 3. COCCOBRYON.

Leaves acuminate, the lower ones cordate at the base, 7 or 9-nerved.

8. *P. diandrum*.

Leaves long-acuminate, the lower ones rounded at the base, 5 or 7-nerved.

9. *P. papantlense*.

Subgenus 4. CARPUNYA.

Anthers articulate.....10. *P. karwinskianum*.

Anthers not articulate.

Leaves subcoriaceous.....11. *P. caladiifolium*.

Leaves membranaceous.

Leaves puberulent beneath along the nerves.....12. *P. sanctum*.

Leaves glabrous.

Peduncles as long as the petioles.....13. *P. commutatum*.

Peduncles much shorter than the petioles.....14. *P. zacuapanum*.

Subgenus 5. STEFFENSIA.

Stigmas 2.....15. *P. bourgeaui*.

Stigma 3.

Style present.....16. *P. teapense*.

Style none.

Fruit trigonous or obovoid.

Bracts cucullate with inflexed apex or obovate.

Leaves pinnate-nerved.....17. *P. lapathifolium*.

Leaves palmate-nerved.....18. *P. schlechtendalii*.

Bracts peltate or truncate-peltate at the apex.

Leaves palmate-nerved.

Leaves glabrous, equal at the base.

Leaves 2.5 to 3 cm. wide.....19. *P. lepturum*.

Leaves 14 to 21 cm. wide.....20. *P. megalophyllum*.

Leaves pubescent, very unequal at the base, about 9 cm. wide.

21. *P. auritum*.

Leaves pinnate-nerved.

Leaves glabrous, 11 to 12 cm. long, 5.5 cm. wide...22. *P. oblongum*.

Leaves pubescent.

Leaves conspicuously bullate.....25. *P. palmeri*.

Leaves not bullate.

Leaf blades 16 to 25 cm. long, 6 to 12 cm. wide.

23. *P. dilatatum*.

Leaf blades about 11 cm. long and 5 cm. wide.

24. *P. pseudoasperifolium*.

Fruit tetragonous.

Bracts cucullate, the apex inflexed.

Leaves pinnate-nerved.

Leaf blades broadly elliptic, 21 to 23 cm. long, 11 cm. wide.

26. *P. rohrii*.

Leaf blades oblong, about 16.5 cm. long and 7 cm. wide.

27. *P. cordovanum*.

Leaves palmate-nerved.

Leaves puberulent beneath along the nerves, 20 to 24 cm. long, 14 to 19 cm. wide, ovate-rounded.....28. *P. potomorphe*.

Leaves glabrous, 5.5 to 7.5 cm. long, 2.5 cm. wide, lanceolate to ovate.

29. *P. variifolium*.

Bracts peltate, truncate-peltate, or truncate at the apex.

Leaves palmate-nerved, acutish at the base.....30. *P. berlandieri*.

Leaves pinnate-nerved.

Central nerve emitting lateral nerves along its whole length.

Leaves pubescent beneath, ovate or ovate-oblong.

31. *P. tuberculatum*.

Leaves glabrous, lance-ovate or lance-oblong.

32. *P. geniculatum*.

Central nerve emitting lateral nerves for only part its length.

Leaves glabrous.

Petioles about 30 mm. long.....33. *P. melanostictum*.

Petioles 8 to 10 mm. long.....34. *P. oaxacanum*.

Leaves pubescent, at least beneath.

Petioles mostly 10 to 15 mm. long.

Leaf blades rounded or cordate at the base.

Leaves glabrous on the upper surface...35. *P. macrophyllum*.

Leaves pilosulous and scabrous on the upper surface.

36. *P. aduncum*.

Leaf blades acute or acutish at the base.

Leaves glabrous on the upper surface.

37. *P. chamissonis*.

Leaves scabrous on the upper surface.

Peduncles hirtellous; leaves 4 to 7 cm. wide.

38. *P. jalapense*.

Peduncles glabrous; leaves about 8 cm. wide.

39. *P. fischerianum*.

Petioles short, usually 4 to 6 mm. long.

Leaf blades acute at the base.

Leaves 7 to 8 cm. wide, not bullate, thin.

Fruit hirsute; leaves acute-acuminate.

40. *P. descourtilsianum*.

Fruit glabrous; leaves subobtuse-acuminate.

41. *P. colipanum*.

Leaves about 4 cm. wide, somewhat bullate, rigid.

42. *P. misantlense*.

Leaf blades cordate to obtuse at the base.

Leaves glabrous and smooth on the upper surface.

Leaf blades obtuse at the base-----43. *P. citrifolium*.

Leaf blades cordate or semicordate at the base.

Leaves about 14 cm. long and 6.5 cm. wide.

44. *P. decipiens*.

Leaves about 23 cm. long and 14 cm. wide.

45. *P. liebmannii*.

Leaves scabrous on the upper surface.

Leaves conspicuously bullate, the pubescence of the lower surface appressed.

Leaf blades elliptic-lanceolate, 6 to 11 cm. wide.

46. *P. hispidum*.

Leaf blades oblong-lanceolate, about 4.5 cm. wide.

47. *P. mexicanum*.

Leaves not bullate, the pubescence not appressed.

Leaf blades tomentose beneath, about 4 cm. wide.

48. *P. leucophyllum*.

Leaf blades hirtellous beneath, 5.5 to 6 cm. wide.

49. *P. angustifolium*.

Subgenus 6. ENCKEA.

Ultimate nerves of the leaves conspicuously transverse-parallel.

Leaves hirtellous beneath, linear-acuminate at the apex.

50. *P. melastomoides*.

Leaves glabrous beneath, acuminate or short-acuminate at the apex.

Leaves rigid, the upper ones obtuse or acutish at the base; petioles about 1.5 cm. long-----51. *P. smilacifolium*.

Leaves membranaceous, cordate at the base; petioles 2 to 4 cm. long.

52. *P. marginatum*.

Ultimate nerves not conspicuously transverse-parallel.

Leaves pubescent on both surfaces.

Petioles 15 to 30 mm. long; leaves deeply cordate at the base.

53. *P. decrescens*.

Petioles 2 to 6 mm. long; leaves rounded or shallowly cordate at the base.

54. *P. kunthii*.

Leaves glabrous on the upper surface, glabrous or pubescent beneath.

Leaf blades broadly rounded-ovate, glabrous-----55. *P. jaliscanum*.

Leaf blades ovate or narrower.

Leaves 6 to 10 cm. long, 2.5 to 4 cm. wide.

Petioles 5 mm. long; leaves puberulent beneath along the nerves.

56. *P. lindenii*.

Petioles 8 mm. long; leaves glabrous-----57. *P. unguiculatum*.

Leaves 11 to 12 cm. long, 4.5 to 6 cm. wide.

Leaves puberulent beneath, 7-nerved, rounded or cordate at the base.
58. *P. medium*.

Leaves glabrous, 5-nerved, acute at the base-----59. *P. uhdei*.

1. *Piper cuernavacanam*¹ C. DC. *Linnaea* 37: 363. 1873.

Known only from the type locality, Cuernavaca, Morelos.

Branchlets velutinous-puberulent; leaves long-petiolate, the blades ovate-rounded, peltate, 18 cm. long, 21 cm. wide, acute at the apex, deeply cordate at the apex.

2. *Piper cordillerianum* C. DC. in DC. *Prodr.* 16¹: 332. 1869.

Cordillera of Veracruz, at 1,050 meters. Guatemala.

Leaves long-petiolate, the blades reniform-orbicular, 21 cm. long, 30 cm. wide, short-acuminate at the apex, deeply cordate at the base.

3. *Piper umbellatum* L. *Sp. Pl.* 30. 1753.

Heckeria umbellata Kunth, *Linnaea* 13: 569. 1839.

Veracruz to Colima and southward. Central America, West Indies, and South America; type from Santo Domingo.

Shrub, 1 to 2.5 meters high; leaves long-petiolate, the blades round-reniform, 17 to 18 cm. long, 22 to 23 cm. wide, attenuate-acute at the apex, deeply cordate at the base. "Mano de zopilote" (Tabasco); "santilla de culebra" (Oaxaca, *Reko*); "baquiña," or "basquiña" (Porto Rico).

4. *Piper muelleri*² C. DC. in DC. *Prodr.* 16¹: 243. 1869.

Veracruz; type from Orizaba. Honduras.

Branches glabrous, or when young densely hirtellous; leaves short-petiolate, the blades ovate-acuminate, 12.5 cm. long, 4.5 cm. wide, 7-nerved, rounded at the base.

5. *Piper yucatanense* C. DC. *Linnaea* 37: 334. 1873.

Forests of Yucatán.

Branchlets glabrous; leaves nearly sessile, the petioles about 3 mm. long, the blades ovate-acuminate, 12 cm. long, 6.5 cm. wide, rounded at the base, 7-nerved.

6. *Piper neesianum* C. DC. in DC. *Prodr.* 16¹: 256. 1869.

Veracruz. Nicaragua.

Branchlets glabrous; petioles 5 to 10 mm. long; leaf blades lanceolate or elliptic-lanceolate, 6 to 8.5 cm. long, 2 to 4 cm. wide, acuminate, acute at the base.

7. *Piper disjunctum* C. DC. *Linnaea* 37: 334. 1873.

Oaxaca and Veracruz; type collected between Huatusco and Jalapa, Veracruz.

Branchlets glabrous; petioles 6 mm. long; leaf blades ovate-lanceolate, 8 to 10 cm. long, 2.5 to 3 cm. wide, long-acuminate, acute or obtuse at the base.

8. *Piper diandrum* C. DC. *Linnaea* 37: 364. 1873.

Veracruz to Michoacán; type from Pital, Veracruz. Guatemala.

Shrub, 3 to 3.5 meters high; branchlets glabrous; petioles 1.5 to 2.5 cm. long; leaf blades ovate, 11 to 15 cm. long, 5.2 to 11 cm. wide, rounded, truncate, or cordate at the base.

¹ Misspelled "*Cuernavacanam*" in the original description.

² Frederick Mueller was an Alsatian, who was sent to Mexico in 1853 by Schlumberger of Mulhouse. He collected chiefly between Veracruz and Orizaba. He disappeared suddenly and was never heard of afterwards, and it is presumed that he was murdered.

9. *Piper papantlense* C. DC. in DC. Prodr. 16¹: 338. 1869.

Veracruz; type from Papantla. Central America.

Branchlets glabrous; petioles 1.2 cm. long; leaf blades ovate or ovate-lanceolate, 10.5 cm. long, 5 cm. wide.

10. *Piper karwinskianum* Kunth; C. DC. in DC. Prodr. 16¹: 327. 1869.

Schilleria karwinskiana Kunth, Linnaea 13: 700. 1839.

Known only from the type locality, near the City of Mexico.

Branchlets short-villous; petioles about 1 cm. long; leaf blades obliquely elliptic, acuminate, rounded at the base, soft-puberulent on both surfaces.

11. *Piper caladiifolium* (Miquel) C. DC. in DC. Prodr. 16¹: 330. 1869.

Artanthe caladiifolia Miquel, Syst. Piper. 387. 1844.

Mexico, the locality not known. Central America.

Branchlets glabrous; leaves long-petiolate, the blades ovate-cordate, short-acuminate, 13 to 21 cm. long, 10 to 14 cm. wide.

12. *Piper sanctum* (Miquel) Schlecht.; C. DC. in DC. Prodr. 16¹: 330. 1869.

Artanthe sancta Miquel, Syst. Piper. 389. 1844.

Veracruz and probably elsewhere; type from Atlacomulco.

Leaf blades rounded-cordate, about 21 cm. long and 18 cm. wide, short-acuminate, puberulent. The following names are reported for this species, although some probably belong to other species, and doubtless most of them are applied to various species indiscriminately: "Santa María" (Tabasco); "acuyo," "hoja de aján" (Veracruz); "hierba santa" (Veracruz, Oaxaca); "santilla de comer" (Oaxaca, *Reko*); "tlamapaquelite," "tianepaquelite," "tlanepaquilitl" (Veracruz, Oaxaca; Nahuatl); "hoja santa;" "hoja de anís."

The leaves have been used by the early and present inhabitants of Mexico as a condiment. In popular medicine the plant is used as a stimulant and as a local anesthetic, and for toothache, stomach affections, and venereal diseases.

13. *Piper commutatum* Steud. (Nom. Bot. ed. 2. 2: 340. 1841, nomen nudum).

Piper plantagineum Lam. err. det. Cham. & Schlecht. Linnaea 6: 353. 1831.

Piper plantagineum Cham. & Schlecht.; C. DC. in DC. Prodr. 16¹: 330. 1869.

Not *P. plantagineum* Lam. 1791.

Described from Mexico, the locality not known.

Branchlets glabrous; petioles 2 cm. long; leaf blades ovate, 9 cm. long, 5 cm. wide, acuminate, rounded or subcordate at the base, glabrous.

14. *Piper zacuapanum* C. DC. in DC. Prodr. 16¹: 330. 1869.

Piper tiliaefolium Schlecht. & Cham. Linnaea 6: 352. 1831. Not *P. tiliaefolium* Desv. 1825.

Veracruz; type from Zacuapan.

Branchlets glabrous; petioles about 6 cm. long; leaf blades ovate, 14 cm. long, 12 cm. wide, acuminate, cordate at the base.

15. *Piper bourgeaui* C. DC. Linnaea 37: 358. 1873.

Known only from the type locality, Cuernavaca, Morelos.

Branchlets densely canescent-villous; petioles 1.2 cm. long; leaf blades oblong-lanceolate, 21 cm. long, 8 cm. wide, acuminate, subcordate at the base, soft-pubescent on both surfaces.

16. *Piper teapense* C. DC. in DC. Prodr. 16¹: 260. 1869.

Known only from the type locality, Teapa, Tabasco.

Branchlets pubescent; petioles 5 mm. long; leaf blades ovate-oblong, 13 cm. long, 5.8 cm. wide, acuminate, cordate at the base, glabrous on the upper surface, pubescent beneath.

17. *Piper lapathifolium* (Kunth) Steud. Nom. Bot. ed. 2. 2: 341. 1841.

Schilleria lapathifolia Kunth, Linnaea 13: 714. 1839.

Veracruz; type from Jalapa. Central America and northern South America.

Shrub, 3.5 to 4.5 meters high; branchlets glabrous; petioles 4 cm. long; leaf blades oblong-ovate, about 24 cm. long and 11 cm. wide, short-acuminate, cordate at the base, glabrous above, hirtellous beneath along the nerves.

18. *Piper schlechtendalii*¹ Steud. Nom. Bot. ed. 2. 2: 343. 1841.

Enckea schlechtendalii Miquel, Syst. Piper. 362. 1844.

Piper schlechtendahlia C. DC. in DC. Prodr. 16¹: 324. 1869.

Known only from the type locality, Misantla, Veracruz.

Branchlets glabrous; petioles 6 mm. long; leaf blades elliptic-lanceolate or lanceolate, 6 to 10 cm. long, 2.5 to 3.5 cm. wide, long-acuminate, obtuse or acute at the base, glabrous.

19. *Piper lepturum* Kunth; C. DC. in DC. Prodr. 16¹: 320. 1869.

Schilleria leptura Kunth, Linnaea 13: 679. 1839.

Oaxaca. Brazil; type from Rio Janeiro.

Branchlets glabrous; petioles 1 cm. long; leaf blades lanceolate or oblong-lanceolate, 11 to 14 cm. long, 2.5 to 3 cm. wide, acuminate, cordate to acutish at the base, glabrous.

20. *Piper megalophyllum* C. DC. Linnaea 37: 357. 1873.

Pital and Mirador, Veracruz, the type localities.

Branchlets glabrous; petioles 6 to 9 cm. long; leaf blades rounded-ovate, 16 to 25 cm. long, 14 to 21 cm. wide, acuminate, cordate at the base, glabrous.

21. *Piper auritum* H. B. K. Nov. Gen. & Sp. 1: 54. 1815.

San Luis Potosí to Oaxaca and Yucatán; type from somewhere in Mexico. Central America; Colombia.

Shrub 1 to 4.5 meters high; branchlets glabrous; petioles 1.5 cm. long; leaf blades ovate-oblong, about 16 cm. long and 9 cm. wide, attenuate to the apex, cordate at the base. "Momo" (Tabasco); "xmacolan" (Yucatán, Maya); "acojo" (Veracruz); "hoja de la estrella" (Costa Rica); "Santa María," "cordoncillo" (Nicaragua); "anisillo," "monca blanca" (Costa Rica); "hoja de jute," "juniapra" (Guatemala, Pittier).

In Veracruz the leaves are used for seasoning tamales. In Costa Rica the fresh leaves are applied to relieve headache.

22. *Piper oblongum* H. B. K. Nov. Gen. & Sp. 1: 52. 1815.

Reported (by C. De Candolle) from Veracruz. Central America and northern South America; type from Venezuela.

Branchlets glabrous; leaves short-petiolate, the blades elliptic, acuminate, acutish at the base; spikes about 8 cm. long.

23. *Piper dilatatum* L. Rich. Act. Soc. Hist. Nat. Paris 1¹: 105. 1792.

Veracruz. Central America, West Indies, and South America.

Shrub 2 to 3 meters high; branchlets nearly glabrous; petioles 5 to 15 mm. long; leaf blades ovate-elliptic or obovate-elliptic, acuminate.

24. *Piper pseudoasperifolium* C. DC. in DC. Prodr. 16¹: 318. 1869.

Known only from Oaxaca, the type locality.

Branchlets hirsute; petioles 1 cm. long; leaf blades lance-elliptic, 11 cm. long, 5 cm. wide, acuminate, obtuse at the base.

25. *Piper palmeri* C. DC.; Rose, Contr. U. S. Nat. Herb. 1: 354. 1895.

Piper palmeri manzanilloanum C. DC.; Rose, Contr. U. S. Nat. Herb. 1: 354. 1895.

Colima; type from the city of Colima.

¹Named for Diedrich Franz Leonhard von Schlechtendal (1794–1866), professor of botany at Halle. He published several important papers describing early collections of Mexican plants.

Shrub 1.8 meters high; branchlets retrorse-pubescent; petioles 1 cm. long or shorter; leaf blades ovate-lanceolate, about 15 cm. long and 5.5 cm. wide, acuminate, unequal at the base. "Matico" (Colima); "hachogue" (Colima, Rose).

The plant is said to be used for washing clothes. A decoction is employed as a remedy for colic in man and horses, and for cutaneous diseases.

26. *Piper rohrii* C. DC. in DC. Prodr. 16¹: 296. 1869.

Oaxaca. Central America and South America; type from French Guiana.

Branchlets glabrous; petioles 2.5 cm. long; leaf blades short-acuminate, subattenuate at the base, glabrous.

27. *Piper cordovanum* C. DC. Linnaea 37: 352. 1873.

Known only from the type locality, Valley of Córdoba, Veracruz.

Branchlets glabrous; petioles 3.5 cm. long; leaf blades acuminate, unequal and obtuse at the base, glabrous.

28. *Piper potomorphe* (Miquel) C. DC. in DC. Prodr. 16¹: 308. 1869.

Artanthe potomorphe Miquel, Syst. Piper. 403. 1844.

Known only from the type locality, Cordillera of Veracruz.

Petioles 7 to 8 cm. long; leaf blades short-acuminate, deeply cordate at the base.

29. *Piper variifolium* (Miquel) C. DC. in DC. Prodr. 16¹: 308. 1869.

Enckea variifolia Miquel, Syst. Piper. 355. 1844.

Veracruz.

Branchlets glabrous; petioles 6 to 8 mm. long; leaf blades acute or acuminate, rounded at the base.

30. *Piper berlandieri* C. DC. in DC. Prodr. 16¹: 295. 1869.

Tamaulipas to Veracruz and Oaxaca; type collected between Tampico and Real del Monte.

Shrub or small tree, 2 to 6 meters high; petioles about 1.5 cm. long; leaf blades obovate-oblong, about 9.5 cm. long and 4.5 cm. wide, short-acuminate, acutish at the base, glabrous.

31. *Piper tuberculatum* Jacq. Icon. Pl. Rar. 2: 2. pl. 210. 1786.

Veracruz to Tepic, Oaxaca, and Tabasco. Central America, West Indies, and South America.

Shrub or small tree, 2 to 6 meters high; branchlets puberulent; leaf blades obliquely ovate or ovate-oblong, 7 to 14 cm. long, 4 to 6 cm. wide, subacuminate, very unequal at the base. "Cordoncillo" (Tabasco, Chiapas).

32. *Piper geniculatum* Swartz, Prodr. Veg. Ind. Occ. 15. 1788.

Veracruz to Tabasco and Chiapas. Central America, West Indies, and South America; type from Jamaica.

Shrub or small tree, up to 6 meters high; leaves short-petiolate, the blades lance-ovate or lance-oblong, sometimes 25 cm. long and 12 cm. wide, acuminate, very unequal at the base. "Cordoncillo" (Tabasco).

33. *Piper melanostictum* (Miquel) C. DC. in DC. Prodr. 16¹: 274. 1869.

Artanthe melanosticta Miquel, Syst. Piper. 404. 1844.

Known only from Tabasco, the type locality.

Branchlets glabrous; leaf blades ovate-oblong, 19 cm. long, 7.5 cm. wide, subobtuse, unequal at the base.

34. *Piper oaxacatum* C. DC. in DC. Prodr. 16¹: 274. 1869.

Known only from the type locality, Oaxaca.

Branchlets glabrous; leaf blades oblong-elliptic or ovate-elliptic, 16.5 cm. long, 6.5 cm. wide, acuminate, unequal and acute at the base.

35. *Piper macrophyllum* H. B. K. Nov. Gen. & Sp. 1: 46. 1815.

Veracruz. Central America, West Indies, and South America; type from Venezuela.

Shrub, about 3 meters high; branchlets glabrous; leaf blades elliptic-oblong, 17 to 24 cm. long, 8 to 12 cm. wide, acuminate; spikes 4 to 5 cm. long.

36. *Piper aduncum* L. Sp. Pl. 29. 1753.

San Luis Potosí to Tepic and Chiapas. Central America, West Indies, and South America; type from Jamaica.

Shrub, 2 to 4.5 meters high; branchlets hirsute or glabrate; leaf blades oblong-elliptic, 17 to 20 cm. long, 7 to 8 cm. wide, acuminate. "Cordoncillo" (Hidalgo, Veracruz); "cordoncillo blanco" (Hidalgo, Veracruz, Nicaragua); "platanillo" (Cuba); "higuillo," "higuillo oloroso" (Porto Rico).

The plant is said to have astringent, stimulant, and diuretic properties. In Brazil it is used to treat ulcers.

37. *Piper chamissonis* (Miquel) Steud. (Nom. Bot. ed. 2. 2: 340. 1841, nomen nudum); C. DC. in DC. Prodr. 16¹: 283. 1869.

Artanthe chamissonis Miquel, Syst. Piper. 457. 1844.

Veracruz and Oaxaca; type from Hacienda de la Laguna, Veracruz.

Petioles 1 cm. long; leaf blades oblong, 15 cm. long, 7 cm. wide, short-acuminate.

38. *Piper jalapense* (Miquel) C. DC. in DC. Prodr. 16¹: 277. 1869.

Artanthe jalapensis Miquel, Syst. Piper. 444. 1844.

Veracruz to Oaxaca; type from Jalapa, Veracruz. Guatemala.

Shrub, up to 4.5 meters high; branchlets densely hirtellous; petioles 1 to 1.5 cm. long; leaf blades ovate-oblong or elliptic-oblong, 13 to 19 cm. long, acuminate; spikes 10 cm. long.

39. *Piper fischerianum* C. DC. in DC. Prodr. 16¹: 277. 1869.

Mexico, the locality not known.

Branchlets glabrous; petioles 1 cm. long; leaf blades lance-elliptic, 19.5 cm. long, acuminate, appressed-hirtellous beneath along the nerves.

40. *Piper descourtilsianum*¹ C. DC. in DC. Prodr. 16¹: 277. 1869.

Veracruz; type from Mirador.

Branchlets glabrous; leaf blades oblong-elliptic, 15.5 cm. long, long-acuminate, glabrous above, puberulent beneath along the nerves.

41. *Piper colipanum* C. DC. Linnaea 37: 348. 1873.

Veracruz; type from Colipa.

Branchlets glabrous; leaf blades oblong-elliptic, 19 cm. long, glabrous above, puberulent beneath.

42. *Piper misantlense* C. DC. in DC. Prodr. 16¹: 286. 1869.

Known only from the type locality, Misantla, Veracruz.

Branchlets glabrous; leaf blades oblong, 14 cm. long, acuminate, glabrous above, puberulent beneath.

43. *Piper citrifolium* Lam. Tabl. Encycl. 1: 80. 1791.

Veracruz and probably Yucatán. Central America, West Indies, and northern South America.

Branchlets hirtellous; leaf blades elliptic-lanceolate or ovate-lanceolate, 12 to 21 cm. long, 5 to 7.5 cm. wide, long-acuminate; spikes 4 to 5 cm. long.

¹Named for Michael Étienne Descourtilz, a French physician, who spent many years in the West Indies, North America, etc. He published a "Flore médicale des Antilles," in 8 volumes, illustrated by 600 colored plates.

44. *Piper decipiens* (Miquel) C. DC. in DC. Prodr. 16¹: 273. 1869.

Artanthe decipiens Miquel, Syst. Piper. 462. 1844.

Known only from the type locality, Cordillera of Veracruz.

Branchlets pubescent; leaf blades ovate-oblong, 14 cm. long, acuminate, puberulent or hirtellous beneath.

45. *Piper liebmannii* C. DC. Linnaea 37: 344. 1873.

Veracruz; type from Mirador.

Branchlets glabrous; leaf blades oblong-elliptic, acute, hirtellous or hirsute beneath; spikes 7.5 cm. long.

46. *Piper hispidum* Swartz, Prodr. Veg. Ind. Occ. 15. 1788.

Piper hirsutum Swartz, Fl. Ind. Occ. 1: 60. 1797.

Veracruz to Tepic and Oaxaca. Central America, West Indies, and South America; type from Jamaica.

Shrub, 2 to 5 meters high; branchlets hirsute; leaf blades 12 to 19 cm. long; spikes 10 to 11 cm. long. "Higuillo," "higuillo oloroso" (Porto Rico).

47. *Piper mexicanum* (Miquel) C. DC. in DC. Prodr. 16¹: 276. 1869.

Artanthe mexicana Miquel, Syst. Piper. 458. 1844.

Tepic to Oaxaca; type from Cordillera of Oaxaca. Guatemala.

Branchlets hirtellous; leaf blades oblong-lanceolate, 14 cm. long, acuminate, unequal at the base.

48. *Piper leucophyllum* (Miquel) C. DC. in DC. Prodr. 16¹: 278. 1869.

Artanthe leucophylla Miquel, Syst. Piper. 460. 1844.

Jalisco to Morelos, Puebla, and Guerrero.

Shrub, 1 to 4 meters high; branchlets tomentose; leaf blades oblong-lanceolate, about 14 cm. long, subacuminate. "Cordoncillo" (Guerrero).

A decoction of the plant is used in Guerrero for fevers and as a wash to kill parasites upon the human scalp.

49. *Piper angustifolium* Ruiz & Pav. Fl. Peruv. Chil. 1: 38. pl. 57. 1798.

Veracruz to Tepic. Central America, West Indies, and South America; type from Peru.

Branchlets densely villous; leaf blades elliptic-lanceolate, 16 cm. long or shorter, acuminate. The following names are said to apply to the plant, although they are probably not confined to this species: "Achiotlín," "soldadillo" (Veracruz); "achotlín" (Colima); "cordoncillo" (Jalisco, Veracruz, Oaxaca, Hidalgo, Nicaragua); "mático" (Oaxaca, Nicaragua); "rabo de zorra," "santilla montés" (Oaxaca); "platanillo," "platanillo de monte" (Cuba).

The leaves, known in commerce as "mático," are an article of export from some parts of tropical America. They are used in medicine to stop the flow of blood and for venereal diseases. It is probable that many different species furnish the "mático" of commerce. In Mexico this plant is used as an astringent and a balsamic stimulant.

50. *Piper melastomoides* Schlecht. & Cham. Linnaea 5: 74. 1830.

Veracruz; type from Jalapa.

Shrub, 3 to 4.5 meters high; branchlets villous; petioles 1 cm. long; leaf blades oblong-ovate or lance-elliptic, about 17 cm. long and 7.5 cm. wide, rounded or acute at the base; spikes 3 cm. long.

51. *Piper smilacifolium* H. B. K. Nov. Gen. & Sp. 1: 56. 1815.

Veracruz. Central America and Venezuela (type locality).

Shrub, 3 to 4.5 meters high; branchlets glabrous; petioles 1.5 cm. long; leaf blades ovate, 14 to 19 cm. long, 11 to 16 cm. wide, cordate to acutish at the base; spikes 11 cm. long.

52. *Piper marginatum* Jacq. Icon. Pl. Rar. 2: 2. pl. 215. 1786.

Michoacán and Guerrero. Central America, West Indies, and South America.

Shrub, up to 5 meters high; branchlets glabrous; leaf blades ovate-rounded, 12 to 16 cm. long and wide, acuminate at the apex. "Anisillo" (Santo Domingo, Nicaragua); "higuillo oloroso" (Porto Rico).

53. *Piper decrescens* (Miquel) C. DC. in DC. Prodr. 16¹: 251. 1869.

Enckea decrescens Miquel, Lond. Journ. Bot. 4: 440. 1845.

Hacienda de los Naranjos. Central America.

Branchlets glabrous; leaf blades ovate or broadly ovate, 8 cm. long, 5 cm. wide, short-acuminate; spikes 8 cm. long.

54. *Piper kunthii* (Miquel) C. DC. in DC. Prodr. 16¹: 250. 1869.

Enckea kunthii Miquel, Syst. Piper. 363. 1844.

Veracruz to Oaxaca and Chiapas; type from Cordillera of Oaxaca.

Branchlets pubescent; leaf blades elliptic-lanceolate, 5 to 7.5 cm. long, 1.5 to 4 cm. wide, long-acuminate.

55. *Piper jaliscanum* S. Wats. Proc. Amer. Acad. 26: 145. 1891.

Jalisco, Sinaloa, and Tepic; type from Guadalajara, Jalisco.

Shrub, 2.5 to 4.5 meters high, glabrous; petioles 6 to 14 mm. long; leaf blades 3.5 to 7.5 cm. long, acute or short-acuminate; spikes 6 cm. long.

56. *Piper lindenbergii* (Miquel) C. DC. in DC. Prodr. 16¹: 248. 1869.

Enckea lindenbergii Miquel, Syst. Piper. 368. 1844.

Known only from the type locality, Teapa, Tabasco.

Branchlets puberulent; leaf blades elliptic-lanceolate, 7 to 10 cm. long, 2 to 4 cm. wide, acuminate.

57. *Piper unguiculatum* Ruiz & Pav. Fl. Peruv. Chil. 1: 34. 1798.

Piper terminale H. B. K. Nov. Gen. & Sp. 1: 57. 1815.

Veracruz and probably elsewhere. Central America, West Indies, and South America; type from Peru.

Shrub, 2 to 5 meters high; branchlets glabrous; leaf blades oblong-ovate, 6 to 9 cm. long, 2.5 to 4 cm. wide, attenuate-acuminate.

58. *Piper medium* Jacq. Icon. Pl. Rar. 1: 2. pl. 8. 1781.

Piper ceanothifolium H. B. K. Nov. Gen. & Sp. 1: 26. 1815.

Veracruz to Yucatán and Oaxaca. Central America, West Indies, and South America.

Shrub, 1 to 4.5 meters high; branchlets puberulent; leaf blades elliptic or ovate-elliptic, acuminate; spikes about 6 cm. long. "Cordoncillo" (Veracruz); "yaxtehc-ché" (Yucatán, Maya); "alcotán" (Costa Rica); "higuillo de limón" (Porto Rico).

In Costa Rica the plant is reputed to be a cure for snake bites.

59. *Piper uhdei*¹ C. DC. in DC. Prodr. 16¹: 248. 1869.

Mexico, the locality not known.

Branchlets glabrous; petioles 7 mm. long; leaf blades elliptic-lanceolate or lanceolate, acuminate.

DOUBTFUL SPECIES.

PIPER ACUTIUSCULUM C. DC. Ann. Cons. Jard. Genève 2: 259. 1898. Type from Valley of Córdoba, Veracruz.

¹ Named for C. A. Uhde, who was Prussian consul at Matamoros about 1845. He made large collections of fruits, seeds, and living orchids, as well as of herbarium specimens, which were sent to the Botanical Garden at Berlin.

PIPER BEGONIAEFOLIUM Hook. & Arn. Bot. Beechey Voy. 310. 1839-40. Described from somewhere in Mexico.

PIPER BREDEMERYI Jacq. Eclog. Pl. Rar. 1: 125. *pl.* 84. 1811-16. Reported from Jalisco.

PIPER CARDIOPHYLLUM C. DC. in DC. Prodr. 16¹: 374. 1869. *Piper populifolium* Opiz in Presl, Rel. Haenk. 1: 160. 1830. Described from some unknown locality in Mexico.

PIPER CHINANTLENSIS Mart. & Gal. Bull. Acad. Brux. 10²: 1843. Type from Chinantla, Oaxaca.

PIPER KERBERI C. DC. Ann. Cons. Jard. Genève 2: 258. 1898. Type from Córdoba, Veracruz.

PIPER LEDEBOURII C. DC. in DC. Prodr. 16¹: 281. 1869. Native of Brazil; reported from Mexico by De Candolle.

PIPER MIRADORENSE C. DC. in DC. Prodr. 16¹: 380. 1869. *Piper patulum* Mart. & Gal. Bull. Acad. Brux. 10²: 128. 1843. Type from Mirador, Veracruz.

PIPER MULTINERVIUM Mart. & Gal. Bull. Acad. Brux. 10²: 130. 1843. Type from Jalapa and Mirador, Veracruz.

PIPER NERVOSUM C. DC. in DC. Prodr. 16¹: 374. 1869. *Piper patens* Hook. & Arn. Bot. Beechey Voy. 310. 1839-40. Described from somewhere in Mexico.

PIPER NITIDULUM Opiz in Presl, Rel. Haenk. 1: 154. 1830. Type from somewhere in Mexico.

PIPER ORIZABANUM C. DC. Ann. Cons. Jard. Genève 2: 258. 1898. Type from the region of Orizaba.

PIPER PLATYPHYLLUM (Benth.) C. DC. in DC. Prodr. 16¹: 375. 1869. *Enckea platyphylla* Benth. Bot. Voy. Sulph. 167. 1844. Type from Manzanillo, Colima.

PIPER RETICULOSUM Opiz in Presl, Rel. Haenk. 1: 155. 1830. Type said to be from Mexico.

PIPER TRIQUETRUM Opiz in Presl, Rel. Haenk. 1: 160. 1830. Described from somewhere in Mexico.

PIPER TRICHOPHYLLUM C. DC. Ann. Cons. Jard. Genève 2: 261. 1898. Type from Mexico.

16. LACISTEMACEAE.

1. LACISTEMA Swartz, Prodr. Veg. Ind. Occ. 12. 1788.

1. *Lacistema myricoides* Swartz, Prodr. Veg. Ind. Occ. 12. 1788.

Veracruz. Central America, West Indies, and tropical America; type from Jamaica.

Shrub or small tree; leaves elliptic-oblong, 10 to 15 cm. long, entire, glabrous; flowers in axillary spikes, apetalous; fruit baccate, ovoid, about 8 mm. long.

17. CHLORANTHACEAE.

1. HEDYOSMUM Swartz, Prodr. Fl. Ind. Occ. 847. 1788.

1. *Hedyosmum artocarpus* Solms in DC. Prodr. 16¹: 485. 1869.

Veracruz, Morelos, and Oaxaca; type from Jalapa, Veracruz.

Shrub, 3 to 4.5 meters high, aromatic and resinous; leaves mostly 12 to 20 cm. long, ovate or oblong-ovate, serrate; flowers dioecious, the staminate spicate, the pistillate capitate; pistillate inflorescence at maturity fleshy, composed of numerous 3-angled drupes, 2 to 3 cm. in diameter.

18. SALICACEAE. Willow Family.

Trees or shrubs; leaves alternate, stipulate, entire, dentate, or lobate, deciduous; flowers dioecious, in catkins; fruit a small capsule, the seeds bearing long white hairs.

The following genera are the only ones of the family:

- Stamens numerous; bracts incised; disk cup-shaped; winter buds with several scales.....1. **POPULUS**.
 Stamens usually less than 5; bracts entire; disk represented by one or two small glands; winter buds with a single scale.....2. **SALIX**.

1. **POPULUS** L. Sp. Pl. 1034. 1753.

The species of *Populus* are generally distinguished from those of *Salix* by their broad leaves, but one Mexican representative, *P. angustifolia*, has leaves as narrow as those of some willows.

The native species are widely used in Mexico as shade trees, for which purpose they are very satisfactory, since they start readily from cuttings or from large branches placed in the ground, and grow rapidly. They are not very long-lived and the trees are frequently killed by mistletoe (*Phoradendron*). The pistillate trees are not desirable as shade trees, for in the spring when the fruit is ripe the seeds fly everywhere through the air, filling people's eyes and nostrils and becoming a general nuisance. This trouble may be avoided by planting only cuttings taken from staminate trees.

Besides the native species, the white poplar, *P. alba* L., of the Old World, and its various forms ("álamo blanco") is cultivated in central and southern Mexico. It is distinguished by having the lower surface of the leaves covered with a dense white tomentum. *P. nigra* L., the black poplar, another Old World species, is said to be cultivated in Mexico.¹

The most common name for the species of the genus is "álamo."

Petioles rounded, not flattened laterally; leaves with very minute teeth.

Leaf blades ovate, dark green above, very pale beneath, rounded at the base.

1. **P. trichocarpa.**

Leaf blades lanceolate, pale green on both sides, obtuse or acute at the base.

2. **P. angustifolia.**

Petioles laterally compressed; leaves usually with large teeth.

Leaf blades not deltoid in outline, orbicular, oval, oblong, or broadly ovate, pale beneath.

Petioles densely tomentose; leaf blades tomentose beneath when young, the teeth large.....3. **P. monticola.**

Petioles and leaves glabrous; leaf blades with small teeth.

4. **P. tremuloides.**

Leaf blades more or less deltoid, not pale beneath.

Pedicels as long as the capsules or longer.

Leaf blades mostly broader than long, the tip short, entire; capsules 10 to 13 mm. long.....5. **P. wislizeni.**

Leaf blades much longer than broad, the tip very long, crenate-serrulate; capsules 7 to 8 mm. long.....6. **P. dimorpha.**

¹Apparently this name has been applied by some Mexican writers to the native *P. mexicana*.

Pedicels much shorter than the capsules.

Capsules 5 mm. long or shorter-----7. *P. arizonica*.

Capsules 6 to 10 mm. long.

Leaf blades usually broadly cuneate or rounded at the base, long-pointed, glabrous or nearly so-----8. *P. mexicana*.

Leaf blades mostly truncate or subcordate at the base, short-pointed.

Petioles and leaves glabrous or nearly so-----9. *P. fremontii*.

Petioles and lower surface of the leaves densely short-pilose or tomentose-----10. *P. macdougalii*.

1. *Populus trichocarpa* Torr. & Gray; Hook. Icon. Pl. 9: pl. 878. 1852.

San Pedro Mártir Mountains of Baja California at an altitude of about 1,350 meters. Northward to Alaska; type from Santa Clara River, California.

Tree, sometimes 60 meters high, but in Baja California much smaller, with a narrow crown; bark light gray, deeply fissured in age; wood soft, weak, brown, its specific gravity about 0.38.

In the United States the wood is used for barrel staves, tubs, bowls, etc. Among the Indians it was a favorite tree for making canoes, and the roots were used in basketry. The sterile Mexican specimens seen by the writer have very small leaves. This species is known in the United States as black cottonwood.

2. *Populus angustifolia* James in Long, Exped. 1: 497. 1823.

Along streams, mountains of northern Chihuahua. Northward to Canada; type from the Rocky Mountains.

In Chihuahua said to be a tree 4.5 to 7.5 meters high, but farther north often much larger, sometimes attaining a height of 20 meters and a trunk diameter of 40 to 50 cm.; bark rough or fissured; leaves 5 to 12 cm. long; catkins 2 to 6 cm. long; wood weak, soft, light brown, its specific gravity about 0.39.

3. *Populus monticola* T. S. Brandeg. Zoe 1: 274. 1890.

Sierra de la Laguna of Baja California at altitudes of 660 to 1,550 meters.

Tree, 15 to 22 meters high, the trunk 60 to 90 cm. in diameter, the bark often smooth and white; branchlets at first densely tomentose; leaf blades coarsely dentate; wood light reddish. "Huirigo."

The wood is used locally for making furniture and other objects. It has been stated by Bailey¹ that this is a form of the Old World *P. alba* which has become naturalized in Baja California, but the writer is convinced from study of specimens that this is not the case.

4. *Populus tremuloides* Michx. Fl. Bor. Amer. 2: 243. 1803.

Mountains of Chihuahua, Sonora, San Luis Potosí, and Durango. Widely distributed in the United States and in Canada (type locality).

Usually a small slender graceful tree, but sometimes 12 meters high or even up to 18 meters, the trunk sometimes 60 cm. in diameter; bark thin, smooth, pale green or grayish; wood soft, weak, light brown, its specific gravity about 0.40. "Alamillo" (Durango, *Patoni*).

Large amounts of aspen wood are used in the United States for paper pulp. The tree is one of the first to spring up in lumbered or burned-over regions, and it often covers large areas. The Mexican specimens seen are all sterile. Probably they should be referred to *P. aurea* Tidestrom,² but the status of that species is still uncertain.

¹ Stand. Cycl. Hort. 2756. 1916.

² Amer. Mid. Nat. 2: 35. 1911.

5. *Populus wislizeni*¹ (S. Wats.) Sarg. Man. Trees N. Amer. 165. 1905.

Populus fremontii wislizeni S. Wats. Amer. Journ. Sci. III. 15: 3. 1878.

Along streams at low altitudes, northern Chihuahua and Sonora. Western Texas to Colorado.

Often 15 meters high, with a very thick trunk and large crown; bark pale gray, fissured; leaves 5 to 10 cm. long; wood soft, brownish, its specific gravity about 0.46. Commonly known as "álamo"; "güérigo" (Chihuahua).

In the Rio Grande Valley the wood is much used for firewood, fence posts, and rafters of houses. It is not very good for fuel, since it burns almost like paper. The fallen leaves are eaten by cattle. This cottonwood is the most common shade tree of New Mexico. It was reported from Mexico by Hemsley as *Populus balsamifera* L., a species of more eastern and northern distribution.

6. *Populus dimorpha* T. S. Brandeg. Zoe 5: 197. 1905.

Along arroyos and streams at low altitudes, Sonora and Sinaloa; type from Culiacán.

A large tree, often planted in parks; remarkable for the dimorphism of its leaves, those on the older branches ovate-deltoid, very long-acuminate, those on young shoots linear-lanceolate to ovate-lanceolate.

7. *Populus arizonica* Sarg. Bot. Gaz. 57: 210. 1919.

Populus arizonica jonesii Sarg. Bot. Gaz. 57: 211. 1919.

Baja California to Chihuahua, Tamaulipas, and Puebla, chiefly in river bottoms; Chiapas (?). Southern California to New Mexico; type from Arizona.

Large tree, sometimes 25 meters high, with a trunk diameter of 1.5 meters; crown rounded, with spreading branches; bark light gray, ridged, or on young trees smooth. Generally known as "álamo," but also as "chopo" (Chihuahua, San Luis Potosí) and "olmo" (Tamaulipas).

The wood is used for fuel, carts and cart wheels, fence posts, water troughs, etc. *P. arizonica jonesii* (type from Valley of Palms, Baja California), to which most of the Mexican material belongs, is a form with longer pubescence than the type.

8. *Populus mexicana* Wesm. in DC. Prodr. 16²: 328. 1864.

Type collected between Tampico, Tamaulipas, and Real del Monte, Hidalgo.

Leaves broadly ovate, 4.5 to 7 cm. long, long-petiolate, abruptly long-acuminate at the apex.

The writer has seen no material agreeing satisfactorily with the type collection.

9. *Populus fremontii* S. Wats. Proc. Amer. Acad. 10: 350. 1875.

Baja California; Sonora (?). California and Nevada; type from Deer Creek, California.

Large tree, sometimes 35 meters high, with a trunk 2 meters in diameter, the branches spreading and drooping; bark light gray and smooth on young trees, brown and ridged in old trees; wood soft, light brown, weak, its specific gravity about 0.48. "Alamo" (Baja California).

¹The species was named for Adolf Wislizenus (1810–1889), who came to the United States from Germany in 1835. He was one of the first of United States botanists to visit Mexico, having gone, by way of the Santa Fe trail, to Chihuahua in 1846. He obtained in that State a large collection of plants, which were reported upon by Dr. George Engelmann in a book published by Wislizenus detailing his travels.

10. *Populus macdougalii*¹ Rose, Smiths. Misc. Coll. 61¹²: 1. 1913.

Northern Sonora and Baja California; type from the delta region of the Colorado River.

Large tree; differing from *P. fremontii* only in the more copious pubescence, and probably not specifically distinct.

2. **SALIX** L. Sp. Pl. 1015. 1753.

REFERENCE: C. Schneider, Bot. Gaz. 65: 1-41. 1918.

The various species of willows are found in nearly all parts of Mexico, usually growing at the edge of water. They are often planted as shade trees. *Salix babylonica* L. ("sauz llorón," the weeping willow), an Old World species, with very long, slender, drooping branches, is sometimes cultivated also.

The wood is used chiefly for firewood, but also for construction to a limited extent. In the United States it is burned for charcoal, which is of excellent quality, being used in medicine and as black crayon by artists. The bark is sometimes used for tanning, and the leaves as forage for stock. The flexible tough branches are employed for making baskets, and they were so used by many tribes of North American Indians. They are used also in Mexico as well as elsewhere in the manufacture of wicker furniture. The bark and leaves contain tannin and salicin. The latter principle is a useful febrifuge, and was widely used before quinine came into general use. A willow decoction is still employed for treating fevers in Mexico in domestic practice, and other medicinal properties are attributed to the plants.

The usual names for species of *Salix* are "sauz" and "sauce." The following ones are said to be applied to species which have not been determined by the writer: "Ahuejote" (Jalisco, Valley of Mexico); "huejocote," "huexotl" (Nahuatl); "tepehuexote" (Valley of Mexico); "yaga-gueza" (Zapotec); "yutnu-nuu" (Oaxaca, Mixtec, *Reko*).

Stamens 3 or more.

Leaves glaucous or glaucescent beneath.

Branchlets yellow or yellowish, glabrous-----4. *S. wrightii*.

Branchlets reddish or purplish or tomentulose.

Branchlets densely tomentose; leaves densely villous-tomentulose beneath when young; petioles 8 mm. long or less; staminate aments 0.8 to 3 cm. long-----5. *S. jaliscana*.

Branchlets glabrous or sparsely pilose; leaves glabrous beneath or nearly so; petioles mostly over 10 mm. long; staminate aments 4 to 6 cm. long-----6. *S. bonplandiana*.

Leaves green beneath.

Branchlets yellowish or yellowish cinereous; ovary often pilose.

3. *S. gooddingii*.

Branchlets reddish or purplish; ovary glabrous.

Capsule ovoid to elliptic, scarcely attenuate or short-attenuate at the apex; leaf blades linear or linear-lanceolate; stipules eglandular.

1. *S. humboldtiana*.

Capsule ovoid-lanceolate, attenuate at the apex; leaf blades linear-lanceolate to broadly lanceolate; stipules glandular on the inner surface.

2. *S. nigra*.

¹ Named in honor of Dr. D. T. MacDougal (1865-), director of the department of botanical research of the Carnegie Institution, distinguished for his contributions to the knowledge of plant physiology. Dr. MacDougal has made limited collections of plants in Mexico, some of which are in the U. S. National Herbarium.

Stamens 2.

Leaves small or very small, linear or lanceolate, with stomata equally distributed on both surfaces.

Aments short, the staminate ones 5 to 13 mm. long, the pistillate ones in fruit 1.2 to 2 cm. long; anthers globose or short-elliptic, about as broad as long-----7. *S. taxifolia*.

Aments longer, or the anthers elliptic and much longer than broad.

Ovary glabrous or sparsely pilose; staminate flowers with 2 glands.

8. *S. exigua*.

Ovary densely sericeous-villous; staminate flowers with a single gland.

9. *S. thurberi*.

Leaves large or broad, without stomata on the upper surface; leaves rarely small, the ovary then long-stipitate.

Aments appearing in the axils of full-grown leaves, 2 cm. long or shorter.

Ovary glabrous or sparsely pilose.

Branchlets glabrous; leaves glabrous-----11. *S. mexicana*.

Branchlets tomentose; leaves more or less tomentulose beneath.

Leaf buds rostrate, glabrous or sparsely pilose at the apex; pedicels not longer than the bracts-----10. *S. hartwegii*.

Leaf buds merely acute, villous-tomentulose; pedicels longer than the bracts-----12. *S. schaffnerii*.

Aments appearing before or with the leaves.

Aments scarcely 1 cm. long; leaves usually 2 cm. long or less.

17. *S. cana*.

Aments more than 2.5 cm. long; leaves mostly much more than 2.5 cm. long.

Ovary glabrous; stigmas short; filaments glabrous.

Leaf blades lanceolate, oblanceolate, or narrowly elliptic; staminate aments about 12 mm. thick; bracts obovate, very obtuse or truncate-----13. *S. lasiolepis*.

Leaf blades elliptic or elliptic-lanceolate; staminate aments 15 to 20 mm. thick; bracts oblong, acute-----14. *S. rowleei*.

Ovary villous; stigmas lanceolate; filaments pilose at the base.

Bracts narrowly lanceolate, acute or short-acuminate.

15. *S. oxylepis*.

Bracts oblong, obtuse or subtruncate, rarely acutish.

16. *S. paradoxa*.

1. *Salix humboldtiana* Willd. Sp. Pl. 4: 657. 1805.

? *Salix oxyphylla* H. B. K. Nov. Gen. & Sp. 2: 19. 1817.

Salix stipulacea Mart. & Gal. Bull. Acad. Brux. 10¹: 343. 1843.

Salix humboldtiana stipulacea C. Schneid. Bot. Gaz. 65: 7. 1918.

Veracruz to Colima, Chiapas, and Tabasco. Central America and South America; type from Peru.

Large or small tree, sometimes 10 meters high, with a trunk 15 to 30 cm. in diameter. "Sauce," "sauz," "sauz blanco" (Tabasco).

The Mexican specimens, as well as those from Central America, belong to *S. humboldtiana stipulacea*. This differs only slightly from the typical form, which ranges from Colombia to Argentina. A form which is possibly a hybrid between this and *S. bonplandiana* is reported from Oaxaca.

2. *Salix nigra* Marsh. Arb. Amer. 139. 1875.

Salix nigra lindheimerii C. Schneid. Bot. Gaz. 65: 9. 1918.

Coahuila to Tamaulipas, Sinaloa, and Tepic. Widely distributed in eastern North America.

Tree, sometimes 20 or even 40 meters high, with a trunk diameter of a meter, but usually smaller; branches slender, spreading or somewhat drooping; bark rough, blackish, coming off in narrow strips; leaves 6 to 15 cm. long; wood light reddish brown, soft, weak, its specific gravity about 0.44. "Sauz" (Tamaulipas).

The bark is sometimes used in domestic medicine for its reputed tonic, febrifuge, anaphrodisiac, carminative, and stimulant properties. Palmer states that in Tamaulipas a decoction of the bark is used as a lotion for erysipelas. All the Mexican material is referred by Schneider to *S. nigra lindheimerii*, which occurs also in western Texas.

3. *Salix gooddingii* Ball, Bot. Gaz. 40: 376. 1905.

Chihuahua to Baja California and Sinaloa. California to New Mexico; type from Clark County, Nevada.

Shrub or tree, sometimes 12 meters high; bark rough, dark; leaves narrowly lanceolate, 5 to 12 cm. long; capsules glabrous. "Sauz" (Chihuahua).

Palmer reports that a decoction is used in Chihuahua for fevers. A form which may represent a hybrid between this and *S. bonplandiana* is reported from Baja California by Schneider.

4. *Salix wrightii*¹ Anderss. Öfv. Svensk. Vet. Akad. Förh. 15: 115. 1858.

Northern Chihuahua. Western Texas and New Mexico. Type from Texas or Chihuahua.

Shrub or small tree.

5. *Salix jaliscana* Jones, Contr. West. Bot. 12: 77. 1908.

Jalisco, the type from Ferreria; Michoacán (?).

Shrub or small tree; leaves elliptic or elliptic-lanceolate.

6. *Salix bonplandiana* H. B. K. Nov. Gen. & Sp. 2: 20. pl. 101, 102. 1817.

Salix pallida H. B. K. Nov. Gen. & Sp. 2: 20. 1817.

Nearly throughout Mexico; type from Hidalgo. Guatemala; southern New Mexico and Arizona.

Small or large tree, sometimes 12 meters high or more, with a trunk 40 cm. in diameter, the branches slender, somewhat drooping; bark brown, thick, irregularly fissured; leaves lanceolate or linear-lanceolate, 12 cm. long or shorter, 1 to 2 cm. wide. "Sauz" (Jalisco, Baja California); "sauce" (*Urbina*).

7. *Salix taxifolia* H. B. K. Nov. Gen. & Sp. 2: 18. 1817.

Salix microphylla Schlecht. & Cham. Linnaea 6: 354. 1831.

Nearly throughout Mexico; type from Querétaro. Western Texas to Arizona; Guatemala; Porto Rico (?).

Shrub or tree, sometimes 18 meters high, with a trunk 50 cm. in diameter; leaves linear or lanceolate, 3 cm. long or shorter, silvery-silky; capsules pubescent. "Taray," "taray de río" (Durango, *Paton*); "tarais" (Chihuahua).

8. *Salix exigua* Nutt. N. Amer. Sylv. 1: 75. 1842.

Chihuahua to Baja California. Northward to Canada; type from Oregon.

Shrub, 2 to 4 meters high, or sometimes a tree 7 meters high.

¹ Named for Charles Wright (1811-1885), one of the most famous of American botanical collectors. From 1847 to 1851 he made very large collections in western Texas, southern New Mexico and Arizona, and Chihuahua and Sonora. These were studied by Gray, and many species of northeastern Mexico were first described from Wright's collections. Later Wright obtained an extensive series of plants in Cuba, and also in Nicaragua and other regions. Sets of his plants are in the U. S. National Herbarium.

9. *Salix thurberi*¹ Rowlee, Bull. Torrey Club 27: 252. 1900.
Salix longifolia angustissima Anderss. Öfv. Svensk. Vet. Akad. Förh. 15: 116. 1858.
 Coahuila and Nuevo León; Durango (?). Western Texas (type locality) and southern New Mexico.
 Medium-sized tree.
10. *Salix hartwegii* Benth. Pl. Hartw. 52. 1840.
 Mexico and Michoacán; type from Aganguio, Michoacán.
 Leaves elongate-lanceolate or narrowly elliptic-lanceolate, 3.5 to 9.5 cm. long.
11. *Salix mexicana* Seemen, Bot. Jahrb. Engler 21: Beibl. 52: 9. 1895.
 Hidalgo, Mexico, and Puebla; type from Zacualtipán, Hidalgo.
 Shrub, 3 to 4.5 meters high.
12. *Salix schaffnerii* C. Schneid. Bot. Gaz. 65: 30. 1918.
 San Luis Potosí and Veracruz; type from San Luis Potosí.
 Leaves elliptic-lanceolate, 6 to 9 cm. long.
13. *Salix lasiolepis* Benth. Pl. Hartw. 335. 1857.
 Chihuahua and Coahuila to Baja California. California, the type from Monterey.
 Tree or shrub, 3.5 to 9 or sometimes 16 meters high; bark brown, rather thin, fissured; leaves 6 to 10 cm. long; wood soft, weak, light brown, its specific gravity about 0.56. "Ahuejote" (Baja California).
14. *Salix rowleei* C. Schneid. Bot. Gaz. 65: 31. 1918.
Salix rowleei cana C. Schneid. Bot. Gaz. 65: 34. 1918.
 Mexico (State); type from Eslava.
 Shrub or tree, sometimes 6 meters high, the branchlets villosulous, the branches blackish; leaves elliptic or elliptic-lanceolate, about 7.5 cm. long.
15. *Salix oxylepis* C. Schneid. Bot. Gaz. 65: 34. 1918.
Salix latifolia Mart. & Gal. Bull. Acad. Brux. 10¹: 344. 1843. Not. *S. latifolia* Forbes, 1828.
 Puebla and Veracruz; type from Mount Orizaba.
 Leaves ovate-elliptic or obovate-oblong, 3.5 to 4.5 cm. long.
16. *Salix paradoxa* H. B. K. Nov. Gen. & Sp. 2: 20. 1817.
 ? *Salix pringlei* Rowlee, Bot. Gaz. 27: 136. 1899.
Salix paradoxa ajuscana C. Schneid. Bot. Gaz. 65: 37. 1918.
 Hidalgo to Oaxaca; type from Morán, Hidalgo.
 Shrub or small tree, up to 6.5 meters high; leaves oblong-elliptic, elliptic-lanceolate, or elliptic, 5 to 13 cm. long.
17. *Salix cana* Mart. & Gal. Bull. Acad. Bruz. 10¹: 344. 1843.
 Mount Orizaba, the type locality, and perhaps elsewhere.
 Leaves narrowly oblanceolate.

DOUBTFUL SPECIES.

SALIX ENDLICHII Seemen, Repert. Sp. Nov. Fedde 5: 19. 1908. Described from the Sierra Madre of Chihuahua. Closely related, according to Schneider, to *S. cana*.

¹George Thurber (1821-1890), a native of Rhode Island, was appointed in 1850 botanist to the United States commission to establish the boundary between the United States and Mexico. He spent five years in making botanical collections, from the Gulf of Mexico to the Pacific Ocean, and discovered many interesting plants, which were described by Gray. He is well known also for his publications upon horticultural subjects.

19. MYRICACEAE. Bayberry Family.

1. MYRICA L. Sp. Pl. 1024. 1753.

REFERENCE: Chevalier, Mém. Soc. Sci. Nat. Cherbourg 32: 85-340. 1901.

Shrubs or small trees; leaves alternate, estipulate, covered with small glands; flowers very small, dioecious, in axillary spikes; fruit small, globose, covered with whitish wax.

Chevalier reports a specimen of *M. hartwegi* S. Wats., collected by Pavón, from Mexico. It is probable that the collection is incorrectly labeled, for that species is confined to California and Oregon, and its known area of distribution is far removed from the Mexican border. Several species of bayberry occur in the United States.

Leaf blades narrowly oblanceolate or oblong-oblanceolate, 5 to 9 cm. long, acute to attenuate----- 1. *M. mexicana*.

Leaf blades obovate, 1.5 to 4 cm. long, rounded to acutish at the apex.

2. *M. pringlei*.

1. *Myrica mexicana* Willd. Enum. Pl. 2: 1011. 1809.

Myrica xalapensis H. B. K. Nov. Gen. & Sp. 2: 10. 1817.

Myrica lindeniana C. DC. in DC. Prodr. 16²: 150. 1864.

Jalisco to Tamaulipas, Veracruz, Yucatán, and Chiapas. Guatemala.

Shrub or small tree, 2 to 6 meters high; leaves entire or with a few coarse teeth. "Arbol de la cera" (Hidalgo, Oaxaca, Veracruz, etc.); "huancanalá" (Veracruz, Oaxaca, etc.); "chac olol" (Chiapas, *Seler*).

Myrica lindeniana is considered a distinct species by Chevalier. It is said to differ in having the leaves dentate above the middle, those of *M. mexicana* being entire or dentate only at the apex. The writer has seen no specimens that are certainly referable to *M. lindeniana*, but in view of the fact that the leaves of *M. mexicana* are sometimes coarsely dentate, it does not seem probable that the former is a valid species.

This is a well-known plant in Mexico because of the wax that is obtained from the fruit. The shrub often occurs in great abundance, forming extensive thickets, and the fruit can be gathered in quantity. It is boiled in water, whereupon the wax rises to the surface and is skimmed off. The crude wax is greenish, or often very dark from impurities, but it may be bleached or purified until it is nearly white. It is not uncommon in the markets of Mexico City. It is used for candles, which burn slowly, with very little smoke, emitting a pleasant balsamic odor. It is used also as a substitute for or adulterant of beeswax, and has been tested for making phonograph records. Small quantities have been exported. The aromatic leaves also contain wax, but only in small quantities.

The wax is a popular remedy, taken internally, for jaundice and diarrhoea. A decoction of the root bark is said to be acrid, astringent, and in large doses emetic.

2. *Myrica pringlei* Greenm. Proc. Amer. Acad. 41: 236. 1905.

Myrica parvifolia confusa Chevalier, Mém. Soc. Sci. Nat. Cherbourg 32: 285. 1901.

Hidalgo, Puebla, and Oaxaca; type from "Honey Station," Puebla, in pine forest, altitude 1,740 meters.

Shrub 0.3 to 1 meter high, similar to the preceding species. "Chilpanxohuilt" (Puebla, *Herrera*).

This species also produces wax.

20. JUGLANDACEAE. Walnut Family.

Large shrubs or usually trees, commonly strong-scented; leaves alternate, pinnate; flowers monoecious, small, greenish, arranged in long drooping catkins; fruit a very hard nut, inclosed in a thick dry husk; seeds deeply lobed, usually edible.

Husk of the fruit indehiscent; fruit very rough; staminate catkins solitary, sessile or nearly so.....1. **JUGLANS**.
Husk of the fruit splitting into valves; fruit smooth or nearly so; staminate catkins in 3's, long-pedunculate.....2. **HICORIA**.

1. **JUGLANS** L. Sp. Pl. 997. 1753.

The wood of the larger species of *Juglans* is highly valued because of its hardness, toughness, and durability. That of *J. nigra* L., the black walnut of the United States, is much used for furniture and gunstocks. The bark and fruit are sometimes used for tanning and dyeing. The seeds are edible and are often used in sweetmeats. *Juglans regia* L. ("nogal," "nuez grande," "nuez de Castilla"), the English walnut, native of Europe, is cultivated in Mexico.

Nuts large, 3 to 4 cm. broad.

Leaflets sparsely pilose beneath or glabrate, glabrate on the upper surface.

1. **J. pyriformis**.

Leaflets densely velvety-pilose beneath, stellate-pubescent on the upper surface.....2. **J. mollis**.

Nuts small, 1 to 2.5 cm. broad.

Nuts 1 to 1.5 cm. broad; leaflets narrow, minutely and obscurely serrulate, strongly falcate; shrub or small tree.....3. **J. rupestris**.

Nuts 2 to 2.5 cm. broad; leaflets broad, conspicuously serrate, scarcely falcate; large tree.....4. **J. major**.

1. **Juglans pyriformis** Liebm. Nat. For. Kjöbenhavn Vid. Medd. 1850: 79. 1850.
Veracruz and Hidalgo to Jalisco; type from Veracruz.

Doubtless a large tree; leaflets 9 to 15, acute to attenuate. "Nogal."

The material at hand is not very satisfactory and it may be that more than one species is involved. A specimen from Durango (*Palmer* 104) has a conspicuously pyriform nut, but the leaflets are almost completely glabrous beneath. Possibly it represents an undescribed species, but it is referred here for the present. Of this collection Palmer gives the following note: "'Nogal'; 15 to 18 meters high, the trunk 0.6 to 1.2 meters in diameter, the crown wide-spreading; the leaves are thrown in water to stupefy fish."

2. **Juglans mollis** Engelm.; Hemsl. Biol. Centr. Amer. Bot. 3: 163. 1883.

Juglans mexicana S. Wats. Proc. Amer. Acad. 26: 152. 1891.

Nuevo León and San Luis Potosí; type from mountains east of San Luis Potosí.

Small or medium-sized tree, or sometimes 15 to 18 meters high, with a trunk diameter of a meter; bark thick, blackish, deeply furrowed; leaflets usually 9 to 15, acutish to attenuate; catkins 7 to 12.5 cm. long; nut reddish brown, with rounded ridges. "Nogal," "nuez meca" (San Luis Potosí).

The tree is said to be valued highly for its wood, which is sawed and is used for bowls, tubs, and other articles. The husks of the fruit are used to procure a coffee-colored dye. The leaves are heated and applied locally for rheumatism. It may be that *J. mexicana* is a distinct species, but no definite characters are observable in the material at hand.

3. *Juglans rupestris* Engelm. in Sitgreaves, Rep. Zuñi & Colo. 171. *pl.* 15. 1854.

Coahuila and probably in Chihuahua. Western Texas and southern New Mexico (type locality).

Shrub, usually less than 5 meters high, growing in clumps and branched almost to the base, or said to be sometimes a tree 9 meters high; bark smooth and yellowish on young stems, in age thick, furrowed, and broken into plates; leaflets 13 to 23; catkins 5 to 10 cm. long; nuts dark brown; wood hard, weak, close-grained, dark brown, its specific gravity about 0.70. "Nogal."

4. *Juglans major* (Torr.) Heller, *Muhlenbergia* 1: 50. 1900.

Juglans rupestris major Torr. in Sitgreaves, Rep. Zuñi & Colo. 171. *pl.* 16. 1854.

Chihuahua and Durango. Arizona (type locality) and New Mexico.

Tree, sometimes 15 meters high, with a trunk diameter of 1.5 meters, the trunk short, the branches spreading, the bark dark gray, rough; leaflets 9 to 19, 6 to 12 cm. long; wood hard, rather weak, coarse-grained, dark brown, its specific gravity about 0.67. "Nogal silvestre" (Chihuahua).

A decoction of the leaves is said to be taken as a tonic.

2. **HICORIA** Raf. *Med. Repos.* N. Y. II. 5: 352. 1808.

About a dozen other species of the genus (the hickory trees) occur in the United States. Their wood is very tough and is much used for articles in which strength and elasticity is needed, such as ax handles, wagon wheels, etc. The seeds of most species have an agreeable flavor and large quantities are eaten.

Leaflets 5; bud scales imbricate.....1. *H. mexicana*.

Leaflets 7 to 15; bud scales valvate.

Leaflets 7 or 9, not falcate; shell of the nut thick...2. *H. myristicaeformis*.

Leaflets usually 11 to 15, conspicuously falcate, shell of the nut thin.

3. *H. pecan*.

1. *Hicoria mexicana* (Engelm.) Britton, *Bull. Torrey Club* 15: 283. 1888.

Carya mexicana Engelm.; *Hemsl. Biol. Centr. Amer. Bot.* 3: 162. 1883.

San Luis Potosí and Querétaro; type from mountains near Álvarez, San Luis Potosí, at an altitude of 2,400 meters.

Tree, 15 to 18 meters high; leaflets obovate, sessile, about 15 cm. long, acuminate, with a pleasant odor; fruit with a thick husk, the nut somewhat angled. "Nogalillo" (San Luis Potosí).

The leaves are used for wrapping tamales. The wood is used locally.

2. *Hicoria myristicaeformis* (Michx. f.) Britton, *Bull. Torrey Club* 15: 284. 1888.

Juglans myristicaeformis Michx. f. *Hist. Arb. Amér.* Sept. 211. 1810.

Carya myristicaeformis Nutt. *Gen. Pl.* 2: 222. 1818.

Nuevo León. Southeastern United States; type from Charleston, South Carolina.

Large tree, sometimes 35 meters high, with a trunk diameter of a meter; bark dark reddish brown, shallowly fissured into close scales; leaflets 5 to 12 cm. long, acute or acuminate; fruit with a thin husk, the nut rounded, smooth, brown; wood hard, tough, strong, close-grained, light brown, its specific gravity about 0.80.

3. *Hicoria pecan* (Marsh.) Britton, *Bull. Torrey Club* 15: 282. 1888.

Juglans pecan Marsh. *Arb. Amér.* 69. 1785.

Carya olivaeformis Nutt. *Gen. Pl.* 2: 221. 1818.

Nuevo León, San Luis Potosí, and Hidalgo; reported from Oaxaca and probably in some other states. Eastern United States.

Large tree, sometimes reaching a height of 50 meters and a trunk diameter of 2 meters; bark light reddish brown, furrowed into narrow ridges; leaflets ovate or oblong-lanceolate, 8 to 15 cm. long; fruit with a thin husk, the nut rounded, reddish brown, thin-shelled; wood hard, rather brittle and weak, close-grained, light reddish brown, its specific gravity about 0.72. The following names are reported from various parts of Mexico: "Nuez encarcelada," "nuez chiquita," "nogal morado," "pacanero," "nogal de nuez chica," "nuez lisa."

The bark is said to have been used in Mexico in the treatment of intermittent fevers and for dyspepsia. The pecan is grown extensively in the southern United States, and the nuts are an important article of commerce. The kernels have a very agreeable flavor and are eaten alone or in candies and other sweetmeats. Most of the cultivated forms have much larger nuts, with thinner shells, than the wild trees.

21 BETULACEAE. Birch Family.

Shrubs or trees; leaves alternate, deciduous, dentate, the stipules usually deciduous; flowers small, dioecious, in catkins.

Pistillate catkins conelike in fruit, the scales woody; staminate flowers 2 or 3 to each bract; perianth none in the pistillate flowers-----1. **ALNUS**.

Pistillate catkins not conelike, the scales thin; staminate flowers solitary above the bract; perianth present in the pistillate flowers.

Fruit inclosed in a bladder-like closed sac-----2. **OSTRYA**.

Fruit merely subtended by a flat leaflike 3-lobed bract-----3. **CARPINUS**.

1. **ALNUS** Hill, Herb. Brit. 510. 1756.

REFERENCES: Fernald, Proc. Amer. Acad. 40: 24-28. 1904; Bartlett, Proc. Amer. Acad. 44: 609-612. 1909.

Numerous species of *Alnus* occur in the United States. The Mexican alders have often been determined as *A. acuminata* H. B. K., and there are many references in literature to the name, but that species, described from the Andes of Peru, does not occur in Mexico.

The bark of the alders is astringent and rich in tannin. It is used in Mexico for tanning skins, giving them a red color, and it is employed also for dyeing skins, blankets, etc., furnishing various colors according to the substances combined with it. The Nueva Farmacopea Mexicana states that the leaves are used as poultices for wounds, an infusion of the bark as a lotion in cutaneous diseases, a decoction of the bark internally for scrofula and venereal diseases, and a decoction of the fruit as an astringent lotion for inflammation of the throat.

The following vernacular names are reported, but it is impossible to determine the species to which they are applied: "Aile" or "ayle" (Jalisco, Morelos, Oaxaca; from the Nahuatl, "ailitl"); "abedul" (Veracruz, Oaxaca); "olmo del país" (Veracruz, Hidalgo, *Ramírez*); "palo de águila" (Oaxaca, *Reko*); "yaga-bizie" (Oaxaca, Zapotec, *Reko*); "palo de lama" (Guatemala, *Pittier*). The Spanish name "aliso" is used in New Mexico and in some parts of Mexico.

Leaves densely covered beneath with yellow wax glands--1. **A. jorullensis**.
Leaves without glands beneath or the glands remote and inconspicuous.

Mature strobiles 7 to 14 mm. long. Veins very coarse and prominent on the lower surface of the leaves-----2. **A. firmifolia**.

Mature strobiles 20 mm. long or longer.

Petioles pubescent.

Leaf blades broadly rounded at the base, broadly elliptic-ovate.

3. *A. pringlei*.

Leaf blades acute or acutish at the base, ovate or oblong-ovate.

4. *A. oblongifolia*.

Petioles glabrous.

Leaves conspicuously pilose beneath, at least on the nerves.

5. *A. arguta*.

Leaves glabrous beneath or nearly so-----6. *A. glabrata*.

1. *Alnus jorullensis* H. B. K. Nov. Gen. & Sp. 2: 27. 1817.

Along streams, Jalisco to Veracruz and Oaxaca; type from Volcán de Jorullo, Michoacán. Guatemala.

Shrub or tree, 3 to 6 meters high or larger, with smooth, reddish brown branches; leaves oblong or obovate, 7 to 13 cm. long; strobiles 1 to 2 cm. long.

2. *Alnus firmifolia* Fernald, Proc. Amer. Acad. 43: 61. 1907.

State of Mexico; type from Cima Station, at an altitude of 3,000 meters. Tree, 6 to 12 meters high.

3. *Alnus pringlei* Fernald, Proc. Amer. Acad. 43: 62. 1907.

Type from Uruapam, Michoacán; perhaps also in Durango and Jalisco. Small tree. "Aliso" (Durango).

Certain doubtful forms are intermediate between this and *A. oblongifolia*, but the type collection appears distinct from the latter species.

4. *Alnus oblongifolia* Torr. U. S. & Mex. Bound. Bot. 204. 1859.

Sonora; perhaps also in Durango and Tepic. Southern New Mexico (type locality) to southern California.

Small or medium-sized tree, sometimes 10 meters high, with a trunk 25 cm. in diameter, the branches reddish brown; bark thin, light brown; leaves 5 to 10 cm. long; catkins 9 cm. long or shorter; strobiles 1 to 1.5 cm. long.

5. *Alnus arguta* (Schlecht.) Spach, Ann. Sci. Nat. II. 15: 205. 1841.

Betula arguta Schlecht. Linnaea 7: 139. 1832.

Alnus arguta cuprea Bartlett, Proc. Amer. Acad. 44: 610. 1909.

Alnus arguta subsericea Bartlett, Proc. Amer. Acad. 44: 610. 1909.

Tamaulipas to Veracruz (type locality), Oaxaca, and Chiapas; apparently also in Chihuahua.

Tree, 6 to 7.5 meters high, the branches brown; leaves ovate or obovate, 4 to 10 cm. long; strobiles 2 to 3 cm. long.

The Chihuahua specimens were referred doubtfully to *A. glabrata* by Bartlett, but seem essentially the same as *A. arguta*. This species has been referred to *A. acuminata* H. B. K., *A. ferruginea* H. B. K., and *A. jorullensis castaneae-folia* (Mirb.) Regel, none of which is known to occur in Mexico.

6. *Alnus glabrata* Fernald, Proc. Amer. Acad. 40: 26. 1904.

Alnus glabrata durangensis Bartlett, Proc. Amer. Acad. 44: 611. 1909.

Hidalgo to Oaxaca; Durango; type from Monte San Nicolás, Guanajuato.

Large or medium-sized tree; leaves oblong-lanceolate or elliptic, coarsely dentate, acuminate. "Aliso" (Durango).

A. glabrata durangensis Bartlett is a form in which the lower surface of the leaves is glaucescent; it may be specifically distinct. Specimens of *A. glabrata* have been reported from Mexico as *A. rhombifolia* Nutt.

2. OSTRYA Scop. Fl. Carn. 414. 1760.

1. *Ostrya guatemalensis* (Winkl.) Rose, Contr. U. S. Nat. Herb. 8: 292. 1905.
Ostrya italica virginiana guatemalensis Winkl. in Engl. Pflanzenreich IV. 61: 22. 1904.

Ostrya mexicana Rose, Contr. U. S. Nat. Herb. 8: 292. 1905.

Veracruz to Tabasco and Chiapas. Guatemala (type locality) to Costa Rica.

Tree, 12 to 15 meters high or smaller, with thin, light brown bark; leaves ovate, doubly serrate; staminate flowers in slender catkins; fruits surrounded by bladder-like bracts, arranged in strobiles like those of common hops (*Humulus lupulus* L.). Commonly known as "guapaque."

This is very closely related to *O. virginiana* (Mill.) Koch, but seems fairly distinct. In the Guatemalan form the pubescence is slightly more copious than in the plants of Veracruz, but there appears to be no essential difference between the two.

The wood of the ironwood is very strong, tough, and durable. It is used for railroad ties and other purposes. The bark is used for dyeing and tanning.

3. CARPINUS L. Sp. Pl. 998. 1753.

1. *Carpinus caroliniana* Walt. Fl. Carol. 236. 1788.

Carpinus caroliniana tropicalis Donn. Smith, Bot. Gaz. 15: 28. 1890.

Veracruz to Jalisco and Chiapas. Guatemala; eastern United States and Canada, the type from Carolina.

Tree, sometimes 12 meters high, the trunk up to 60 cm. in diameter, usually compressed or fluted, the bark thin, smooth, grayish; leaves oblong-ovate, acuminate; staminate catkins 2 to 3 cm. long; wood hard, light brown, very difficult to work, its specific gravity about 0.73. "Lechillo," "palo silo," "palo barranco" (Michoacán, *Altamirano*).

Carpinus caroliniana tropicalis is a form with more copious pubescence than the type. Both forms of the American hornbeam occur in Mexico.