

Map of the region of the Río de Bavispe, northeastern Sonora, Mexico. For details see pages 296 and 297. The numbered stations may be identified as follows:

1. Western foothills of the Sierra de la Cabellera.
2. Mesa de las Carreras.
3. La Vega Azul.
4. Agua Zarca.
5. Molino Quemado.
6. Rancho del Cumarito.
7. La Fiebre, Cañón de la Palomita.
8. La Matancita.
9. Rancho de Cruz Díaz.
10. Rancho de Ortiz.
11. Puerto de los Aseraderos.
12. Cañón International.
13. Cañón de Santa Rosa.

# LLOYDIA

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## The Vegetation and Flora of the Region of the Río de Bavispe in Northeastern Sonora, Mexico\*

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### INTRODUCTION

The present study of the botanical features of the region of the Río de Bavispe, one of the larger tributaries of the Río Yaqui, was undertaken to advance our knowledge of an area which, to quote Mearns (27): "to this day . . . remains the principal *terra incognita* of Mexico . . . certain to yield many new species of plants and animals when its exploration becomes possible." Whether this is the principal *terra incognita* of all Mexico may well be questioned, but it certainly is one of the least known regions of the north Mexican border.

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In the following pages an attempt will be made to describe the salient features of the vegetation, and to delineate the relationships of the flora. It is hoped that this treatment will partially fill the gap which has long existed in our knowledge of the vegetation of northwestern Mexico. The desert regions of Sonora on the west, and of Chihuahua on the east, are fairly well known, but up to now northeastern Sonora (for that matter practically all of the eastern part of the state) has been almost completely neglected by botanists.

#### PREVIOUS EXPLORATIONS IN NORTHEASTERN SONORA

The period of Spanish explorations in what is now the state of Sonora began in 1533 when Diego de Guzman reached the lower Río Yaqui from the south.<sup>1</sup> Two or three years later Alvar Núñez Cabeza de Vaca, after an overland trip from the Texas coast, arrived at an Indian village, which he called "Corazones," situated on the upper reaches of either the Río Yaqui or Río Sonora. He was the first European to see this part of Sonora, as well as the territory through which he had just traveled. There followed a number of expeditions to the north, some of them reaching the Gila River, and at the same time missions and settlements were being established. The first mission in Sonora was founded among the Mayo Indians in 1613. Missionaries entered the upper Yaqui territory in 1617, and in 1638 Padre Bartolomé Castaño began his residence among the Opata Indians. About 1640 the Franciscan friars reached Bavispe, and perhaps other towns on the Río de Bavispe. Oposura (Moctezuma) was founded in 1640. The church of Bacadé-huachi was built sometime before 1655.

The first English description of Sonora appears to be that of Hardy (16), who traveled over much of Mexico during the years 1825-27. Scarcely any mention is made of the vegetation although in his "general outline" of the province of Sonora he lists the principal plant products as follows:

"The soil produces wheat, maize, beans, sugar, cotton, cardons, pines, aspin, seven or eight species of oak, chino, mesquite, willow, poplar, ash, palofierro, guayacán, palobrazil, tisota, tesita, pitch-tree, palo blanco, paloverde, palo axtac, palo guavavillo, and lignum vitae. Add copal, palo samóca, which produces the gomilla, or gum of California, chestnut, walnut, cherry, peach, apple, pear, orange and grape.

"Of herbs there is also a great variety, among which are senna and jalap.

"Of resins there is a good kind obtained from the petaya (a species of cactus), which, when mixed with tallow, makes a good tar for ships, gum arabic, dragon's blood, gum lac, cooutchouc, which the Indians dissolve in the juice of the higuerilla (the shrub which produces castor oil). There are several fragrant gums besides copal."

In his record of travels through northeastern Sonora Hardy mentions the presence of oaks and grass at "Guepare" (probably the Huépari of this paper), and at Peñulas, Chihuahua, a short distance beyond Carretas, he found oak, walnut, and wild cherry.

Hardy derives the name Bavispe from the Opata "babipa" which he states means "the point where the river takes a new course." This interpretation is based on a mistaken notion as to the location of Bavispe,

<sup>1</sup>Data for this sketch of the early Spanish explorations are largely taken from Bancroft (2) and Bandelier (3).

for his map, as well as some earlier ones, shows Bavispe in the position that Colonia Oaxaca now occupies. Here the river does take a new course, to the westward, but at Bavispe there is no change of course. Although not giving us any clue to the meaning of the word, Bandelier (3) makes it clear that the name comes from a group of Opata Indians known as "Bapispes." Similarly other towns in this region took their name from various groups of the Opatas, e.g., Guásabas or Huásabas (Buasdabas), Cumpas (Cumupas), Nacozari (Nacosuras) and Ures (Hures).

Real botanical knowledge of northern Sonora began with the Mexican Boundary Survey of 1848 (52). Six botanists were attached to the surveying parties, but at this date only the steps of Thurber can be traced in detail (for part of the survey period) thanks to Bartlett's journal (4). The travels of Wright in southwestern United States have been summarized by Wooten (62). The itineraries of the other botanists, Parry, Bigelow, E. K. Smith and Schott, are so obscure that even Rodgers (33, 34) and Waller (58), writers on the botany and botanists of this period, do not attempt to trace them. Nevertheless, it is evident from Torrey's "Botany of the Boundary" (52) that all of them collected in Guadalupe Canyon and Pass in extreme northeastern Sonora, near the Arizona-New Mexico boundary, and at Santa Cruz in north central Sonora.

Returning to Thurber, his collections were made along his route from Guadalupe Canyon westward to near the present location of Agua Prieta, and thence to Fronteras, Mábari and Arizpe. He returned to the Copper Mines in New Mexico, his original starting point, by the same route. Later, on a trip eastward from California, he passed through Santa Cruz, San Bernardino, and again through Guadalupe Canyon.

In an effort to determine which of the many Sonora localities given in the "Botany of the Boundary" are in the area treated here it was necessary to spend considerable time identifying all the place names credited to this state. Places located in northeastern Sonora are the following: Guadalupe Canyon and Pass (also partly in Arizona and New Mexico), San Bernardino, Fronteras, Mábari (spelled Mababi and Mabibi by Torrey) and Blackwater Creek (Agua Prieta).

A number of places, mistakenly assigned to Sonora by Torrey, are actually in Arizona, New Mexico, Chihuahua or even Texas. Below is a list of these places with the correct or probable location indicated:

<i>Sonora Place Name as Given by Torrey</i>	<i>Actual or Probable Location</i>
Janos, or Yanos.....	Janos, Chihuahua
Sierra de los Tanos.....	Probably Sierra de los Janos, Chih.
Las Playas.....	Las Playas, New Mexico
Piloncilla.....	Sugar Loaf Mountain, Arizona
Puerto del Paisano.....	Probably near Paisano, Texas
Tubac.....	Tubac, Arizona
Sonoita (Wright's locality).....	Sonoita, Arizona, south of Tucson
San Francisco Springs.....	Ojo de San Francisco, in extreme northwestern Chihuahua
Bufotillo Ranch.....	Probably Bofecilla Ranch, Texas
Babocomori.....	Babocomori, Arizona
Babuquibari.....	Babuquibari, Arizona
Las Animas.....	Las Animas, New Mexico
Socosso.....	Probably Socorro, Chihuahua, southeast of Ciudad Juárez. This locality is shown on Bartlett's map (4).

The following localities I have been unable to identify: El Podrero (Potrero?), San Esteban (possibly in Texas), Táscale, Agua Zarca, Sierra de Nayos, Camp Tezotat and Punta de Agua.

After the first boundary survey no further scientific investigations were carried out in northern Sonora until the entry of Bandelier in 1880 for the purpose of making ethnological studies (3). In his introduction he gives a brief and general outline of the topography, geology, climate, flora and fauna of the area with which he was concerned, i.e., New Mexico, Arizona, Sonora and Chihuahua. A valuable feature of his book is the copious use of quotations from the records of the early Spanish chroniclers, many of them in manuscript form and not readily accessible.

A few notes on the nature of the country along the San Bernardino and upper Bavispe Rivers are given by Rourke (6), who in 1883 accompanied Gen. Crook's expedition into Sonora and Chihuahua in pursuit of the Apache Indians.

In 1890 the Lumholtz archaeological expedition left Bisbee, Arizona, and passed through the Sonoran towns of Fronteras, Cochuta, Oputo, Guásabas, Bacadéhuachi and Nácori en route to the highlands of western Chihuahua (24). From here the expedition turned southward and finally reached Mexico City. Considering that two botanists, Hartman and Lloyd, accompanied Lumholtz, surprisingly little botanical information resulted from these explorations. Lumholtz himself paid scant attention to the vegetation, and the only strictly botanical publication on the collections of Hartman and Lloyd is a paper by Robinson and Fernald (31) devoted mainly to descriptions of new species.

Two years after Lumholtz and his party had passed into Chihuahua, Mearns of the second Mexican Boundary Survey was gathering materials for what was to be the second important contribution to the botany of northeastern Sonora, although his activities were necessarily confined to the immediate vicinity of the boundary. Mearns' primary interest was the mammals of the region, but he recognized the importance of presenting as complete an account as possible of their environment. His "Mammals of the Mexican Boundary of the United States" (27) is as a result the first coherent account of the vegetation of the border. He devotes several pages to the "general character of the region explored" and to the "flora of the Mexican boundary region"; in addition he gives lists of plants found at his collecting stations, all of which are carefully located with reference to towns, boundary markers or unmistakable topographic features. Unfortunately, Mearns gave little attention to strictly herbaceous plants; and grasses, which are of prime importance throughout the southwest, are scarcely mentioned.

On the border immediately north of the Río de Bavispe Mearns collected in the San Luis Mountains, on the Sonora-Chihuahua boundary; at the head of the "right fork of the Cajón Bonito Creek," a tributary of the San Bernardino; Animas Valley; Hall's Ranch; Guadalupe Canyon; near the mouth of Cajón Bonito Creek; Agua Prieta Ranch; Piedras Negras and Sulphur Spring Valley.

In the adjoining portion of Chihuahua, E. W. Nelson, E. A. Goldman and Townsend and Barber collected in the vicinity of Casas Grandes and some of the Mormon colonies during the years 1898 and 1899.

Marcus E. Jones worked in this same area in 1903. Finally, Harde La Sueur, about a decade ago, explored much of northern Chihuahua, and his observations were published in 1945 (22). According to his own statement, however, he did not visit any part of northwestern Chihuahua except Las Palomas.

#### PRESENT EXPLORATIONS

My field work in northeastern Sonora began in the summer of 1938 when I accompanied Dr. Ralph W. Imlay, then of the University of Michigan Museums, who was engaged in making a paleogeographical survey of the area. Collections were made in the vicinity of Moctezuma, Colonia Oaxaca, Cañón de Santa Rosa, Arroyo del Púlpito, and Carretas, Chihuahua on the Sonora border. In 1939 I was accompanied by LeRoy H. Harvey, who was interested primarily in securing materials for his forthcoming monograph of the genus *Eragrostis*; most of the summer was spent in Texas, Nuevo León, Coahuila and Chihuahua, and only the first two weeks of September were allotted to collecting in Sonora. This period was spent at Huépari, between Oputo and Huachinera. The collections made in other states, except those of Carretas, Chihuahua, are not included in this report.

The third field trip, in 1940, was made in company with Edwin Allen Phillips, who devoted most of his time to the collection of bryophytes.<sup>2</sup> The area covered on this trip extends from Bavispe and Huachinera westward to Las Tierritas and Oputo; in addition a rapid reconnaissance survey was made from Oputo southward to Guásabas and then eastward to Bacadéhuachi and northeastward to Huachinera. Extremely dry conditions prevailed at the time of this survey, and collections were made only at Aguaje de Bacatejaca, La Palmita and La Galera. Within the Bavispe River area proper, however, some of the larger canyons of the eastern slopes of the Sierra del Tigre were thoroughly explored, as well as the pine land in the vicinity of Las Tierritas.

José Vera Santos, an agrostologist, accompanied me on the final trip in 1941. His collections were almost exclusively grasses. The principal collecting stations this year were Agua Prieta, Hacienda de San Rafael, La Nacha, Colonia Morelos, the northern end of the Sierra del Tigre, and a portion of the Sierra de la Cabellera.

The region circumscribed by the loop of the Bavispe River, which was selected for intensive study, varies in width from 29 to 32 kms. and measures about 80 kms. in length. The total area therefore is over 2400 square kms. Although not particularly large for a phytogeographic study, the vegetation within this area presents sufficient variation (from desert to pine forest) to justify the time spent on it.

Some of our collecting stations can be reached by car, but most of our work was carried out in places far removed from automobile roads. Much of our travel was therefore on horseback, and on long trips as many as four or five pack mules were required to carry our equipment. On such trips plants as collected were dried over coals.

At all of the principal collecting stations it was my aim to secure

<sup>2</sup>The mosses are the subject of a supplementary paper being prepared by Dr. W. C. Steere.

a complete representation of the pteridophytes, gymnosperms and angiosperms growing in the locality. This led perhaps to an excessive number of collections of some of the common species, yet this practice makes it possible more readily to compare one site with another. Had this method not been followed, undoubtedly a number of species not easily distinguished in the field, as in the genus *Euphorbia*, would have been overlooked. I am confident, therefore, that few species of summer-flowering plants have been omitted, although I am well aware, as will be pointed out later, of the existence of certain plants which were not collected.

#### TOPOGRAPHY, GEOLOGY AND SOILS

The nature of the topography of northeastern Sonora can be judged by the drainage pattern. The rivers, with the exception of the Fronteras and the upper arm of the Bavispe, flow from north to south, paralleling the mountain ranges and having their sources near the international boundary or north of it. The elevation of the land increases therefore toward the headwaters of the rivers in the north and toward the Sierra Madre Occidental on the east. The highest points, however, are not located on the border but about 75 kms. south of it at the northern end of the Sierra del Tigre,<sup>3</sup> and in the adjacent portion of the Sierra Madre. North of here the country is characterized by more or less undulating plains with scattered ranges of low mountains.

The Sierra del Tigre, lying between the two arms of the Bavispe River, becomes higher and more massive northward, and ends abruptly just south of the northern bend of the river. Here there is a descent of more than 1000 m. in a distance of a little more than 5 kms. Considering that there are peaks rising to a height of nearly 2400 m. (perhaps some are even higher), deep canyons cut through solid rock (Fig. 26), and nearly everywhere a rugged terrain, it is not without reason that Bandelier (3) spoke more than once of "the formidable Sierra de Teras."

Inlay (18) has described the geological features of northeastern Sonora. In brief the rock formations represented are Quaternary conglomerates, Tertiary igneous rocks, Permian and Cretaceous limestones, and occasional outcrops of Paleozoic rocks. Lava, ash deposits and other evidences of vulcanism are widespread.

The soils are for the most part thin and stony, and those of the lowlands are practically devoid of humus. Overgrazing and consequent sheet and gully erosion are of general occurrence (Fig. 11). Along the rivers and in some of the larger canyons there are deposits of alluvium which, because they are easily irrigated, are the only lowland areas under cultivation.

In the high mountains there are a number of meadows (Fig. 14), usually rather small in size, which may once have been lakes. These meadows, with their muck soils, are sometimes cultivated.

#### CLIMATE

Brand (8) has described the climate of northwestern Chihuahua, and Turnage and Mallory (54) have analyzed that of the Sonoran desert. From these studies it is possible to outline in a general way

<sup>3</sup>Sometimes called Sierra de la Madera and Sierra de Teras.

the climatic features of northeastern Sonora. Brand has characterized the climate of northwestern Chihuahua as follows:

"The climatic complex can be described as involving low relative humidity (highest in September and least in May), intense insolation (least in December and January, most in June), excessive evaporation (over 2,000 mm. in the desert), considerable daily and seasonal temperature ranges, summer convectional rainy season with cyclonic minor maximum in December and January, prevalence of southwest winds of about 10 m.p.h. average velocity, and a generally intense light."

The above is no doubt true of northeastern Sonora, although there are no meteorological data available from this area.

According to Turnage and Mallory, the winter precipitation varies from 0 to 125 mm., and the summer precipitation from 250 to 380 mm.; thus the rainfall is at least twice as heavy in summer as in winter. They do not state to what elevations these values apply, but the upper limit apparently is not much above 1200 m. Douglas, Arizona, at approximately 1200 m. elevation, has an average annual precipitation of 324 mm. (55).

From the temperature records of southeastern Arizona, southwestern New Mexico (55) and northwestern Chihuahua (8), it is evident that none of these areas is free of annual frosts. How far south the zone of annual frosts extends (considering here only low elevations) is uncertain, but Haurwitz and Austin (17), without giving the source of their information, state that the average annual temperature extremes at Ures, Sonora (elevation 430 m.) are 0.6° and 42.7° C. This would indicate that frosts are not unusual there, even though they may not be an annual occurrence. During the exceptional cold wave of 1937 frost was reported as far south as Cedros (53).

It appears safe to conclude, therefore, that frosts are an annual occurrence throughout northeastern Sonora. Judging by the data for southeastern Arizona and southwestern New Mexico (55), the length of the frost-free period probably varies from 200 to 230 days, according to elevation. As LeSueur (22) has pointed out, however, the initiation of plant growth is quite as dependent on the beginning of the rainy season as on the cessation of frost, and the growing season may be reduced to as little as 90 days.

In his map of the dry climates of the United States, Russell (35) classifies the climate of southeastern Arizona and southwestern New Mexico as BWhw (hot desert with dry winters) with islands of BShw (hot steppe with dry winters). This is a much broader concept of a desert than is held by Shreve (44) and other students of desert vegetation. A small vegetation map presented in the same paper, although used to illustrate another matter, describes this area as "grasslands and forests;" this in itself would indicate that his definition of a desert is too inclusive.

More nearly conforming to the types of vegetation is Brand's map of the climates of northwestern Chihuahua and adjacent Sonora (8). The climates are here classified according to Koppen's system. In general Brand gives each type of climate a more humid classification compared to Russell's system, i.e., some of Russell's desert areas become steppe (BShw) and steppe becomes warm temperate rainy climate (Cw).

In a later study of the dry climates of the United States Russell (36) presents evidence that in southern Arizona and New Mexico "desert years" occur about as frequently as "dry years" and therefore a close approach to desert conditions is to be expected. This is indeed true in northeastern Sonora, as will be brought out more fully in the discussion of the vegetation.

Three principal types of vegetation may be recognized in northeastern Sonora: mesquite-grassland, oak-grassland and pine forest. To summarize the climatic features of these types the following table presents their approximate altitudinal ranges, estimated average annual precipitation and mean annual temperature, and the corresponding climatic symbol, using Koppen's classification. These figures are meant to apply particularly to the Sierra del Tigre.

Type of Vegetation	Vertical Range	Av. Ann. Precip.	Mean Ann. Temp.	Climatic Symbol
Mesquite-grassland.....	below 1100 m.	250-350 mm.	18-20 ° C.	BShw.
Oak-grassland.....	1100-1800	350-475	12-18	BShw
Pine forest.....	above 1800	475-650*	8-12	Cw

\*Both Brand (8) and LeSueur (22) estimate that in places the average annual precipitation in the pine forest may reach 800 mm.

#### VEGETATION

The Bavispe River area, as well as the surrounding territory, lies within the Apachian biotic province as defined by Dice (11), who recognizes four life zones: desert, arid grassland, encinal (oak-woodland), and a montane belt consisting mainly of pine forests. The last three of these are present in the vicinity of the loop of the Bavispe River; each is discussed below under the headings Mesquite-grassland, Oak-grassland and Pine forest. The desert zone, which might well be recognized, occupies a relatively small area along the lower river valley, and is therefore treated as a desert community within the mesquite-grassland.

The altitudinal limits of the vegetational zones were presented in the section on climate. These are meant to apply only to the Sierra del Tigre and the areas lying immediately to the east and west. Farther north the limits are shifted upwards, an effect, apparently, of the lack of mountains high enough to intercept and cool moisture-laden winds. Thus in the Sierra de la Cabellera the mesquite-grassland persists to an altitude of more than 1200 m., and at 1830 m. there is not a trace of pine forest, although in the Sierra del Tigre the pine forest is well developed at this altitude.

#### *Mesquite-Grassland*

This is the most extensive association of northeastern Sonora. As Brand (7) has mapped it, it reaches in the northern half of the state from the Sierra Madre westward to near the position of the Southern Pacific Railway; toward the south it gradually becomes narrower and reaches its limit near Ciudad Obregón. In the Bavispe River area the

mesquite-grassland forms a narrow band along the river as far as Huachinera (see map), being confined on the east between the Sierra Madre and the Sierra del Tigre, and on the west between the latter range and the Sierra de Oposura. Northward, however, it continues in an unbroken stretch to the United States border.

In composition the mesquite-grassland correspond rather closely to what Nichol has called in Arizona "Desertland grass" (29). The commonest and most conspicuous plants in this type of vegetation are *Prosopis chilensis*, *Larrea divaricata*, *Acacia constricta*, *Fouquieria splendens* and various species of *Opuntia* and other cacti. With the exception of *Larrea*, which does not extend south of the Bavispe River,<sup>4</sup> these plants are to be found throughout the mesquite-grassland, although their relative abundance and minor associates vary from place to place. Widespread but less common shrubs are *Celtis pallida*, *Rhus microphylla*, *Condalia lycioides*, *Ephedra trifurca*, *Jatropha cardophylla*, *Parthenium incanum*, *Seloa glutinosa*, and various Acalyphas and Crotons.

The species of herbaceous plants, including grasses, are numerous, yet they rarely form a complete ground cover. The densest herbaceous vegetation is found in the shade of mesquite and other trees and shrubs, and as these are widely spaced, except on alluvial land, there is much bare ground even in the rainy season.

The principal grasses of the mesquite-grassland are *Sporobolus Wrightii* (Fig. 15), *Hilaria mutica*, *H. Belangeri*, *Aristida Adscensionis*, several Boutelouas, especially *B. Rothrockii*, *Echinochloa colonum*, *Cynodon Dactylon*, *Cenchrus pauciflorus*, *Digitaria sanguinalis*, *Muhlenbergia Porteri*, *Pappophorum Wrightii*, *Setaria macrosyachya*, *Triodia mutica* and *T. pulchella*. Other herbaceous plants are mostly members of the *Compositae*, *Euphorbiaceae*, *Malvaceae* and *Nyctaginaceae*; it is scarcely necessary to add that there is no lack of chenopodiums, amaranths and other weeds common to inhabited places.

An account of the different habitats within the mesquite-grassland can be most conveniently given by describing in detail one of the most important collecting stations, with references to conditions in other places.

The most extensive collections of the lowland vegetation were made in the vicinity of Colonia Morelas. This village, like Colonia Oaxaca farther east, was founded by the Mormons some time prior to 1890, and was abandoned by its founders about 1910 as a consequence of the Mexican Revolution. The substantial brick houses of the Mormons, which are still standing, make a strange contrast with the adobe buildings found in typical Mexican villages.

Colonia Morelos, with a population of perhaps 800, is located at the confluence of the Bavispe and San Bernardino<sup>5</sup> Rivers and has an elevation of 795 m. Immediately to the south lies the abrupt northern

<sup>4</sup>Dr. W. J. Spencer, a resident of Bacerac, has informed me in a personal communication that creosote bush is present near that village. This is probably an isolated colony, for I failed to find it on several trips through the area. It is not present at Colonia Oaxaca, Bavispe or Huachinera, where I spent considerable time.

<sup>5</sup>Locally called "Rio Batepi" (raccoon).

end of the Sierra del Tigre which in a distance of a few kilometers rises to a height of more than 2100 m. About 16 km. to the east one encounters the lower and more arid Sierra de la Cabellera which, in the places visited at least, barely reaches an elevation of 1840 m.

The concentration of human settlement along the river valley has brought about considerable modification of the natural vegetation through agriculture, grazing and the cutting of mesquite and other trees for fuel and construction. These activities, carried on without any thought of conservation, inevitably bring about deterioration of the soil, and the natural landscape therefore acquires a more arid aspect than one would expect from the climatic conditions.

Near Colonia Morelos the principal habitats are the alluvial flats near the river, the more elevated *Larrea* plains, cactus plains, and finally the transition to the oak-grassland. Each of these is described below.

*Plants of the Alluvial Flats.*—The riparian vegetation will be discussed below. Away from the immediate shore line, and generally above the high-water mark during flood times, there is a narrow strip of nearly level alluvial land bordering the north bank of the Río de Bavispe and the east bank of the Río San Bernardino. It is here that the mesquite is most abundant, and when left undisturbed it forms dense thickets with a canopy 5 or more meters high. In 1941 Santos and I had an opportunity to study a mesquite thicket which for a number of years had been fenced off and protected from animals and wood-cutters. This area undoubtedly represented the closest approach to the natural vegetation on this type of habitat that could be found in the vicinity.

The only tree of importance is *Prosopis*. In small clearings *Sambucus coerulea*, *Celtis reticulata*, *Acacia Greggii*, *Cercidium praecox*, *Lycium Andersonii*, *L. Torreyi* and *Condalia spathulata* may occur. The *Sambucus* and *Celtis* reach a height of 8 m. or more and thus overtop the average mesquite, but they are not numerous enough to be considered a dominant, or even prominent, element of the vegetation. *Lycium*, *Condalia* and *Acacia* occur only sporadically in the mesquital, as they are more characteristic of dry rocky hillsides.

The herbaceous ground cover is composed mainly of sun-loving species, and the greatest variety of plants is to be found in the clearings.

Plants characteristic of the shady areas are:

*Rivinia humilis*  
*Acalypha ostryaefolia*  
*Ayenia pusilla*

*Verbena carolina*  
*Ruellia nudiflora* var. *glabrata*  
*Tetramerium hispidum*

Other plants of the alluvial land are:

*Bouteloua Rothrockii*  
*Digitaria sanguinalis*  
*Echinochloa colonum*  
*E. Crus-galli* var. *mitis*  
*Leptochloa filiformis*  
*Paspalum distichum*  
*Setaria Grisebachii*  
*S. macrostachya*  
*Chenopodium* spp.  
*Amaranthus Palmeri*

*Tidestromia lanuginosa*  
*Allionia incarnata*  
*Boerhaavia caribea*  
*B. Coulteri*  
*Portulaca retusa*  
*Cassia leptadenia*  
*Phaseolus heterophyllus*  
*Rhynchosia texana*  
*Kallstroemia californica*  
*Tribulus terrestris*

<i>Janusia gracilis</i>	<i>Opuntia</i> spp.
<i>Croton texensis</i>	<i>Haplophyton cimicidum</i>
<i>Ditaxis serrata</i>	<i>Evolvulus alsinoides</i>
<i>Bidens pilosa</i>	<i>Ipomoea desertorum</i>
<i>Helianthus annuus</i>	<i>Marrubium vulgare</i>
<i>Euphorbia dentata</i> var. <i>cuphosperma</i>	<i>Datura meteloides</i>
<i>E. hyssopifolia</i>	<i>D. quercifolia</i>
<i>E. revoluta</i>	<i>Physalis Wrightii</i>
<i>Abutilon californicum</i>	<i>Solanum elaeagnifolium</i>
<i>A. Pringlei</i>	<i>Martynia fragrans</i>
<i>Sida procumbens</i>	<i>Cucurbita digitata</i>
<i>Sphaeralcea laxa</i>	<i>C. foetidissima</i>
<i>Mentzelia multiflora</i>	<i>Arctium Lappa</i>
<i>Echinocereus rigidissimus</i>	<i>Pectis linifolia</i>
<i>Mammillaria</i> spp.	<i>Verbesina encelioides</i>
	<i>Viguiera dentata</i>

*Evolvulus alsinoides* and *Ayenia pusilla* apparently are here at the lower limit of their vertical range, for all other collections were made at higher elevations, principally in the oak-grassland.

The only vines collected in this mesquital are *Clematis Drummondii*, *Passiflora mexicana*, *Vitis cinera*, *Cocculus diversifolius*, *Sarcostemma heterophylla* and *Echinopepon Wrightii*.

Plants observed in this area, but not collected, are: *Cuscuta* sp., growing on *Amaranthus*; *Phoradendron* sp., on *Prosopis* and *Populus*, and *Mirabilis Wrightiana*.

On the banks of an irrigation ditch which runs through the mesquital there are a number of plants characteristic of the riparian vegetation. These are: *Salix Gooddingii* var. *vallicola*, *Populus Fremontii*, *Nicotiana glauca*, *Baccharis glutinosa*, *Ambrosia aptera* and *Polygonum lapathifolium*.

The differences between this protected mesquital and those which have suffered from grazing and deforestation lie not so much in the species present in the two areas, although shade-loving plants are rare or absent where the trees have been cut, as in the density of the vegetation and the proportion of weeds. In unprotected places the stature of woody plants is low, as all large trees are immediately cut for fuel. Grasses are lacking, and other herbaceous plants are of a weedy character, such as *Solanum elaeagnifolium*, *Allionia incarnata*, *Boerhaavia* spp., *Datura* spp. and *Cucurbita foetidissima*.

*Plants of the Larrea Plains*.—To the north and west of Colonia Morelos, and also for a short distance eastward, the *Larrea* association dominates the landscape. Some portions of this area are relatively flat, but a rolling to rugged topography prevails, although generally with little relief. In traveling from Agua Prieta southward to Fronteras, and southeastward to Colonia Morelos one sees vast stretches of a monotonous vegetation consisting of *Larrea*, *Fouquieria splendens*, *Prosopis*, *Acacia constricta* and a number of minor species.

Although Shreve (44) places the eastern border of the Sonoran Desert near Arizpe and Moctezuma, the vegetation of the *Larrea* and cactus plains (the latter to be described below) has a strong desert aspect. This is to be expected since there exists a direct connection, through the lower Bavispe valley, with the desert area south of Moctezuma.

Besides the plants mentioned above, the following, considered by Shreve (41) to belong to the desert, occur on the *Larrea* and cactus plains:

<i>Celtis pallida</i>	<i>Fouquieria Macdougallii</i>
<i>Atriplex canescens</i>	<i>Lemaireocereus Thurberi</i>
<i>Acacia Greggii</i>	<i>Lycium Andersonii</i>
<i>Jatropha cardiosyphilla</i>	<i>Bebbia juncea</i>
<i>Condalia spathulata</i>	<i>Encelia farinosa</i>
	<i>Hymenoclea monogyra</i>

Other woody plants found here, some of them also associated with desert conditions, are: *Koeberlinia spinosa* (Fig. 10), *Condalia lycioides*, *Parthenium incanum*, *Rhus microphylla*, *Chilopsis linearis*, *Lippia Wrightii*, *Hibiscus denudatus* var. *involutellatus*, *H. Coulteri*, *Coldenia canescens*, *Menodora scabra*, *Polygala macradenia* and *Krameria parvifolia*.

During the rainy season a surprising number of herbaceous species are found in the *Larrea* association. Below is a list of the herbaceous and suffrutescent plants collected:

<i>Notholaena sinuata</i> var. <i>integerimma</i>	<i>Dalea mollis</i>
<i>Aristida ternipes</i>	<i>D. Parryi</i>
<i>Bouteloua barbata</i>	<i>Phaseolus</i> sp.
<i>B. curtipendula</i>	<i>Janusia gracilis</i>
<i>B. filiformis</i>	<i>Croton corymbulosus</i>
<i>B. hirsuta</i>	<i>Ditaxis neomexicana</i>
<i>B. Rothrockii</i>	<i>D. serrata</i>
<i>Cynodon Dactylon</i>	<i>Euphorbia capitellata</i>
<i>Eragrostis cilianensis</i>	<i>E. florida</i>
<i>E. pectinacea</i>	<i>Abutilon incanum</i>
<i>Muhlenbergia Porteri</i>	<i>Sphaeralcea Fendleri</i>
<i>Panicum fasciculatum</i> var. <i>reticulatum</i>	<i>Cereus Greggii</i> (Fig. 16)
<i>P. hirticaule</i>	<i>Mammillaria</i> sp.
<i>Pappophorum Wrightii</i>	<i>Opuntia</i> sp.
<i>Setaria Grisebachii</i>	<i>Ipomoea leptotoma</i>
<i>Sporobolus cryptandrus</i>	<i>Quamoclit coccinea</i>
<i>Triodia mutica</i>	<i>Q. coccinea</i> var. <i>hederifolia</i>
<i>T. pulchella</i>	<i>Chamaesaracha Coronopus</i>
<i>Eriogonum Abertianum</i>	<i>Martynia althaeifolia</i>
<i>Allionia incarnata</i>	<i>Siphonoglossa longiflora</i>
<i>Boerhaavia spicata</i>	<i>Cucurbita digitata</i>
<i>Molluga verticillata</i>	<i>Aster spinosus</i>
<i>Cassia Covesii</i>	<i>Brickellia Coulteri</i>
<i>C. leptocarpa</i>	<i>Franseria tenuifolia</i>
<i>Calliandra eriophylla</i>	<i>Gutierrezia lucida</i>
<i>G. microcephala</i>	<i>Iva ambrosiaeefolia</i>
<i>Haplopappus gracilis</i>	<i>Melampodium cinereum</i>
	<i>Zinnia pumila</i>

Worthy of mention is the following group of plants found, in the vicinity of Colonia Morelos, only at Puerto del Molino Quemado, a rocky hill with an elevation of 1000 m.:

<i>Ephedra trifurca</i>	<i>Eysenhardtia orthocarpa</i>
<i>Phaulothamnus spinescens</i>	<i>Nissolia Schottii</i>
<i>Acacia millefolia</i>	<i>Dodonaea viscosa</i>
	<i>Lycium Berlandieri</i>

This is the only station for this species of *Lycium*, and the *Phaulothamnus* was found elsewhere only at Tonibabi.

*Plants of the Cactus Plains.*—This is a minor subdivision of the mesquite-grassland, confined to the low river valley from Colonia

Morelos southward. This and the *Larrea* plains constitute the desert community of the Bavispe River region.

La Vega Azul (elev. 760 m.), on the south side of the river and southwest of Colonia Morelos, may be considered the northern end of the cactus plains. It is sharply set off from the *Larrea* plains on the north by the complete absence of *Larrea*, and by a greater abundance of various cacti, of which *Opuntia fulgida* (Fig. 18) is the most numerous. *Opuntia spinosior* (Fig. 22) and other species of the genus are also present, and the genera *Echinocereus*, *Cereus*, *Mammillaria* and perhaps others are also represented.

South of San Juan del Río *Lemaireocereus Thurberi* (Fig. 16) becomes common, reminding one of the sahuaro forest of Arizona. *Fouquieria Macdougalii*, *Bumelia occidentalis* and *Sapium bilobulare*, whose distribution lies mainly to the west and south, are associated with the pitaya, and the Bavispe River valley is probably their eastern limit.

Our southernmost collections were made along the trail between Guásabas and Bacadéhuachi. This trail defines almost exactly the northernmost extension of the Sinaloan avifaunal province as mapped by van Rossem (56). Although the thorn forest of the Sinaloa lowlands is not developed here (Fig. 33 perhaps represents an approach to it), some of the plants collected at Aguaje de Bacatejaca and La Palmita, as well as at Moctezuma and Tonibabi, clearly proclaim the beginnings of a different biotic province. The following plants of the Sinaloan province apparently have their northern limits at this latitude:

<i>Ficus petiolaris</i>	<i>Stemmadenia tomentosa</i> var. <i>Palmeri</i>
<i>Acacia pennatula</i>	<i>Ipomoea aborescens</i>
<i>Esenbeckia Hartmanii</i>	<i>Palo del astra</i> <sup>a</sup>
<i>Ceiba acuminata</i>	<i>Parthenium Stramonium</i>

The following plants are also members of the Sinaloan vegetation (42), and their northernmost stations in the Bavispe River area, according to our collections, are as indicated:

<i>Phaulothamnus spinescens</i> .....	Colonia Morelos
<i>Acacia cymbispina</i> .....	Huépari
<i>Lysiloma microphylla</i> .....	Cafión del Agua Amarga
<i>Mascagnia macroptera</i> .....	Cafión de Santa Rosa
<i>Lagascea decipiens</i> .....	Cafión del Carricito (a branch of the Estacas)

All of these Sinaloan plants are rare in the Bavispe region, as is to be expected at the periphery of their geographical range.

*Upper Limits of the Mesquite-Grassland*.—Colonia Oaxaca, at an elevation of 915 m., may be taken as the upper limit of the desert conditions prevailing in the lower river valley. From this point southward to Huachinera (elev. approximately 1000 m.) *Larrea* is absent, *Fouquieria* diminishes in numbers, and *Prosopis* acquires a number of new associates, including: *Eysenhardtia orthocarpa*, *Mimosa biuncifera*, *M. laxiflora*, *M. Wrightii*, *Erythrina flabelliformis*, *Celtis reticulata*, *Rhus virens*, *Dodonaea viscosa*, *Tecoma incisa* and many grasses and herbs. A quite complete ground cover makes a favorable contrast with the expanses of bare ground at lower elevations, and is a good indication

<sup>a</sup>Not collected. According to Martínez (25) and Standley (47) this is *Cordia Sonorae* Rose.

of ameliorated moisture conditions. On the western slopes of the Sierra del Tigre *Washingtonia Sonorae* occurs sporadically (Fig. 21).

At 1000 m. the first oaks and junipers appear, marking the beginning of the oak-grassland. Of the eleven species of oak found in the area, only *Quercus chihuahuensis* is regularly present at this elevation, but *Q. Toumeyi* may also occur.

#### Oak-Grassland

This association begins at an elevation of approximately 1100 m. and continues upward to about 1800 m. Within the loop of the Bavispe River the oak-grassland forms a narrow band above the mesquite zone, varying in width from 4 or 5 kilometers in the north to about 15 kilometers in the south. Unlike the lowland regions, where only the largest canyons have a permanent stream of water, in this zone many of the lesser water courses, if dry at all, become so only at the end of the dry season.

The beginning of the oak zone may be recognized by the appearance of *Quercus chihuahuensis* along the waterways and northeast slopes (Fig. 13). *Prosopis* and *Fouquieria* may still persist at this elevation (Fig. 12), but extend little above it. With increasing altitude other oaks, principally *Q. arizonica* and *Q. Emoryi*, appear and extend their domain to an ever greater extent over the hillsides. At 1300 m. as many as six species of oak can be found growing together. Scattered pine trees (*Pinus arizonica*, *P. cembroides*, *P. chihuahuana* and *P. ponderosa*) are first seen at about 1525 m (Fig. 23), and they rapidly increase in numbers until at 1800 m. their dominance over other trees marks the beginning of the pine forest.

The oak-grassland is relatively uniform throughout its extent; it lacks such diversities in composition and physiognomy as are presented in the lowland areas by the mesquite thickets and *Larrea* and cactus plains. The oaks which are consistently present, besides the three already mentioned, are *Q. oblongifolia*, *Q. viminea* and *Q. hypoleucoides*. *Q. Toumeyi* is not so regularly found, but where present it may form dense thickets which give it the vernacular name of "encino chaparro". Other trees associated with the oaks are:

*Juniperus Deppeana* var. *pachyphloea*  
*J. flaccida*  
*Prunus virens*  
*Erythrina flabelliformis*

*Lysiloma microphylla*  
*L. Watsoni*  
*Sapindus Saponaria*  
*Fraxinus Greggii*

The following shrubs are the most common ones of the oak-grassland. Those preceded by an \* show a preference for moist shady places:

<i>Cassia leptocarpa</i>	<i>Gossypium Thurberi</i>
<i>Eysenhardtia orthocarpa</i>	<i>Hibiscus Coulteri</i>
<i>Mimosa Wrightii</i>	<i>Zauschneria arizonica</i>
<i>Acalypha papillosa</i>	* <i>Mandevilla foliosa</i>
<i>Manihot angustiloba</i>	* <i>Macrosiphonia brachysiphon</i>
<i>Rhus choriophylla</i>	<i>Tecoma incisa</i>
<i>Dodonaea viscosa</i>	* <i>Bouvardia glaberrima</i>
* <i>Rhamnus betulaefolia</i>	<i>Randia Watsoni</i>

*Dasyliion* (Fig. 12) and *Agave* (Fig. 20) are also common.

In the oak-grassland the grasses make their finest display, especially at elevations of 1300 to 1500 m. (Figs. 19, 12, and 13). Extensive

grassy plains, affording excellent grazing, exist at Carretas, La Nacha, and to a lesser degree at Huépari and Piedra Parada. Numerous species grow on these plains, but the most important ones belong to the genera *Bouteloua*, *Muhlenbergia* and *Aristida*. A partial list of the grasses collected at these four places, chiefly by Harvey and Santos, reveals the richness of the grass flora:

<i>Aegopogon tenellus</i>	<i>Eriochloa aristata</i>
<i>Andropogon barbinodis</i>	<i>Heteropogon contortus</i>
<i>A. cirratus</i>	<i>H. melanocarpus</i>
<i>Aristida Adscensionis</i>	<i>Leptochloa filiformis</i>
<i>A. Schiedeana</i>	<i>Lycurus phleoides</i>
<i>A. ternipes</i>	<i>Muhlenbergia arizonica</i>
<i>Bouteloua aristidoides</i>	<i>M. ciliata</i>
<i>B. chondrosioides</i>	<i>M. Emmerleyi</i>
<i>B. curtipendula</i>	<i>M. monticola</i>
<i>B. glandulosa</i>	<i>M. pauciflora</i>
<i>B. hirsuta</i>	<i>M. texana</i>
<i>B. radicans</i>	<i>Panicum bulbosum</i>
<i>B. Rothrockii</i>	<i>P. dichotomiflorum</i>
<i>Bromus frondosus</i>	<i>P. hirticaule</i>
<i>Chloris virgata</i>	<i>Pappophorum Wrightii</i>
<i>Echinochloa colonum</i>	<i>Setaria Grisebachii</i>
<i>Elyonurus barbicularis</i>	<i>S. macrostachya</i>
<i>Eragrostis cilianensis</i>	<i>Sporobolus microspermus</i>
<i>E. diffusa</i>	<i>Trachypogon Montufari</i>
<i>E. intermedia</i>	<i>Trichachne californica</i>
<i>E. neomexicana</i>	<i>T. insularis</i>
	<i>Tripsacum lanceolatum</i>

Among the herbs, other than grasses, it is to be noted that a number of families, rare or absent in the lowlands, becomes conspicuous in the oak-grassland, and many of the species which first appear in this zone extend upward into the pine forest. The most prominent of these families are the *Polypodiaceae*, *Cochlospermaceae*, *Geraniaceae*, *Labiatae* and *Scrophulariaceae*. Similarly, the herbaceous genera of the *Leguminosae* are infrequent in the lowlands, but common at higher altitudes.

Some of the more common herbs of the oak-grassland are listed below:

<i>Adiantum Capillus-Veneris</i>	<i>Clematis Drummondii</i>
<i>Asplenium Palmeri</i>	<i>Heuchera sanguinea</i>
<i>A. Trichomanes</i>	<i>Cassia leptocarpa</i>
<i>Bommeria hispida</i>	<i>C. Wrightii</i>
<i>Cheilanthes Lindheimeri</i>	<i>Crotalaria longirostrata</i>
<i>Ch. Pringlei</i>	<i>C. sagittalis</i>
<i>Selaginella rupincola</i>	<i>Dalea diffusa</i>
<i>Ch. Wrightii</i>	<i>D. Lumholtzii</i>
<i>Notholaena aurea</i>	<i>Desmodium batocaulon</i>
<i>N. Grayi</i>	<i>D. neomexicanum</i>
<i>N. sinuata</i>	<i>D. cinerascens</i>
<i>Pellaea Wrightiana</i>	<i>Lotus puberulus</i>
<i>Woodsia mexicana</i>	<i>Nissolia Schottii</i>
<i>Tillandsia recurvata</i>	<i>Phaseolus heterophyllus</i>
<i>Commelinia crispa</i>	<i>Krameria Grayi</i>
<i>Tradescantia pinetorum</i>	<i>K. parvifolia</i>
<i>Anthericum Torreyi</i>	<i>Linum neomexicanum</i>
<i>Milla biflora</i>	<i>Kallstroemia grandiflora</i>
<i>Allionia incarnata</i>	<i>Aspicarpa hirtella</i>
<i>Boerhaavia caribaea</i>	<i>Polygala hemipterocarpa</i>
<i>B. erecta</i>	<i>P. obscura</i>
<i>Portulaca suffrutescens</i>	<i>Cnidoscolus angustidens</i>

<i>Euphorbia heterophylla</i>	<i>Verbena bipinnatifida</i>
<i>E. hirta</i> var. <i>typica</i>	<i>V. ciliata</i>
<i>Jatropha macrorrhiza</i> var. <i>septemfida</i>	<i>Hedeooma oblongifolium</i>
<i>Kosteletskya Thurberi</i>	<i>Monarda austromontana</i>
<i>Ayenia pusilla</i>	<i>Stachys coccinea</i>
<i>Waltheria americana</i>	<i>Gerardia Wrightii</i>
<i>Amoreuxia palmatifida</i>	<i>Castilleja tenuiflora</i>
<i>Passiflora bryonioides</i>	<i>Houstonia Wrightii</i>
<i>Cuphea Wrightii</i>	<i>Ageratum corymbosum</i>
<i>Prionosciadium Watsoni</i>	<i>Bidens pilosa</i>
<i>Amsonia pogonosepala</i>	<i>Coreocarpus arizonicus</i> var. <i>pubescens</i>
<i>Asclepias glaucescens</i>	<i>Erigeron neomexicana</i>
<i>Gonolobus productus</i>	<i>Guardiola platyphylla</i>
<i>Evolvulus alsinoides</i>	<i>Heliotropis parvifolia</i>
<i>E. arizonicus</i>	<i>Hymenothrix Wislizeni</i>
<i>Ipomoea ancisa</i>	<i>Melampodium appendiculatum</i>
<i>I. costellata</i>	<i>Pectis prostrata</i>
<i>Gilia Pringlei</i>	<i>Zexmenia podocephala</i>
<i>Bouchea prismatica</i> var. <i>brevirostris</i>	<i>Zinnia multiflora</i>

A special habitat within the oak-grassland zone which should be mentioned is Cañón de Santa Rosa, a few kilometers east of El Tigre. Here there are limestone deposits, and among the plants collected on this site *Bumelia rigida*, *Cheilanthes leucopoda*, *Hechtia montana*, *Mortonia scabrella* and *Tragia laciniata* were found nowhere else, indicating the possibility of a soil factor limiting their distribution in this area. Except for the above six species the vegetation on limestone soil was in no way exceptional.

The highest elevation in the oak-grassland from which extensive collections are available is Rancho Carretas, Chihuahua. Although physiographically not a part of the Bavispe River system, as its drainage is toward the northeast, ending in Lake Guzmán, the vegetation is the same as that found on the west side of the Continental Divide. It is to be noted here that many of the lowland species which persist into the oak-grassland appear to reach their upper limit at this elevation (1470 m.). Some of these are:

<i>Chilopsis linearis</i>	<i>Gutierrezia lucida</i>
<i>Aster tagetinus</i>	<i>Ipomoea costellata</i>
<i>Baccharis glutinosa</i>	<i>Sphaeralcea Fendleri</i>
<i>Boerhaavia erecta</i>	<i>Datura meteloides</i>
<i>Commicarpus scandens</i>	<i>Celtis reticulata</i>

Numerous others, especially grasses, might be mentioned, but they can be identified by referring to the Table of Altitudinal Distribution in the Appendix.

The position of the Carretas grasslands is indicated on many maps by the name "Llanos de Carretas". My 1938 collections, and those of Harvey and myself of 1939, were made in the southern portion of the grassland area, in the immediate vicinity of the ranch and the Sierra Madre. The open grassland is therefore limited to the valley of the Arroyo Carretas, and the hills and mountains are covered with oak, juniper and, at high levels, pine.

Perhaps forty species of grass grow here, belonging for the most part

to the genera *Bouteloua*, *Aristida*, *Muhlenbergia* and *Eragrostis*. The commonest species are:

<i>Bouteloua gracilis</i>	<i>Aristida ternipes</i>
<i>B. barbata</i>	<i>A. Ascensionis</i>
<i>B. aristidoides</i>	<i>A. barbata</i>
<i>B. curtipendula</i>	<i>A. Schiedeana</i>
<i>B. radicans</i>	<i>Muhlenbergia arizonica</i>
<i>B. hirsuta</i>	<i>M. montana</i>
<i>Eragrostis ciliaris</i>	<i>M. Emmersleyi</i>
<i>E. neomexicana</i>	<i>Panicum hirticaule</i>
<i>E. diffusa</i>	<i>P. bulbosum</i>
<i>E. intermedia</i>	<i>P. arizonicum</i>
<i>Cenchrus pauciflorus</i>	<i>Hilaria mutica</i>
<i>Leptochloa dubia</i>	<i>Lycurus phleoides</i>

The herbs associated with the grasses are those common elsewhere in this zone, namely various species of *Ipomoea*, *Boerhaavia*, *Gomphrena*, prostrate *Euphorbiae*, *Desmodium*, *Dalea*, *Verbena*, *Argemone*, and several genera of *Compositae*.

On rocky hills occur a few cacti of the genera *Opuntia*, *Echinocereus* and *Mammillaria*. These, like *Agave* and *Dasytilirion* which also persist to this altitude, are much less frequent than at lower elevations.

### Pine Forest

I place the beginning of the pine forest at an elevation of from 1800 to 1900 m. although Shreve (43) and Brand (8) consider the lower edge of the pine forest, in western Chihuahua, to be 2100 m. Shreve recognizes, however, that west of the continental divide the pine forest descends to 1800 m. and a mixture of pine and oak is found as low as 1525 m. (Fig. 23). Gentry (14) considers that in southern Sonora the pine forest extends from 1525 to 2750 m.

The pine forest in the Sierra del Tigre is characterized by the presence of five species of pine which occur in places in nearly pure stands, and elsewhere in mixture with oak, *Arbutus*, *Pseudotsuga* and *Juniperus*. The five pines are:

<i>Pinus ponderosa</i>	<i>P. chihuahuana</i>
<i>P. arizonica</i>	<i>P. Ayacahuite</i> var. <i>brachyptera</i>
	<i>P. cembroides</i>

The common oaks in the pine zone are *Quercus arizonica*, *Q. Emoryi*, *Q. hypoleucoides*, *Q. diversicolor*, *Q. oblongifolia* and *Q. viminea*. At the higher elevations *Q. hypoleucoides* and *Q. diversicolor* are more regularly present than the other species. A rare oak, *Q. albaefolia*, was collected in three different places at elevations of 1860 to 2310 m.

The best stands of pine occur on relatively level areas, either on plateaus, or in broad and shallow valleys. Such a forest has a park-like appearance (Fig. 25), with a thin understory of oak, *Cercocarpus eximius*, *Prunus virens*, *Rhus trilobata*, and *Spiraea dumosa*.

The herbaceous flora is surprisingly rich, and many of the most attractive flowers of the whole region are to be found in the pine zone. The characteristic species are:

<i>Pteridium aquilinum</i>	<i>Vicia pulchella</i>
<i>Agropyron arizonicum</i>	<i>Helianthemum majus</i> (rare)
<i>Blepharoneuron tricholepis</i>	<i>Begonia Martiana</i>
<i>Bromus anomalus</i>	<i>Chimaphila maculata</i> (rare)
<i>Tigridia Pringlei</i>	<i>Macromeria Thurberi</i>
<i>Malaxis corymbosa</i>	<i>Cosmos crithmifolius</i>
<i>Silene laciniata</i>	<i>C. parviflorus</i>
<i>Agrimonia striata</i>	<i>Pinaropappus roseus</i>
<i>Potentilla atrorubens</i>	<i>Stevia Palmeri</i>
<i>Cologania angustifolia</i>	<i>Viguiera cordifolia</i>
<i>C. Lemmoni</i>	<i>Xanthocephalum Wrightii</i>

Also to be found are many species of the oak-grassland, including *Commelina crispa*, *Tradescantia pinetorum*, *Anthericum Torreyi*, *Milla biflora*, *Gilia Pringlei*, *Monarda austromontana*, etc.

On hillsides oak is generally more abundant than pine, and may be dense enough to bring about impoverishment of the ground cover by shading (Fig. 24).

The pine cover is sparse or absent on rocky ridges and other places where the soil is shallow. The vegetation on such sites may consist of a thin stand of grasses cacti and other herbs, or there may be open to dense thickets of oak, juniper, *Garrya*, *Arctostaphylos* and *Cercocarpus*.

The high mountain meadows (Fig. 14) have an assemblage of plants which differs little in composition from the herbaceous vegetation of the drier pine slopes yet it has a distinctive appearance because of the denser growth and the greater abundance of a few showy species. More than any other single plant, *Oenothera Hookeri* var. *irrigua* sets the meadow off from the adjacent vegetation, but besides this *Geranium atropurpureum*, *G. Wislizeni*, *Verbena ciliata*, *Centaurea americana* and sedges and rushes contribute to the distinctive appearance of this habitat. Below is a complete list of the plants collected in a meadow near Las Tierritas, located a few kilometers south of El Tigre at an elevation of about 1850 m. Only the plants mentioned above are omitted.

<i>Polygonum aviculare</i>	<i>Phaseolus dilatatus</i>
<i>Rumex crispus</i>	<i>Trifolium lacerum</i>
<i>R. salicifolius</i>	<i>Vicia pulchella</i>
<i>Chenopodium Berlandieri</i>	<i>Eryngium Lemmoni</i>
<i>Amaranthus hybridus</i>	<i>Gilia Pringlei</i>
<i>Mirabilis Jalapa</i>	<i>Monarda austromontana</i>
<i>Agrimonia striata</i>	<i>Salvia Townsendii</i>
<i>Potentilla atrorubens</i>	<i>Datura quercifolia</i>
<i>Cologania angustifolia</i>	<i>Castilleja patriotica</i>
<i>C. Lemmoni</i>	<i>Penstemon barbatus</i>
<i>Lotus chihuahuensis</i>	<i>Bahia chrysanthemoides</i>
<i>Cosmos parviflorus</i>	<i>Stevia Palmeri</i>
<i>Erigeron canadensis</i>	<i>S. salicifolia</i>
<i>E. delphinfolius</i>	<i>Tagetes micrantha</i>
<i>Galinsoga parviflora</i>	<i>Xanthocephalum Wrightii</i>
<i>Hieracium Fendleri</i>	<i>Zinnia multiflora</i>

*Pseudotsuga* is usually found only in deep well watered canyons and on northeast slopes (Fig. 26). There are therefore no large stands of this tree, but where conditions are favorable they reach a large size and form a dense cover. At the head of the Cañón de Bavispe a small stand of Douglas fir occupies a deep and narrow ravine where high cliffs afford protection from winds and the afternoon sun. A number of springs keep the ground well watered and the atmospheric humidity

high enough to support a heavy growth of *Tillandsia* on the trees. The following plants were collected in this habitat:

<i>Polypodium erythrolepis</i>	<i>Aralia humilis</i>
<i>Smilacina racemosa</i>	<i>Polemonium pauciflorum</i>
<i>Malaxis corymbosa</i>	<i>Phacelia platycarpa</i>
<i>Heuchera sanguinea</i>	<i>Solanum tuberosum</i> var. <i>boreale</i>
<i>Begonia Marianna</i>	<i>Lonicera arizonica</i>
	<i>Cacalia decomposita</i>

This site is our only station for the *Polypodium*, *Smilacina* and *Polemonium*.

At a place called Puerto de los Aserraderos, west of Bavispe, Phillips and I had an opportunity to collect on an area which had been severely burned the year before. The large pine trees survived the fire, but most of the oaks were killed and at the time of our visits (June and August, 1940) were already sending up root sprouts. The fire appeared to favor a number of species, for a great abundance of *Lotus puberulus*, *Verbena ciliata* and *Bouvardia glaberrima* was noted on burned areas as compared with the undisturbed forest. On the other hand *Geranium Wishizeni*, *Gilia Pringlei*, *Gerardia Wrightii* and *Milla biflora* were not found and presumably had been eliminated.

Our highest collecting station is Picacho del Pilar, which rises abruptly from the Bavispe River southwest of Colonia Oaxaca to a height of 2310 m. On the exceedingly steep slopes of the upper portion of this peak the pine forest gives way to oak except in canyons with a north or northeast exposure; this I attribute to the rapid run-off and consequent low moisture content of the soil.

The oaks present on the Picacho are *Quercus arizonica*, *Q. diversicolor*, and *Q. albaefolia*. *Q. hypoleucoes* is to be expected but it was not seen. *Arctostaphylos pungens*, *Ceanothus Huichagorare* and *Cercocarpus eximius* likewise still persist at this altitude, and in places are abundant. A single specimen of *Opuntia* was taken at an elevation of 2100 m. and this genus is thus represented at all elevations in this area. Other plants collected from 2100 m. and higher are:

<i>Pteridium aquilinum</i>	<i>Drymaria effusa</i>
<i>Juniperus</i> sp.	<i>Sedum</i> sp.
<i>Cyperus aristatus</i>	<i>Spiraea dumosa</i>
<i>C. Fendlerianus</i>	<i>Phaseolus heterophyllus</i>
<i>Commelinia</i> sp.	<i>Lopezia gracilis</i>
<i>Tradescantia</i> sp.	<i>Pterospora Andromedae</i>
<i>Anthericum Torreyi</i>	<i>Gentiana microcalyx</i>
<i>Hypoxis</i> sp.	<i>Salvia</i> sp.
<i>Chenopodium incisum</i>	<i>Castilleja laxa</i>
<i>Penstemon Torreyi</i>	<i>Malacothrix saxatilis</i>
<i>Diodia teres</i> var. <i>angustata</i>	<i>Schkuhria Wislizeni</i>
<i>Valeriana sorbifolia</i>	<i>S. Wrightii</i>
<i>Artemisia Ludoviciana</i>	<i>Senecio Hartwegi</i>
<i>Bidens leptcephala</i>	<i>Stevia salicifolia</i>
<i>Heterospermum pinnatum</i>	<i>Viguiera longifolia</i>

*Silene laciniata* and *Quamoclit coccinea* were seen here but not collected; the latter is noteworthy because it is one of the few species present at all altitudes in this area.

Santos collected the following grasses:

<i>Aegopogon tenellus</i>	<i>Muhlenbergia longiligula</i>
<i>Agropyron arizonicum</i>	<i>M. montana</i>
<i>Andropogon cirratus</i>	<i>M. pauciflora</i>
<i>A. hirtiflorus</i>	<i>M. polycaulis (?)</i>
<i>Aristida divaricata</i>	<i>M. pusilla</i>
<i>A. Schiedeana</i>	<i>M. rigida</i>
<i>Blepharoneuron tricholepis</i>	<i>M. texana</i>
<i>Bromus anomalus</i>	<i>Panicum bulbosum</i>
<i>Chloris submutica</i>	<i>Piptochaetium fimbriatum</i>
<i>Koeleria cristata</i>	<i>Sporobolus ramulosus</i>
<i>Muhlenbergia Emmersleyi</i>	<i>Stipa Pringlei</i>

### Riparian Vegetation

The banks of the Río de Bavispe support a fringe of vegetation very much like that found in similar situations throughout northern Mexico. The cottonwoods and willows (Fig. 9) which mark the course of the river are among the largest trees of the region, being equaled or exceeded in height only by the pines and Douglas fir. Despite the fine appearance of the shore vegetation from a distance, on closer examination it is found to be for the most part of a weedy character, with monotonous stretches of *Baccharis glutinosa*, *Hymenoclea monogyna*, *Nicotiana glauca*, and *Ricinus communis*, together with scattered trees of *Juglans major*, *Chilopsis linearis*, *Celtis pallida*, *C. reticulata*, *Prosopis* and *Acacia Greggii*. *Clematis Drummondii* is sure to be found here, and other undergrowth is composed of *Ambrosia aptera* (in shady spots), *Amaranthus*, *Datura*, *Croton texensis*, *Quamoclit coccinea*, *Ipomoea*, *Portulaca*, *Euphorbia*, *Acalypha*, *Chenopodium*, *Boerhaavia* and other species common in the mesquitales.

### Canyon Vegetation

The well watered upper parts of the larger canyons have a characteristic vegetation which, because of the special conditions prevailing in them, cuts across the vegetational zones described above. Permanent running water is found from the pine zone down to the upper part of the oak zone, and a high water table, as evidenced by numerous pools in the canyon bottom, persists to near the upper border of the mesquite-grassland.

In such a habitat the characteristic trees are *Juglans major*, *Platanus Wrightii*, *Sapindus Saponaria*, *Acer brachypterum*, *Alnus oblongifolia*, *Ostrya virginiana* and *Fraxinus velutina*. At low elevations the oaks also make their first appearance in the canyons and with increasing gradually extend their area, first on northern slopes and finally over all exposures. *Ungnadia speciosa* was found in only two places: Arroyo del Púlpito and Cañón de la Bellota.

The herbaceous plants which are confined to the canyons are few in number. *Begonia Martiana* is undoubtedly more definitely restricted to a canyon habitat than any other plant in the area. It is to be looked for on shady ledges or even in rock crevices in vertical canyon walls, but an abundant water supply and a relatively high atmospheric humidity are required. Since these conditions are not found at low elevations *Begonia Martiana* is present only in the oak-grassland and pine zones, and is more abundant in the latter. It is probably resistant to light frosts.

Among the other plants to be expected in the canyons the following must be mentioned: *Adiantum Capillus-Veneris*, *Phanerophlebia auriculata*, *Thalictrum Fendleri*, *Mimulus* spp., *Mirabilis Wrightiana*, *Heuchera sanguinea*, *Geranium atropurpureum*, *G. Wislizeni*, *Ayenia pusilla*, *Cuphea Wrightii*, *Lopezia gracilis*, *Gilia formosissima*, *Agastache Barberi*, *Galium* spp., *Lonicera cerviculata*, *Lobelia cardinalis*, and *Senecio Hartwegi*.

With the exception of the genus *Cheilanthes* most ferns show a preference for a canyon habitat. Whitehead (60) and Wiggins (61) have described the habitats of some of the ferns occurring in the Sonoran desert and their account, except for some of the associated plants, would serve very well for many of the canyons of the Sierra del Tigre.

The dry lower portion of the canyons requires little comment for here the vegetation scarcely differs from that of the mesquite-grassland. Present here are: *Chilopsis linearis*, *Celtis pallida*, *Tecoma incisa*, *Dodonaea viscosa*, *Rhus microphylla*, *Rhus Rydbergii*, *Pithecellobium mexicanum*, *Acaciae* and *Mimosae*. *Populus*, *Salix*, *Baccharis* and other elements of the riparian vegetation may also be present.

#### UTILIZATION OF NATURAL RESOURCES

Throughout the area under consideration grasses constitute one of the principal natural resources and the raising of livestock has a corresponding importance. Although in the mesquite-grassland good forage grasses are not abundant, especially during the dry season, mesquite and other browse plants supplement the diet of cattle and other grazing animals. Along the larger streams, such as the Bavispe, Fronteras and San Bernardino Rivers with their fringe of permanently green vegetation, are located the most prosperous of the lowland cattle ranches.

The most favorable conditions for the grazing industry are found in the oak-grassland zone which has extensive areas of unbroken grasslands (Figs. 19, 12 and 13), abundant water and a temperate climate. The best examples of cattle ranches in this zone are La Nacha, Huépari and Carretas, Chihuahua.

A single example of a dairy business came to my attention. At La Nacha a score or so of cows were milked daily and the milk sent to La Angostura which then had a large transient population engaged in the construction of an irrigation dam.

At higher elevations grazing is of minor importance, although in places the cattle are moved into the pine zone during the rainy months in order to conserve the lower grazing lands for the dry season.

Agriculture is practised only on a small scale, mainly on the alluvial land of the river bottom. The area suitable for cultivation is severely limited as in many places the river passes through narrow rocky gorges. The mainstay of the local diet, as throughout Mexico, is corn and beans. These are likewise the principal crops, but each family commonly cultivates a small plot of vegetables, the most common ones being peppers, squash, watermelons, cantaloupes and tomatoes. Near Huachinera and Bacerac there are peach and apple orchards, but the people in general are accustomed to eating little fruit and most of that is wild (e.g. tuna, pitaya, garambullo etc.).

A minor crop is wheat, which finds its way to a small flour mill at Colonia Morelos. Cotton culture was at one time attempted near Colonia Morelos, but according to the inhabitants it was not successful because of insect pests.

The construction of a dam at La Angostura, north of Oputo, makes it possible to irrigate much of the valley land below this point.

A sawmill located in the pine zone at Las Tierritas is the only commercial form of forest exploitation. Its products find an outlet through El Tigre.

A clandestine and illicit activity carried out in certain sections is the distillation of mescal from roasted *Agave* stumps. The Cañón de la Mescalera appears to have been named for some rustic stills once in use there. The leaves of the *Agave* are used to some extent for manufacturing rope.

Since the Opata Indians who originally inhabited the Río Bavispe region have long since lost their tribal identity their manner of using the native plants is virtually unknown. For an account of the ethnobotany of the neighboring tribes the reader is referred to the works of Bennett and Zingg (5), Castetter and Underhill (10), Studhalter (50) and Wagner (57).

#### PHYTOGEOGRAPHY AND FLORAL RELATIONSHIPS OF THE REGION

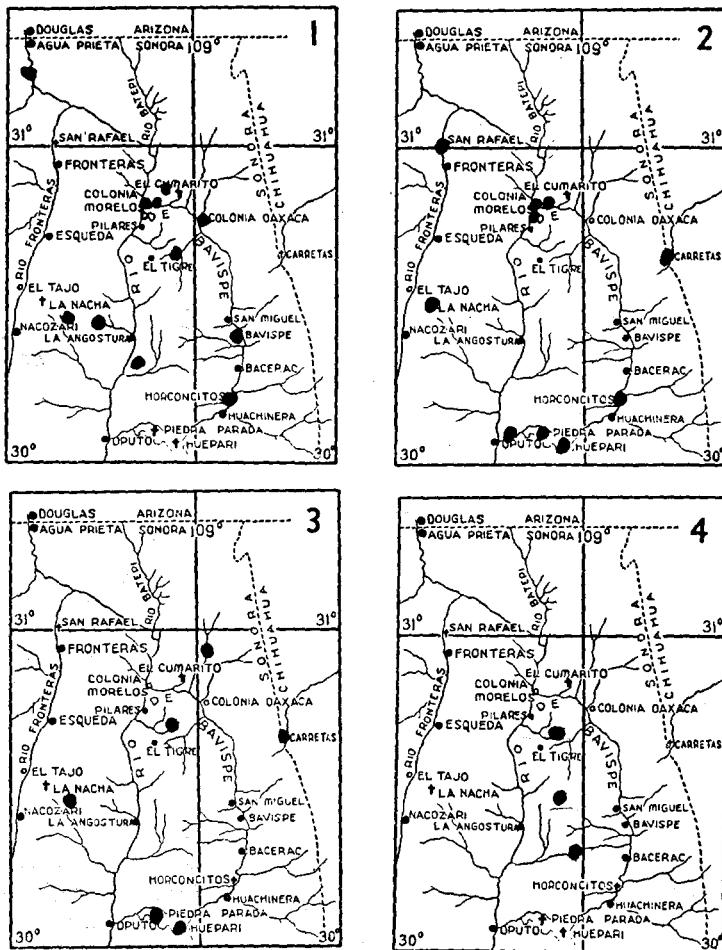
##### *Local Distribution of Plants*

In plotting the stations where different species of plants were collected within the loop of the Bavispe River, it will readily be observed that the plants of the three life zones have a more or less concentric distribution pattern; i.e. plants of the mesquite-grassland follow the course of the river as far as Huachinera. Oak-grassland plants in turn are present chiefly between the 1000 and 1800 m. contours and, finally, the highland species are restricted to a narrow band extending from near El Bilito southward to near the latitude of Horconcitos. Examples of these distribution patterns are shown in Figs. 1-8.

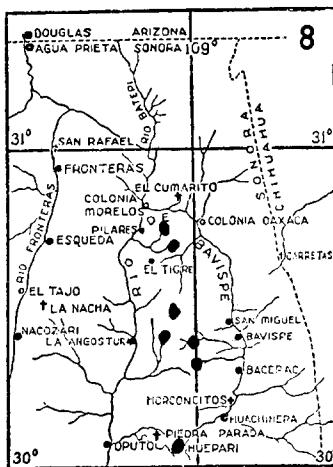
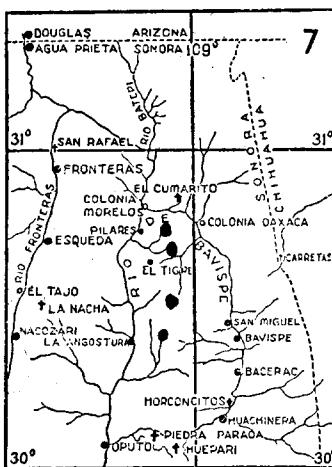
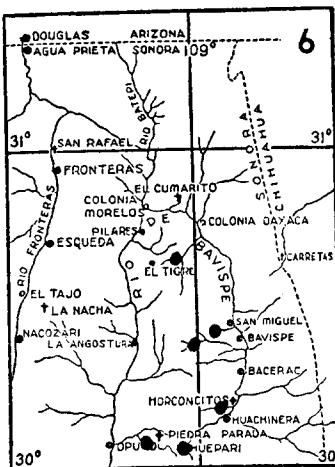
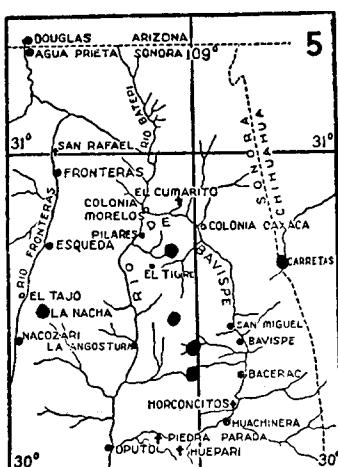
Not all plants can be placed definitely in one or another life zone; many of the common ones are found almost throughout the area and seem little restricted by habitat requirements. Here belong the cosmopolitan weeds *Digitaria sanguinalis*, *Eragrostis ciliaris*, *E. intermedia*, *Solanum nigrum*, *Verbena carolina*, *Quamoclit coccinea* and *Aster exilis*.

On the contrary, there are plants which occur only in a small part of a single zone. Thus the only palm in the area, *Washingtonia Sonorae*, was seen only in Cañón del Temblor, C. de la Gallina and along the road between La Angostura and La Nacha (Fig. 21). While it is very likely present in other canyons on the western side of the Sierra del Tigre, it is entirely absent on the eastern side. The place name La Palmita, west of Bacadéhuachi, may indicate the presence of this palm in that vicinity, but it was not seen there.

Other species which have a restricted distribution within a single zone are: *Cathetecum erectum*, collected only in the lowlands from Colonia Morelos southward to Oputo; *Eragrostis neomexicana*, found only in the vicinity of Huépari; *Piptochaetium fimbriatum*, from the vicinity of El Tigre, El Roble and El Bilito; *Triodia mutica*, found at San Rafael and near Colonia Morelos; and *T. pulchella*, with a similar



Figs. 1-4. Distribution patterns of species characteristic of the three major vegetational types. The mesquite-grassland extends along the Río de Bavispe to Huachinera; the oak-grassland represents a belt between 1000 and 1800 m. elevations; the highland species occupy a narrow strip above 1800 m. elevation ranging between El Bilito and Horconcitos. For details see pages 237-251.



Figs. 5-8. Distribution patterns of species characteristic of the three major vegetational types. The mesquite-grassland extends along the Río de Bavispe to Huachinera; the oak-grassland represents a belt between 1000 and 1800 m. elevations; the highland species occupy a narrow strip above 1800 m. elevation ranging between El Bilito and Horconcitos. For details see pages 237-251.

distribution. Although it may be argued that the apparent restricted distribution of these plants is due to the accidents of collection, the above examples were selected with a view to reducing that possibility as much as possible. Since two agrostologists were in the field with me, the *Gramineae* were probably more thoroughly collected than any other large family; furthermore the above plants, all from the western side of the Sierra del Tigre, could hardly have escaped notice on the eastern side if they had been present there, for much the greater part of the collecting was done on the eastern slopes.

The plants of the Sinaloan province have already been mentioned. Most of them apparently reach their northern limit near the latitude of Moctezuma and Bacadéhuachi. Unless it be assumed that these species are still extending their range northward, this line seems best interpreted as a climatic barrier beyond which they cannot pass. Shreve (40) and later Turnage and Hinckley (53) have shown the effect of frost in limiting the distribution of plants, but it cannot be stated now whether it is frost or some other climatic barrier operating in this case.

#### *Relationships of the Flora*

Of the 1200 species and varieties of plants recorded here approximately 90% are listed in "Flowering Plants and Ferns of Arizona" (21). Since all of my collecting was carried out within 175 km. of the border and most of it within 140 km. it is not surprising that only a small percentage of the plants collected should not be known in that state. The plants not reported from Arizona, numbering 150 species, are distributed among 43 families. Three of these, the Begoniaceae, Bombacaceae and Cistaceae are not represented at all in either Arizona or New Mexico (21, 51).

With respect to their areas of distribution the plants of northeastern Sonora may be grouped into the following geographical categories: 1, endemic; 2, north Mexican Pacific slope; 3, Sierra Madre; 4, Central Plateau; 5, western United States; 6, eastern United States; 7, continental; 8, tropical; and 9, plants with anomalous distribution. Some plants with peculiar ranges must be assigned rather arbitrarily to one or another of the above groups, but generally speaking there is little difficulty in determining where a given plant belongs.

As these categories include plants of similar distribution, but not necessarily of similar ecological requirements, the terms adopted appear suitable in that they imply nothing as to habitat. Each of these groups is discussed below.

1. *Endemic Plants*.—Here are placed the species known to occur only in the highland area of southwestern New Mexico, southeastern Arizona, eastern Sonora and western Chihuahua.<sup>7</sup> So far as is known they are not found beyond the limits of the Apachian biotic province. The least known species are those which have recently been described as new: *Eriosaema laetum* (19), *Phacelia heterophylla* var. *sonorensis*,

<sup>7</sup>Distribution data were taken from Kearney and Peebles (21), Robinson and Fernald (32), Small (45), Standley (46), Tidestrom and Kittell (51), and various monographs. In some cases herbarium specimens were consulted for supplementary information.

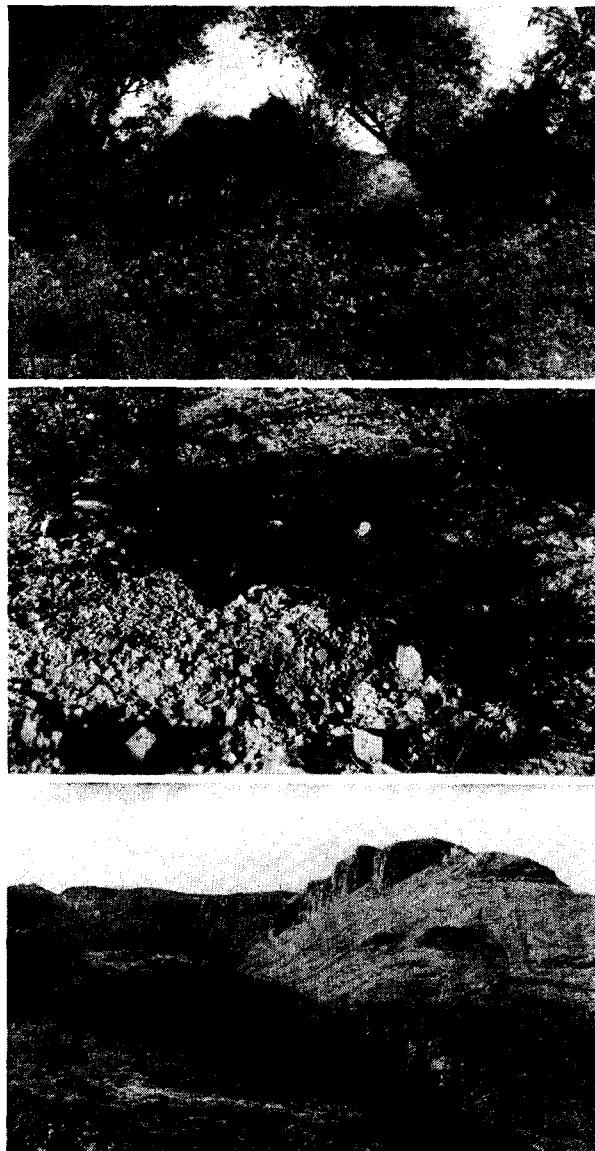


FIG. 9 (upper). River-bank vegetation near Colonia Morelos consisting of *Populus*, *Salix*, *Nicotiana glauca*, *Baccharis glutinosa* and other plants mentioned in text.

FIG. 10 (center). *Koeberlinia spinosa* in *Larrea* association about 5 km. east of Colonia Morelos.

FIG. 11 (lower). Overgrazed and eroded slopes above Cañón de Bavispe.

The slopes have a sparse cover of grass and weeds; on the talus slopes and walls of the canyon are found *Haplophyton cimicicidum*, *Ipomoea* spp., *Cassia* spp., *Hibiscus denudatus* var. *involucellatus*, *Dodonaea viscosa* and others.

*Penstemon campanulatus* var. *subglandulosus* and *Lonicera cerviculata* (59). These have been collected only in the Bavispe River region. *Ipomoea Lemmoni*, also found here, was previously known only from the Huachuca Mountains of Arizona (21, 51). Other more wide-ranging species are:

<i>Cheilanthes Pringlei</i>	<i>Indigofera sphaerocarpa</i>
<i>Polypodium erythrolepis</i>	<i>Mimosa Grahamii</i>
<i>Agave Hartmanii</i>	<i>Euphorbia Plummerae</i>
<i>Quercus albaefolia</i>	<i>Agastache Barberi</i>
<i>Q. chihuahuensis</i>	<i>Silvia Parryi</i>
<i>Silene Thurberi</i>	<i>Cacalia decomposita</i>
<i>Ranunculus arizonicus</i>	<i>Hieracium Lemmoni</i>
<i>Cassia Wrightii</i>	<i>Schkuhria Wislizenii</i>
<i>Desmanthus bicornutus</i>	<i>S. Wrightii</i>

2. *Plants of the North Mexican Pacific Slope.*—The northern Pacific slope of Mexico, including Baja California, southeastern California and southwestern Arizona, corresponds rather closely with Ochoterena's north Sinaloan and west Sonoran arid sub-region (30), with Dice's Sonoran and Sinaloan biotic provinces (11), and with Atwood's Sonoran physiographic province (1.). Much of this area is arid or semi-arid, and the plants which enter northeastern Sonora from the west or southwest for the most part belong to the hot dry lowlands. Nevertheless, there are a few which I found either in part or exclusively in the oak-grassland zone, and at least two (*Verbena neomexicana* var. *xylopoda* and *Metastelma Watsonianum*) extend upward into the pine zone.

The following are the species collected in the Bavispe River area whose range, so far as known, does not extend beyond the north Mexican slope region:

<i>Pityrogramma triangularis</i>	<i>Janusia californica</i>
<i>Bouteloua Rothrockii</i>	<i>Acalypha papillosa</i>
<i>Eriochloa aristata</i>	<i>Cridoscolus angustidens</i>
<i>Muhlenbergia dumosa</i>	<i>Jatropha cordata</i>
<i>Washingtonia Sonorae</i>	<i>Rhamnus illicifolius</i>
<i>Hechtia montana</i>	<i>Abutilon Sonorae</i>
<i>Salix jaliscana</i>	<i>Gossypium Thurberi</i>
<i>Alnus oblongifolia</i>	<i>Kosteletskya Thurberi</i>
<i>Ficus petiolaris</i>	<i>Fouquieria Macdougallii</i>
<i>Boerhaavia Coulteri</i>	<i>Echinocereus rigidissimus</i>
<i>Phaulothamnus spinescens</i>	<i>Opuntia arborescens</i>
<i>Crossosoma Bigelowii</i>	<i>Bunelia occidentalis</i>
<i>Acacia cymbispina</i>	<i>Buddleia Wrightii</i>
<i>Dalea Grayi</i>	<i>Stemmadenia tomentosa</i> var. <i>Palmeri</i>
<i>D. mollis</i>	<i>Matelea triflorum</i>
<i>D. Parryi</i>	<i>Metastelma Watsonianum</i>
<i>Lysiloma Watsonii</i>	<i>Ipomoea Gentryi</i>
<i>Nissolia Schottii</i>	<i>Verbena neomexicana</i> var. <i>xylopoda</i>
<i>Krameria parvifolia</i>	<i>Aster aquifolius</i>
<i>Esenbeckia Hartmanii</i>	<i>Bidens Gentryi</i>
<i>Bursera laxiflora</i>	<i>Milleria quinqueflora</i>

3. *Plants of the Sierra Madre.*—The ranges of the plants placed here fall largely within Ochoterena's Sierra Madre region, Dice's Apachian, Durangan and Potosian biotic provinces, and Atwood's Western, Southern and Eastern Sierra Madre physiographic provinces. Dice does not define the southern borders of his Durangan and Potosian provinces, but it must be assumed that they have a common boundary



FIG. 12 (upper). Grassland at Puerto del Cumarito, elev. 1650 m. Besides grasses some of the plants collected and observed here are *Fendlera Wrightii*, *Garrya Wrightii*, *Eysenhardtia orthocarpa*, *Quercus Emoryi*, *Q. oblongifolia*, *Dasyliion Wheeleri*, *Nolina microcarpa*, *Polanisia uniglandulosa*, *Haplopappus laricifolius*, *Brickellia californica*, *Gilia Pringlei* and *Bouvardia glaberrima*. *Fouquieria splendens* here reaches its upper limit.

FIG. 13 (center). Lower margin of the oak-grassland with some juniper; elev. 1390 m. Compare Fig. 19 from the same area.

FIG. 14 (lower). Wet meadow in the pine zone at El Bilito; elev. 1890 m.

in the southern Sierra Madre unless another intervening biotic province is to be recognized.

The plants of the Sierra Madre region are of course associated with pine and oak forests. The species with which we are here concerned are for the most part restricted to the Sierra Madre Occidental, yet there are a number of plants which are also present in the eastern Sierra Madre, or at least are represented there by a closely related form. Some members of this group extend southward to southern Mexico or even Guatemala (e.g. *Phacelia platycarpa*) and presumably the other species have, or at one time had, a similar connecting link between the two extremes of their ranges.

Illustrations of this type of distribution are found in Epling's monograph of the genus *Salvia* (12). *Salvia pinguifolia*, according to his distribution map, is found in southeastern Arizona, southern New Mexico and in the Sierra Madre of Chihuahua, while the closely related *S. ballotaeflora* ranges from south central Texas to Hidalgo. *S. microphylla* of the southern Sierra Madre is represented in the Sierra Madre Oriental by var. *neurepia* and in the Sierra Madre Occidental by var. *Wislizeni*. *S. Seemanii* occurs only in the western Sierra Madre, but the section *Angulatae* to which it belongs is well represented in eastern and southern Mexico, as well as in Central America. In other plant families, *Selaginella novoleonensis*, *Polypodium polypodioides*, *Tigridia Pringlei*, *Rhamnus betulaefolia* and *Penstemon campanulatus* are examples of this same type of distribution. *Ostrya virginiana* might also be mentioned here (15, 59), but this species will be included among those of the eastern United States.

That the Sierra Madre serves as a highway for plant migration is indicated by the presence in northeastern Sonora of the following species, the ranges of which lie principally in southern Mexico:

<i>Muhlenbergia pusilla</i>	<i>Acacia filicoides</i>
<i>Salix jaliscana</i>	<i>Lysiloma microphylla</i>
<i>Mahonia trifolia</i>	<i>Sievea salicifolia</i>

*Zexmenia ceanothifolia*

Of the above, only the last named species was collected by Gentry (14) in the Rio Mayo valley of southern Sonora.

Other plants belonging to the Sierra Madre region are:

<i>Asplenium Palmeri</i>	<i>Tephrosia leiocarpa</i>
<i>Cheilanthes pyramidalis</i>	<i>Cuphea Wrightii</i>
<i>Pinus ayacahuite</i> var. <i>brachyptera</i>	<i>Eryngium heterophyllum</i>
<i>Anthericum Torreyi</i>	<i>Arbutus arizonica</i>
<i>Malaxis corymbosa</i>	<i>Arctostaphylos pungens</i>
<i>Quercus Endlichiana</i>	<i>Halenia recurva</i>
<i>Q. fulva</i>	<i>Castilleja laxa</i>
<i>Cologania Lemmoni</i>	<i>C. patriotica</i>
<i>Desmodium arizonicum</i>	<i>Gerardia Wrightii</i>
<i>D. batocaulon</i>	<i>Lamorouxia viscosa</i>
<i>D. cinerascens</i>	<i>Penstemon campanulatus</i>
<i>D. gramineum</i>	<i>Bouvardia glaberrima</i>
<i>D. Rosei</i>	<i>Lobelia laxiflora</i>
<i>Diphysa Thurberi</i>	<i>Aspilia stenophylla</i>

4. *Plants of the Central Plateau.*—The Central Plateau area, wherein many plants of northeastern Sonora have the principal part of their geographical range, includes the Northern or Texano-Mexican subregion of Ochoterena, Dice's Chihuahuan Biotic Province, together

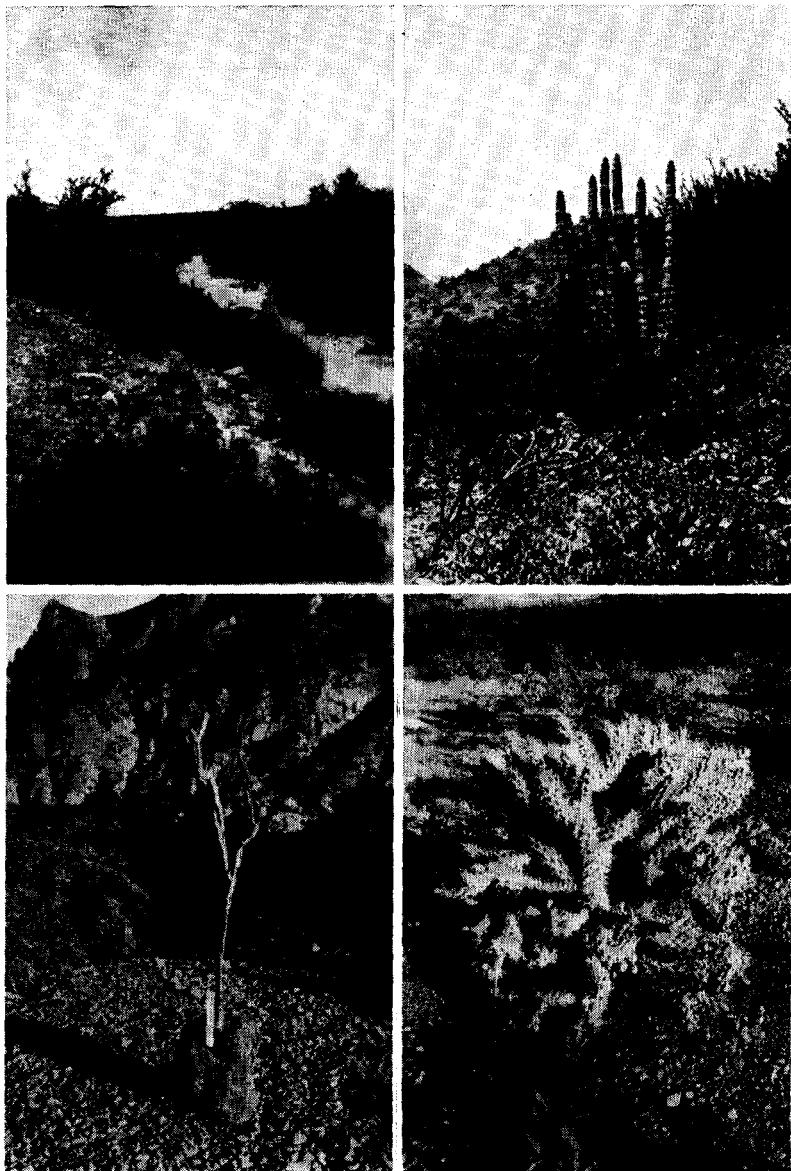


FIG. 15 (upper left). Dry arroyo 10 km. east of Agua Prieta on road to Colonia Morelos. *Rhus microphylla* and *Sporobolus Wrightii* on left; *Chilopsis linearis* on the right.

FIG. 16 (upper right). *Lemaireocereus Thurberi* 15 km. west of La Angostura. Trees in background are mesquite and palo verde; a cholla is in the foreground.

FIG. 17 (lower left). *Cereus Greggii*, showing massive storage root. Colonia Morelos.

FIG. 18 (lower right). *Opuntia fulgida* from Mesa de las Carreras, west of Colonia Morelos.

with portions of neighboring provinces to the north and west, and Atwood's Mexican Plateau and Colorado Plateau Physiographic Provinces. Considered as a whole, this is a region of medium elevation, characterized by an arid or semiarid climate and its corresponding type of vegetation. As in the case of the Pacific slope, the Central Plateau contributes mainly to the lowland vegetation of northeastern Sonora, but a few (e.g. *Dasylirion Wheeleri*, *Trichachne californica*, and *Vitis arizonica*) are present in the upland oak and pine zones.

The distribution of the plants in the following list is in general from west Texas to Arizona, or southeastern California, southward to Zacatecas, San Luis Potosi and Hidalgo; a few (e.g. *Fendlera rupicola*) extend northward into Colorado, and others are found as far south as Puebla or Oaxaca (e.g. *Cocculus diversifolius*, *Calliandra eriophylla*). There are other species, however, limited to northern Mexico and southwestern United States; *Bernardia myricaefolia*, *Baileya Thurberi*, *Eriogonum Abertianum*, *Polygala macradenia*, *Ungnadia speciosa* and *Bumelia rigida* are examples of this type of distribution.

The following are some of the more important representatives of the Central Plateau in northeastern Sonora:

<i>Cheilanthes leucopoda</i>	<i>Condalia lycooides</i>
<i>C. Lindheimeri</i>	<i>C. spathulata</i>
<i>Ephedra trifurca</i>	<i>Abuutilon incanum</i>
<i>Aristida barbata</i>	<i>Hibiscus Coulteri</i>
<i>Bouteloua rigidiseta</i>	<i>H. denudatus</i> var. <i>involucellatus</i>
<i>Muhlenbergia Emmersleyi</i>	<i>Sida tragiæfolia</i>
<i>Triodia pulchella</i>	<i>Fouquieria splendens</i>
<i>Celtis pallida</i>	<i>Mentzelia asperula</i>
<i>Eriogonum Wrightii</i>	<i>M. hispida</i>
<i>Boerhaavia Torreyana</i>	<i>Bumelia rigida</i>
<i>Clematis Drummondii</i>	<i>Fraxinus Greggii</i>
<i>Acacia constricta</i>	<i>Coldenia canescens</i>
<i>A. vernicosa</i>	<i>Lippia lycooides</i>
<i>Cassia Wilsizeni</i>	<i>L. Wrightii</i>
<i>Calliandra humilis</i>	<i>Priva mexicana</i>
<i>C. reticulata</i>	<i>Verbena Ehrenbergiana</i>
<i>Dalea diffusa</i>	<i>Lycium Berlandieri</i>
<i>Eysenhardtia orthocarpa</i>	<i>Nicotiana glauca</i>
<i>Mimosa biuncifera</i>	<i>Cucurbita digitata</i>
<i>Krameria Grayi</i>	<i>Ibervillea tenuisecta</i>
<i>Thryallis angustifolia</i>	<i>Lobelia fenestralis</i>
<i>Polygala scopariooides</i>	<i>Eupatorium Greggii</i>
<i>Croton corymbulosus</i>	<i>E. solidaginifolium</i>
<i>Rhus microphylla</i>	<i>Parthenium incanum</i>
<i>R. virens</i>	<i>Trixis californica</i>
	<i>Verbesina Rothrockii</i>

5. *Plants of the Western United States.*—This heading is used to designate a group of widespread plants with a generalized range extending from the Mississippi valley westward to the Pacific states, and from southwestern Canada southward to northern Mexico. There are a few plants which are distributed over much of this area; these are: *Marsilea vestita* (South Dakota to British Columbia and southward to Oklahoma, southern California and northern Mexico), *Bromus marginatus* and *Sitanion Hystrix* (South Dakota to British Columbia and southward to Arizona and northern Mexico), *Juncus interior* (Illinois and Missouri westward to Washington and southward to Arizona), *Commandra pallida* (Minnesota to British Columbia and southward

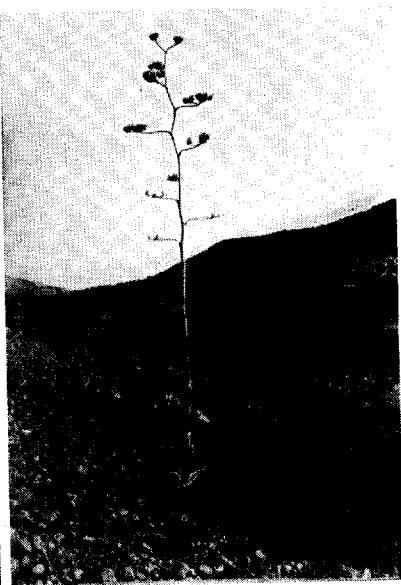
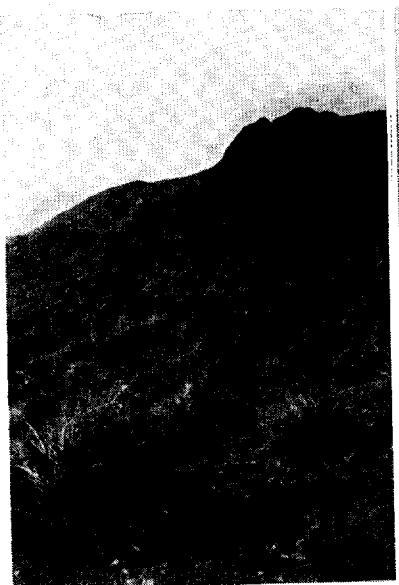


FIG. 19 (upper left). Open grassland above Cañón de la Bellota; elev. of foreground 1390 m. Plants present are *Quercus arizonica* (on slope in background), *Rhus choriophylla*, *Mahonia haematocarpa*, *Garrya Wrightii*, *Dasylyrion Wheeleri*, cacti and grasses.

FIG. 20 (upper right). *Agave Parryi* at La Nacha in the oak-grassland; elev. 1310 m. Shrub in right foreground is *Dodonaea viscosa*, a rare plant at this altitude; trees in background are oaks.

FIG. 21 (lower left). *Washingtonia Sonorae* 18 km. east of La Nacha near the lower margin of the oak zone. This palm occurs only on the western slopes of the Sierra del Tigre and is of sporadic occurrence.

FIG. 22 (lower right). *Opuntia spinosior* at Sierra de la Cabellera, with *Quercus* in background.

to Texas and California) and *Atriplex canescens* (South Dakota to Oregon and southward to Baja California and Zacatecas).

However, most of these western plants fall into either an eastern or western subdivision, corresponding roughly to the Great Plains and Rocky Mountain regions. The plants of the eastern portion are:

<i>Paspalum stramineum</i>	<i>Gilia longiflora</i>
<i>Sporobolus texanus</i>	<i>Scutellaria resinosa</i>
<i>Commelinia crispa</i>	<i>Chamaesaracha Coronopus</i>
<i>Populus acuminata</i>	<i>Physalis lanceolata</i>
<i>Eriogonum Jamesii</i>	<i>Cucurbita foetidissima</i>
<i>Freelichia gracilis</i>	<i>Cyclanthera dissecta</i>
<i>Portulaca suffrutescens</i>	<i>Berlandiera lyraea</i>
<i>Croton texensis</i>	<i>Chrysopsis villosa</i>
<i>Oenothera speciosa</i>	<i>Haplopappus spinulosus</i>
<i>Asclepias galactodes</i>	<i>Verbesina encelioides</i>
<i>Convolvulus incanus</i>	<i>Zinnia grandiflora</i>

The following plants belong to the Rocky Mountain region, but some of them range westward to the Pacific states:

<i>Pinus ponderosa</i>	<i>Epilobium Drummondii</i>
<i>Pseudotsuga mucronata</i>	<i>Asclepias speciosa</i>
<i>Bromus polyanthus</i>	<i>Mimulus cardinalis</i>
<i>Juncus saximontanus</i>	<i>M. nasutus</i>
<i>Zygadenus paniculatus</i>	<i>Samocucus coerulea</i>
<i>Habenaria sparsiflora</i>	<i>Erigeron concinnum</i>
<i>Populus angustifolia</i>	<i>Gnaphalium chilense</i>
<i>Rhus trilobata</i>	<i>Gutierrezia Sarothrae</i>

6. *Plants of the Eastern United States.*—The plants grouped here have their main areas of distribution in the eastern United States, i.e. east of the Mississippi River. Some of those listed below, however, range westward as far as North Dakota (*Eragrostis pectinacea*), Nebraska (*Panicum dichotomiflorum*), Utah (*Euphorbia dentata*), Colorado (*Phalaris caroliniana*), Texas (*Ostrya virginiana*) and Arizona (*Phytolacca americana*). The distribution of some of the others, in the United States, is restricted to the southeastern states, with the northern limit varying from the Gulf States to the latitude of Virginia and Delaware. The species considered to be typically eastern are the following:

<i>Ophioglossum Engelmanni</i>	<i>Phytolacca americana</i>
<i>Chelone tomentosa</i>	<i>Acalypha ostryaeifolia</i>
<i>Eragrostis pectinacea</i>	<i>Euphorbia dentata</i>
<i>Panicum dichotomiflorum</i>	<i>E. heterophylla</i>
<i>Phalaris caroliniana</i>	<i>Helianthemum majus</i>
<i>Hexalectris spicata</i>	<i>Ambrosia aptera</i>
<i>Ostrya virginiana</i>	<i>A. psilostachya</i>
<i>Rumex altissimus</i>	<i>Heterotheca subaxillaris</i>
<i>Chenopodium Berlandieri</i>	<i>Lactuca graminifolia</i>

It is interesting to note here, in connection with the presence of eastern plants in northwestern Mexico, that Sharp (39) and Schornherst (37) have found that certain mosses of the southwestern states and northern Mexico occur in the southern Appalachians and northern Florida. If these subtropical mosses migrated into the southeastern United States, as Schornherst believes, then northern plants must have had at the same time an opportunity to migrate southward into whatever areas provided a suitable habitat. We find a clear indication of such migration in *Ostrya virginiana*, which now has a not too discontinuous distribution from southeastern Canada to Nuevo León (28). South

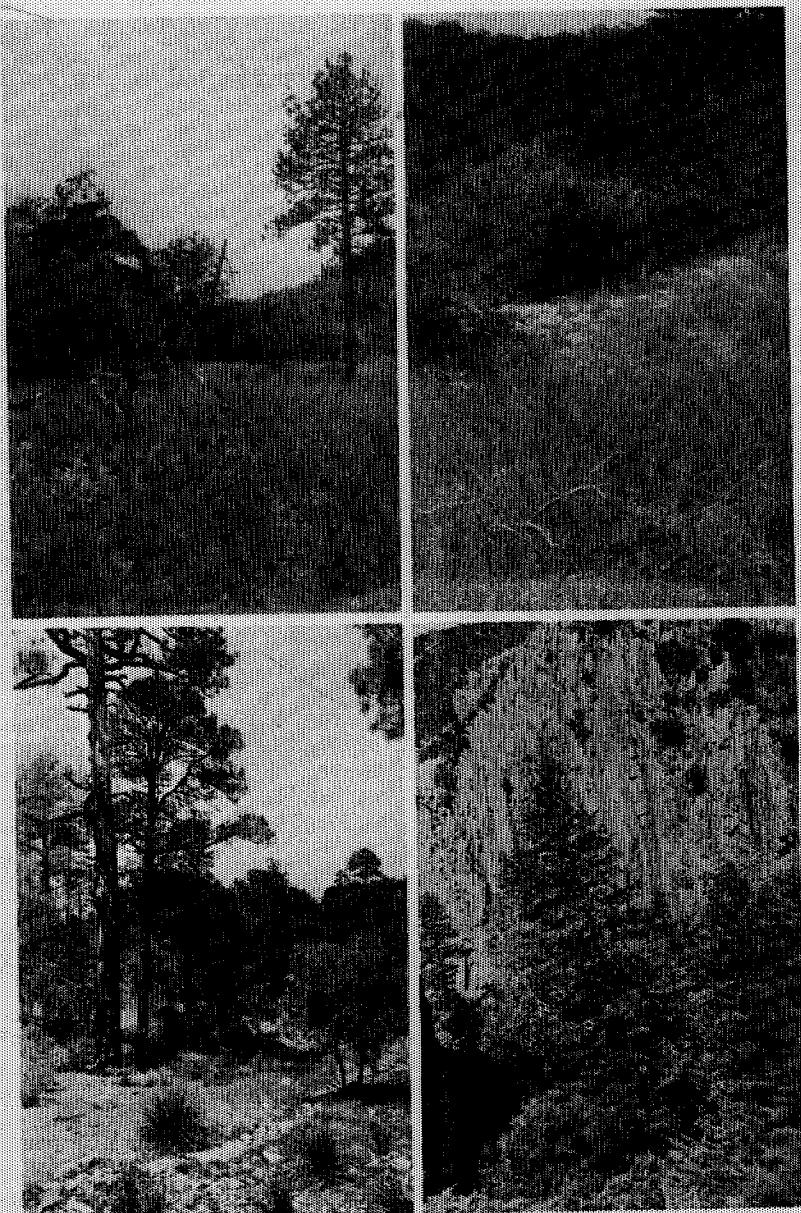


FIG. 23 (upper left). Pine trees in the upper oak-grassland at La Nacha; elev. 1525 m. Among plants collected here are *Arbutus arizonica* and its parasite *Phoradendron bolleanum*, *Arctostaphylos pungens*, *Quercus* spp., *Pinus cembroides*, *P. chihuahuana*, *P. ponderosa*, *Lonicera cerviculata* and others characteristic of the oak-grassland.

FIG. 24 (upper right). A thicket of oak, *Arctostaphylos* and *Cercocarpus eximius* with scattered pines and junipers. Slope of Picacho del Pilar; elev. 2080 m.

FIG. 25 (lower left). An open park-like stand of pine with an understory of oak. El Roble, 1830 m.

FIG. 26 (lower right). Cañón de Carabinas near El Roble. A deep inaccessible canyon with a small stand of *Pseudotsuga mucronata*.

of this point it is replaced by the very similar *O. guatemalensis* (Winkl.) Rose which continues southward into Guatemala and is also present in the western Sierra Madre at least as far north as Jalisco. Going still farther north we again find *O. virginiana* in Sinaloa (15) and Sonora. In a previous paper (59) I suggested the possibility that *Ostrya* in northwestern Mexico is a relic of Miocene and Pliocene times when the fossil type known as *O. oregoniana* Chaney (considered to be identical with *O. virginiana*) occupied portions of our northwestern states (46). Two possible routes by which *O. virginiana* could have migrated to northwestern Mexico were pointed out, namely southward from northwestern United States or westward from the eastern states. It is worthwhile pointing out that this disjunct distribution of *Ostrya virginiana* very closely parallels that of *Platanus* as outlined by Cain (9). He concludes from the present distribution of the sycamores and other trees (e.g. *Juglans* and *Fraxinus*) that a non-desert type of vegetation was once continuous across southwestern United States, and that this continuity was broken by the onset of desert conditions in the late Cenozoic. In the case of *Platanus* we have in the east *P. occidentalis*, in the southwest *P. Wrightii* and in California *P. racemosa*. *Ostrya* is not represented in California, but in west Texas and New Mexico there is *O. Baileyi* and in Arizona and Utah, *O. Knowltoni*; besides these two species the eastern form, *O. virginiana*, still persists in at least two small areas in northwestern Mexico. This circumstance lends additional support to the hypothesis that a continuous mesophytic vegetation extended across the southwestern states (and northern Mexico) prior to the establishment of desert conditions.

The possibility of a continuous distribution of *Ostrya virginiana*, during past geologic times, from northwestern Mexico to northwestern United States is not ruled out, however, although paleontological evidence for such a connection has not yet been found. The present and fossil occurrence of the sections *Saccharina* and *Palmata* of the genus *Acer*, as presented by Cain (9), strongly suggests that there may have been a connecting link between these two remote areas of western North America.

In the light of the preceding discussion it is not difficult to understand the presence of other eastern species in southwestern United States and northwestern Mexico.

7. *Plants with Continental Distribution*.—We are here first concerned with a group of plants which are widely distributed throughout North America, especially in the northern portion, and which are commonly represented by the same or a closely related form on other continents. Fernald (13) has pointed out that these species are to be regarded as members of an ancient, widespread boreal vegetation. Stopes (49) believes that this vegetation was in existence at least by the Cretaceous period, and that it was rather uniform in composition throughout its geographical range. The present distribution of the surviving members of that vegetation must therefore be interpreted in the light of past geological history, especially the incursion and recession of epicontinental seas, mountain building, glaciation, and the changes in climate which accompany these phenomena.

The following species, collected in northeastern Sonora, appear to be remnants of this early northern flora:

<i>Ophioglossum vulgatum</i>	<i>Agrimonia striata</i>
<i>Asplenium Trichomanes</i>	<i>Rhus strigosus</i>
<i>Koeleria cristata</i>	<i>Rhus glabra</i>
<i>Sporobolus cryptandrus</i>	<i>R. Rydbergii</i>
<i>Juncus Torreyi</i>	<i>Parthenocissus quinquefolia</i>
<i>Smilacina racemosa</i>	<i>Vitis cinerea</i>
<i>Cerastium nutans</i>	<i>Chimaphila maculata</i>
<i>Silene antirrhina</i>	<i>Pterospora Andromedae</i>
	<i>Limosella aquatica</i>

A smaller group of plants with a wide distribution in North America appears to have its affinities in the tropics, although some of the species range as far north as southern Canada. These are:

<i>Adiantum Capillus-Veneris</i>	<i>Sphenopholis obtusata</i>
<i>Pellaea atropurpurea</i>	<i>Crotalaria sagittalis</i>
<i>Bouteloua hirsuta</i>	<i>Physalis pubescens</i>

*Diodia teres* var. *angustata*

8. *Tropical Plants.*—Besides a number of pan-tropical weeds, this group includes many species confined to the western hemisphere. The northern limit of these tropical plants is roughly from Florida to southern California, but with regard to their southern limits two distribution patterns may be distinguished. We find the plants of the principal distribution area ranging almost throughout the mainland of Mexico (exclusive of the Yucatán Peninsula), and southward for varying distances into Central America, many species reaching northern, or even southern, South America. A smaller group of species, besides occupying the above area, is also found in Yucatán and the West Indies.

In the first group the following may be mentioned:

<i>Asplenium Palmeri</i>	<i>Cassia leptocarpa</i>
<i>Cheilanthes pyramidalis</i>	<i>Crotalaria pumila</i>
<i>Notholaena aurea</i>	<i>Dalea leporina</i>
<i>Aristida divaricata</i>	<i>Parkinsonia aculeata</i>
<i>Bouteloua aristidoides</i>	<i>Phaseolus heterophyllus</i>
<i>B. filiformis</i>	<i>Vicia pulchella</i>
<i>Cottea pappophoroides</i>	<i>Zornia diphylla</i>
<i>Eragrostis intermedia</i>	<i>Cuphea Wrightii</i>
<i>E. mexicana</i>	<i>Oenothera laciniata</i>
<i>Muhlenbergia microsperma</i>	<i>Haplophyton cimicidum</i>
<i>Panicum hirticaule</i>	<i>Loeselia glandulosa</i>
<i>Pappophorum Wrightii</i>	<i>Valeriana sorbifolia</i>
<i>Setaria Liebmanni</i>	<i>Lobelia laxiflora</i>
<i>Sporobolus micropermus</i> <sup>8</sup>	<i>Aster spinosus</i>
<i>Tripsacum lanceolatum</i>	<i>Baccharis glutinosa</i>
<i>Cyperus flavus</i>	<i>Eupatorium pycnocephalum</i>
<i>C. Manimae</i> var. <i>asperrimus</i>	<i>Flaveria trinervia</i>
<i>Eleocharis nodulosa</i>	<i>Pinaropappus roseus</i>
<i>Stenophyllus capillaris</i>	<i>Selloa glutinosa</i>
<i>Salix taxifolia</i>	<i>Zexmenia podocephala</i>

The species also found in Yucatán and the West Indies are:

<i>Notholaena sinuata</i>	<i>Commicarpus scandens</i>
<i>Pellaea ternifolia</i>	<i>Sida procumbens</i>
<i>Polypodium thyrsanolepis</i>	<i>Evolvulus sericeus</i>
<i>Aristida ternipes</i>	<i>Trixis radialis</i>

<sup>8</sup>Ranges northward to Montana and Washington.

It should be noted that most of the plants in the first of the above lists have their distribution principally in western North America, a fact which may be interpreted as a result of the inundation of eastern Mexico and much of central United States by Cretaceous seas (38). During the lower Cretaceous all but a narrow western border of Mexico was under water, but at the same time there was a direct connection between this elevated area and the West Indies through Nicaragua and the southern border of Honduras and Guatemala. This connection provides us with an answer to Standley's question: "Por qué (con la excepción de la península yucateca) el mayor número de elementos de la flora antillana que existen en México, se encuentran en la costa del Pacífico y no en la del Caribe?" (48).

9. *Plants with anomalous distribution.*—Anomalous distributions are here considered to be those which are discontinuous over two or more continents. The outstanding examples among the plants collected in Bavispe River area are *Ceterach Dalhousiae* and *Asplenium exiguum*, which are known only from southwestern United States, northwestern Mexico, Africa and northern India (21, 51).

The following are plants which have a disjunctive distribution in North and South America:

<i>Bouteloua chondrosioides</i>	<i>Larrea divaricata</i>
<i>B. simplex</i>	<i>Dodonaea viscosa</i>
<i>Leptochloa dubia</i>	<i>Koeberlinia spinosa</i>
<i>Scleropogon brevifolius</i>	<i>Gaura parviflora</i> var. <i>lachnocarpa</i>
<i>Prosopis chilensis</i>	<i>Evolvulus arizonicus</i>

Johnston (20) has discussed the significance of the woody plants common to North and South America deserts, and considers that they are primarily of southern origin, while the herbaceous species are of northern derivation.

#### SUMMARY

1. The present paper is based on collections made during the years 1938-1941; approximately 4000 numbers were obtained representing some 1200 named species and varieties of pteridophytes and phanerogams. Most of the collecting was done in the Sierra del Tigre, within the loop of the Río de Bavispe, an area of about 2400 square kilometers.

2. The climate varies from arid at low elevations to warm temperate rainy at high altitudes (1800 m. or more). The climatic symbols applicable are BShw for elevations of 1800 m. or less and Cw for areas of more than 1800 m. The average annual precipitation is estimated to range from 250 mm. to 650 mm. or more according to altitude.

3. Three broad types of vegetation are recognized: 1, the mesquite-grassland at an elevation of 1000 m. or less; 2, oak-grassland from 1000 m. to 1800 m. and 3, pine forest above 1800 m. These are discussed and lists of characteristic plants are given.

4. Approximately 10% of the species recorded here do not occur in Arizona. Most of these are Mexican plants which here reach their northern limit, but others, such as *Ostrya virginiana* and *Helianthemum majus* appear to be relics of an ancient boreal flora.

5. The flora of the region of the Río de Bavispe as a whole is similar to that of other parts of northwestern Mexico and southwestern United States, and similarly contains certain species which indicate a relationship with other parts of North America, with the West Indies, South America and even other continents.

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## CATALOG OF COMMON NAMES

An attempt was made to record the local names of all plants collected. In general it may be stated that all the conspicuous plants, such as trees, shrubs, cacti, agaves, yuccas and certain grasses, as well as medicinal and other plants of economic value, have standardized names. A species may have more than one common name, but a given common name is seldom applied to more than one kind of plant, unless it be to a group of closely related species.

Agoriza.....	<i>Juniperus</i> sp.	Cardo santo.....	<i>Cirsium arizonicum</i>
Alamillo.....	<i>Alnus oblongifolia</i>	Cebolla.....	<i>Allium</i> spp.
Alamo.....	<i>Populus</i> spp.	Chamiso.....	<i>Encelia farinosa</i>
Alamo loco.....	<i>Nicotiana glauca</i>	Chichicayota.....	<i>Cucurbita digitata</i>
Algodoncillo.....	<i>Gossypium Thurberi</i>	Chichiquelite.....	<i>Solanum nigrum</i>
Aliso.....	<i>Platanus Wrightii</i>	Chichiquelite.....	<i>Solanum</i> sp.
Amapola.....	<i>Papaver somniferum</i>	Chicoria.....	<i>Bouvardia glaberrima</i>
Amol.....	<i>Agave Schottii</i>	Chilicote.....	<i>Erythrina flabelliformis</i>
Amole.....	<i>Agave Hartmanni</i>	Chicuri.....	<i>Franseria ambrosioides</i>
Amolillo.....	<i>Agave Schottii</i>	Chillilo.....	<i>Polygonum</i> spp.
Amor.....	<i>Mentzelia hispida</i>	Chinita.....	<i>Sonchus asper</i>
Antipusi.....	<i>Rhynchosia pyramidalis</i>	Chino.....	<i>Pithecellobium mexicanum</i>
Azucena del campo.....	<i>Milla biflora</i>	Chirahui.....	<i>Acacia pennatula</i>
Baburia.....	<i>Ipomoea acinsa</i>	Chirrión.....	<i>Sapindus Saponaria</i>
Bachata.....	<i>Condalia lycioides</i>	Chual.....	<i>Chenopodium</i> spp.
Bagote.....	<i>Parkinsonia aculeata</i>	Chuchumi.....	<i>Ambrosia aptera</i>
Baiburín.....	<i>Kallstroemia grandiflora</i>	Ciénaga.....	<i>Eleocharis</i> spp.
Baisómari.....	<i>Mimulus</i> spp.	Cocolmeca.....	<i>Phaseolus Metcalfei</i>
Barba de chivo.....	<i>Clematis Drummondii</i>	Cola de zorra.....	<i>Muhlenbergia dumosa</i>
Barba de viejo.....	<i>Clematis Drummondii</i>	Colita de ratón.....	<i>Polypogon mon-</i> <i>speliensis</i>
Batamote.....	<i>Baccharis glutinosa</i>	Cordoncillo.....	<i>Elytraria</i> spp.
Bavisa.....	<i>Cosmos crithmifolius</i>	Cuetito.....	<i>Ruellia nudiflora</i> var. <i>glabrata</i>
Bebelama.....	<i>Bumelia occidentalis</i>	Cúmaro.....	<i>Celtis reticulata</i>
Bellota.....	<i>Quercus Emoryi &amp; Q. vimeina</i>	Dátil.....	<i>Yucca</i> sp.
Berro.....	<i>Radicula Nasturtium- aquaticum</i>	Encino.....	<i>Quercus</i> spp.
Binorama.....	<i>Acacia constricta</i>	Encino azul.....	<i>Quercus arizonica, Q. oblongifolia</i>
Bledo.....	<i>Amaranthus</i> spp.	Encino blanco.....	<i>Quercus arizonica</i>
Brea.....	<i>Cercidium praecox</i>	Encino chaparro.....	<i>Quercus Toumeyi</i>
Caballito.....	<i>Tecomaria incisa</i>	Encino chino.....	<i>Quercus chihuahuensis</i>
Cabecita de viejo.....	<i>Mammillaria</i> spp.	Encino colorado.....	<i>Quercus hypoleucoes</i>
Calabacilla.....	<i>Cucurbita digitata</i>	Encino hueja.....	<i>Quercus Endlichiana</i>
Canahuala.....	<i>Notholaena sinuata</i>	Encino hueja.....	<i>Quercus fulva</i>
Canutillo.....	<i>Ephedra trifurca</i>	Escobita de la Virgen.....	<i>Eriogonum Ainsliei</i>
Cañaire.....	<i>Begonia martiana</i>	Preza silvestre.....	<i>Rubus</i> sp.
Capulin.....	<i>Rumex</i> spp.	Fresno.....	<i>Fraxinus</i> spp.
Cardo.....	<i>Prunus virens</i>	Fresno.....	<i>Ptelea trifoliata</i>
	<i>Argemone alba</i>		

Frijol.....	<i>Phaseolus vulgaris</i>	Junco.....	<i>Ceanothus Huichagorare</i>
Gallinita.....	<i>Mascagnia</i> spp.	Lágrima de Maria.....	<i>Commelina</i> sp.
Garambullo.....	<i>Celtis pallida</i>	Lama del agua..	<i>Potamogeton diversi-</i> <i>folios</i>
Gatitio.....	<i>Martynia</i> spp.	Lechuguilla.....	<i>Agave</i> spp.
Gatuño.....	<i>Martynia fragrans</i>	Lila.....	<i>Melia Azedarach</i>
Gatuño.....	<i>Mimosa Wrightii</i>	Lima.....	<i>Rhus</i> spp.
Girasol.....	<i>Helianthus annuus</i>	Lima de la sierra.....	<i>Rhus microphylla</i>
Golondrina.....	<i>Euphorbia</i> spp.	Limita (de la sierra).....	<i>R. microphylla</i>
Guasarcaco.....	<i>Parthenium Stramonium</i>	Limoncillo.....	<i>Dalea Lumholzii</i>
Hiedra.....	<i>Rhus Rydbergii</i>	Limiatiuna.....	<i>Abutilon</i> spp.
Hierba del aire..	<i>Baccharis thesioides</i>	Limiatiuna.....	<i>Kosteletzky Thurberi</i>
Hierba del aire..	<i>Trixis radialis</i>	Madroño.....	<i>Arbutus arizonica</i>
Hierba colorada.	<i>Potentilla atrorubens</i>	Mala mujer.....	<i>Tragia laciniata</i>
Hierba colorada.	<i>Rumex mexicana</i>	Mameique.....	<i>Krameria Grayi</i>
Hierba del empeine.....	Undet. sp. of <i>Cassia</i> . Plant lost.	Manzánilla de coyote.....	<i>Perityle microglossa</i>
Hierba de la flecha.....	<i>Sapium bilobulare</i>	Manzanita.....	<i>Arctostaphylos pungens</i>
Hierba del indio.	<i>Aristolochia Watsoni</i>	Maravilla.....	<i>Mirabilis Wrightiana</i>
Hierba del indio.	<i>Sarcostemma crispum</i>	Marrubia.....	<i>Marrubium vulgare</i>
Hierba loca....	<i>Crotalaria lupulina</i>	Matarique.....	<i>Cacalia decomposita</i>
Hierba del manso.....	<i>Anemopsis californica</i>	Mauto.....	<i>Lysiloma microphylla</i>
Hierba del oso..	<i>Prionosciadium Watsoni</i>	Melón de coyote.....	<i>A podantha undulata</i>
Hierba pegajosa.	<i>Mentzelia multiflora</i>	Mescal lechuguilla.....	<i>Agave</i> sp.
Hierba del piojo.	<i>Cassia leptocarpa</i>	Mesquite.....	<i>Prosopis chilensis</i>
Hierba del piojo.	<i>Haplophyton     cimicidium</i>	Mirto.....	<i>Bouvardia glaberrima</i>
Hierba del piojo.	<i>Mandevilla foliosa</i>	Mora.....	<i>Morus alba</i>
Hierba salada..	<i>Gaura parviflora</i> var. <i>lachnocarpa</i>	Mostaza.....	<i>Brassica nigra</i>
Hierba de la tortola.....	<i>Croton texensis</i>	Nogal.....	<i>Juglans major</i>
Hierba del venado.....	<i>Porophyllum macro-</i> <i>phyllum</i>	Nopal.....	<i>Opuntia</i> spp.
Hierba de la víbora.....	<i>Berlandiera lyrata</i>	Nopal duraznillo.....	<i>Opuntia</i> sp.
Higuera.....	<i>Ficus Carica</i>	Ocotillo.....	<i>Fouquieria</i> spp.
Higuerrilla.....	<i>Ricinus communis</i>	Ocotillo (del corral).....	<i>F. splendens</i>
Hipasote.....	<i>Chenopodium     ambrosioides</i>	Orégano.....	<i>Monarda austromontana</i>
Hinojo.....	<i>Foeniculum vulgare</i>	Oreja de mula..	<i>Asclepias glaucescens</i>
Hoja semita ..	<i>Senecio Hartwegi</i>	Ortiga.....	<i>Polanisia uniglandulosa</i>
Hojasén.....	<i>Cassia Covensis</i>	Ortiguilla.....	<i>Cnidoscolus angustidens</i>
Hojasén.....	<i>Cassia</i> sp.	Ortiguilla.....	<i>Tragia nepetaefolia</i>
Huajuco.....	<i>Bumelia rigida</i>	Ortija.....	<i>Cnidoscolus angustidens</i>
Huata.....	<i>Juniperus</i> sp.	Palma.....	<i>Washingtonia Sonorae</i>
Huate.....	<i>Juniperus</i> sp.	Palmilla.....	<i>Nolina microcarpa</i>
Huérico.....	<i>Populus acuminata</i>	Palo amarillo..	<i>Mahonia haematoxarpa</i>
Huérico.....	<i>P. monticola</i>	Palo del asta....	<i>Cordia Sonoreæ</i> <sup>9</sup>
Huinol.....	<i>Acacia cymbispina</i>	Palo azucar.....	<i>Acer brachypetrum</i>
Jaboncillo.....	<i>Tillandsia recurvata</i>	Palo blanco.....	<i>Ipomoea arboreascens</i>
Jarilla.....	<i>Baccharis glutinosa</i>	Palo dulce.....	<i>Eysenhardtia</i> spp.
Jarilla.....	<i>Salix jaliscana</i>	Palo loco.....	<i>Nicotiana glauca</i>
Jécota.....	<i>Hymenoclea monogyra</i>	Palo mulato.....	<i>Bursera laxiflora</i>
Jécota.....	<i>Sellowia glutinosa</i>	Palo santo.....	<i>Aralia humilis</i>
Juanilipili.....	<i>Boerhaavia</i> spp.	Pamita cimarrón.....	<i>Lepidium Eastwoodiae</i>
Júcaro.....	<i>Alnus oblongifolia</i>	Papache.....	<i>Randia Watsoni</i>
Júcaro.....	<i>Ostrya virginiana</i>	Parra.....	<i>Vitis arizonica</i>
Jumete.....	<i>Euphorbia</i> spp.	Pata de cuervo..	Undetermined malvaceous plant

<sup>9</sup>Observed but not collected east of Guasabas.

Pera.....	<i>Pyrus communis</i>	Táscali.....	<i>Juniperus</i> spp.
Pinabete.....	<i>Pseudotsuga mucronata</i>	Té Limón.....	<i>Dalea Lumbholzii</i>
Pino.....	<i>Pinus</i> spp.	Témacui.....	<i>Amoreuxia palmatifida</i>
Pino blanco.....	<i>P. ponderosa</i>	Tepeguaje.....	<i>Lysiloma Watsoni</i>
Pino chimonque.....	<i>P. chihuahuana</i> & <i>P. ayacahuite</i> var. <i>brachyptera</i>	Tepeit uaje.....	<i>Lysiloma Watsoni</i>
Piñón.....	<i>P. cembroides</i>	Tésota.....	<i>Acacia Greggii</i>
Piocha.....	<i>Melia Azedarach</i>	Tezcalama.....	<i>Ficus petiolaris</i>
Pionía.....	<i>Zizemnia podocephala</i>	Tihuinahua.....	<i>Hieracium Fendleri</i>
Pitaya.....	<i>Lemnairocereus</i> <i>Thurberi</i>	Tininahua.....	<i>Hieracium Fendleri</i>
Pochote.....	<i>Ceiba acuminata</i>	Toji.....	<i>Phoradendron</i> spp.
Poño.....	<i>Cowania Stansburiana</i>	Toloache.....	<i>Datura</i> spp.
Quelite.....	<i>Amaranthus</i> spp.	Tomate.....	<i>Lycopersicum</i> <i>exculentum</i>
Quesito.....	<i>Anoda cristata</i>	Tomatillo.....	<i>Physalis ixocarpa</i>
Rama de amores.....	<i>Physalis hederifolia</i>	Tomatillo cimarrón.....	<i>Physalis Wrightii</i>
Romerillo.....	<i>Baccharis sarothrodes</i>	Tomatito.....	<i>Physalis</i> spp.
Saetilla.....	<i>Bidens pilosa</i>	Tomatito.....	<i>Solanum elaeagnifolium</i>
Salicieso.....	<i>Lycium Andersonii</i>	Tomatito de buena mujer.....	<i>Solanum elaeagnifolium</i>
Salicieso.....	<i>Rhamnus betulacefolia</i>	Torota.....	<i>Bursera confusa</i>
Salsamora.....	<i>Morus microphylla</i>	Torota blanca.....	<i>Jathropha cordata</i>
Sámota.....	<i>Esenbeckia Hartmannii</i>	Torota prieta.....	<i>Bursera laxiflora</i>
Sandía.....	<i>Citrullus vulgaris</i>	Torota prieta.....	<i>Jatropha cordata</i>
Sangregado.....	<i>Jatropha cardiophylla</i>	Tortolita.....	<i>Croton texensis</i>
San Miguelito.....	<i>Antigonon leptopus</i>	Tostón.....	<i>Cosmos parviflorus</i>
San Miguelito.....	<i>Kallstroemia grandiflora</i>	Trébol.....	<i>Melilotus indica</i>
Saramatraca.....	<i>Cereus Greggii</i>	Trompillo.....	<i>Ipomoea desertorum</i>
Sauce.....	<i>Salix</i> spp.	Trompillo.....	<i>Quamoclit coccinea</i> var. <i>hederifolia</i>
Sauco.....	<i>Sambucus</i> spp.	Tronador.....	<i>Crotalaria lupulina</i>
Sauz.....	<i>Salix</i> spp.	Tulito.....	<i>Juncus Torreyi</i>
Saya.....	<i>Amoreuxia palmatifida</i>	Tulusisi.....	<i>Saracha procumbens</i>
Siemprevive.....	<i>Selaginella pilifera</i> var. <i>Pringlei</i>	Tutuqui.....	<i>Phaulothamnus</i> <i>spinescens</i>
Socoyoli.....	<i>Oxalis albicans</i>	Uña de león.....	Undetermined legumi- nous shrub
Sotol.....	<i>Dasyllirion Wheeleri</i>	Uva cimarrona.....	<i>Vitis cinerea</i>
Tabachín.....	<i>Caesalpinia</i> spp.	Uva trepadora.....	<i>Cocculus diversifolius</i>
Tabaco de coyote.....	<i>Nicotinia trigonophylla</i>	Uva tullidora.....	<i>Cocculus diversifolius</i>
Tamichi.....	<i>Krameria parvifolia</i>	Uvita tullidora.....	<i>Cocculus diversifolius</i>
Tapiro.....	<i>Buddleia Wrightii</i>	Verdolaga.....	<i>Portulaca oleracea</i>
Tarachico.....	<i>Dodonaea viscosa</i>	Zacate tule.....	<i>Tripsacum lanceolatum</i>
Tarachique.....	<i>Dodonaea viscosa</i>	Zacatón.....	<i>Tripsacum lanceolatum</i>
Taraíz.....	<i>Salix taxifolia</i>	Zapote.....	<i>Stenmadenia tomentosa</i> var. <i>Palmeri</i>
Táscale.....	<i>Juniperus</i> spp.		

## ANNOTATED LIST OF SPECIES

The following list includes all the higher plants collected in north-eastern Sonora and at Carretas, Chihuahua, except a few which are not yet determined. The letters H, P, and S after collection numbers serve to identify collections by Harvey, Phillips and Santos respectively; other numbers represent my own collections.

A complete set of plants of all collectors is preserved in the University of Michigan Herbarium. Harvey and Santos have already distributed their grasses, but as I have no record of where they were sent, only the distribution of my plants is indicated in the list. The herbaria which have some of my plants (in most cases a rather complete set) are shown below with their identifying symbol:

C—Prof. C. Conzatti, Oaxaca, Oaxaca, Mexico.

G—Gray Herbarium, Harvard University.

M—Instituto de Biología, Mexico, D. F.

S—Dr. Forrest Shreve, Tucson, Arizona.

US—United States National Herbarium, Washington, D. C.

Most of Phillips' plants and some of my own have not yet been distributed.

Besides the plants collected sterile plants of *Viola* were seen on Picacho del Pilar, and of *Lupinus* at Puerto de los Aserraderos. Chu-chupate (*Ligusticum Porteri* Coulter & Rose, according to Kearney and Peebles, 21) was never seen, yet it must exist in the area, for it is well known to the natives.

Thanks to the thorough collecting of Harvey and Santos the list of *Gramineae* presented here may well be one of the most complete local grass floras ever published for any part of Mexico. Even so, some omissions are probable, for a number of grasses not collected (e.g., *Poa* and *Trichloris*) are known from southeastern Arizona and northern Mexico (21).

#### Ophioglossaceae

*Ophioglossum Engelmanni* Prantl—4095.

*Ophioglossum vulgatum* L.—791-P; 4335.

#### Polypodiaceae

*Adiantum Capillus-Veneris* L.—538-P; 551-P; 592-P; 784-P; 382 C, G, S; 3297 C, G; M, S; 3304 G, M, S.

*Asplenium exiguum* Bedd.—550-P.

*Asplenium Palmeri* Maxon—1743-H; 281-P; 390-P; 391-P; 516-P.

*Asplenium Trichomanes* L.—548-P; 549-P; 584-P.

*Bommeria hispida* (Mett.) Underw.—1694-H; 381-P; 778-P; 543; 997 S; 4049; 4334 C, G, M, S.

*Ceterach Dalhousiae* (Hook.) C. Chr.—547-P.

*Cheilanthes castanea* Maxon—1695-H ?.

*Cheilanthes Eatoni* Baker—525-P.

*Cheilanthes Fendleri* Hook.—4204.

*Cheilanthes leuco-poda* Link—529.

*Cheilanthes Lindheimeri* Hook.—303-P; 342-P; 759-P; 512 S; 961 S; 3229 C, G, M, S; 3888 M, S; 4045 M, S; 4452 M.

*Cheilanthes Pringlei* Davenp.—360-P; 361-P; 363-P; 392-P; 524-P; 526-P; 536-P.

*Cheilanthes pyramidalis* Féée—642-P; 674-P; 4323.

*Cheilanthes tomentosa* Link—270-P; 282-P.

*Cheilanthes Wootoni* Maxon—1696-H; 4050 M, S.

*Cheilanthes Wrightii* Hook.—1735-H; 326-P; 373-P; 380-P; 513-P; 537-P; 779-P; 4047 M, S.

*Cystopteris fragilis* (L.) Bernh.—720-P.

*Dryopteris Féei* C. Chr.—747-P; 381 G, S.

*Dryopteris pilosa* (Mart. & Gal.) C. Chr.—719-P.

*Notholaena aurea* (Poir.) Desv.—272-P; 273-P; 292-P; 378-P; 379-P; 389-P; 4213 G.

All of the above except 379-P were distributed as *N. bonariensis* C. Chr.

*Notholaena ferruginea* Hook.—4653 M; 4744 M.

*Notholaena Grayi* Davenp.—293-P; 316-P; 4044a G, M, S; 4046 M.

*Notholaena incana* Presl—512-P; 750-P US.

*Notholaena limitanea* Maxon—738-P US.

*Notholaena sinuata* (Lag.) Kaulf.—Canahuala. 337-P; 532 G, S; 3890; 4044 G, M, S; 4856.

*Notholaena sinuata* var. *integerrima* Hook.—4585 M; 4869.

*Notholaena Standleyi* Maxon—4730 M, S.

*Pellaea atropurpurea* (L.) Link—4091.

- Pellaea intermedia* Mett.—3303 C, G, M, S; 4743 G.  
*Pellaea mucronata* D. C. Eaton—511-P.  
*Pellaea ternifolia* (Cav.) Link—4221.  
*Pellaea Wrightiana* Hook.—274-P; 338-P; 419-P; 4222.  
*Phanerophlebia auriculata* Underw.—546-P; 725-P.  
*Pityrogramma triangularis* (Kaulf.) Maxon—527-P.  
*Polypodium erythrolepis* Weatherby—496-P US.  
*Polypodium polypodioides* (L.) Watt.—515-P.  
*Polypodium thysanolepis* A. Br.—1706-H; 307-P.  
*Pteridium aquilinum* (L.) Kuhn—418-P; 721-P; 4800.  
*Woodsia mexicana* Fee—1721-H; 288-P; 447-P; 675-P; 4084.

## Marsileaceae

- Marsilea vestita* Hook. & Arn.—805-P.

## Equisetaceae

- Equisetum laevigatum* A. Br.—3977.

## Selaginellaceae

- Solaginella novoleonensis* Hieron.—388-P US.  
*Selaginella pilifera* A. Br. var. *Pringlei* (Baker) Morton—Siemprevive. 522 G, S; 2809.  
*Selaginella rupinicola* Underw.—1722-H; 284-P; 298-P; 343-P; 355-P; 533-P; 744-P; 775-P; 510 S; 2807 C; 3982 M, S.  
*Selaginella Wrightii* Hieron. ?—800-P.

## Pinaceae

- Abies concolor* (Gordon & Glendinning) Hoopes—506-P.  
*Cupressus arizonica* Greene—581-P; 4175.  
*Juniperus Deppeana* Steud. var. *pachyphloea* (Torr.) Martínez—2592; 2815; 3122; 3180; 3932; 4173.  
*Juniperus durangensis* Martínez—4788 M.  
*Juniperus flaccida* Schlecht.—3112; 3184?; 4093 M.  
*Juniperus monosperma* (Engelm.) Sarg.—846-P; 2991; 3654?  
*Pinus arizona* Engelm.—Pino, pino blanco. 528 G, S; 3360? G, M, S.  
*Pinus ayacahuite* Ehr. var. *brachyptera* Shaw—Pino chimonque. 3423 G, M, S; 3467 G, M, S.  
*Pinus cembroides* Zucc.—Piñon. 959 G, M, S; 2828 C, G, M, S; 3509, G, M; 3941 M; 4321 M; 4738 M.  
*Pinus chihuahuana* Engelm.—Pino. 565 G, S; 2732 G, M, S; 2827 C, G, M, S; 3174 C, G, M, S; 3409 C, G, M, S; 3942 M; 4202 M; 4789 M.  
*Pinus ponderosa* Doug.<sup>10</sup>—Pino blanco. 2748 G, M, S; 2829 G, M, S; 3175 G, M; 3176 G, M, S; 3943 M; 4266 M.  
*Pseudotsuga mucronata* (Raf.) Sudw.—Pinabete. 586-P; 3134 G, M, S; 3424 G, M, S.

## Gnetaceae

- Ephedra trifurca* Torr.—Canutillo. 2854; 3826 M; 3878 M; 4525 G, M, S.

## Naiadaceae

- Potamogeton diversifolius* Raf.—Lama del agua. 806-P.

## Gramineae

- Aegopogon tenellus* (Cav.) Trin.—1714-H; 1927-S; 2143-S; 2153-S.  
*Agropyron arizonicum* Scribn. & Smith—1920-S; 1962-S; 2163-S; 3157 G, S.  
*Agrostis verticillata* Vill.—711 G, S; 716; 765 S.

<sup>10</sup>Apparently overlooking the fact that in the original description *P. arizonica* is characterized as having 5 leaves per fascicle (rarely only 3), Martínez considers that *P. ponderosa* in Mexico is confined to Baja California and calls the 3-leaved pine of Sonora and Chihuahua *P. arizonica*, and the 5-leaved pine he has described as *P. arizonica* forma *quinquefoliata*. This was previously pointed out in Little's review of Martínez's monograph on the Mexican pines (23).

- Andropogon barbinodis* Lag.—1615-H; 1719-H; 868-P; 1800-S; 1829-S; 1871-S; 1908-S; 1954-S; 1980-S; 2014-S; 2066-S; 2068-S; 2111-S; 1114 G, S; 3540 G, M, S; 3767 G.
- Andropogon cirratus* Hack.—1625-H; 1677-H; 1731-H; 1859-S; 1914-S; 1932-S; 2083-S; 2113-S; 2159-S.
- Andropogon hirtiflorus* (Nees) Kunth—1821-S; 1951-S; 2158-S.
- Aristida Adscensionis* L.—1593-H; 1635-H; 1675-H; 1784-S; 1858-S; 2020-S; 2030-S; 2081-S; 3035; 3544 G, S; 3768 G, M.
- Aristida arizonica* Vasey—3546 G, M, S.
- Aristida barbata* Fourn.—1602-H; 1947-S.
- Aristida divaricata* Humb. & Bonpl.—1631-H; 1910-S; 2156-S.
- Aristida glauca* (Nees) Walp.—1760-S; 2031-S.
- Aristida Orcuttiana* Vasey—1986-S; 2021-S.
- Aristida panae* Woot. & Standley—1766-S; 2069-S.
- Aristida Schiedeana* Trin. & Rupr.—1638-H; 1709-H; 1826-S; 1928-S; 2157-S.
- Aristida ternipes* Cav.—1594-H; 1633-H; 1728-H; 1789-S; 1797-S; 1806-S; 1853-S; 2006-S; 2036-S; 2070-S; 3060 G, M, S; 3567 G, M, S; 3764 G, M, S; 3766 ? G, M, S.
- Arundo Donax* L.—1892-S.
- Avena fatua* L.—2026-S.
- Blepharoneuron tricholepis* (Torr.) Nash—1923-S; 1967-S; 2147-S.
- Bouteloua aristidoides* (H. B. K.) Griseb.—1599-H; 1657-H; 1780-S; 1830-S; 1993-S; 2047-S; 3575 G, M, S; 657 G, S; 3805 G, M.
- Bouteloua barbata* Lag.—1593-H; 2051-S.
- Bouteloua chondrosioides* (H. B. K.) Benth.—1725-H; 1783-S; 3655 G, S.
- Bouteloua curtipendula* (Michx.) Torr.—1611-H; 1613-H; 1648-H; 850-P; 865-P; 1753-S; 1773-S; 1799-S; 1814-S; 1946-S; 1964-S; 2004-S; 2071-S; 2121-S; 766 S; 3062; 3541 G, M, S; 3662 G, M, S; 3763 G, M, S.
- Bouteloua eriopoda* (Torr.) Torr.—1981-S; 2029-S; 2122-S.
- Bouteloua filiformis* (Fourn.) Griffiths—863-P; 1763-S; 1854-S; 2007-S; 2019-S; 2034-S; 2072-S; 2103-S; 3050 G; 3339 G; 3563 G, M, S; 3755 G, S.
- Bouteloua glandulosa* (Cerv.) Swallen—1710-H.
- Bouteloua gracilis* (H. B. K.) Lag.—1597-H.
- Bouteloua hirsuta* Lag.—1632-H; 1679-H; 1711-H; 864-P; 1801-S; 1812-S; 1864-S; 1934-S; 1949-S; 2005-S; 2087-S; 2120-S; 2137-S; 3143; 3661 ? G, S.
- Bouteloua Parryi* (Fourn.) Griffiths—3570 G.
- Bouteloua radicosa* (Fourn.) Griffiths—1612-H; 1678-H; 1803-S; 1933-S; 1960-S; 2102-S; 3660 G, M, S.
- Bouteloua rigidiseta* (Steud.) Hitchc.—1762-S; 1813-S.
- Bouteloua Rothrockii* Vasey—1642-H; 1712-H; 813-P; 1779-S; 1848-S; 2003-S; 1886-S; 757.
- Bouteloua simplex* Lag.—1940-S.
- Bromus anomalus* Rupr.—2079-S; 2136-S; 2167-S.
- Bromus ciliatus* L.—2128-S.
- Bromus frondosus* (Shear) Woot. & Standley—1693-H; 1915-S; 1939-S.
- Bromus laciniatus* Beal—2129-S.
- Bromus marginatus* Nees—3482 G, M, S.
- Bromus polyanthus* Scribn.—638-P.
- Bromus* sp.—1840-S.
- Cathartesum erectum* Vasey & Hack.—1788-S; 1899-S; 2033-S; 2571 M, S.
- Cenchrus pauciflorus* Benth.—1605-H; 857-P; 1776-S; 2046-S; 649 S; 2904 G; 3783.
- Chloris submutica* H. B. K.—2168-S.
- Chloris virgata* Swartz—1629-H; 1678-H; 1831-S; 1845-S; 1872-S; 1944-S; 2023-S; 2117-S; 3670 G, S.
- Cottea papophoroidea* Kunth.—2022-S; 2094-S; 2170-S.
- Cynodon Dactylon* (L.) Pers.—1655-H; 1786-S; 1810-S; 1868-S; 1883-S; 2001-S; 2118-S.
- Deschampsia Pringlei* Scribn.—2127-S.
- Digitaria argillacea* (Hitchc. & Chase) Fernald—1673-H; 1708-H.
- Digitaria sanguinalis* (L.) Scop.—1595-H; 1650-H; 819-P; 1827-S; 1844-S; 1869-S; 1878-S; 1902-S; 1941-S; 1998-S; 647 S; 3036 G, M, S; 3710 G, M, S; 3752 G, M, S.
- Echinochloa colonum* (L.) Link—1656-H; 319-P; 828-P; 1807-S; 1841-S; 1866-S; 1877-S; 1997-S; 3048 G, M, S; 3754 G, M, S.
- Echinochloa Crus-galli* (L.) Beauv.—1867-S.
- Echinochloa Crus-galli* var. *mitis* (Pursh) Peterm.—1876-S.
- Echinochloa Crus-galli* var. *zelayensis* (H. B. K.) Hitch.—1945-S.
- Elyonurus barbiculmis* Hack.—1865-H; 1819-S; 1860-S; 1931-S; 1950-S; 1979-S; 2082-S; 2112-S.

- Eragrostis cilianensis* (All.) Link—1592-H; 1681-H; 1811-S; 1833-S; 1847-S; 1881-S; 1893-S; 1942-S; 1996-S; 1999-S; 2095-S; 673 S; 764 G, S; 2883 G; 3659 G, M, S; 3770 G, M, S.
- Eragrostis diffusa* Buckl.—1591-H; 1604-H; 1718-H; 822-P; 3753.
- Eragrostis erosa* Scrib.—1749-H; 1991-S.
- Eragrostis intermedia* Hitch.—1603-H; 1626-H; 1645-H; 589-P; 1771-S; 1791-S; 1805-S; 2040-S; 2080-S; 2123-S; 715; 3061 G; 3329 G, M, S; 3614 G, S; 3671 G, M, S; 3743 G, M, S.
- Eragrostis mexicana* (Hornem.) Link—2113-S.
- Eragrostis neomexicana* Vasey—1590-H; 1646-H; 1672-H.
- Eragrostis pectinacea* (Michx.) Nees—1929-S; 1955-S; 2000-S; 2057-S; 747.
- Eragrostis* sp.—1911-S; 2119-S.
- Eriochloa aristata* Vasey—1649-H; 2024-S.
- Eriochloa gracilis* (Fourn.) Hitchc.—1622-H; 1792-S; 1835-S; 1870-S; 1884-S; 1912-S; 1943-S.
- Eriochloa gracilis* var. *minor* (Vasey) Hitchc.—1846-S.
- Eriochloa Lemmoni* Vasey & Scribn.—1652-H; 3760.
- Eriochloa* sp.—1887-S.
- Festuca octoflora* Walt.—1774-S; 1828-S.
- Hackelochloa granularis* (L.) Kuntze—1674-H; 1953-S.
- Heteropogon contortus* (L.) Beauv.—1618-H; 1683-H; 1767-S; 1795-S; 1809-S; 1852-S; 1983-S; 2035-S; 2073-S; 2114-S; 3798 G, M.
- Heteropogon melanocarpus* (Elz.) Benth.—1717-H.
- Hilaria Belangeri* (Steud.) Nash—1770-S; 1782-S; 1802-S; 1815-S; 2032-S; 3651 G, M, S.
- Hilaria cenchroides* H. B. K.—1621-H; 1680-H.
- Hilaria mutica* (Buckl.) Benth.—1634-H; 1751-S; 1775-S; 2062-S.
- Koeleria cristata* (L.) Pers.—1977-S; 2126-S; 2161-S.
- Leptochloa dubia* (H. B. K.) Nees—1620-H; 1764-S; 1804-S; 1825-S; 1906-S; 2010-S; 2043-S; 2089-S; 2116-S; 2171-S; 1115 G, S; 3547 G, M, S; 3606 G, M, S; 3750 G, M, S.
- Leptochloa filiformis* (Lam.) Beauv.—1607-H; 1713-H; 1734-H; 321-P; 1843-S; 1880-S; 1905-S; 1994-S; 3738.
- Lycurus phleoides* H. B. K.—1610-H; 1692-H; 1818-S; 1917-S; 1936-S; 1952-S; 1982-S; 2039-S; 2088-S; 2124-S; 2130-S; 3335 G, S; 3605 G, M, S.
- Muhlenbergia arizonica* Scribn.—1624-H; 1697a-H; 953 S.
- Muhlenbergia ciliata* (H. B. K.) Kunth—1742-H.
- Muhlenbergia dumosa* Scribn.—Cola de zorra. 589 G, S; 2823 G, M, S.
- Muhlenbergia Emmersleyi* Vasey—1627-H; 1641-H; 1688-H; 1798-S; 1820-S; 1925-S; 1974-S; 2090-S; 2109-S; 2110-S; 2166-S; 3631.
- Muhlenbergia longiligula* Hitch.—1963-S; 2164-S.
- Muhlenbergia microperma* (DC.) Kunth—2048-S; 2172-S.
- Muhlenbergia montana* (Nutt.) Hitchc.—1639-H; 1924-S; 2138-S.
- Muhlenbergia monticola* Buckl.—1659-H; 1729-H; 1793-S; 1817-S; 1824-S; 1909-S; 1919-S; 1975-S; 2041-S; 2078-S; 2084-S; 2125-S; 3762 G, S.
- Muhlenbergia polycaulis* Scribn.—1823-S; 1935-S; 2086-S; 2097-S; 2146-S?
- Muhlenbergia pauciflora* Buckl.—1715-H; 1930-S; 1958-S; 1961-S; 1965-S; 1966-S; 2165-S.
- Muhlenbergia Porteri* Scribn.—1897-S; 1976-S; 2008-S; 2011-S; 2042-S; 2054-S; 2018-S.
- Muhlenbergia pusilla* Steud.—2140-S.
- Muhlenbergia repens* (Presl) Hitch.—2134-S.
- Muhlenbergia rigens* (Benth.) Hitch.—1988-S; 2096-S; 2131-S.
- Muhlenbergia rigida* (H. B. K.) Kunth—2139-S.
- Muhlenbergia texana* Buckl.—1697-H; 1957-S; 2141-S.
- Muhlenbergia virescens* (H. B. K.) Kunth—1926-S.
- Oplismenus Burmanni* (Retz.) Beauv.—1644-H.
- Panicum arizonicum* Scribn. & Merr.—1601-H; 1785-S; 1834-S; 1861-S; 1890-S; 1903-S; 2016-S; 2045-S; 2101-S; 3301; 3543 G, S.
- Panicum bulbosum* H. B. K.—1647-H; 637-P; 1822-S; 1839-S; 1937-S; 2160-S; 603; 604-S; 3144 G, M, S; 3413 G, M, S; 3500 G, M, S.
- Panicum bulbosum* var. *minus* Vasey—1616-H; 1916-S.
- Panicum dichotomiflorum* Michx.—602.
- Panicum fasciculatum* Swartz—1838-S; 1885-S.
- Panicum fasciculatum* var. *reticulatum* (Torr.) Beal—2050-S.

- Panicum Ghiesbreghtii* Fourn.—1794-S; 1932-S.  
*Panicum hirticaule* Presl—1600-H; 1653-H; 1836-S; 1842-S; 1850-S; 1907-S; 2009-S; 2015-S; 2052-S; 2100-S; 3568; 3658; 3758.  
*Panicum lepidulum* Hitchc. & Chase—3542 G, M, S.  
*Panicum obtusum* H. B. K.—1630-H; 1752-S; 1781-S; 1808-S; 1882-S; 2065-S.  
*Pappophorum Wrightii* Wats.—1748-H; 2056-S; 2061-S; 2169-S.  
*Paspalum Botterii* (Fourn.) Chase—1654-H.  
*Paspalum convexum* Humb. & Bonpl.—1707-H.  
*Paspalum distichum* L.—1875-S.  
*Paspalum stramineum* Nash—1849-S ?  
*Phalaris caroliniana* Walt.—2027-S.  
*Piptochaetium fimbriatum* (H. B. K.) Hitchc.—1913-S; 1921-S; 2145-S; 2155-S.  
*Polypogon monspeliensis* (L.) Desf.—Colita de ratón. 714 G, S.  
*Scleropogon brevifolius* Phil.—1873-S.  
*Selaria Grisebachii* Fourn.—1596-H; 1716-H; 1741-H; 1889-S; 1904-S; 1948-S; 1992-S; 2055-S.  
*Setaria Liebmanni* Fourn.—1111 G, S; 3545 G.  
*Setaria macrostachya* H. B. K.—322-P; 1754-S; 1755-S; 1759-S; 1772-S; 1777-S; 1863-S; 1888-S; 1987-S; 2018-S; 2044-S; 2067-S; 2115-S; 648; 733; 2884; 3611 G, M, S.  
*Setaria villosissima* (Scribn. & Merr.) Scribn.—2098-S.  
*Setaria viridis* (L.) Beauv.—3732 G, M, S.  
*Sitanion Hystrix* (Nutt.) G. Smith—1682-H; 2085-S; 2135-S.  
*Sorghum halapense* (L.) Pers.—1651-H; 1837-S; 1879-S.  
*Sorghum vulgare* Pers.—2059-S; 2060-S.  
*Sorghum vulgare* var. *saccharatum* (L.) Boerl.—2049-S.  
*Sphenopholis obtusata* (Michx.) Scrib.—320-P.  
*Sporobolus contractus* Hitchc.—2063-S.  
*Sporobolus cryptandrus* (Torr.) Gray—2025-S; 2058-S; 2063-S.  
*Sporobolus interruptus* Vasey—686-P ?  
*Sporobolus microspermus* (Lag.) Hitchc.—1623-H; 1658-H; 1816-S; 1926-S; 2017-S; 2093-S; 2132-S; 2144-S; 2656 B; 2759 G, S.  
*Sporobolus ramulosus* (H. B. K.) Kunth—2142-S; 2162-S.  
*Sporobolus texanus* Buckl.—1637-H.  
*Sporobolus Wrightii* Munro—1606-H; 1750-S; 1778-S; 1891-S; 2064-S.  
*Stipa Pringlei* Scribn.—1922-S; 1959-S; 2154-S.  
*Trachypogon Montufari* (H. B. K.) Nees—1640-H; 1686-H; 1730-H; 1769-S; 1856-S; 1985-S; 2099-S.  
*Tragus Berteroianus* Schult.—1614-H.  
*Trichachne californica* (Benth.) Chase—1619-H; 1727-H; 1761-S; 1765-S; 1855-S; 1862-S; 1898-S; 1918-S; 1978-S; 1989-S; 2012-S; 2013-S; 2037-S; 2038-S; 2074-S; 2076-S; 2104-S; 2106-S.  
*Trichachne insularis* (L.) Nees—1726-H; 1757-S; 1768-S; 1787-S; 1790-S; 1857-S; 1900-S; 2075-S; 2105-S; 3636 G, S; 3771 G.  
*Trichachne patens* Swallen—3765 G.  
*Triodia mutica* (Torr.) Scribn.—1756-S; 1895-S; 1984-S; 2028-S; 2053-S.  
*Triodia pulchella* H. B. K.—867-P; 1758-S; 1874-S; 1896-S; 1990-S; 2002-S.  
*Tripsacum lanceolatum* Rupr.—Zacatón. 591-P; 1660-H; 1796-S; 1851-S; 601; 3336 M; 3604 G, S; 3751 G.

## Cyperaceae

- Carex leucodonta* Holm—584 G, S; 2729 G, M, S.  
*Carex ultra* Bailey—709 G, S.  
*Cyperus aristatus* Rottb.—4790.  
*Cyperus aristatus* var. *inflexus* (Muhl.) Boeckl.—2610.  
*Cyperus dipsaceus* Liebm.—944 G, S.  
*Cyperus esculentus* L.—2607 C, G, M, S.  
*Cyperus Fendlerianus* Boeckl.—4782.  
*Cyperus flavus* (Vahl) Nees—1109 G, S; 3223 C, G, M, S; 4728.  
*Cyperus Manimae* H. N. K. var. *asperrimus* (Liebm.) Kükent.—2640 G, M, S.  
*Cyperus odoratus* L.—780 G, S.  
*Cyperus uniflorus* Torr. & Hook.—587-P; 3098 G, M, S; 3263 G, M, S.  
*Cyperus* sp.—1969-S; 1970; 1972.  
*Eleocharis acicularis* (L.) R. & S.—2967 G, S.  
*Eleocharis nodulosa* (Roth.) Schult.—3094 G, M, S.

*Eleocharis palustris* (L.) R. & S. Ciénaga. 1098 G, S.  
*Stenophyllum capillaris* (L.) Britt.—2745 G, M, S.

Palmae

*Washingtonia Sonorae* Wats.—590-P.

Lemnaceae

*Lemna minor* L.—4415.

Bromeliaceae

*Hechtia montana* Brandeg.—541 G, S.  
*Tillandsia recurvata* L.—514-P; 847-P; 2764 G, M, S; 3269 G, M, S; 3641 G, M, S;  
 3804 G.

Commelinaceae

*Commelina crispa* Woot.—613 C, G, S; 2662 G, M, S; 3243 C, G, M, S; 3327 G, S;  
 3955; 4618.  
*Commelina dianthifolia* Delile—629-P; 951 G, S; 2596 G, M, S; 4258.  
*Commelina* sp.—4798.  
*Tradescantia pinetorum* Greene—991 C, S; 2609; 2726 G, M, S; 3246; 3478; 4259.  
*Tradescantia* sp.—4773.

Juncaceae

*Juncus saximontanus* A. Nels.—720 S.  
*Juncus interior* Wiegand—4409 M, US; 4836 M, US.  
*Juncus macer* S. F. Gray—721.  
*Juncus Torreyi* Cov.—Tulito. 710 S.

Liliaceae

*Allium cernuum* Roth—4387 M.  
*Allium scaposum* Benth.—995 S; 3947.  
*Anthericum Torreyi* Baker—652-P; 677-P; 932; 9963; 2554 C, G, M, S; 2740 G, M, S;  
 3183; 3998 M; 4235; 4264; 4831.  
*Asparagus officinalis* L.—752.  
*Dasyliion Wheeleri* Wats.—Sotol. 575 G, S; 3064 G, M, S; 3234 G, M, S; 3555  
 G, M, S; 4216; 4480.  
*Milla biflora* Cav.—2569 G; 2652 G, M, S; 4152; 4244; 4263.  
*Nolina microcarpa* Wats.—Palmilla. 4200.  
*Smilacina racemosa* (L.) Desf.—3283 G, M, S.  
*Yucca Schottii* Engelm.—Dátil.—584-P; 1119 G, S; 3128 G, M, S; 4217.  
*Zygadenus paniculatus* (Nutt.) Wats.—412a.

Amaryllidaceae

*Agave Hartmanni* Wats.—Amole. 2820 G, M, S.  
*Agave Palmeri* Engelm.—Lechuguilla. 517 G, S.  
*Agave Parryi* Engelm.—Lechuguilla. 3920 M; 4580 M.  
*Agave Schottii* Engelm.—amol, amolillo. 628 S; 4466 M; 4721 ?  
*Hypoxis* sp.—4774.

Iridaceae

*Sisyrinchium* sp.—4236.  
*Tigridia Pringlei* Wats.—580-P; 3468; 4250; 4839.

Orchidaceae

*Habenaria sparsiflora* Wats.—3466 G, M, S.  
*Hexalectris apicala* (Walt.) Barnhart—4348.  
*Malaxis corymbosa* Kuntze—3280 G, M, S; 4312a; 4351.

Saururaceae

*Anemopsis californica* Hook. & Arn.—Hierba del manso. 410 G, S; 3901 G, M, S.

Salicaceae

*Populus acuminata* Rydb.—Huérigo. 4705 M.  
*Populus angustifolia* James—740-P.

- Populus Fremontii* Wats.—Alamo. 429 G, S; 2614 G, M, S; 2935 G, M; 3396 G, M, S; 3537 G, M, S; 3863; 4128; 4679.  
*Populus monticola* Brandeg.—Huérigo. 691 G, S.  
*Populus Palmeri* Sarg.—357 G, S.  
*Populus tremuloides* Michx.—4817 C, G, M, S.  
*Salix Bonplandiana* H. B. K.—3530 G, M, S, US.  
*Salix Bonplandiana* var. *Toumeyi* Schneid.—Sauce. 609 G, S, US; 618 G, S, US; 2833 C, G, M, S, US; 3944 C, G, M, S.  
*Salix Gooddingii* Ball var. *vallicola* (Dudley) Ball—Sauce, sauz. 428 G, S; 2615 G, M, S; 2881 G, M, S; 2973 G, M, S; 3862 G, M, S; 4102 C, G, M, S.  
*Salix jaliscana* Jones—Jarilla. 3312 C, G, M, S.  
*Salix lasiolepis* Benth. var.—Sauz. 3397 G, M, S; 4276 C, G, M, S.  
*Salix taxifolia* H. B. K.—Taraiz. 331-P; 2990 G, M, S; 3726 G, M, S; 4221 C, G, M, S.

#### Juglandaceae

- Juglans major* (Torr.) Heller—Nogal. 464, G, M, S; 499; 2616 C, G, M, S; 2824 G, M, S; 2875 G, M, S; 2925 G, M, S; 2971 G, M, S; 2994 G, M, S; 3496 G, M; 3527 G, M, S; 4161 C, G, M, S; 4704 M.

#### Betulaceae

- Alnus oblongifolia* Torr.—Alamillo, jucaro. 496 G, S; 2808 G, M, S; 2965 G, M, S; 3116 G, M, S; 3481 G, M, S.  
*Ostrya virginiana* (Mill.) Koch—Jucaro. 583 G, S; 605; 3388 G, M, S; 3504 G, S.

#### Fagaceae

- Quercus albaefolia* C. H. Muñl.—3480 G, M, S; 4349 M; 2827 G, M, S.  
*Quercus arizonica* Sarg.—Encino azul, encino blanco. 501 G, S; 943 G, S; 496 G, S; 2511 G, M, S; 2746 C, G, M, S; 2798 G, M, S; 3150 G, M, S; 3200 G, M, S; 3371 G, M, S; 3944 C, G, M, S; 4219 G, M, S; 4375, G, M, S; 4371 G, M, S; 4825, G, M, S.  
*Quercus chihuahuensis* Trel.—Encino chino. 2932 G, M, S; 3124 G, M, S; 3616 G, M, S; 3965 C, G, M, S.  
*Quercus diversicolor* Trel.—Encino. 3202 G, M, S; 3382 G, M, S; 4197 C, G, M, S; 4308 G, M, S; 4786 G, M, S; 4826 G, M, S.  
*Quercus Emoryi* Torr.—Bellota, encino. 942 G, S; 2549 G, M, S; 4689 C, G, M, S; 2799 G, M; 3233 G, S; 3921 C, G, M, S; 3931 G, M, S; 4075 G, M, S; 4251 G, M, S; 4658, G, M, S.  
*Quercus Endlichiana* Trel.—Encino hueja. 3193 G, M, S.  
*Quercus fulva* Liebm.—Encino hurja. 3358 G, S.  
*Quercus hypoleucoides* A. Camus—Encino colorado. 502; 2727 C, G, M, S; 2826 G, M, S; 3151 G, M, S; 3372 G, M, S; 4251 C, G, M, S; 4737 G, M, S.  
*Quercus oblongifolia* Torr.—Encino azul. 2688 C, G, M, S; 3911 C, G, M, S; 4645 G, M, S; 4731 G, M, S.  
*Quercus Toumeyi* Sarg.—Encino chaparro. 572 G, S; 958 G, S; 2742 G, M, S; 2819 G, M, S; 3051 C, G, M, S; 3173 G, M, S; 3212 G, M, S; 3940 G, M, S; 4220 C, G, M, S; 4741.  
*Quercus viminea* Trel.—Bellota, encino. 526 G, S; 566 G, S; 568 G, S; 2743 C, B, M, S; 3370 G, M, S.

#### Garryaceae

- Garrya Wrightii* Torr.—573 G, S; 4096; 4378 C, G, M, S; 4640 G, M, S.

#### Ulmaceae

- Celtis pallida* Torr.—Garambullo. 323-P; 408 G, S; 437 G, S; 3065 G, M, S; 3532 G, M, S; 3889 M; 4021 M; 4435 G, M, S; 4566 C, G, M, S.  
*Celtis reticulata* Torr. Cumaro. 394 G, M, S; 441 G, S; 1118 G, S; 2588 G, S; 2894 G, M, S; 2974 G, M, S; 3000 G, M, S; 4105 C, G, M, S.

#### Moraceae

- Ficus Carica* L.—Higuera. 380 G, S.  
*Ficus petiolaris* H. B. K.—Texcalama. 383; 2910 G, S.  
*Morus microphylla* Buckl.—Salsamora. 2893 G, M; 2925-a G, A; 3749 G, M, S; 4847.  
*Morus alba* L.—Mora. 452 G, S.

## Loranthaceae

- Phoradendron Bolleanum* (Seem.) Eichl.—3926 C, G, M, S.  
*Phoradendron Coryae* Trel.—Toji. 2801 G, M, S; 3992 C, G, M, S.  
*Phoradendron juniperinum* Engelm.—Toji. 3623 G, M, S; 3867 C, G, M, S; 4240 G, M, S.  
*Phoradendron macrophyllum* Cockerell—1121 S; 2553 G, M, S.

## Santalaceae

- Comandra pallida* A. DC.—607 G, S.

## Aristolochiaceae

- Aristolochia brevipes* Benth.—1088?  
*Aristolochia Watsoni* Woot. & Standley—Hierba del indio. 643.

## Polygonaceae

- Antigonon leptopus* Hook. & Arn.—San Miguelito. 340.  
*Eriogonum Abertianum* Torr.—475-P; 763-P; 816-P; 459; 653; 655; 668 G, S; 2515 G, M, S; 2664 C, G, M, S; 3040; 3111 G, S; 3236; 3241 G, M, S; 3260 M; 3898 M; 3916 M; 4039 M, S; 4331 M; 4429 M; 4442 M; 4474 M; 4639.  
*Eriogonum Ainsliei* Standley—Escobita de la virgen. 1110 G, S.  
*Eriogonum Jamesii* Benth.—4293; 4742.  
*Eriogonum polycladon* Benth.—Escobita de la virgen. 2516 G, M, S.  
*Eriogonum Brightii* Torr.—2556; 2587 G, S; 4646; 4720 M.  
*Eriogonum* sp.—8795 M, S.  
*Polygonum amphibium* L.—2960; 3686 M, S.  
*Polygonum aviculare* L.—3415 G, M; 4072.  
*Polygonum Hydropiper* L.—Chilillo. 435 S; 645 G, S.  
*Polygonum hydropiperoides* Michx.—Chilillo. 298.  
*Polygonum lapathifolium* L.—Chilillo. 830-P; 701 G, S; 3249 G, M, S; 3775 G, S; 4103; 4324.  
*Rumex altissimus* Wood.—Cañaire. 2877 G, M, S.  
*Rumex crispus* L.—Cañaire. 2749 G, M; 3362 G, M, S.  
*Rumex hymenosepalus* Torr.—4294 M.  
*Rumex mexicanus* Meisn.—Hierba colorada. 458 G, S; 651; 670; 2958 G, S.  
*Rumex salicifolius* Weim.—Cañaire. 3363 G, M, S.

## Chenopodiaceae

- Atriplex canescens* (Pursh) Nutt.—782 G, S; 3846 M; 4141; 4475.  
*Atriplex elegans* (Moq.) D. Dietr.—639; 4106.  
*Chenopodium ambrosioides* L.—Nipasote. 457 G, S; 704 G, S; 2946 G, M, S.  
*Chenopodium Berlandieri* Moq.—Chual. 449 S; 2890 G, M; 3356 G, M, S.  
*Chenopodium Fremontii* Wats.—Chual. 2513 G, M, S; 3187 G, M; 3298 M; 4037 M; 4443 M; 4695 M.  
*Chenopodium glaucum* L.—3864 M.  
*Chenopodium incanum* (Wats.) Heller—4117-a.  
*Chenopodium incisum* Poir.—4405; 4478 M; 4829.  
*Chenopodium leptophyllum* Nutt.—Chual. 2959 G, M, S.  
*Chenopodium Palmeri* Standley—4117?

## Amarantaceae

- Amaranthus blitoides* Wats.—4656.  
*Amaranthus hybridus* L.—Bledo, quelite. 447 G, S; 1102 G, S; 3393 G, M, S; 3806 G, M.  
*Amaranthus Palmeri* Wats.—Bledo, quelite. 762 G, S; 1113 G, S; 2519 G, S; 2731 G, S; 2889 G, M, S; 3962 M; 4107.  
*Amaranthus Powellii* Wats.—4386 M.  
*Froelichia gracilis* Moq.—2517.  
*Froelichia interrupta* (L.) Moq.—1095 S.  
*Gomphrena caespitosa* Torr.—4708.  
*Gomphrena decumbens* Jacq.—3086.  
*Gomphrena nitida* Rothr.—829-P; 2508 G, M, S; 2667 G, M, S; 4401.  
*Gomphrena Sonorae* Torr.—471-P; 472-P; 762-P; 2774 G, M, S; 2785 G, M, S; 2929 G, S; 3058 G, S; 3553 G, M, S; 3620 G, S; 3966 M; 4025 M; 4157; 4471 M; 4682 M.

*Guilleminea densa* (Willd.) Moq.—3087 G, M, S; 3278 G, M, S; 3514 G, M, S; 3933 M.  
*Iresine paniculata* (L.) Kuntze—3248 G, M, S; 4664.  
*Tidestromia lanuginosa* (Nutt.) Standley—4145; 4479.

#### Nyctaginaceae

*Allionia incarnata* L.—765-P; 446 S; 612 M; 2942; 3068 G, M, S; 3839 M, S; 3958 M, S;  
 4030 M, S; 4464 M; 4478 M; 4515 M, S; 4579 M, S.  
*Boerhaavia caribaea* Jacq.—Juanilipili.—327-P; 751-P; 356; 443; 676 S; 905 G, S;  
 2530 G, M, S; 2546 G; 2961 G, M, S; 3316 M, S; 3649 G, M, S; 3744 G, M, S;  
 3844 M, S; 3961 M, S; 4146 S; 4698 M, S.  
*Boerhaavia Coulteri* (Hook. f.) Wats.—Juanilipili. 4136.  
*Boerhaavia erecta* L.—641; 662; 671; 2507 G, M, S; 2676 G, M, S; 2943 G, M, S; 3666  
 G, M, S; 3885 M, S; 3983 M, S; 4483 M; 4689.  
*Boerhaavia gracillima* Heimerl—3338 G, M.  
*Boerhaavia intermedia* M. E. Jones—687 S; 771; 3524 G, M, S; 4433 M, S;

*Boerhaavia spicata* Choisy—686; 3740 G, M, S; 4028 M, S; 4605 M, S.

*Boerhaavia Torreyana* (Wats.) Standley—2677.

*Commicarpus scandens* (L.) Standley—334-P; 849-P; 742 C, S; 775 C, G, S; 3265  
 G, M, S; 3566 M, S; 4421 M, S; 4663 M; 4688 M, S.

*Mirabilis corymbosa* Cav.—2710 G, M, S.

*Mirabilis Jalapa* L.—3400 M, S.

*Mirabilis Wrightiana* Gray—Maravilla. 2585 C, G, M, S; 2969; 3275 G, M; 3736  
 G, S; 4423 M. Nos. 2585 and 3275 were incorrectly labeled. *M. Wrightii* Gray.

*Oxybaphus coccineus* Torr.—3884.

*Oxybaphus comatus* (Small) Weatherby—994; 4292 M; 4767.

*Oxybaphus linearis* (Pursh) Robins.—1091 S; 2537 G, S.

#### Phytolaccaceae

*Phaulothamnus spinescens* Gray—Tútucui. 413 S; 4529 M.

*Phytolacca americana* L.—427-P?; 3386 G, M, S.

*Rivina humilis* L.—739 S; 2885 G, M, S; 3018 G, M, S; 3074 M, S; 3244 G, M, S;  
 3756 G, M, S; 3383; 3101 C, G, S; 4436 G, M, S; 4683.

#### Aizoaceae

*Mollugo verticillata* L.—4168; 4545 M; 4712 M.

#### Portulacaceae

*Portulaca lanceolata* Engelm.—3881; 4057; 4088 M, S.

*Portulaca oleracea* L.—Verdolaga. 434.

*Portulaca retusa* Engelm.—4118.

*Portulaca suffrutescens* Engelm.—665; 2564; 3071 G, M, S; 3299; 4056 S; 4399.

*Portulaca* sp.—4813; 4814; 4879.

*Talinum aurantiacum* Engelm.—3562 G; 3859; 3893; 4468; 4713.

*Talinum confertiflorum* Greene—3976.

*Talinum paniculatum* (Jacq.) Gaertn.—469-P; 766-P; 2769 G, M, S; 3066 G, M, S;  
 3242 G, M, S; 3792 M; 4109 M, S; 4437 M, S; 4725.

*Talinum* sp.—4859.

#### Caryophyllaceae

*Arenaria saxosa* Gray—3181 G, M, S.

*Cerastium nutans* Raf.—409-P; 672-P; 2845.

*Drymaria effusa* Gray (2)—4766?

*Drymaria nodosa* Engelm.—2557 G, M, S; 4125; 4403.

*Drymaria sphaeraloidea* Gray—970.

*Drymaria tenella* Gray—2733 C, G, M, S.

*Silene antirrhina* L.—723.

*Silene laciniata* Cav.—411-P; 653-P; 3452 G, M, S; 3506 G, M, S; 4257 S.

*Silene Thurberi* Wats.—2755 G, M, S; 3296 G, S; 4172; 4393; 4673 M; 4727 M.

#### Ranunculaceae

*Aquilegia chrysanthra* Gray—2797; 2811.

*Aquilegia formosa* Fischer—644-P.

*Clematis Drummondii* Torr. & Gray—Barba de chivo, barba de viejo. 297; 326 G,  
 M, S; 424; 2593 C, G, M, S; 2765 G, M, S; 2867 M, S; 2978 G, M, S; 3294; 3375  
 G, M, S; 3835 G, M, S; 3986 C, G, M, S; 4126 C, G, M, S.

*Ranunculus arizonicus* Lemmon ex Gray—3129 ? G, M, S.

*Ranunculus Hookeri* Schlecht.—3902.

*Ranunculus trichophyllum* Chaix—2957 C, G, M, S; 3682 G, M, S.

*Thalictrum Fendleri* Engelm.—2928 G; 3081 G, M, S; 3149 G, M, S; 3465 G, M, S; 4051 M; 4394 M.

*Thalictrum occidentalis* Gray—3054 G, M, S.

#### Berberidaceae

*Mahonia haematoxarpa* (Woot.) Fedde—Palo amarillo. 4628 C, G, M, S; 4696 G, M, S.

*Mahonia trifolia* Cham. & Schlecht.—3681 M, S.

*Mahonia Wilcoxii* (Kearney) Rehder—661-P.

#### Menispermaceae

*Cocculus diversifolius* DC.—387 S; 438 G, M, S; 3034 G, M, S; 4120 G, S.

#### Papaveraceae

*Argemone alba* Lest.—325 G, S; 420 G, S; 790 G, M, S; 2977 G, M, S.

*Argemone intermedia* Sweet—3852 ?

*Papaver somniferum* L.—Amapola, amapolita. 2876.

#### Cruciferae

*Brassica nigra* (L.) Koch—Mostaza. 2871 G, M, S.

*Draba petrophila* Greene—4395.

*Erysimum asperum* DC.—4634 M, S.

*Hesperidanthus linearifolius* (Gray) Rydb.—706; 2525 G, M, S; 2690 G, S; 3017 G; 3052 G, M, S; 3093 G, M, S; 3140 G, M, S; 3185 G, M, S; 3226 G, S; 3230; 3366 G, S; 3938; 4268; 4644; 4671. Some of the above numbers were distributed as *Sisymbrium* and *Thelypodium*.

*Lepidium Eastwoodiae* Woot.—Pamita cimarrón. 440; 638 S; 2865; 2941 G, M, S; 3037 G, M, S; 3818; 3869 M, S.

*Lepidium virginicum* L. var. *pubescens* C. L. Hitchc.—2856.

*Pennellia micrantha* (Gray) Nieuwland—541-P; 3053 G, M, S; 3215 G, M, S; 3253 G; 3367; 3494.

*Radicula Nasturtium-aquaticum* (L.) Britt. & Rendle—769.

#### Capparidaceae

*Polanisia uniglandulosa* (Cav.) DC.—432 G, M, S; 2869 G, M, S; 4651.

*Wislizenia refracta* Engelm.—3845 M.

#### Crassulaceae

*Graptopetalum occidentale* Rose—1733-H; 4160; 4223; 4307; 4337; 4844; 4857. All of the above are live plants growing in the Botanical Gardens of the University of Michigan. Only 1733-H has flowered permitting certain determination, but probably no more than one species is represented.

*Sedum stelliforme* Wats.—785-P?

#### Saxifragaceae

*Fendlera rupestris* Gray—626 G, S; 3273 G, M, S.

*Fendlera Wrightii* (Gray) Heller—530 G, S; 3055 G, M, S; 3095 G, M, S; 4296 M; 4636 M.

*Fendlerella utahensis* (Wats.) Heller—4317 G, M, S.

*Heuchera parviflora* Nutt.—643-P.

*Heuchera sanguinea* Engelm.—655-P; 2712 G, M, S; 3287 G, S; 3678 G, M, S; 4082 C, G, S; 4305 G, M, S; 4734.

*Philadelphus serpyllifolius* Gray—423-P.

#### Platanaceae

*Platanus Wrightii* Wats.—Sliso. 498 G, S; 2503 G, M, S; 2591 C, G, M, S; 2756 2802; 2996 G, M, S; 3491 G, M, S; 4413 C, G, M, S.

#### Crossosomataceae

*Crossosoma Bigelovii* Wats.—678 G, S; 3517 C, G, M, S; 4850 C, S.

## Rosaceae

- Agrimonia striata* Michx.—639-P; 3351 G, M; 4354 C, G, M, S.  
*Cercocarpus eximius* (C. Schneid.) Rydb.—574 G, S; 590 G, S; 3142 G, M, S; 4241 G, S; 4736 G, M, S.  
*Cowenia Stansburiana* Torr.—Pofio. 840-P; 598.  
*Fallugia paradoxa* (Don) Endl.—2548 G, M, S; 2594 G, M, S.  
*Potentilla atrorubens* Rydb.—408-P; 3188 G, M; 3350 G, M, S; 4189 G, S.  
*Prunus virens* (Woot. & Standley) Shreve—Capulin. 2509 G, M, S; 2790 G, M, S; 3127 G, M, S; 3159 G, M, S; 3348 G, M, S; 4237 C, G, M, S.  
*Pyrus communis* L.—753 G, S.  
*Rubus strigosus* Michx.—630-P?  
*Rubus* sp.—Freza silvestre. 3189 G, M, S.  
*Spiraea dumosa* Nutt.—685-P; 3199 C, G, M, S; 4184 C, G, M, S; 4256 C, G, S; 4785.

## Leguminosae

- Acacia angustissima* (Mill.) Kuntze—2555 G, M, S; 2584 C, G, M, S; 3488 G, M, S; 4719 M, S.  
*Acacia constricta* Benth.—Binorama. 845-P; 633 G, M, S; 2862 G, M, S; 3868 C, G, M, S; 4130 S.  
*Acacia crinita* Brandeg.—3963 M, S.  
*Acacia cymbispina* Spreng. & Riley.—Huinole. 2767.  
*Acacia filicoides* (Cav.) Trel.—2624 G, S; 4328.  
*Acacia Greggii* Gray—Tésota. 453 G, M, S; 4563 M; 4597.  
*Acacia millefolia* Wats.—339 G, M, S; 539 G, M, S; 679 G, M, S; 2860 M; 3002 G, M, S; 3019 G, M, S; 4034 S; 4511 M, S; 4609 M, S.  
*Acacia pennatula* (Schlecht. & Cham.) Benth.—Chirahui. 403 G, M, S; 408 G, M, S.  
*Acacia vermicosa* Standley—3817 M, S.  
*Amorpha occidentalis* Abrams—4412 M, S.  
*Astragalus* Wootoni Sheldon—2964 G.  
*Benthamantha Edwardsii* (Gray) Rose—3118 G, M, S; 3497 C, G, M, S; 4098.  
*Benthamantha glabella* (Gray) Rydb.—2737.  
*Benthamantha Wrightii* Rydb.—2602 C, G, M, S; 2651 G, M, S.  
*Caesalpinia Gilliesii* (Hook.) Wall.—418 C, G, S; 4556.  
*Caesalpinia pulcherrima* (L.) Swarts—395 G, M, S; 2934.  
*Calliandra eriophylla* Benth.—4623 S.  
*Calliandra formosa* (Kunth) Benth.—3609 C, G, M, S.  
*Calliandra humilis* (Schlecht.) Benth.—3917 M.  
*Calliandra reticulata* Gray—525 S; 3076; 4350 M, S.  
*Cassia bauhinoides* Gray—2568 G, S; 3841 M, S. The root of this species has a rhubarb odor.  
*Cassia Covensis* Gray—Hojasén. 431 S; 455 S; 4122 S; 4543 M, S.  
*Cassia leptadenia* Greenm.—2540 G, M, S; 2620 C, G, M, S; 3503 G, M, S; 3791; 3973 M, S.  
*Cassia leptocarpa* Benth.—Hierba del piojo. 2567 C, G, M, S; 2789 G, M, S; 2868 G, M; 3056 G; 3254 G, S; 3520 G, M, S; 3615 G, M, S; 3729; 4554 M, S.  
*Cassia Lindheimeriana* Scheele—3525 G, M, S.  
*Cassia Wislizeni* Gray—3853 C, G, M, S.  
*Cassia Wrightii* Gray—625; 2738 C, G, M, S; 3012 G, S; 3077; 3272 G, M, S; 3633 G, M, S; 3927 M, S.  
*Cercidium praecox* (R. & P.) Harms—Brea. 663; 4032.  
*Cologania angustifolia* Kunth—3406; 3411; 3472; 4254.  
*Cologania Lemmoni* Gray—3164a; 3172 ? ; 3399 C, G, M, S; 3405 G, S; 4253.  
*Cologania longifolia* Gray—2599 G, M, S; 2840; 3139 G; 3250; 3207; 3935; 4255.  
*Crotalaria longirostrata* Hook. & Arn.—523-P; 3308; 3519 C, G, M, S; 4086 M, S.  
*Crotalaria pumila* Ortega—Hierba loca, tronader. 2619 C, G, M, S; 3669 M, S; 3712 G, M, S.  
*Crotalaria sagittalis* L. 2735 C, G, M, S; 3637; 3653; 4370 M, S.  
*Crotalaria vitellina* Ker-Gawl.—3105; ? 3255 ?  
*Dalea albiflora* Gray—3489 G, M, S; 4181 S.  
*Dalea astragalopsis* Standley—3180 S.  
*Dalea diffusa* Moric.—2687 G, M, S; 3707 G, M, S; 3946 M, S.  
*Dalea filiformis* Gray—4297 M, S.

- Dalea filiformis* Gray var.—2725 C, G, M, S.  
*Dalea Gravi* Vail—2579 C, G, M, S; 2686.  
*Dalea lachnostachys* Gray—843-P.  
*Dalea logopina* Rydb.—4806 M, S.  
*Dalea leporina* (Ait.) Kearney & Peebles ex Hemsl.—2705 G, M, S.  
*Dalea Lumholtzii* Robins. & Fern.—Limoncillo, té limón. 557-P; 945 G, S; 2521 G, M, S; 3192 G, M, S; 3484 G, M, S; 4179 S. This species has a lemon-like odor, and may be used either fresh or dry for making tea.  
*Dalea mollis* Benth.—4589.  
*Dalea Ordiae* Gray—2580 ? C, G, M, S; 4716 M, S.  
*Dalea Parryi* Torr. & Gray—4591 ? M, S.  
*Dalea pogonathera* Gray—2851.  
*Dalea Wrightii* Gray—4148 S.  
*Desmanthus bicornutus* Wats.—3598 G, M, S; 4033.  
*Desmodium arizonicum* Wats.—3404; 3430 G, M, S; 3485 G, M, S.  
*Desmodium batocaulon* Gray—969 G, S; 2523 G, M, S; 2541 G, S; 2622 C, G, M, S; 3667 H, S; 3742 G, S; 3999 M.  
*Desmodium cinerascens* Gray—2532 C, G, M, S; 3585 C, G, M, S.  
*Desmodium gramineum* Gray—522-P; 3632 C, G, M, S.  
*Desmodium neomexicanum* Gray—971; 2621 C, G, M, S; 3437; 3285 M.  
*Desmodium prehensile* Schlecht.—820-P; 3398 G, M, S; 3435 G, M, S.  
*Desmodium purpureum* (Miller) Faw. & Rendle—2623 C, G, M, S; 2757 G, M, S.  
*Desmodium Rosei* Schubert—2539 G, M, S; 3665 G, M, S.  
*Desmodium* sp.—2987 G, M, S.  
*Diphysa Thurberi* (Gray) Rydb.—2625 C, G, M, S; 4079 M, A.  
*Eriosema laetum* Johnston—2650 G, M, S.  
*Erythrina flabelliformia* Kearney—Chilicote. 379 G, S; 507; 2761; 2813; 3126 G, M; 4097; 4757.  
*Eysenhardtia orthocarpa* (Gray) Wats.—Palo dulce. 490; 5083; 3078 G, S; 3554 G, M, S; 3887 C, G, M, S; 4512 M, S; 4648 M, S.  
*Eysenhardtia polystachya* (Ort.) Sarg.—535 ? S; 2821 ? M, S. Lvs. in these are 9–21 foliolate, and more pubescent than in typical *E. polystachya*.  
*Galactia striata* (Jacq.) Urban—4568.  
*Galactia Wrightii* Gray—3007 G; 3119 G, M, S; 3262 G, M, S; 3900 M, S; 4657 M, S.  
*Hoffmannseggia densiflora* Benth.—904 S; 2611 C, G, M, S; 3825.  
*Indigofera sphaerocarpa* Gray—4677 M.  
*Lathyrus arizonicus* Britt.—3436 G, M, S.  
*Lotus chihuahuanus* (Wats.) Greene—2586 G, M, S; 3340 G, M, S.  
*Lotus neomexicanus* Greene—2831 ?  
*Lotus puberulus* (Benth.) Greene—2837 G, M, S; 3106 G, M, S; 3132 G, M, S; 3274 G, S.  
*Lotus Wrightii* (Gray) Greene—564; 599 C, G, S; 966 G, S; 4201 S; 4729 M, S; 4805, M, S.  
*Lysiloma microphylla* Benth.—Mauto. 397 G, M, S; 3808 M, S.  
*Lysiloma Watsonii* Rose—Tepeguaje, tepehuaje. 396 G, S; 622 G, S; 2783 G, M, S; 3020 G, M, S; 3538 G, M, S.  
*Melilotus indica* (L.) All.—Trebol. 303; 2901 G, M, S.  
*Mimosa biuncifera* Benth.—2978 G, M; 3643 M, S; 3801 G, M, S; 3834 M, S.  
*Mimosa dysocarpa* Benth.—4675 M, S.  
*Mimosa Grahamii* Gray—3668 G, M, S; 4295.  
*Mimosa laxiflora* Benth.—3564 C, G, M, S; 4035; 4533 M, S.  
*Mimosa Wrightii* Gray—Gatuño. 579 S; 3006 G, M, S; 3227 G, M, S; 3892 S; 3972 M, S; 4678.  
*Nissolia Pringlei* Rose—3035 G, M, S.  
*Nissolia Schottii* (Torr.) Gray—543-P; 534 G, S; 734 G, S; 3075 G, M, S; 3268 G, M, S; 3557 G, S; 3587 G, M, S; 3886 G, M, S; 4524 C, G, M, S.  
*Parkinsonia aculeata* L.—Bagota. 355 G, S.  
*Petalostomon exilis* Gray—4383 M.  
*Petalostemon oligophyllum* (Torr.) Rydb. 824-P.  
*Petalostemon Sonorae* Rydb.—842-P.  
*Phaseolus acutifolius* Gray—4613.  
*Phaseolus angustissimus* Gray—838-P.  
*Phaseolus angustissimus* var. *latus* M. E. Jones—3419 G, S.  
*Phaseolus heterophyllus* Willd.—2542 C, G, M, S; 4062 S; 4186 S; 4777.

- Phaseolus Metcalfei* Woot. & Standley—Coeolmeca. 3453 G.  
*Phaseolus ritensis* Jones.—2707 C, G, S; 3408 G; 4369 M.  
*Phaseolus vulgaris* L. Frijol. 3919.  
*Phaseolus Wrightii* Gray—636-P; 2561; 3083 G; 3148 G, M, S; 3438 G, M, S. 2561  
and 3082 were distributed as *P. heterophyllus* Willd.  
*P. Wrightii* var. *Grayanus* (Woot. & Standley) Kearney & Peoples 3473 C, G, M, S.  
*Pithecellobium mexicanum* Rose—Chino. 386 G, S; 3003 G, M, S; 3802 M.  
*Prosopis chilensis* (Mol.) Stuntz—Mesquite. 402 G, S; 419 G, S.  
*Rhynchosia pyramidata* (Lam.) Urban—Antipusi. 2919 G, M, S.  
*Rhynchosia texana* Torr. & Gray—4488.  
*Robinia neomexicana* Gray—660-P; 4803. These were distributed as *R. luxurians* (Dieck.) Rydb.  
*Tephrosia leiocarpa* Gray—3008; G, M, S; 3626 C, M, S.  
*Tephrosia purpurea* (L.) Pers.—3583-C, G, M, S.  
*Tephrosia Thurberi* Gray—2706 C, G, M, S; 3225 C, G, M, S; 3502 C, G, M, S.  
*Trifolium lacorum* Greene—1099 G, S; 3353 C, G, M, S.  
*Vicia leucophaea* Greene—3208 G, M, S.  
*Vicia pulchella* H. B. K.—2848 G; 3138 C, M, S; 3354 C, G, M, S; 4316 M, S.  
*Zornia diphylla* (L.) Pers.—3082; 3594; 4149.

#### Krameriaceae

- Krameria Grayi* Rose & Painter—Mamelique. 2816 G, M, S; 2954 G, M, S; 3042 G, M, S; 3270 G, M, S.  
*Krameria parvifolia* Benth.—Tamichi. 624 S; 2786 G; 3642 G, S; 3924 M; 4151; 4528 M; 4592 G, M, S.  
*Krameria paucifolia* Rose—3896 G, S.

#### Geraniaceae

- Geranium atropurpureum* Heller—3133 G, M, S; 3343 G, M, S; 4182 C, G, M, S.  
*Geranium Wislizeni* Wats.—2719 G, S; 3147 G, M, S; 3314; 3342 G, M, S; 3978 C, G, M, S; 4198 C, G, M, S.

#### Oxalidaceae

- Oxalis albicans* H. B. K.—757-P; 306 S; 577; 968 S; 2544 G, S; 2545 G, S; 3330 G, S.  
*Oxalis divergens* Benth.—3201 C, G, M, S.  
*Oxalis Grayi* (Rose) Kunth—2907; 3146 C, G; 4252.  
*Oxalis stricta* L.—544-P; 4058.  
*Oxalis violacea* L.—3460.  
*Oxalis* sp.—4797.

#### Linaceae

- Linum hypericifolium* Presl—3458 C, G, M, S.  
*Linum neomexicanum* Greene—3196 C, G, M, S; 3322; 3377 G; 3439 G, M, S; 4199; 4849.  
*Linum puberulum* (Engelm.) Heller—4061.

#### Zygophyllaceae

- Kallstroemia californica* (Wats.) Vail—634 G, S; 4615 M.  
*Kallstroemia grandiflora* Torr.—Baiburín, San Miguelito. 854-P; 766; 2512; 2986 G, M, S; 3027 G; 3029 G, M, S; 3785; 3866; 3967; 4108; 4469 M.  
*Kallstroemia laetivirens* Thornber—686; 2527 G, M, S.  
*Kallstroemia longipes* Rydb.—781 ? ; 3551 ?  
*Larrea divaricata* Cas.—3819 G, M, S; 4131 G, M, S; 4558 C, G, M, S.  
*Tribulus terrestris* L.—4042; 4112.

#### Rutaceae

- Esenbeckia Hartmannii* Robins. & Fern.—Samota. 2921 ? G, M, S.  
*Ptelea trifoliata* L.—Fresno. 506 G, S; 3009 G, M, S.

#### Simaroubaceae

- Ailanthes glandulosa* Desf.—754 G, S.

#### Burseraceae

- Bursera confusa* (Rose) Engler.—Torota. 3625 G, M, S; 3959.  
*Bursera laxiflora* Wats.—Torota prieta, palo mulato. 384 G, S; 399 G, S.

## Meliaceae

*Melia Azedarach* L.—Lila, piocha. 421 S.

## Malpighiaceae

*Aspicarpa hirtella* Tich.—3476 G; 3997; 4063; 4158.

*Janusia californica* Benth.—546; 3271 G, M, S; 3629 G, M, S.

*Janusia gracilis* Gray—683 G, S; 3080 G, S; 3894 M, S; 4493 M, S; 4569 M, S.

*Mascagnia cana* Small—Gallinita. 482.

*Mascagnia macroptera* (Moc. & Sessé) Niedenzu—Gallinita. 391; 486.

*Thryallis angustifolia* (Benth.) Kuntze—3574 G, M, S.

## Polygalaceae

*Monnieria Wrightii* Gray—2724 G, M, S.

*Polygala alba* Nutt.—3703.

*Polygala hemipterocarpa* Gray—524; 2570 G; 2817; 3922.

*Polygala macradenia* Gray—4523; 4581 M.

*Polygala obscura* Benth.—952 G, S; 2595 C, G, M, S; 2698; 3240; 3376; 3923.

*Polygala scoparioides* Chodat—608.

## Euphorbiaceae

*Acalypha Lindheimeri* Muell. Arg.—1097 G, S; 3702 G, S.

*Acalypha neomexicana* Muell. Arg.—2680 G, M, S; 4089; 4138 S.

*Acalypha ostryaefolia* Riddell—3716 G, M, S; 3960; 4137.

*Acalypha papillosa* Rose—392; 511 G, S; 2812 G, M, S; 2931 G, M, S; 2999 G, M, S; 3001 G, M, S; 3026 G, M, S; 3237 G, M, S; 3552 G, M, S; 3769 G, M, S; 3956 M.

There is considerable variation in the above specimens and perhaps more than one species is represented.

*Acalypha phleoides* Ca.—2497 G, M, S; 2546 G, M, S; 2655 C, G, M, S.

*Bernardia myricaefolia* Wats.—4870.

*Cnidoscolus angustidens* Torr.—Ortiguilla, ortija. 518; 531 G, S; 2695 C, G, M, S; 3634 G, M, S; 3913 M, S.

*Croton corymbulosus* Engelm.—4583.

*Croton texensis* (Klotzsch) Muell. Arg.—Hierba de la tortola, tortolita. 327 G, S; 2873 G, M, S; 2939 G, M, S; 3685 M, S; 3885 M, S; 4144 S.

*Ditaxis neomexicana* (Muell.) Arg.) Heller—4428 M.

*Ditaxis serrata* (Torr.) Heller—4502; 4601; 4861.

*Euphorbia Abramsiana* Wheeler—Golondrina. 642 S.

*Euphorbia albomarginata* Torr. & Gray—Golondrina. 632 S; 3855 M, S; 3914 M, S.

*Euphorbia arizonica* Engelm.—463; 3046 G, S; 4448 M; 4726 M, S; 4863.

*Euphorbia capitellata* Engelm.—851-P; 4565-a; 4603; 4864; 4865.

*Euphorbia chamaesula* Boiss.—4071 S.

*Euphorbia colorata* Engelm.—2648 G, M, S; 3646 G, S.

*Euphorbia dentata* Michx.—2583 G, S.

*Euphorbia dentata* var. *cuphosperma* Engelm.—Jumete. 4074; 4612; 4676.

*Euphorbia dentata* var. *lasiocarpa* Boiss.—2499 G, M, S.

*Euphorbia exstipulata* Engelm.—4714.

*Euphorbia florida* Engelm.—2685 G, S; 4027; 4565 M, S.

*Euphorbia heterophylla* L. sensu latoire—835-P; 2626 G, M, S; 2775 G, M, S; 3592 G; 3690 G, S; 4614; 4685 M, S.

*Euphorbia hirta* L. var. *procumbens* (DC.) N. E. Brown—2679 G, M, S.

*Euphorbia hirta* var. *typica* Wheeler—760 S; 3311; 3650; 3697; 4087 M, S; 4166 S; 4448 M, S; 4661 M, S; 4868.

*Euphorbia hyssopifolia* L.—2582 C, G, M, S; 3596 H; 3722; 3918 M, S; 4135 S; 4629; 4715.

*Euphorbia indivisa* (Engelm.) Tidestrom—2681 G, S; 3696; 4404.

*Euphorbia micromera* Boiss.—4535.

*Euphorbia Parryi* Engelm.—640 S.

*Euphorbia Plummerae* Wats.—Golondrina. 3198; 3220.

*Euphorbia revoluta* Engelm.—4446; 4503.

*Euphorbia setiloba* Engelm.—4476; 4860.

*Jatropha cardiophylla* (Torr.) Muell, Arg.—Sangregado. 661 G, S; 3578 G, M, S; 4019 M, S; 4482.

*Jatropha cordata* (Ortega) Muell. Arg.—Torota prieta, torota blanca. 404 G, S; 2924 G, M, S; 2925-b G, M, S.

*Jatropha macrorrhiza* Benth. var. *septemfida* Engelm.—623 G, S; 3824 M, S.  
*Manihot angustiloba* (Torr.) Muell. Arg.—542 G, S; 2758 G, M, S; 2930 G, M, S;  
 3013; 3103; 3647.

*Phyllanthus polygonoides* Nutt.—3800.

*Ricinus communis* L.—Higuerilla. 296 G, S; 4610 M.

*Sapium bilobulare* (Wats.) Pax—Hierba de la flecha. 401 G, S; 2916 G, M, S.

*Tragia laciniata* (Torr.) Muell. Arg.—Mala mujer. 586.

*Tragia nepetaefolia* Cav.—Ortiguilla. 954 S; 3163 C, M, S.

#### Anacardiaceae

*Rhus choriophylla* Woot. & Standley—Lima. 841-P; 2660, G, M, S; 2759 G, S;  
 3988 G, M, S; 4380 C, G, M, S; 4692 G, M, S.

*Rhus glabra* L.—581 G, S; 3381 G, M, S.

*Rhus microphylla* Engelm.—Lima de la sierra, limita. 487 G, S; 736; 2861 G, M, S;  
 3837 C, G, M, S; 4699 M.

*Rhus Rydbergii* Small—Hiedra. 497 G, S; 2551 G, M, S; 2763 G, M, S; 3295 G,  
 M, S; 3505 G, M, S; 3990 M; 4238 M.

*Rhus trilobata* Nutt.—527 G, S; 2547 G, M, S; 2814 G, M, S; 3178 G, M, S; 3907  
 C, G, M, S; 4239 G, M, S; 4732 G, M, S.

*Rhus virens* Lindh.—Lima. 528-P; 2805 G, M, S; 3235 G, M, S; 3648 G, M, S;  
 3794 G, M, S.

#### Celastraceae

*Mortonia scabrella* Gray—520 G, S.

#### Aceraceae

*Acer brachypterum* Woot. & Standley—Palo azúcar. 500 G, S; 3011 G, M, S;  
 3205 G, M, S; 3390 G, M, S; 4318 G, M, S.

#### Sapindaceae

*Cardiospermum Halicacabum* L.—748-P.

*Dodonaea viscosa* Jacq.—Tarachico, tarachique. 400 G, M, S; 514, G, M, S; 2800  
 G, M, S; 2834; 2995 G, M, S; 3228; 3621 M, S; 4041 G, M, S; 4520 C, G, M, S.

*Sapindus Saponaria* L.—Chirrón. 504 G, S; 693 G, S; 3025 G, M, S; 3588 G, M, S.  
*Ungnadia speciosa* Endl.—694 G, S; 4684 C, G, M, S.

#### Rhamnaceae

*Ceanothus coerulescens* Lag.—507-P.

*Ceanothus Huichagorare* Loesn.—Junco. 404-P; 635-P; 2850; 3425 G, S; 3912 M;  
 4188; 4214.

*Condalia lycoidea* (Gray) Weverb.—Bachata. 862-P; 417 G, S; 785 S.

*Condalia spathulata* Gray—818-P; 4487.

*Rhamnus betulaeifolia* Greene—Salicieso. 582 G, S; 2708 C, G, M, S; 3194 G, M, S;  
 3499 G, M, S; 3695 G, M, S; 3979.

*Rhamnus illicifolia* Kellogg—4846. Sterile specimen from the only plant seen.

#### Vitaceae

*Cissus trifoliata* L.—318-P.

*Parthenocissus quinquefolia* (L.) Planch.—2899 G, M, S.

*Vitis arizonica* Engelm.—Parra. 505-P; 2665 C, G, M, S; 2736 C, G, M, S; 2825  
 M, S; 3389 G, M, S; 4094 C, G, M, S; 4167 G, M, S; 4278 C, G, M, S.

*Vitis cinerea* Engelm.—Uva cimarronna. 2895 G, M, S; 2970 G, M, S; 4489.

#### Malvaceae

*Abutilon californicum* Benth.—4494 ? M.

*Abutilon crispum* (L.) Sweet—3044 G, M, S.

*Abutilon incanum* (Link) Sweet—4562 M.

*Abutilon Pringlei* Hochr.—4495 M.

*Abutilon reventum* Wats.—Limpia tuna. 467-P; 3518 G, M, S; 4163.

*Abutilon Sonorae* Gray—3277 G, M, S; 3748 M, S; 4681.

*Anoda cristata* (L.) Schlecht.—Quesito. 556-P; 825-P; 2627 G, M, S; 2673; 2892  
 G, M, S; 4099; 4382 M.

*Anoda hastata* St. Hil.—2498 G, M, S; 3858.

*Anoda Wrightii* Gray—912 S.

*Anoda* sp.—3618 G, M, S.

*Gossypium Thurberi* Todaro—521 S; 2753 G, M, S; 3090 G; 3133 G, M, S; 3603 G; 3746 G, M, S; 4718 C, G, M, S. The above were distributed as *Ingenhouzia triloba* DC.

*Hibiscus Coulteri* Harv. ex Gray—621 G, S; 3091 a; 3318 G; 3318-a; 3747 G, M, S; 4584; 4665.

*Hibiscus denudatus* Benth. var. *involucellatus* Gray—682; 3069 G, M, S; 4557; 4574.

*Kosteletksya Thurberi* Gray—Limpia tunas. 2770 M.

*Malvastrum coromandelianum* (L.) Garke—3591 G, M, S.

*Pseudabutilon Sonorae* Wiggins—3586 G, M, S.

*Sida augustifolia* Lam.—3561 G, M, S; 3599 G, M, S.

*Sida hastata* St. Hil.—3858 M.

*Sida hederacea* Torr.—633 S; 1108 G, S.

*Sida lepidota* Gray—2613 C, G, M, S.

*Sida neomexicana* Gray—2563 G, M, S; 2566 C, G, M, S; 3996.

*Sida procumbens* Sw.—474-P; 859-P; 2858; 2944 G, M; 2975 G, M, S; 3045 G, S; 3109; 3264 G, S; 3600 G, M, S; 4477; 4500; 4711 M.

*Sida tragiaefolia* Gray—3560 G.

*Sida* sp.—3857.

*Sphaeralcea angustifolia* (Cav.) Don—4888.

*Sphaeralcea exilis* (Gray) Jepson—4439.

*Sphaeralcea Fendleri* Gray—333-P; 559-P; 743 ? ; 1116 S; 2510 G, M, S; 3346 G, M, S; 4279; 4376; 4620 M.

*Sphaeralcea Fendleri* var. *albescens* Kearney—558-P.

*Sphaeralcea hastulata* Gray—2571 G.

*Sphaeralcea laxa* Woot. & Standley—3325 G, M; 3581 G, M, S; 4129; 4686.

*Sphaeralcea* sp.—627; 3070; 3088.

#### Bombacaceae

*Ceiba acuminata* (Wats.) Rose—Pochote. 385 G, M, S; 2911 G.

#### Sterculiaceae

*Ayenia pusilla* L.—3084 M, S; 3238 G, M, S; 3589 G, M, S; 4026; 4481; 4501 M; 4518.

*Waltheria americana* L.—2908; 3014 G, M, S; 3582 C, G, M, S; 4029 G, M, S; 4150 C, G, M, S.

#### Fouquieriaceae

*Fouquieria Macdougallii* Nash—Ocotillo. 398 G, S; 3535.

*Fouquieria splendens* Engelm.—Ocotillo, ocotillo del corral. 405 G, S.

#### Cistaceae

*Helianthemum majus* (L.) B. S. P.—3434 C, G, M, S; 3513 C, G, M, S; 4262; 4406.

#### Cochlospermaceae

*Amoreuxia palmatifida* M. & S.—Sayá, témaqui. 630 C, S; 2668 G, M, S; 2953 G, M, S; 3041; 3079 G; 3969 M, S.

#### Koeberliniaceae

*Koeberlinia spinosa* Zucc.—4586.

#### Passifloraceae

*Passiflora bryonioides* H, B, K.—466-P; 760-P; 2638 G, M, S; 3073 G, M, S; 3392 G, M, S; 4043 S.

*Passiflora foetida* L.—521-P; 3576; 3607 G, M, S.

*Passiflora mexicana* Juss.—3806 G, M, S; 4490 M, S.

#### Loasaceae

*Mentzelia asperula* Woot & Standley—2675 C, G, M, S; 3773.

*Mentzelia hispida* Willd.—2718 C, G, M, S; 4553 ?

*Mentzelia multiflora* (Nutt.) Gray—Hierba pegajosa. 844-P; 323 G, S; 422 G, S; 1103 G, S; 2518 G, M, S; 2872 G, M, S; 2980 G, M, S; 4125; 4452a.

*Mentzelia* sp.—4654.

## Begoniaceae

*Begonia Martiana* Link & Otto—Cañaira. 552-P; 641-P; 2720 G, M, S; 3286; 3387 G, S; 4286 C, G, M, S; 4838.

## Cactaceae

*Cereus Greggii* Engelm.—4537.

*Echinocereus rigidissimus* (Engelm.) Rose—1608-H; 792-P; 4280; 4506; 4874.

*Echinocereus Virickii*—562-P.

*Opuntia arbuscula* Engelm.—Collection number lost.

*Opuntia hystricina* Engelm. & Bigel.—3829.

*Opuntia imbricata* (Haworth) DC.—313-P.

*Opuntia Kleiniae* DC.—317-P.

*Opuntia leptocaulis* DC.—Collection data lost.

*Opuntia Lindheimeri* Engelm.—305-P; 344-P; 370-P.

Besides the above, several mammillarias were collected which have not been identified. *Opuntia Engelmannia*, *O. Loomisii*, *O. versicolor* and *O. fulgida* were not collected but were identified from photographs by Dr. E. U. Clover.

## Lythraceae

*Cuphea Wrightii* Gray—464-P; 2538; 2674 C, G, M, S; 3319 G, M, S; 3365 G, S; 3694; 3777; 4090 C, G, M, S; 4330 G, M, S.

*Lythrum californicum* Torr. & Gray—328-P; 703 G, S; 975. The above were distributed as *L. linearifolium* (Gray) Small.

## Onagraceae

*Epilobium Halleanum* Hausskn.—700; 977; 3511 G, M, S. Distributed as *E. Drummondii* Hausskn.

*Gaura coccinea* Nutt.—405-P; 2572 G, M, S; 3442 G, M, S.

*Gaura coccinea* var. *epilobioides* (H. B. K.) Munz—1105 G, S.

*Gaura gracilis* Woot. & Standley—417-P.

*Gaura parviflora* Dougl. var. *lachnocarpa* Weatherby—Hierba salada. 299 G, S; 436 G, S; 777 S; 2902 G, M, S; 2958 G, S; 3808 G, M, S; 4419 M.

*Lopezia gracilis* Wats.—4314; 4779.

*Oenothera albicaulis* Nutt.—3856?

*Oenothera caespitosa* Nutt. var.—571 S; 1117; 2577 C, G, M, S.

*Oenothera Greggii* Gray—3190 C, G, M, S.

*Oenothera Hartwegii* Benth. var. *Toumeyi* (Small) Munz—993 G, S; 2842; 3446 G, M, S.

*Oenothera Hookeri* Torr. & Gray var. *irrigua* (Woot. & Standley) Gates—332-P; 744 G, S; 3186 C, G, M, S; 3324 C, G, M, S; 3361 C, G, M, S; 4187 M, S.

*Oenothera laciniate* Hill—3441.

*Oenothera rosea* Ait.—326-P; 304 G, S; 578; 667; 2898 G, M, S; 2988 G, M, S; 3385 G, M, S.

*Oenothera speciosa* Nutt.—595; 2949; 3252; 3443; 3524; 3711; 4052.

*Zauschneria arizonica* Davidson—2533 G, M, S; 3038 G, S; 3307 G, M, S; 4092; 4274 S; 4666 M, S.

## Araliaceae

*Aralia humilis* Cav.—Palo santo. 709-P; 2728 C, G, M, S; 2760 G, M, S; 2777 G, M, S.

*Aralia pubescens* DC.—4672 C, G, M, S.

*Aralia racemosa* L.—3282 M, S.

## Umbelliferae

*Eryngium Lemmoni* Coulter. & Rose—3429 G, M, S.

*Eryngium heterophyllum* Engelm.—2659; 3700 G, M, S; 3724 G; 4070.

*Foeniculum vulgare* Hill—Hinojo. 300.

*Prionosciadium Watsoni* C. & R.—Hierba del oso. 2661 G, M, S; 3219 G, M, S; 3305 G, M, S; 3673 G, M, S.

## Ericaceae

*Arbutus arizonica* (Gray) Sarg.—Madroño. 2714 G, M, S; 2830 G, M, S; 3152 G, M, S; 3391 G, M, S; 3925 C, G, M, S; 4802.

*Arctostaphylos pungens* H. B. K.—Manzanita. 634-P; 513 G, S; 2652 C, G, M, S; 2744 G, M, S; 2818 G, M, S; 3177 G, M, S; 3232 G, M, S; 3946 C, G, M, S; 4267 G, S.

*Chimaphila maculata* (L.) Pursh—3444 G; 4832 G, M, S.  
*Pterospora Andromedae* Nutt.—4824.

#### Primulaceae

*Anagallis arvensis* L.—305 G, S.

*Samolus floribundus* H. B. K.—409 S; 713; 770 G, S.

#### Plumbaginaceae

*Plumbago scandens* L.—692 G, S; 2852 G; 2912; 3266 G, M, S; 3534 G, M, S; 3899.

#### Sapotaceae

*Bumelia occidentalis* Hemsl.—Bebelama. 416 G, S; 3539 G, M, S.

*Bumelia rigida* (Gray) Small—Huajuco. 503.

#### Oleaceae

*Fraxinus Greggi* Gray—736-P; 3880 M; 4674 M.

*Fraxinus Standleyi* Rehder—Fresno. 3209 G, M, S.

*Fraxinus Standleyi* var. *lasia* Rehder—Fresno. 3421 G, M, S.

*Fraxinus velutina* Torr.—Fresno. 594 G, S; 2803 G, M, S; 2966 G, M, S; 3529 G, M, S; 4083 M; 3273; 4414 M.

*Fraxinus velutina* var. *glabra* Rehder—Fresno. 690 G, S; 2899 G, M, S.

*Fraxinus velutina* var. *Toumeyi* Rehd.—3096 G, M, S.

*Fraxinus* sp.—3989 M; 4196.

*Menodora scabra* Gray—4576 M; 4886.

#### Loganiaceae

*Buddleia Wrightii* Robins.—Tapiro. 295.

#### Gentianaceae

*Centaureum venustum* (Buckl.) Robins.—674; 767. The above were distributed as  
*Erythraea calycosa* Buckl.

*Eustoma exaltatum* (L.) Griseb.—415 G, M, S.

*Gentiana microcalyx* Lemmon ex Engelm.—4771 M.

*Halenia recurva* (Smith) Allen—648-P; 3462. The above were distributed as  
*Halenia Rothrockii* Gray.

#### Apocynaceae

*Amsonia pogonosepala* Woods.—3021 G, M, S; 3861 M.

*Apocynum androsaemifolium* L.—671-P; 576.

*Haplophyton cimicidium* A. DC.—Hierba del piojo. 473-P; 485; 536 G, S; 738; 3023 G, M, S; 3572 G, M, S; 3796 G, M, S; 4498 G, M, S; 4521; 4624 G, C, M, S.

*Mandevilla foliosa* (Muell. Arg.) Hemsl.—Hierba del piojo. 481-P; 588 G, S; 2752 G, M, S; 3107 G, M, S; 3267 G, M.

*Stemmadenia tomentosa* Greenm. var. *Palmeri* (Rose) Woods.—Zapote. 2927 G, S.

#### Asclepiadaceae

*Asclepias galloides* H. B. K.—463-P; 479-P; 1039 G, S; 2590 C, G, M, S; 3114 G, M, S; 3364 G, S.

*Asclepias glaucescens* H. B. K.—Oreja de mula. 2803 G, M, S; 2654 G; 3117 G, M, S; 3260 G, M; 3984.

*Asclepias hypoleuca* (Gray) Woods.—Oreja de mula. 2847 G, M, S; 3156 G; 3428.

*Asclepias Linaria* L.—2766 G, M, S; 3059 G, M, S; 3928 M.

*Asclepias mexicana* Cav.—505 S; 563; 619.

*Asclepias tuberosa* L.—610 G, S; 3440 G, M, S; 3676 G.

*Gonolobus productus* Torr.—529-P; 752-P; 617 S; 2822 G; 3257 G, M, S; 3776 G, M, S.

*Marsdenia edulis* Wats.—615 G, S; 2915 G, M, S.

*Matelea triflorum* (Standley) Woods.—470-P; 3005; 3293 G, M, S. In the above specimens the flowers are somewhat smaller than described.

*Metastelma angustifolium* Turcz.—540-P; 523; 4377 M.

*Metastelma Watsonianum* Standley—530-P; 591 G, S; 3239 G, S; 3602 G, S.

*Sarcostemma crispum* Benth.—Hierba del indio. 2810.

*Sarcostemma cynanchoides* Decne.—3720 G, M, S.  
*Sarcostemma heterophyllum* Engelm.—354 G, S; 425 G, S; 727 G, S; 3719 G, M, S;  
 4462 M.

#### Convolvulaceae

*Convolvulus incanus* Vahl—2528 G, M, S.  
*Cuscuta odontolepis* Engelm. var. *typica* Yunck.—2730 G, M.  
*Evolvulus alsinoides* L.—538; 3332 G, M, S; 3593 G; 3704 G, M, S; 4034 C, G, M, S;  
 3499 C, G, M, S; 4862.  
*Evolvulus arizonicus* Gray—611 G, S; 616; 2531 G, M, S; 2656 G; 2657 G; 3028 G,  
 M, S; 3784; 3970 G, M, S.  
*Evolvulus sericeus* Sw.—956; 2835.  
*Ipomoea ancisa* House—Baburia. 917 G, S; 2552 G, M, S; 2578 C, G, M, S; 2598  
 C, G, M, S; 2691 G, M, S; 2692 G, M, S; 3672.  
*Ipomoea arborescens* (H. B. K.) Don—Palo blanco. 2923 G, S.  
*Ipomoea barbatisepala* Gray—4855.  
*Ipomoea costellata* Torr.—545-P; 746 S; 761 G, S; 2534 G, M, S; 2671 G, M, S; 3300,  
 4432.  
*Ipomoea desertorum* House—Trompillo. 3328; 4110 C, G, M, S; 4367 G, M, S;  
 4424 M; 4425 G, M, S; 4461 M.  
*Ipomoea Gentryi* Standley—4159 G, S.  
*Ipomoea hirsutula* Jacq.—Teompillo. 1112 G, S; 2550 C, G, M, S; 2606 G, M, S;  
 2669 C, G, M, S; 3463 G; 3528; 3733; 3734; 4853.  
*Ipomoea Lemmoni* Gray—3473 G, M, S.  
*Ipomoea leptotoma* Gray—4031; 4560 G, S; 4619 C, G, M, S; 4851 ? ; 4854.  
*Ipomoea longifolia* Benth.—3601 G.  
*Ipomoea muricata* Cav.—4059.  
*Ipomoea patens* (Gray) House—632-P.  
*Ipomoea* sp.—4765.  
*Jacquemontia Pringlei* Gray—3550 G; 4038.  
*Quamoclit coccinea* (L.) Moench.—821-P; 2536 G, M, S; 4234-a; 4539 M; 4687.  
*Quamoclit coccinea* var. *hederifolia* (L.) House—Trompillo. 965; 2535 C, G, M, S;  
 2670 G, M, S; 3780 G; 4081; 4156 C, G, M, S; 4234; 4587-a.

#### Polemoniaceae

*Gilia formosissima* (Greene) Woot. & Standley—3216; 3380 G; 3487 G, M.  
*Gilia longiflora* (Torr.) Don—637; 4484.  
*Gilia Macombii* Torr. ex Gray—2597 ?  
*Gilia Pringlei* Gray—973; 2520 G, M, S; 2739 G, M, S; 3433 G; 3447 M, S; 3933; 4177  
 G, S; 4260 G, M, S; 4444 G, M, S; 4637 G, M, S.  
*Loeselia glandulosa* (Cav.) Don—4669 M.  
*Polemonium pauciflorum* Wats.—3288 G, M, S.

#### Hydrophyllaceae

*Nama hispidum* Gray—444 G, S; 445 S; 461; 699; 2897 C, G, M, S; 2940 G, M, S.  
*Nama undulatum* H, B, K.—324 G, S.  
*Nama* sp.—636.  
*Phacelia heterophylla* Pursh var. *sonorensis* White—4641 M.  
*Phacelia platycarpa* (Cav.) Spreng.—3279; 3454.

#### Boraginaceae

*Coldenia canescens* DC.—3852 M; 4582 M.  
*Lithospermum cobrense* Greene—407-P; 2575 C, G, M, S; 2791.  
*Lithospermum multiflorum* Torr.—3158 C, G, M, S.  
*Macromeria Thurberi* (Gray) Mackenzie—673-P; 3155 G, M, S; 4275.

#### Verbenaceae

*Bouchea prismatica* (Jacq.) Kuntze var. *brevirostris* Grenz—2605; 2634 C, G, M, S;  
 3728 G; 4055.  
*Lantana macropoda* Torr.—4564 M.  
*Lippia lycioides* Steud.—741 G, S.  
*Lippia nodiflora* Michx.—411 G, S.  
*Lippia Wrightii* Gray—3891 M; 4467 M; 4561 M; 4588 M; 4733 M.  
*Priva mexicana* (L.) Pers.—2635 C, G, M, S.

- Verbena ambrosiifolia* Rydb. forma *eglandulosa* Perry—3929 M.  
*Verbena bipinnatifida* Nutt. var. *latilobata* Perry—2543 G, S; 3131 G, M, S; 3261 G, M; 3731.  
*Verbena carolina* L.—2647; 2989 G, S; 3309; 3379 G, M, S; 3715 G, M, S; 4104.  
*Verbena ciliata* Benth.—569 S; 708 G, S; 774 G, S; 2836 G, M, S; 3085 G, M, S; 3344 G, M, S; 3787; 4178.  
*Verbena Ehrenbergiana* Schauer—329-P; 3790 G, M, S.  
*Verbena elegans* H. B. K. var. *asperata* Perry—3964.  
*Verbena gracilis* Desf.—947?  
*Verbena neomexicana* (Gray) Small—2787 G, M, S; 3836 M; 3882 M.  
*Verbena neomexicana* var. *hirtella* Perry—3836a.  
*Verbena neomexicana* var. *xylopoda* Perry—3985 M; 4176.  
*Verbena xutha* Lehm. 753-P; 3099 G, M, S.  
*Verbena* spp.—654; 2938 G, M, S; 3310.

#### Labiatae

- Agastache Barberi* (Robins.) Epling—415-P; 2722 G; 4194; 4306 M.  
*Agastache cana* (Hook.) Woot. & Standley—3486 G, M, S; 4391. This species has a licorice odor when fresh.  
*Hedeoma Drummondii* Benth.—2532 G, M; 3245; 3470 G, M, S.  
*Hedeoma oblongifolium* Heller—955 G, S; 2684 G, S; 3160 G, M, S; 3706 G; 3937; 4269; 4638 M.  
*Hyptis albida* Kunth—2778 G, M, S.  
*Hyptis Seemannii* Gray var. *stenocephala* Robins. 2780 G, M, S.  
*Marrubium vulgare* L.—Marrubia. 2984 G; 3644 G, M, S; 4355 M; 4617 M.  
*Mentha spicata* L.—461-P; 804-P; 3123 G, S.  
*Mentha sylvestris* L.—2936 G, M, S.  
*Monarda austromontana* Epling—Orégano. 940 G, S; 2589; 2751 G, S; 3341 G, M, S; 4068; 4243 M.  
*Salvia microphylla* H. B. K.—3203 G, S; 3210 G, M, S; 3475 G, M, S; 4772.  
*Salvia Parryi* Gray—3619 G, M, S; 3895 M; 3968 M.  
*Salvia pinguisfolia* (Fern.) Woot. & Standley—2717 C, G, M, S; 4379 M; 4652 M.  
*Salvia Seemannii* Fern.—330-P; 3302 G, M.  
*Salvia subincisa* Benth.—2768 G, M, S; 3909 M.  
*Salvia tiliacefolia* Vahl—3145? G, M, S; 3457, G, M, S.  
*Salvia Townsendii* Fern.—836-P; 2633 G, M, S; 3357 G; 3691 G, M, S.  
*Scutellaria resinosa* Totr.—462-P; 3102 G, M, S.  
*Stachys coccinea* Jacq.—2604 G, M, S; 2723; 3674; 3910 M; 4650 M; 4697.  
*Trichostema arizonicum* Gray—656-P; 866-P; 962 G, S; 3221; 3373 G, M, S; 3549 G, M, S; 4212 M.

#### Solanaceae

- Capsicum baccatum* L.—2920 G, S; 3640 G, M, S.  
*Chamaesaracha coronopus* (Dunal) Gray—4547 M.  
*Datura meteloides* DC.—Toloache. 430 G, M, S; 763 G, M, S; 1089 G, M, S; 2962 G, M, S; 3526; 3735 G, S; 4458.  
*Datura quercifolia* H. B. K.—Tokache. 433; 3395 G, M, S; 3730 G, M, S; 4454 C, G, M, S; 4457.  
*Lycium Andersonii* Gray—4143 M.  
*Lycium Berlandieri* Dunal—4527.  
*Lycium Torreyi* Gray—4496 M.  
*Lycopersicum esculentum* Mill.—Tomate. 768 G, S. (volunteer on site of an abandoned army garrison).  
*Nicotiana glauca* Graham—Alamo loca, palo loco. 826-P; 293 G, M, S; 427 G, S; 2947 G, M, S; 3378 G, M, S; 3536 G, M, S; 4139 C, G, M, S; 4440 G, M, S.  
*Nicotiana trigonophylla* Dunal—Tabaco de coyote. 476-P; 232 G, S; 454; 652 S; 2918 G, M, S; 3032 G, M, S; 3772; 3849 C, G, M, S; 4445.  
*Petunia parviflora* Juss.—307 S; 658.  
*Physalis crassifolia* Benth.—4018.  
*Physalis hederaefolia* Gray—Rama de amores. 580 G, S; 3224 G, M, S; 4693.  
*Physalis ixocarpa* Brot.—Tomatillo, tomatito. 677; 637; 2888 M, S.  
*Physalis lanceolata* Michx.—3285 G, M, S; 3431 M, S.  
*Physalis pubescens* L.—672; 2846; 3207; G, M, S.  
*Physalis Wrightii* Gray—Tomatillo cimarrón. 758 G, S; 2576 G, M, S; 3714; 4134 C, G, M, S.

*Saracha procumbens* (Cav.) R. & P.—Tulusisi. 2682; 2982 G, S.

*Solanum deflexum* Greenm.—2672; 3334.

*Solanum elaeagnifolium* Cav.—Tomatito, tomatito de buena mujer. 439 G, S; 2526 G, M, S; 2574 C, G, M, S; 2870; 3822 G, M, S; 3879 G, M, S; 4133 C, G, M, S.

*Solanum Jamesii* Torr.—2501 G, M, S.

*Solanum nigrum* L.—Chichiquelite. 442 G, S; 669 G, M, S; 2636 G, M, S; 2878 G, M, S; 2937 G, M, S; 2952 G, M, S; 3291 G, M, S; 3383 G, M, S; 3725 G, M, S; 3930; 4069 C, G, M, S; 4462 C, G, M, S.

*Solanum tuberosum* L. var. *boreale* Gray—3284 H; 3498.

#### Scrophulariaceae

*Bacopa procumbens* (Mill.) Greenm.—644; 656; 717 C, G, S; 779 S; 1001 S; 2933 G; 2955; 3030; 3323 G, S; 3597 G, M, S; 3788 G, S. All of the above, except 656 and 3788, were distributed as *Mecardonia procumbens* (Mill.) Small.

*Buchnera pusilla* H. B. K.—3331 G, S.

*Castilleja angustifolia* (Nutt.) Don—2762; 3091.

*Castilleja integra* Gray—1000.

*Castilleja lanata* Gray—629 S; 3067.

*Castilleja laxa* Gray—3905; 4080 M, S; 4398 M; 4783.

*Castilleja lithospermoides* H. B. K.—567; 3945.

*Castilleja patriotica* Fern.—3355 G, M, S.

*Castilleja tenuiflora* Benth.—3135 G, S; 3548 G, M, S.

*Conobea intermedia* Gray—2693 C, G, M, S; 4402.

*Gerardia Wrightii* Gray—412-P; 2704 C, G, M, S; 3579 M, S; 4203.

*Lamourouxia viscosa* H. B. K.—2715 G, S.

*Limosella aquatica* L.—460.

*Maurandia antirrhiniflora* H. & B. ex Willd.—740 G, S; 4422 M.

*Mimulus cardinalis* Dougl.—465-P; 684 G, S.

*Mimulus glabratus* H. B. K.—2950 G, M, S.

*Mimulus guttatus* DC.—456 S.

*Mimulus nasutus* Greene—341 G, S; 2917 G, S.

*Mimulus pallens* Greene—4841 M. This specimen scarcely agrees with Grant's treatment of the species (15a), being glandular-pubescent rather than glabrous, but it appears to be identical with one or two collections annotated by her in the U. S. National Herbarium.

*Pentstemon barbatus* (Cav.) Nutt.—3352; 4304.

*Pentstemon campanulatus* (Cav.) Willd.—413-P; 3306 C, G, M, S; 3677 C, G, S. The above were distributed as *P. pulchellus* Lindl.

*Pentstemon campanulatus* var. *subglandulosus* White—2645 G, M, S.

*Pentstemon Parryi* Gray—3699.

*Pentstemon secundiflorus* Benth.—2948 G, M, S.

*Pentstemon Torreyi* Benth.—972; 2841 G, M, S; 3141 C, G, M, S; 3448 G; 4770.

*Pentstemon* sp.—4807.

*Seymeria bipinnatifida* Seem.—414-P; 3403 G, M, S.

*Stemodia durantifolia* (L.) Sw.—657 G, S; 2913 G, M, S; 3031 G; 3789 G, M, S.

*Veronica peregrina* L.—342.

#### Bignoniaceae

*Chilopsis linearis* (Cav.) Sweet—737 G, S; 1090 G, S; 2617 G, M, S; 3833 C, G, M, S; 4123 G, S; 4540.

*Tecoma incisa* (Rose & Standley) Johnston—Caballito. 468-P; 537 G, M, S; 2779 G, M, S; 2926 G, M, S; 3004 G, M, S; 3617 G; 3957 C, M, S.

#### Martyniaceae

*Martynia altheaefolia* Benth.—407 G, S; 3850 C, G, M, S; 4555.

*Martynia fragrans* Lindl.—Gatito, gatuño. 451 S; 2905; 3683 S; 4077; 3359 M.

#### Acanthaceae

*Anisacanthus insignis* Gray—4845.

*Dicliptera resupinata* Juss.—2886 G, M, S.

*Dyschoriste decumbens* (Gray) Kuntze—2696; 3705 G; 3761 G, M, S; 4060.

*Elytraria imbricata* (Vahl) Pers.—Cordoncillo. 2649 G, M, S; 2772 G, S.

*Elytraria squamosa* (Jacq.) Lindau—Cordoncillo. 491; 540.

*Jacobinia candicans* (Nees) Benth. & Hook.—755-P.

*Ruellia nudiflora* (Engelm. & Gray) Urban var. *glabratula* Leonard—Cuetito. 759  
G, S; 3565 G, M, S; 3809; (distributed as *Rueilla tuberosa* L. var. *occidentalis*  
Gray); 4111.

*Siphonoglossum longiflora* Gray—3590 G; 4622.

*Tetramerium hispidum* Nees—761-P; 837-P; 852-P; 2773 G, M, S; 3333 G, M, S;  
3612; 3727 G, M, S; 4455 M; 4470 M; 4632 M.

#### Plantaginaceae

*Plantago major* L.—325-P.

#### Rubiaceae

*Bouvardia glaberrima* Engelm.—Chicoría, mirto. 509 S; 2653 G, S; 2716 C, G,  
M, S; 2806; 3024 G, S; 3057 G, S; 3092 G; 3170 G, M, S; 3384; 3793; 3974 M, S;  
4224 M, S; 4703 M.

*Crusea brachyphylla* Cham. & Schlecht.—4272 ?

*Crusea hispida* (Mill.) Robins.—2618 C, G, M, S.

*Diodia teres* Walt. var. *angustata* Gray—4385 M; 4780.

*Galium aspernum* Gray—4192 C, S.

*Galium mexicanum* H, B, K.—2709 G, M, S.

*Galium microphyllum* Gray—964 S; 4171; 4751 M.

*Galium Rothrockii* Gray—3204 G, M, S; 4319 M; 4320 M; 4643 M.

*Houstonia angustifolia* Michx. var. *rigidiuscula* Gray—3108.

*Houstonia rubra* Cav.—3327 G, M, S.

*Houstonia Wrightii* Gray—592; 967; 2608.

*Randia Watsoni* Robins.—Papache. 2782; 3630.

#### Caprifoliaceae

*Lonicera arizonica* Rehd.—3281 C, M, S; 4801.

*Lonicera cerviculata* White—2832 G, M, S; 3422 G, M, S, (distributed as *L. sullivantii* Gray); 3934 M; 4195; 4277 M.

*Sambucus caerulea* Raf.—Sauco. 660 G, S; 4133.

*Sambucus mexicana* Presl—Sauco. 504-P; 2972 G, M, S.

#### Valerianaceae

*Valeriana sorbifolia* H, B, K.—4781.

#### Cucurbitaceae

*Apodanthera undulata* Gray—Melón de coyote. 631 S; 919 G, M, S; 3781 G, M, S  
3827.

*Citrullus vulgaris* Schrad.—Sandía. 772.

*Cucurbita digitata* Gray—Calabacilla, chichicayota. 450; 4570 C, G, M, S.

*Cucurbita foetidissima* Gray—3810; 3828; 4127 C, G, M, S.

*Cyclanthera dissecta* (Torr. & Gray) Arn.—2754 G, S.

*Echinopepon Wrightii* (Gray) Wats.—754-P; 4036 M, S; 4449 C, M; 4463.

*Ibervillea tenuisecta* (Gray) Small—3680.

*Sicyosperma gracile* Gray—3723 G, M, S.

#### Lobeliaceae

*Lobelia cardinalis* L.—628-P; 669-P; 702 G, M, S.

*Lobelia fenestrata* Cav.—707.

*Lobelia laxiflora* H. B. K.—343 G, S; 3113 G, M, S.

#### Compositae

*Ageratum corymbosum* Zucc.—3010 G, M, S; 3222 G; 3247 G, S; 3501 G, S; 3558  
G, S; 3584 G, M, S; 3897.

*Ambrosia aptera* DC.—Chuchuni. 3739 G, M, S; 4115 C, G, S.

*Ambrosia psilostachya* DC.—861-P; 2700 C, G, M, S.

*Arctium Lappa* L.—4460.

*Artemisia gnaphalodes* Nutt.—4001 M; 4450 M.

*Artemisia ludoviciana* Nutt.—2703 G, M, S; 4392; 4830.

*Aspilia stenophylla* Greenm.—2663 G, M, S.

*Aster canescens* Pursh var. *latifolius* Gray—2903.

*Aster exilis* Ell.—827-P; 712; 750 G, S; 2981 G; 3110 G, M, S; 3420 G, M, S; 2687  
G, M, S; 3971 M; 4170; 4750.

- Aster Leucelene* Blake, var.—2559 G.  
*Aster potosinus* Gray—3125 G, M, S.  
*Aster spinosus* Benth.—4541 C, G, M, S.  
*Aster tagetinus* (Greene) Blake—764-P; 814-P.  
*Aster tanacetifolius* H. B. K.—4124 C, G, M, S.  
*Baccharis glutinosa* Pers.—Bamatote, jarilla. 675 G, S; 2601 C, G, M, S; 3276 G, M, S; 3531 G, M, S; 3745 G, M, S; 3843 G, M, S; 3987 C, G, M, S; 4140 C, G, M, S; 4749.  
*Baccharis sarothrooides* Gray—Romerillo. 4611; 4867.  
*Baccharis thesioides* H. B. K.—Hierba del aire. 787; G, S; 974 G, S.  
*Bahia dissecta* (Gray) Britton—429-P; 3349 G, M, S; 3416 G, M, S; 4191; 4300 C, G, M, S. These specimens were distributed as *C. chrysanthemoides* Gray.  
*Bahia opositifolia* (Nutt.) DC.—4885.  
*Baileya Thurberi* Rydb.—3823; 3903 C, G, M, S.  
*Bebbia juncea* Greene—745 S; 786 S; 3577 M, S.  
*Bellis mexicana* Gray var.—3692 G, M, S.  
*Berlandiera lyrata* Benth.—Hierba de la víbora. 596; 3708; 3821 G, M, S.  
*Bidens anthriscoides* DC.—Saetilla. 2643; 3652 G, M, S.  
*Bidens Bigelovii* Gray—3610 G, M, S.  
*Bidens Gentryi* Sherff—3374 C, G, M, S; 4411 ? M.  
*Bidens heterosperma* Gray—4299 M.  
*Bidens leptcephala* Sherff—2522 G, M, S; 4775.  
*Bidens pilosa* L.—Saetilla. 853-P; 2641 G, M, S; 2984 G, M, S; 3559; 3721 G, S; 3980 M; 4326 M; 4616 M; 4694 M.  
*Brickellia californica* (Torr. & Gray) Gray—4642.  
*Brickellia Coulteri* Gray—4567 M.  
*Brickellia grandiflora* (Hook.) Nutt. var. *petiolaris* Gray—4408 G, M, S.  
*Brickellia simplex* Gray—3693 G, M, S.  
*Brickellia venosa* (Woot. & Standley) Robins—4516 M.  
*Cacalia decomposita* Gray—Matarique. 651-P; 2741 G, M, S; 3289 G, M; 4353.  
*Centaurea americana* Nutt.—3347 G, M, S.  
*Chrysopsis villosa* (Pursh) Nutt.—3493 G, S; 4388 C, G, M, S.  
*Cirsium arizonicum* (Gray) Petrank—Cardo santo. 600; 2573 G, S; 2711 G, S; 2849 G; 2976; 3161 G, M, S; 3449 G, M, S; 4311; 4739.  
*Conyza sophiaeefolia* H. B. K.—4169.  
*Coreocarpus arizonicus* (Gray) Blake var. *pubescens* (Robins. & Fern.) Blake—542-P; 697; 4668 M; 4752. 542-P was distributed as *Leptosyne arizonica* Gray var. *pubescens* Robins. & Fern., and 697 as *C. arizonicus* (Gray) Blake.  
*Cosmos crithmifolius* (Jacq.) H. B. K.—Bavisa, tostón. 631-P; 3153; 3206 G, M, S; 3455 G; 3456 G, M, S.  
*Cosmos parviflorus* (Jacq.) H. B. K.—Tostón. 2701 C, G, M, S; 3394 G, M, S; 4183 C, G, S; 4763.  
*Dyssodia anomala* Robins.—3321 G, M, S; 3627 G, M, S.  
*Eclipta alba* (L.) Hassk.—650 G, S.  
*Encelia farinosa* Gray—Chamiso. 3573 G, S; 4880.  
*Encelia subaristata* Gray—3120 G, S; 3292 G, M, S; 4155 G, S.  
*Erigeron Bellidiastrum* Nutt.—4076; 4078.  
*Erigeron canadensis* L.—698 G, S; 749 S; 3359 G, M, S; 3492 H, M, S; 3737 G, M, S.  
*Erigeron concinnus* (Hook. & Arn.) Torr.—480-P.  
*Erigeron delphinifolius* Willd.—3477 G, S; 3490 G.  
*Erigeron divergens* Torr. & Gray—2665 G; 4246.  
*Erigeron filifolius* Nutt.—705 G, S.  
*Erigeron flagellaris* Gray—597; 2560.  
*Erigeron neomexicanus* Gray—992; 3137; 3628 G, S; 4410 M; 4709.  
*Erigeron philadelphicus* L.—3507 M, S.  
*Erigeron quercifolius* Lam.—2721.  
*Erigeron* sp.—2896 G, N, S, US.  
*Eupatorium coelestinum* L.—2631 C, G, M, S.  
*Eupatorium grandidentatus* DC.—4407.  
*Eupatorium Greggii* Gray—3854 C, G, M, S.  
*Eupatorium Lemmoni* Robins.—4373 M.  
*Eupatorium pycnocephalum* Less.—4670 M.  
*Eupatorium Rothrockii* Gray—4804 M.  
*Eupatorium solidaginifolium* Gray—4438 M.

- Flaveria trinervia* (Spreng.) C. Mohr.—3842.  
*Franseria ambrosioides* Cav.—Chicuri. 4022 G, M, S; 4534 C, G, M, S.  
*Franseria tenuifolia* Gray—4020 G, M, S; 4427 C, G, M, S; 4604 G, M, S.  
*Gaillardia pinnatifida* Torr.—2524 G, M, S.  
*Galinsoga parviflora* Cav.—948 S; 2500 G, M, S; 3401 G, M, S.  
*Gnaphalium chilense* Spreng.—719 G, S; 2963 G, M, S; 4245 G, S.  
*Gnaphalium leptophyllum* DC.—4245-a.  
*Gnaphalium Wrightii* Gray—3595 G, M; 4649 G, M, S; 4717 G, M, S.  
*Guardiola platyphylla* Gray—620 G, S; 2683 C, G, M, S; 3022 G, M, S; 3256 G, M, S;  
 3533 G, M, S; 3906 C, G, M, S.  
*Gutierrezia lucida* Greene—4465 G, S; 4526 G, M, S; 4593 C, G, M, S; 4706 G, M, S.  
*Gutierrezia microcephala* (DC.) Gray—4132 G, S; 4546 M.  
*Gutierrezia Sarothrae* (Pursh) Britt. & Rusby—3840 C, G, M, S.  
*Haplopappus gracilis* Gray—858-P; 2506 G, M, S; 2699 C, G, M, S; 3684; 3173 G, S.  
*Haplopappus laricifolius* Gray—4635 C, G, M, S.  
*Haplopappus spinulosus* (Pursh) DC.—756 G, S; 3847 C, G, M, S; 3873.  
*Helenium Thurberi* Gray—778; 2891 M, S; 2914 G, M, S; 2945; 3043 G, M, S; 3115;  
 3782 G, M, S.  
*Helianthus annuus* L.—Girasol. 448 S; 2874 G, M, S; 2956 G, M, S; 3718 G, S;  
 4116 C, G, S.  
*Helianopsis parvifolia* Gray—423-P; 3072 G, M; 3104 G, M, S; 3121 G, M, S; 3154  
 G, M, S; 3214 G, M, S; 3259 G, M, S; 3368 G, M, S; 3939 G, M, S; 4289 C, G,  
 M, S; 4291 M; 4389 M; 4647 G, M, S.  
*Heliospasis* sp.—2839 G.  
*Heterospermum pinnatum* Cav.—2702 C, G, M, S; 4299-a; 4775-b.  
*Heterotheca subaxillaris* (Lam.) Britt. & Rusby—2906; 4418 C, G, M, S.  
*Hieracium Fenderi* Sch. Bip.—Tinhuinahua, tininahua. 593; 2734 C, G, M; 3315;  
 3418.  
*Hieracium Lemmoni* Gray—3211 G, S.  
*Hymenoclea monogyra* Torr. & Gray—Jécota. 4538 G, M, S; 4866 G, S.  
*Hymenothrix Wishiseni* Gray—2505 G, M, S; 2792 G, M, S; 3701 G, S; 4417 G, M, S.  
*Hymenothrix Wrightii* Gray—3778; 4248 C, G, M, S; 4753 M.  
*Iva ambrosiaefolia* Gray—4544.  
*Kuhnia oreithales* Robins.—2581 G, M, S.  
*Kuhnia rosmarinifolia* Vent.—4366 M.  
*Lactuca graminifolia* Michx.—3482 G, S.  
*Lactuca pulchella* DC.—3251 G.  
*Lactuca scariola* L. f. *integrifolia* Bogenhard—4310.  
*Lagascea decipiens* Hemsl.—3097 G; 3624 G, M, S; 3797 G, M, S. These were  
 distributed as *Nocca decipiens* (Hemsl.) Kuntze.  
*Laphamia Palmeri* Gray?—3015.  
*Malacothrix saxatilis* Torr. & Gray—4368; 4787.  
*Melampodium appendiculatum* Robins.—2784 G, M, S; 3516 G, M, S; 3779; 3908  
 G, M, S; 4153 C, G, S.  
*Melampodium cinereum* DC.—839-P; 4513 C, G, M, S; 4587 G, M, S.  
*Melampodium hispidum* H. B. K.—2642 C, G, S; 2788 G, M, S.  
*Melampodium longicornu* Gray—4073.  
*Milleria quinqueflora* L.—824-P; 3875 G, M, S.  
*Parthenice mollis* Gray—2711 G, M, S; 3786 G, M, S; 4164 C, G, M, S.  
*Pathenium incanum* H. B. K.—2855 G, M, S; 3838 C, G, M, S; 4530 G, M, S; 4594  
 G, M, S.  
*Pathenium Stramonium* Greene—Guasaraco. 393 G, S; 2922 G, M, S.  
*Pectis filipes* Gray—848-P; 1094 S; 2694 G, S; 3688; 4577.  
*Pectis imberbis* Gray—856-P; 3337 G, S.  
*Pectis linifolia* L.—4456 M.  
*Pectis longipes* Gray—3689.  
*Pectis prostrata* Cav.—815-P; 1096; 1101 G, S; 2644; 3698 G, M, S; 3995; 4165 C, G,  
 M, S.  
*Perezia nana* Gray—3876.  
*Perezia Thurberi* Gray—2776 G, M, S; 4517.  
*Perityle microcephala* Gray—4852.  
*Perityle microglossa* Benth.—Manzanilla de coyote. 510-P; 301; 3320 G, M, S.  
*Pinaropappus roseus* Less.—2844 H; 3191 G, M, S; 3445.  
*Porophyllum macrocephalum* DC.—Hierba del venado. 2666 C, G, M, S; 3664.

- Rudbeckia laciniata* L.—683-P.  
*Sanvitalia Aberti* Gray—2504 G, M; 4747.  
*Schkuhria Wislizeni* Gray—4775-a.  
*Schkuhria Wrightii* Gray—4792.  
*Selloa glutinosa* Spreng.—Jécota. 817-P; 2857; 3741 G, M, S; 4162 G, S; 4451 G, M, S; 4625 C, G, M, S.  
*Senecio Hartwegi* Benth. Hoja semita. 3464; 4818.  
*Senecio longilobus* Benth.—2750 G, M; 4416 G, M, S. (distributed as *S. filifolius* Nutt.).  
*Senecio Parryi* Gray—3197 M.  
*Solidago Wrightii* Gray—3450.  
*Sonchus asper* (L.) Hill—Chinita. 412 S; 963; 2887.  
*Sonchus oleraceus* L.—3412 G, M, S.  
*Stephanomeria Thurberi* Gray—2529 G, M, S; 4746 ?  
*Stevia Palmeri* Gray—3166 G, S; 3169 G, M, S; 3202 G, M, S; 4190 M.  
*Stevia Plummerae* Gray—654-P; 3168 C, G, M, S.  
*Stevia Plummerae* var. *alba* Gray—3167 G, M, S; 4372 C, G, M, S.  
*Stevia salicifolia* Cav.—646-P; 3345 G, M, S; 4784 M.  
*Stevia viscida* H. B. K.—4374 C, G, M, S.  
*Tagetes alamensis* Rydb. var.—4735 C, G, M, S; 4833 G, M, S.  
*Tagetes micrantha* Cav.—2747 C, G, M, S; 3479 G; 4298 G, M, S.  
*Tithonia Thurberi* Gray—3645 G, M, S; 3717 G, M, S.  
*Tragoceros zinnioides* H. B. K.—2628 C, G, M, S; 3515 G, M, S.  
*Trixis californica* Kellogg—4472 G, M, S; 4646 C, G, M, S.  
*Trixis radialis* (L.) Kunze—Hierba del aire. 2853; 2992 G, M, S.  
*Verbesina enceloides* (Cav.) B. & H.—426 S; 659 G, S; 2866 G, M, S; 2985; G, S; 3851; 4114 C, G, S.  
*Verbesina longifolia* Gray—2713 C, G, M, S; 2843; 3171 G, M; 3290 G, M, S; 3471 G, M; 4249 G, M, S.  
*Verbesina Rothrockii* Robins. & Greenm.—3871.  
*Viguiera annua* (Jones) Blake—4003 C, G, M, S; 4655 G, M, S; 4690 G, M.  
*Viguiera cordifolia* Gray—3426 G, M, S; 4290 G, M, S; 4371 C, G, M, S.  
*Viguiera dentata* (Cav.) Spreng.—756-P; 4119 C, G, S; 4434 G, M, S; 4514 G, M, S.  
*Viguiera dentata* var. *helianthoides* (H. B. K.) Blake—4691 C, G, M, S.  
*Viguiera dentata* var. *lancifolia* Blake—3039 G, M, S; 3326 G, M, S; 4631 G, S.  
*Viguiera longifolia* (Robins. & Greenm.) Blake—4828.  
*Xanthocephalum Wrightii* Gray—684-P; 3410 G, M, S; 3451 G, M, S; 4247; 4261; 4834.  
*Zaluzania Grayana* Robins. & Greenm.—4390.  
*Zexmenia ceanothifolia* (Willd.) Sch. Bip.—2781 G, M, S.  
*Zexmenia podocophala* Gray—Pionfa. 855-P; 957 G, S; 2600 C, G, M, S; 2630 C, G, M, S; 2838; 3072-a; 3089 G; 3136; 3258 G, M, S; 3936; 4333 C, G, M, S.  
*Zinnia grandiflora* Nutt.—2558 G, M, S; 2993; 3831.  
*Zinnia multiflora* L.—834-P; 2629 C, G, M, S; 3100; 3369; 3663 G, M, S; 3975; 3981.  
*Zinnia pumila* Gray—664 G, S; 3820 G, M, S; 4575 C, G, M, S.

#### MAP OF THE REGION OF THE RIO DE BAVISPE

The limits of the vegetational types, outside of the loop of the Bavispe River, are taken from Brand (7). In comparing Brand's vegetation map with the one presented here, only two significant differences are noted: his map gives no indication of pine land in the Sierra de El Tigre, and between Moctezuma and Guásabas he shows an "oak-agave-juniper" type where there is actually mesquite-grassland, or more precisely, a transition from desert to thorn forest as described by Shreve (44). The southern limit of the oak-grassland occupying the Nacozari highlands remains undetermined.

The numbered stations on the map may be identified by the following list:

- |  |                                    |
|--|------------------------------------|
| 1. Western foothills of the Sierra de la Cabellera | 7. La Fiebre, Cañón de la Palomita |
| 2. Mesa de las Carreras                            | 8. La Matancita                    |
| 3. La Vega Azul                                    | 9. Rancho de Cruz Díaz             |
| 4. Agua Zarca                                      | 10. Rancho de Ortiz                |
| 5. Molino Quemado                                  | 11. Puerto de los Aserraderos      |
| 6. Rancho del Cumarito                             | 12. Cañón International            |
|  | 13. Cañón de Santa Rosa.           |

#### INDEX TO COLLECTING STATIONS

The stations of all plants included in this paper are listed below in chronological order. The collection numbers corresponding to each station enable the reader to determine the location of any plant in the Annotated List of Species. As in that list the initials H, P and S identify the collections of Harvey, Phillips and Santos, respectively.

The elevation of each station is given where known (as determined by aneroid reading), otherwise the vegetational zone is indicated.

#### 1938

- |          |  |
|----------|--|
| 293- 307 | June 24. Río Moctezuma near Moctezuma. Lower mesquite-grassland.   |
| 308- 321 | June 26. Arroyo El Sauce, Sierra de Oposura, about 16 km. east of Moctezuma. Mesquite-grassland.             |
| 322- 357 | June 27-29. Río Moctezuma, near Moctezuma.   |
| 358- 397 | June 30. Cajón de la Higuera, west of Moctezuma. A deep well-watered canyon in the upper mesquite-grassland. |
| 398- 406 | July 1. 8-12 km. north of Moctezuma on road to Cumpas. Mesquite-grassland.                                   |
| 407- 417 | July 1. Near Tonibabi, east of Montezuma. Mesquite-grassland.  |
| 418- 464 | July 6-7. Colonia Oaxaca, 915 m.   |
| 465- 599 | July 12-19. Cañón de Santa Rosa, 1200-1510 m.  |
| 600- 610 | July 19. Cañón del Oso, a branch of the Santa Rosa. Elev. approximately 1250 m.                              |
| 611- 620 | July 20. Cañón de Santa Rosa, 1250 m.  |
| 621- 632 | July 20. Various points between Cañón de Santa Rosa and Bavispe. Mesquite-grassland.                         |
| 633- 686 | July 23-30. Colonia Oaxaca and vicinity.   |
| 684- 726 | July 30. Arroyo del Púlpito, 1080 m.   |
| 727- 737 | July 31. Colonia Oaxaca.   |
| 738- 751 | July 31. Arroyo del Púlpito.   |
| 752- 755 | Aug. 1-2. Colonia Oaxaca.  |
| 756- 760 | Aug. 3. Between Colonia Oaxaca and Qrroyo del Púlpito, 1160 m.   |
| 761- 786 | Aug. 3. Arroyo del Púlpito.  |
| 787      | Aug. 5. Colonia Oaxaca.  |
| 788-1140 | Aug. 14-31. Carretas, Chih., 1460 m.   |

#### 1939

- |             |  |
|-------------|--|
| 1590-1642-H | Aug. 26-28. Carretas, Chih.  |
| 2496-2617   |  |
| 1644-H      | Aug. 31. Between Bacerac and Huachinera. Upper mesquite-grassland.     |
| 1645-1744-H | Sept. 1-8. Huépari and vicinity. Oak-grassland.                        |
| 2618-2700   | Sept. 2-3. Cañón de Huépari, 1310 m.                                   |
| 2701-2709   | Sept. 4. Cerro del Capulín, near Huépari, 1860 m.                      |
| 2730-2731   | Sept. 4. Cañón de Huépari.   |
| 2732-2748   | Sept. 5. Cañón de Aribabi, near Huépari, 1400 m.                       |
| 2749-2750   | Sept. 5. Cañón de Huépari.   |
| 2751-2764   | Sept. 6. Cañón de los Apaches, a branch of the Huépari. Oak-grassland. |
| 2765-2790   | Sept. 7. Puerto de Huépari, south of Huépari, 1390 m.                  |
| 2791-2792   | Sept. 7. Cañón de Huépari.   |
| 1747-H      | Sept. 9. Huachinera. Upper mesquite-grassland.                         |

- 1749-H Sept. 12. Between San Miguel and Carretas. Mesquite-grassland.  
 260- 303-P June 23. Cañón de la Escalera. Lower oak-grassland.  
 2793-2823  
 304- 317-P June 24. Cañón de los Metates,<sup>11</sup> a branch of the Excalera. Upper  
 2824-2832 oak-grassland.  
 2833-2835 June 25. Cañón de la Escalera.  
 2836-2850 June 25. Puerto de los Aserraderos. Lower pine forest.  
 2851-2873 June 27. Bavispe. Mesquite-grassland.  
 2874-2906 June 28. Labores de Durazno, about 3 km. south of Bavispe along  
 river. Mesquite-grassland.  
 318- 334-P June 29. Arroyo de Bavispe, east of Bavispe. Mesquite-grassland.  
 2907-2908 June 30. Bavispe.  
 2909 July 2. Horconcitos. Upper mesquite-grassland.  
 335- 336-P July 4. Bacapiri. Lower oak-grassland.  
 337- 339-P July 7. Aguaje de Bacatejaca. Mesquite-grassland.  
 2910-2925b  
 340- 344-P July 7. La Palmita. Lower oak-grassland.  
 2926-2933  
 345- 347-P July 8. La Galera, north of Bacadéhuachi. Mesquite-grassland.  
 2934-2938  
 348- 351-P July 11. Horcencitos. Upper mesquite-grassland.  
 2939-2992  
 2993 July 17. Bavispe.  
 352- 363-P July 25. Cañón de Bavispe, 5-8 km. west of Bavispe. Mesquite-  
 2994-3026 grassland.  
 364- 365-P July 26. Cañón de las Estacas. Mesquite-grassland.  
 3027-3048  
 366- 373-P July 27. Arroyo de la Galera, south of Bavispe. Mesquite-grassland.  
 3049-3064  
 3065-3066 July 29. Bavispe.  
 3067-3091a July 30. Cañón de las Estacas.  
 374- 384-P July 30. Cañón del Carricito, a small branch of the Estacas. Upper  
 3092-3102 mesquite-grassland.  
 385- 393-P July 31. Cañón de Bavispe. Lower oak-grassland.  
 3103-3127  
 394- 399-P Aug. 3. Cañón de la Escalera.  
 3128  
 3129 Aug. 4. Puerto de las Playitas, above Cañón de la Escalera. Oak-  
 grassland.  
 411- 418-P Aug. 4-6. Puerto de los Aserraderos.  
 3130-3185  
 3186-3202 Aug. 7. Cañón de la Ciénaga Alta, a small canyon north of  
 Aserraderos. Pine forest.  
 419- 434-P Aug. 7. Above Rancho de Cruz Díaz. Pine forest.  
 3203-3205  
 435- 448-P Aug. 8-9. Puerto de los Aserraderos.  
 3206-3225  
 449- 487-P Aug. 11-12. Cañón de Bavispe. Upper oak-grassland.  
 3226-3278  
 488-509-P Aug. 13. Rancho de Cruz Díaz. Pine forest.  
 3279-3290  
 510- 565-P Aug. 13-14. Cañón de Bavispe.  
 3291-3317a  
 3318-3339 Aug. 15. Cañón de la Petaquilla, a small branch of the Bavispe.  
 Oak-grassland.  
 566- 579-P Aug. 18. Las Tiarritas del Trembler. Pine forest.  
 3340-3363  
 580- 615-P Aug. 19. Cañón del Temblor. Oak-grassland.  
 3364-3392  
 616- 666-P Aug. 19-21. Las Tierritas.  
 3393-3443  
 667- 701-P Aug. 22. Between Las Tierritas and El Tigre. Pine forest.

<sup>11</sup>This is an archaeological site mentioned by Bandelier (3).

3444-3473	
3474-3479	Aug. 23. Las Tierritas.
702-730-P	Aug. 23. Head of Cañón Internacional. Lower pine forest.
3480-3508	
3509-3514	Aug. 23-24. Las Tierritas.
731-736-P	Aug. 24. Cañón del Temblor.
737-P	Aug. 24. Las Tierritas.
738-740-P	Aug. 25. Between Las Tierritas and Cañón de la Gallina. Pine forest to upper mesquite-grassland.
741-749-P	Cañón de la Gallina. Upper mesquite-grassland.
3515-3525	
3526-2539	Aug. 28. Cañón de los Otates. Mesquite-grassland.
750-766-P	Aug. 28. Valle de Teras. Mesquite-grassland.
3540-3564	
3565-3578	Aug. 29-30. Cañón de las Bellotas. Mesquite-grassland.
767-780-P	Aug. 30-31. Cañón del Agua Amarga. Lower oak-grassland.
3579-3645	
781-801-P	Sept. 1-3. Piedra Parada. Oak-grassland.
3646-3675	
3676-3681	Sept. 3. Cañón de los Apaches.
802-813-P	Sept. 3. Rancho de Babidianchi, Cañón de Huépari. Oak-grassland.
3682-3711	
813-870-P	Sept. 5-7. Horconcitos and vicinity.
3712-3810	

## 1941

1750-1754-S	Aug. 7. 5-10 km. east of Agua Prieta, road to Colonia Morelos.
3817-3838	Elev. 1200 m.
1755-S	Aug. 8. 6 km. south of Agua Prieta. Elev. 1200 m.
3839-3848	
3849-3853	Aug. 8. 19 km. south of Agua Prieta, road to Fronteras. Mesquite-grassland.
3854-3858	Aug. 9. 2 km. south of Agua Prieta, road to Fronteras. Elev. 1200 m.
1756-1783-S	Aug. 9-12. Hacienda San Rafael, 975 m.
3859-3904	
1784-1787-S	Aug. 13. La Angostura. Elev. 855 m.
1788-1803-S	Aug. 13. 1032 km. west of La Angostura. Elev. 1190 m.
1804-1831-S	Aug. 14-15. La Nacha, 1310-1525 m.
3905-3954	
1832-1837-S	Aug. 16. 32 km. west of La Angostura, 1130 m.
3955-3969	
1838-1851-S	Aug. 16-18. La Nacha.
3970-4017	
1852-1863-S	Aug. 19. 14 km. west of La Angostura, 885 m.
4043-4054	
1864-1872-S	Aug. 20. Río Fronteras at El Tajo, 1280 m.
4055-4077	
4078-4100	Aug. 20. La Nacha.
1873-1874-S	Aug. 21. Hacienda San Rafael.
1874-1893-S	Aug. 24-27. Colonia Morelos, 795 m.
4101-4147	
1894-1899-S	Aug. 28. Rancho de los Robles, 915 m.
4148	
1900-1911-S	Aug. 29. La Fiebre, Cañón de la Palomita, 1130 m.
4149-4160	
1912-1918-S	Aug. 30-31. La Matancita, 2 km. west of El Tigre, 1300 m.
4161-4174	
1919-1926-S	Sept. 1. Between El Tigre and El Roble, 1830 m.
1927-1973-S	Sept. 2-13. El Roble, 1830 m.
4175-4414	
1974-1983-S	Sept. 14. North of El Roble, on trail to Colonia Morelos, 1830 m.
1984-2009-S	Sept. 15-18. Colonia Morelos and vicinity.
4415-4430	

2010-2018-S	Sept. 19. Agua Zarca, south of Colonia Morelos, 1040 m.
4431-4452a	
2019-2027-S	Sept. 19-21. Colonia Morelos.
4453-4464	
2028-2032-S	Sept. 22. Western foothills of the Sierra de la Cabellera, 1040 m.
4465-4486	
4487-4510	Sept. 23. Colonia Morelos.
2033-2048-S	Sept. 24. Puerto del Molino Quemado, east of Colonia Morelos,
4511-4537	1000 m.
2048-2060-S	Sept. 25. Mesa de las Carreras, west of Colonia Morelos, 795 m.
4538-4552	
4553-4556	Sept. 26. Colonia Morelos.
4557-4573	Sept. 26. Mesa de las Carreras.
2061-2066-S	Sept. 30. 4 km. east of Colonia Morelos, 795 m.
4574-4608	
4609-4611	Oct. 1. Puerto del Molino Quemado.
4612-4618	Oct. 2-4. Colonia Morelos.
4619-4623	Oct. 5. Between Colonia Morelos and El Curmarito, about 800 m.
2067-2077-S	Oct. 5. Rancho del Cumarito, 1190 m.
4624-2632	
2078-2092-S	Oct. 6. Puerto del Cumarito, 1650 m.
4633-4660	
2093-2113-S	Oct. 7-8. Cañón de la Bellota, Sierra de la Cabellera, 1310 m.
4661-4702	
4703-4724	Oct. 8. Cañón de la Mescalera, a branch of the Bellota, 1495-1585 m.
4725-4726	Oct. 8. Cañón de la Bellota.
2114-2125-S	Oct. 9. Head of Cañón de la Mescalera, 1770 m.
4727-4753	
4754-4761	Oct. 9-10. Cañón de la Bellota.
2126-2137-S	Oct. 11. El Bilito, <sup>12</sup> 1890 m.
4762-4765	
2138-2160-S	Oct. 12. About 5 km. east of El Bilito, 2080 m.
4766-4800	
4801-4814	Oct. 12-13. El Bilito.
2161-2168-S	Oct. 13. Picacho del Pilar, 2080-2310 m.
4815-4832	
4833-4843	Oct. 14. El Bilito.
4844-4849	Oct. 14. Between El Bilito and Colonia Morelos, 1740 m.
2169-2172-S	Oct. 15. La Vega Azul, southwest of Colonia Morelos, 730 m.
4850-4885	
2173-2187-S	Oct. 19. 11 kms. east of Douglas, Ariz., on road to San Bernardino,
4884-4888	about 1200 m.

## TABLE OF ALTITUDINAL DISTRIBUTION

The vertical ranges of some of the more common plants of the Bavispe River region are presented in the following table. The species which are found in more than one vegetational type are placed in whichever zone they are most common. Thus *Eriogonum Abertianum* grows at elevations as high as 1800 m., but it is clearly a plant of the lowlands, judging by its abundance and presence in various types of habitat in the mesquite-grassland.

The ranges as given below are mostly based on at least four collections, supplemented in some instances by recorded observation. No attempt was made in the field to determine the exact altitudinal extremes of the different species, and the limits given should be regarded only as approximations. Certainly, however, these plants are rare beyond the limits indicated, except the many mesquite-grassland

<sup>12</sup>The name is apparently derived from the American nickname "Bill."

species which extend indefinitely below our lowest recorded elevation of 795 m. (Colonia Morelos). Some of the plants of the lower Bavispe valley are here shown at 600 m. (estimated).

Elevation in meters	1000	1500	2000
<i>Gomphrena Sonorae</i> .....	.....	.....	.....
<i>Rhus microphylla</i> .....	.....	.....	.....
<i>Haplopappus cimicidium</i> .....	.....	.....	.....
<i>Chilopsis linearis</i> .....	.....	.....	.....
<i>Echinocereus rigidissimus</i> .....	.....	.....	.....
<i>Atriplex canescens</i> .....	.....	.....	.....
<i>Aster tagetinus</i> .....	.....	.....	.....
<i>Baccharis glutinosa</i> .....	.....	.....	.....
<i>Haplopappus gracilis</i> .....	.....	.....	.....
<i>Parthenium incanum</i> .....	.....	.....	.....
<i>Selloa glutinosa</i> .....	.....	.....	.....
<i>Verbesina encelioides</i> .....	.....	.....	.....
<i>Cucurbita foetidissima</i> .....	.....	.....	.....
<i>Croton texensis</i> .....	.....	.....	.....
<i>Euphorbia heterophylla</i> .....	.....	.....	.....
<i>Jatropha cardiophylla</i> .....	.....	.....	.....
<i>Fouquieria splendens</i> .....	.....	.....	.....
<i>Ephedra trifurca</i> .....	.....	.....	.....
<i>Aristida Adscensionis</i> .....	.....	.....	.....
<i>Bouteloua filiformis</i> .....	.....	.....	.....
<i>B. Rothrockii</i> .....	.....	.....	.....
<i>Hilaria mutica</i> .....	.....	.....	.....
<i>Muhlenbergia monticola</i> .....	.....	.....	.....
<i>Pappophorum Wrightii</i> .....	.....	.....	.....
<i>Sporobolus Wrightii</i> .....	.....	.....	.....
<i>Triodia mutica</i> .....	.....	.....	.....
<i>Acacia constricta</i> .....	.....	.....	.....
<i>Prosopis chilensis</i> .....	.....	.....	.....
<i>Eriogonum Abertianum</i> .....	.....	.....	.....
<i>Cheilanthes Lindheimeri</i> .....	.....	.....	.....
<i>Clematis Drummondii</i> .....	.....	.....	.....
<i>Salix Gooddingii</i> var. <i>vallicola</i> .....	.....	.....	.....
<i>Celtis pallida</i> .....	.....	.....	.....
<i>C. reticulata</i> .....	.....	.....	.....
<i>Larrea divaricata</i> .....	.....	.....	.....
<i>Rhus choriophylla</i> .....	.....	.....	.....
<i>R. Rydbergii</i> .....	.....	.....	.....
<i>R. virens</i> .....	.....	.....	.....
<i>Microsiphonia Brachysiphon</i> .....	.....	.....	.....
<i>Tecoma incisa</i> .....	.....	.....	.....
<i>Amoreuxia palmatifida</i> .....	.....	.....	.....
<i>Guardiola platyphylla</i> .....	.....	.....	.....
<i>Hieracium Fendleri</i> .....	.....	.....	.....
<i>Zexmenia podocephala</i> .....	.....	.....	.....
<i>Zinnia multiflora</i> .....	.....	.....	.....
<i>Evolulus alsinoides</i> .....	.....	.....	.....
<i>E. arizonicus</i> .....	.....	.....	.....
<i>Ipomoea acnoides</i> .....	.....	.....	.....
<i>Arbutus arizonica</i> .....	.....	.....	.....
<i>Arctostaphylos pungens</i> .....	.....	.....	.....
<i>Cnidoscolus angustidens</i> .....	.....	.....	.....
<i>Manihot angustiloba</i> .....	.....	.....	.....
<i>Quercus arizonica</i> .....	.....	.....	.....
<i>Q. chihuahuensis</i> .....	.....	.....	.....
<i>Q. Emoryi</i> .....	.....	.....	.....

Elevation in meters	1000	1500	2000
<i>Q. hypoleucoides</i>			
<i>Q. oblongifolia</i>			
<i>Q. Toumeyi</i>			
<i>Q. viminea</i>			
<i>Garrya Wrightii</i>			
<i>Geranium Wislizeni</i>			
<i>Aristida Schiedeana</i>			
<i>Bouteloua radicosa</i>			
<i>Hilaria Belangeri</i>			
<i>Muhlenbergia Emersleyi</i>			
<i>M. polycaulis</i>			
<i>Tripsacum lanceolatum</i>			
<i>Monarda austromontana</i>			
<i>Stachys coccinea</i>			
<i>Trichostemma arizonicum</i>			
<i>Benthamantha Edwardsii</i>			
<i>Milla biflora</i>			
<i>Yucca Schottii</i>			
<i>Gossypium Thurberi</i>			
<i>Fraxinus Greggii</i>			
<i>F. velutina</i>			
<i>Zauschneria arizonica</i>			
<i>Gilia Pringlei</i>			
<i>Adiantum Capillus-Veneris</i>			
<i>Bommeria hispida</i>			
<i>Notholaena aurea</i>			
<i>N. sinuata</i>			
<i>Bouvardia glaberrima</i>			
<i>Heuchera sanguinea</i>			
<i>Gerardia Wrightii</i>			
 <i>Begonia Martiana</i>			
<i>Macroromeria Thurberia</i>			
<i>Silene laciniata</i>			
<i>Quercus albaefolia</i>			
<i>Q. diversicolor</i>			
<i>Agropyron arizonicum</i>			
<i>Blepharoneuron tricholepsis</i>			
<i>Bromus anomalus</i>			
<i>Tigridia Pringlei</i>			
<i>Cologania angustifolia</i>			
<i>C. Lemmoni</i>			
<i>Malaxis corymbosa</i>			
<i>Pinus arizonica</i>			
<i>P. ayacahuite</i> var. <i>brachypetra</i>			
<i>P. cembroides</i>			
<i>P. chihuahuana</i>			
<i>P. ponderosa</i>			
<i>Pseudotsuga mucronata</i>			
<i>Pteridium aquilinum</i>			
<i>Ceanothus Huichagorare</i>			
<i>Cercocarpus eximius</i>			