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# A Preliminary Study of the Vegetation of the Region Between Cerro Tancitaro and the Río Tepalca- tepec, Michoacan, Mexico

William C. Leavenworth\*

## Introduction

Cerro Tancitaro is one of a number of isolated high mountains in southwestern Michoacán. It lies about forty miles west of the town of Uruapan, from which it is accessible only by a tiring and rather difficult journey by horseback or on foot. The peak of Tancitaro is the second highest in western Mexico, reaching an altitude of twelve thousand feet, exceeded only by the two peaks of Colima, some seventy-five miles to the west. To the south, scarcely forty miles away, lies the valley of the Río Tepalcatepec, only about one thousand feet above sea level. The pine-clad summit of the mountain is always cold, and is blanketed with snow in winter, while the river valley to the south lies parched with tropical heat throughout the year. Such extreme conditions make the region very interesting for the student of plant distribution, and provide a rich collecting ground, but until recent years this region remained almost untouched by the biologist. Humboldt and Bonpland collected in Michoacán, but apparently they went no farther than the vicinity of the Volcán de Jorullo. Some later collectors went as far as Uruapan, but stopped there, since until 1941 that town was the last point reached by railway. In recent years Mr. George Hinton has collected extensively in southern

\* William Clarence Leavenworth, born at Crawfordsville, Indiana, February 23, 1917, killed in action in eastern France October 29, 1944. He received the degree of Bachelor of Science in Botany and Master of Science in Botany at Hamilton College in June 1938 and University of Maryland, June 1939, respectively. He held a teaching fellowship in botany at the latter institution during the academic year 1938-39. He was admitted to the Graduate School of the University of Illinois on September 15, 1939, and was a Fellow in Botany in 1941-42. He had passed the preliminary examination for the Ph.D. in botany, and was completing his thesis at the time of entering the army.

During the summers he made several trips to Mexico as field botanist with the Hoogstraal expeditions from the University of Illinois, and had the opportunity to lay a foundation for his doctoral thesis, a taxonomic study of the Mexican and Central American species of *Zeugites*, a genus of grasses, which was stopped by the removal of type specimens from the principal botanical institutions as a war measure, and by his induction into the armed services of the United States.

Mr. Leavenworth, Lieutenant in the Air Force, was commissioned as a photographer in the Army Air Force in June, 1943 and received his Navigator's wings December, 1943 at Selman Field, Louisiana. He had been overseas since February, 1944. He is survived by his wife, Martha MacGalliard Leavenworth, University of Illinois '43, and a year-old son, William Burgess, of Crawfordsville, Indiana.

The present paper is a timely one because it treats of the vegetation in an area immediately adjacent to that of the celebrated new volcano, Paricutin. The field work was completed only shortly before the eruption of Paricutin.—PAUL C. STANLEY, Chicago Natural History Museum.

Michoacán and Guerrero, including the valley of the Río Tepalcatepec and Cerro Tancítaro, and these collections have been rich in new species, but no description of the vegetational character of the region has been published.

During the summers of 1940 and 1941 the members of the Hoogstraal Mexican Biological Expeditions spent five months in the area between Cerro Tancítaro and the Rio Tepalcatepec. The expedition made its headquarters the first summer and six weeks of the second summer in the village of Tancítaro, nestled at the foot of the mountain of the same name. The members of the expedition lived in a twelve-room house, which they rented from one of the village officials for a total of twelve pesos the first year, the price being more of a formality than a business transaction. The same spirit of friendship and cooperation which characterized this procedure was noticeable in all of our contacts with the villagers.

The village of Tancítaro lies on a high plateau which stretches southward from the base of the mountain for some miles at an elevation of about six thousand feet before sloping down toward the river valley. Back of the village there is another small plateau which rises abruptly for about five hundred feet above the town. From this plateau the land slopes up to the base of the mountain proper, about six miles away. The base of the mountain meets the plateau at an altitude of seven thousand two hundred feet. Two camps were established on the mountain at altitudes of 7,800 and 10,500 feet, respectively, as bases from which to work. Because of the continual clouds and rain which prevail at these altitudes, all plant collections had to be sent on mules to Tancitaro, where they were dried over ovens made for the purpose.

A few days the first year and six weeks of the second were spent collecting in the river valley, with the town of Apatzingan as headquarters. Here the expedition was fortunate to be able to stay at the hotel of Don Pablo Frisch, who put all available resources at our disposal, as well as acting as guide, interpreter, and agent of general information. Apatzingan is a thriving town of five thousand inhabitants, lying about fourteen miles from the Río Tepalcatepec at its closest point. Situated as it is near the border of the flat river valley, it is the center of trade for the various industries of the area, principally rice-farming and cattle-raising. The high temperatures and constant sunshine, combined with a dry atmosphere, made drying the plants an easy task in this region.

### Geology and Physiography of the Region

Cerro Tancítaro is an outlier of the mountains which border the southern edge of the great central plateau of Mexico. During the Cretaceous Period the area now covered by this plateau was submerged, and during the various uplifts following that period there was an enormous amount of extrusion and volcanic activity in the southern part of the plateau. Hundreds of volcanic cones were raised and great areas were covered with igneous material. Cerro Tancítaro is one of the largest and earliest of these ancient volcanoes. Due to its great age it has been eroded and its typical volcanic shape has been lost. It now has the form of a rugged peak, with long, steeply-sloping shoulders radiating to the north and south.

The plateau immediately south of the mountain has an altitude of about 6,000 feet for the most part. It is gently rolling and broken here and there by numerous small volcanic cones, in many of which the crater is still plainly visible. One of these smaller mountains, Cerro San Miguel, lying about three miles southwest of the village of Tancítaro, reaches a height of over 8,000 feet and differs markedly from the surrounding country in the character of its vegetation. South of the village about two miles there is a chain of rocky hills about five miles long. The area covered by these apparently bare, rough ridges is known as the Pedregal, the name by which similar formations are known all through Mexico. This formation is due to a peculiar kind of extrusion which has occurred often along the fault line marking the area of volcanic activity in southern Mexico. The plateau itself is covered by a deep soil and is cultivated to a large extent on the level parts.

For about five miles south of the village of Tancítaro the general level of the plateau does not change much, then it slopes gradually to an altitude of 3,000 feet, where it descends abruptly to the valley below, at about 1,200 feet. The steep edge of the plateau in this area is cut by numerous deep canyons where the larger streams have cut their way into the underlying igneous rocks. At about 1,200 feet the slopes begin to flatten out, and a nearly level plain extends to the river, some sixteen miles away.

### Climate

The upper part of the plateau and the mountain receive an abundant amount of rainfall, much greater than the region immediately to the south. Heavy rains fall nearly every day during the rainy season, which lasts from the middle of June until late in September. Clouds are present much of the time on the upper part of the plateau and nearly continually on the mountain. During the late morning and afternoon rain usually falls in torrents. The intensity of the downpour is so great that a rubber bathtub, placed in one corner of the patio to collect water from the roof, would overflow in five minutes. The heaviest and most continual rains fall on the lower slopes of the mountain, below 9,500 feet. The summit is often covered with clouds, but receives less actual precipitation. The rainfall decreases gradually south of the mountain until on the edge of the plateau, at an elevation of 3,000 feet, there are only occasional thunder storms, while in the valley of the Tepalcatepec a real rain is rare.

There are no meteorological records available for the region immediately around Tancítaro, but in Uruapan, located at nearly the same altitude forty miles to the east, the average annual precipitation between 1929 and 1933 was 152.9 cm. The rainfall at Tancítaro is undoubtedly much greater than this, but how much greater there is no way of telling. By far the greater portion of this rain fell in the rainy season, *las lluvias*, in the months of June, July, August, and September. There was often little or no precipitation in November, and that in the winter months was slight. In March and April there was usually no rain at all. This is the period known as *las secas*, the dry season.

The rainfall cycle is the same in the river valley, but the total amount of precipitation is much less. The average precipitation for Apatzingan during

the same period of time was only 66.3 cm., less than one half that of Uruapan. The effective precipitation is even less in the valley because much of the soil is rocky and drains quickly, and the water requirement of plants there is greater because of the intense sunshine, higher temperatures, and dry atmosphere.

The temperature at this latitude does not vary much in summer. During June and July of 1941 our thermometer in Tancítaro registered between 14° and 20° C. except for one high record of 23° C. It is interesting to note that this is slightly but distinctly colder than the temperature in Uruapan, although the elevations of the two towns are nearly the same. In Uruapan the maximum daily temperatures during June and July are often above 30° C., while the minimum is seldom below 14°. Apparently the presence of the mountain exerts a marked influence on the climate of the plateau to the south, for the vegetation there also shows marked differences from that at similar elevations elsewhere. This is because clouds coming from the south and west pile up against the mountain, shutting off much of the sunlight from the plateau in the immediate vicinity. In winter the temperature at night drops below freezing in Tancítaro. Snow covers the peak of the mountain much of the time during this season, and there are occasional light snows on the plateau around the village of Tancítaro. These melt quickly, however, as there is little cloudiness in winter and the temperature during the day often reaches 20° C.

Temperatures in the river valley are high throughout the year. In Apatzingan the average daily temperature for the coldest months, December, January, and February, is above 24° C. The lowest temperature recorded during the years from 1929 to 1933 was 12° C., but this was exceptional, and temperatures of below 17° were rare.

The great differences in temperature resulting from altitudinal variation have given rise to the names, cold country or *tierra fría*, temperate country or *tierra templada*, and hot country or *tierra caliente*. These terms are somewhat loosely used by the natives and apply more to the particular climatic conditions than to the exact altitude, although they are usually defined in terms of altitude. The *tierra caliente* includes the tropical and subtropical regions up to approximately 4,500 feet, the *tierra templada* comprises the region between 4,500 and 8,000 feet, and the *tierra fría* is that land above 8,000 feet.

### Agriculture

The only utilization of land in the *tierra fría* is for grazing and the collection of resin for turpentine, but in the area in which most of our work was done grazing was infrequent and the trees had not yet been tapped for resin. In some parts of the forest on Cerro Tancítaro the trees have already been tapped, and it is probable that very soon trees on all parts of the mountain will be used for this purpose, but at present there is little sign of human activity on the south side of the mountain above 8,000 feet. In the upper parts of the *tierra templada* there are large herds of sheep and goats and some cattle, which find good pasturage in the sloping meadows between 6,000 and 8,000 feet. On the level parts of the plateau are numerous cornfields and a few fields of wheat and barley. Many vegetables are grown, among them carrots, radishes,

squash, string beans, tomatoes, onions, potatoes, and sweet potatoes (*camotes*), of which the last named grow unusually well in the region. The main fruit raised in and around the village of Tancitaro is the peach, which flourishes but is very poor in quality because of the lack of proper methods of selection and disease control. Some tropical fruit trees grow in the village, but they bear poor quality fruit or none at all. A few miles south, however, with less rain and more sunshine, a good many of these produce well, among them mango, avocado, fig, chirimoya, and changunga. The southern slope of the plateau below about 4,500 feet is blessed with a nearly perfect climate and, although here the cultivation is limited to a few stream valleys, the variety is great. Around the village of Acahuato, on the southern edge of the plateau, both temperate and tropical vegetables and fruits will thrive. In the *huertas* above the village onions, turnips, cucumbers, squash, and tomatoes flourish along with bananas of many varieties, two or three varieties of figs, avocados, mangos, mameys, oranges, limes, and coffee. The important product of the uncultivated southern plateau regions is turpentine. The largest settlements between Tancitaro and Acahuato are the *resinarias* or turpentine ranches, where the resin tapped in the extensive pine forests is collected and distilled.

Cultivation in the *tierra caliente* is limited to areas under irrigation, and here are extensive plantations of coconut, papaya, lime, orange, avocado, and some grapefruit, although the last named has only recently been introduced. In a few parts of the valley there are large rice fields. Corn is planted but does not produce well because of the very high temperatures. Perhaps the most important industry is cattle raising and some of the largest and finest herds in Mexico are found on the ranches in this valley.

### Vegetation

The area under consideration may be divided into the following sections according to the general vegetational composition:

- I. *Tropical Region*, the area below 3,000 feet, including the river valley and adjoining slopes up to the edge of the plateau.
  1. Tropical Deciduous Forest, covering the low parts of the valley floor, mostly along or near streams, where plants have access to abundant ground water.
  2. Open Arid Scrub Forest, covering the greater part of the plains of the valley floor.
  3. Dense Arid Scrub Forest, forming a transition belt between the open arid scrub and the mesic deciduous forest.
  4. Homogeneous Scattered Slope Vegetation, on the steep arid slopes between the plains and the edge of the plateau, characterized by a few species of trees in great constancy.
  5. Heterogeneous Canyon and Valley Forest, on the broken slopes and in canyons below the edge of the plateau, consisting in places of nearly open slopes with scattered trees and in other parts of dense scrub forest.

**II. Subtropical Transition Zone.**

6. This area is entirely covered by open pine forest, and extends from the edge of the plateau north to an altitude of 4,500 feet, although the upper limit is ill-defined. In the pine forests of this region there is a strong intermingling of the tropical element.

**III. High Plateau Temperate Region,** the northern part of the plateau between the altitudes of 4,500 and 7,200 feet.

7. Upper Plateau Pine Forest, including a great deal of area under cultivation or used for grazing, and no longer forested.
8. Pedregal Vegetation. The Pedregal is a range of hills two miles south of the village of Tancitaro, extending in an east-west direction across the plateau for about five miles, composed entirely of volcanic rock and harboring a very distinctive vegetation.

**IV. Mountain Temperate Region,** including the mountain proper and beginning at an altitude of about 7,200 feet.

9. Ridge Forest and Low Mountain Forest, extending up the unbroken slopes and ridges of the mountain to 9,000 feet or higher, a continuation of the pine forests found on the slopes of the plateau.

10. Valley Forest, found in the deep, humid stream valleys and canyons which lie between the shoulders of the mountain.
  - A. Transition to Cloud Forest, extending up the streams from 7,200 to nearly 7,500 feet.
  - B. Cloud Forest, extending up the valleys to heights of 9,500 feet, characterized by a very heavy epiphytic vegetation of ferns, bryophytes, and lichens.

11. High Mountain Area, the area above 9,500 feet, consisting mostly of open pine forest.
  - A. Open Pine Forest or Parkland, covering most of the area above 9,500 feet.
  - B. Ridge flora, found mostly along the rocky crests of the ridges above 9,500 feet, but including any prominent rocky outcrops in the area.

In considering the individual areas in detail it should be emphasized that there are few species which are limited entirely to one vegetational type. A species may be so widespread as to be characteristic of two or more vegetational types, in which case it is the frequency, size, or form of the plants, as well as the associated species, which give character to the type.

**1. TROPICAL DECIDUOUS FOREST**

This type of forest is found near streams or in marshy or low-lying areas. Formerly it covered extensive areas of the river valley, but in many areas the land has been cleared for cultivation so that now only solitary trees are left as remnants of the forest which once flourished there. Where this forest is yet undisturbed, many of the trees reach heights of from seventy-five to one hundred feet and have crowns so dense that little sunlight penetrates to the ground; as a result the herbaceous flora is not rich. Characteristic of this type of forest

are many species of trees, all of which are abundant but none of which is predominant as compared to the rest. Some of the more prominent among them are *Trichilia hirta* and *Bursera Simaruba*, conspicuous for their long, slender trunks and smooth, red bark which peels off in papery sheets, giving rise to the name *papelillo*, by which they are both known. Among the figs with buttressed trunks are *Ficus padifolia* (*higuero negro*), *F. mexicana* (*higuero blanco*), and *F. Goldmanii*. Other members of the Moraceae are *Castilla elastica*, widely known as *ule*, and *Brosimum Alicastrum*. Very common and widely distributed is the *capiri*, *Sideroxylon Capiri*, a large sapotaceous tree with yellow, edible fruits. Another member of the Sapotaceae, commonly cultivated, but growing half wild in places, is the *mamey*, *Calocarpum mammosum*. *Diospyros Ebenaster*, known in this region as *sapote negro*, is another common forest tree with edible fruits. Among the Leguminosae, *Enterolobium cyclocarpum* (*parota*), and *Tamarindus indicus* are conspicuous with their wide, feathery crowns. In the more open parts of the forest are the legumes, *Pithecellobium dulce*, *P. lanceolatum*, and *Inga spuria*. Common species of other families are *Annona reticulata*, *Forchhammeria pallida*, *Licania arborea*, *Calophyllum brasiliense* var. *Rekoi*, *Gyrocarpus americanus*, and *Tabebuia pentaphylla*.

## 2. OPEN ARID SCRUB FOREST

This type of vegetation covers by far the greater part of the river valley. Most of the trees in this area do not reach a height of more than forty feet and trees of this height are rather rare, so that the general appearance of the more thickly wooded areas is somewhat like that of chaparral, although the component species are different. In places the thorny thickets are impenetrable, while in others the individual trees and shrubs are so widely spaced that the appearance is that of an open plain with scattered vegetation. In general the scrub forest is characterized by many species in more or less equal abundance, but in places it consists of more or less pure stands. Near the river there are several square miles where there is little but mesquite and *huisache* (*Acacia cymbispina*), and in some of this area there is nothing but *huisache*. East of Apatzingan are arid stretches where little vegetation of any kind is found except isolated trees of *Crescentia alata*. The four species most nearly ubiquitous throughout the scrub forest are mesquite, *huisache*, *corungoro* (*Zizyphus sonorensis*), and *guayaacán* (*Guaiacum Coulteri*). The latter two grow even in the mesic forest, where they reach a height of forty feet or more. Other species commonly found in much of the arid scrub land are *Caesalpinia platyloba*, *Diphysa floribunda*, *Colubrina heteroneura*, *Malpighia mexicana*, *Celtis iguanaea*, *Cyrtocarpa procera*, *Bursera jorullensis*, *Jacquinia pungens*, *Cordia elaeagnoides*, and various species of *Randia*. Somewhat more localized but very abundant are *Acacia macrantha*, *A. angustissima*, *A. riparia*, *Apoplanesia paniculata*, *Calliandra densifolia*, *Lysiloma microphyllum*, *Mimosa distachys*, *Caesalpinia pulcherrima*, *Pithecellobium velutinum*, *Cordia alba*, *Erythroxylon Pringlei*, *Malpighia Galeottiana*, *Bursera grandifolia*, *Guettarda elliptica*, *Rauwolfa hirsuta*, *Achatocarpus nigricans*, *A. oaxacanus*, *Manihot tomatophylla*, *Croton niveus*, and *Capparis angustifolia*.

Cacti are not so prominent or abundant here as in many other similar arid

parts of Mexico, but they do constitute an important element of the vegetation on the arid plains. The two commonest species in the open arid scrub forest are *Pachycereus pecten-aboriginum* and *Acanthocereus pentagonus*. These are somewhat localized in distribution, being absent from large areas and very abundant in others. Near the Río Tepalcatepec they are found growing in the dense forest close to streams. A large species of *Opuntia* is common on the arid slopes immediately above the valley, and extends down onto the arid plains. This species is very conspicuous locally up to 1,400 feet, but mostly absent above that altitude.

There is a rich herbaceous covering throughout the more open parts of the scrub forest. The lower areas near the river, where there is a good soil, are covered with a turf of *Opizia stolonifera*, but over most of the region grasses are not prominent. *Panicum hirticaule*, *P. fasciculatum*, and *Leptochloa filiformis* are the only species found throughout the plains except along streams or in irrigated fields. The species making up the herbaceous cover in this region are to a great extent vines and spreading herbs of the families Zygophyllaceae, Nyctaginaceae, and Convolvulaceae. *Kallstroemia maxima*, *K. glabrata*, *Okenia hypogaea*, and *Ipomoea pedatisecta* are common on poor and rocky soils throughout the valley, while in cultivated and waste fields *Tribulus cistoides* grows in solid mats. Other herbs found in great abundance are *Jatropha tubulosa*, *J. angustidens*, and *Solanum cornutum*, all of which make collecting in some places very unpleasant because of their spiny, nettle-like characteristics. *Ruellia nudiflora* is probably the most abundant species on the plains. Its purple flowers are conspicuous everywhere, even in mesic woods. *Datura pruinosa* is common but somewhat localized. *Hybanthus oppositifolius* is common everywhere but especially in rocky situations. Further representatives of the Nyctaginaceae are *Boerhaavia erecta* and *B. caribaea*. *Anoda cristata* is the only common mallow. Among other herbs or suffrutescent plants may be mentioned *Melochia pyramidata*, *Trianthema Portulacastrum*, *Martynia annua*, *Solanum deflexum*, *Asclepias curassavica*, *Cassia uniflora*, and *Melampodium americanum*. The curious root parasite, *Lennoa madreporioides*, is common locally throughout the arid parts of the entire tropical region. The supposedly rare *Tradescantia orchidophylloides* is very common locally where there is a fairly good soil and continuous shade.

### 3. DENSE ARID SCRUB FOREST

There is no sharp line of demarcation between the mesic deciduous forest and the thorny scrub forest of the arid plains on either side. As one travels away from the streams and into well drained soil the persisting mesic forest species become smaller and a mixture of arid forms comes in. Isolated giant trees of fig and *capiri* rise above impenetrable thickets of *Celtis iguanaea*, *Vallesia glabra*, and various species of *Randia*. Still farther from the streams the forest is made up almost entirely of arid species, but the individuals are larger and more numerous, forming dense thickets, often covering large areas. There is no need to enumerate the species in these transition forests, because they are only extensions of the scrub forest which have reached an optimum stage of development as a consequence of having access to more water.

#### 4. HOMOGENEOUS SCATTERED VEGETATION OF THE ARID SLOPES

There are few places where the slopes below the plateau are unbroken by canyons and washes, but between Acahuato and Apatzingan there is an outlier of the plateau on the relatively smooth slopes of which the vegetation is sufficiently distinctive to be mentioned. This outlier is a cone about 3,000 feet high known as Cerro Apatzingan and connected with the plateau by a broad ridge about five hundred feet below the summit. Although there are deep washes and gullies near the top of the mountain, over most of its area the slopes are fairly even and unbroken by rock outcrops. There are only a few species of trees growing here, but these few are abundant and widely and evenly spaced so as to give the appearance from a distance of a regularly planted orchard. This effect is enhanced by the low, spreading, symmetrical crowns of the predominant species, *Pseudosmodingium perniciosum*. Over much of the mountain this species forms nearly pure stands, interspersed occasionally with *Cyrtocarpa procera*, *Comocladia mollissima*, and a few species of *Bursera*. On the lower slopes *Juliania* becomes very prominent and in places nearly supplants *Pseudosmodingium*. It is interesting to note that three of the prominent species of this area belong to the Anacardiaceae, whereas a fourth belongs to the little-known and very localized Julianiaceae. The trees throughout this area are widely enough spaced to permit the development of a continuous stand of grass. The two important species are *Cathestecum erectum* and *Hilaria cenchroides*.

#### 5. HETEROGENEOUS FOREST OF CANYON AND VALLEY

The vegetation of the slopes and canyons below the plateau is even more varied than that of the arid plains. The two areas have many species in common, as is to be expected since the conditions of temperature and rainfall in both are almost exactly the same. Furthermore, rocky ridges extend from below the plateau far out into the plains, and low, rocky ridges and mesas are scattered throughout the plains, all of which bear a vegetation similar to that of the dissected slopes below the plateau, but intergrading with the arid scrub of the plains with respect to many species. No species can be said to be predominant in this type of vegetation, but some families are more heavily represented than others in number of individuals. Among these the Burseraceae are undoubtedly first, with no less than twelve species of the genus *Bursera*, most of which are very common. The Malpighiaceae are second in abundance, although their heaviest distribution is limited to the upper slopes above 2,000 feet. Among the species are *Heteropteris laurifolia*, *H. Palmeri*, *Malpighia mexicana*, and *Byrsonima crassifolia*, known by the name of *changunga* and prized for its fruit. Of these, *Byrsonima crassifolia* is not found at all below 2,000 feet, but above this altitude it becomes in many places the commonest member of the arborescent vegetation. The Anacardiaceae are prominent throughout the area, from the plains to 3,000 feet, with four species which are very common, *Pseudosmodingium perniciosum*, *Cyrtocarpa procera*, *Comocladia mollissima*, and *Spondias purpurea*. Among the other families most heavily represented should be mentioned the Leguminosae, Compositae, Ru-

biaceae, Euphorbiaceae, Verbenaceae, Julianiaceae and Gramineae. Among the legumes are *Apoplanesia paniculata*, *Caesalpinia pulcherrima*, *Diphysa floribunda*, *Erythrina americana*, *Haematoxylon Brasiletto*, *Indigofera Palmeri*, *Lysiloma microphyllum*, and *Piscidia piscipula*. Most of the Compositae are herbs, of which the commonest are *Tridax procumbens*, *Zinnia maritima*, and several species of *Melampodium* and *Pectis*. These are abundant on open grassy slopes along with the grasses *Cathestecum erectum* and *Hilaria cenchroides*, and the amaranthaceous herb, *Gomphrena dispersa*. The composite shrub, *Porophyllum nutans*, is common throughout the lower slopes and especially on the steep slopes of canyons. Other common composites, mostly of the upper slopes, are *Perymenium Berlandieri*, *Brickellia paniculata*, *Salmea Palmeri*, *Trixis hyposericea*, *T. longifolia*, *Zexmenia hispida*, and *Sclerocarpus uniserialis*. The family Rubiaceae is represented on the arid slopes by *Randia echinocarpa*, *R. Nelsoni*, and *R. laetivirens*, while in the canyons near the streams are found *Guettarda elliptica*, *Hamelia jorullensis*, and *Cephalanthus salicifolius*. In the Euphorbiaceae *Euphorbia hirta*, *E. umbellata*, and *E. Schlechtendalii* are common herbs, while *Croton flavescens*, *Manihot angustiloba*, *M. mobilis*, and *Phyllanthus micrandrus* are woody forms. *Vitex Hemisleyi* and *V. mollis* of the Verbenaceae are common trees on the upper slopes. The family Julianiaceae is represented by only one species of *Julania*, but on the slopes bordering the plains this species is often more common than any others. A number of grasses are represented in this vegetational area, although most of them are confined to the stream valleys. Besides *Hilaria cenchroides* and *Cathestecum erectum* on the open slopes are *Bouteloua filiformis*, *Heteropogon contortus*, and *Panicum hirticaule*, while in the canyons along the streams are found *Arundinella Berteroniana*, *Eragrostis diffusa*, *Paspalum plicatum*, *P. convexum*, and *P. paniculatum*, *Digitaria sanguinalis*, *Aristida terripipes*, and *Hyparrhenia dissoluta*.

Several species not belonging to any of the above mentioned families are characteristic of this type of vegetation. Among them should be mentioned *Thevetia peruviana* var. *pinifolia* and *Plumeria rubra* of the Apocynaceae, *Crescentia alata* of the Bignoniaceae, *Ficus petiolaris* of the Moraceae, and *Ipomoea arborescens* of the Convolvulaceae.

#### 6. SUBTROPICAL TRANSITION FOREST

At an altitude of 3,000 feet, just at the southern edge of the plateau, there is an abrupt change from the arid slopes with their scrubby, scattered vegetation to a forest of tall pines. This forest extends continuously from 3,000 feet to the base of Cerro Tancitaro, and up the mountain in places to 9,000 feet or more. In the area below 5,000 feet *Pinus pseudostrbus* is the dominant, and perhaps the only, species, but above that altitude *P. Ayacahuite* and *P. Montezumae* are found in varying abundance. It is the herbaceous and shrubby flora which largely determines the characters of the various levels of the open pine forest.

Along the lower border of the pine forest are found most of the species common on the upper arid slopes of the tropical region. *Ficus petiolaris*, *Bursera bicolor*, *B. fagaroides*, *B. grandifolia*, *Byrsonima crassifolia*, *Vitex Hem-*

*sleyi*, and *V. mollis* are a few of those species which reach their highest development on the arid slopes just below the pine forest but are also very common in the lower parts of the forest itself. Arborescent or shrubby species reaching their highest development in the lower part of the pine forest between 3,000 and 3,500 feet are *Ficus Pringlei*, *Annona longiflora*, *Acacia pennatula*, *Calliandra callistemon*, *Bignonia podalyrioides*, *Dodonaea viscosa*, *Psidium Guajava*, *Cordia brevispicata*, and in the valleys near streams, *Piper acapulcense*. Among the herbs characteristic of this region are *Rhynchosia nigropunctata*, *Zornia diphylla*, *Cuphea micropetala*, *Evolvulus alsinoides*, *Macromeria exserta*, *Heliotropium mexicanum*, *Galeana pratensis*, *Galinsoga ciliata*, and *Cosmos sulphureus*. *Tripsacum lanceolatum* is a common grass on well-drained ridges in this area. *Adiantum Shepherdii* is the most abundant fern on open slopes. In the moist soil of rocky ledges along streams are *Galium Aschenbornii*, *Impatiens Balsamina*, *Begonia gracilis*, and various species of *Achimenes*. Many species are common throughout the transition area, but especially prominent above 3,500 feet. These include the shrubs *Eriosema grandiflora*, *Calliandra Houstoniana*, *Calea urticifolia*, *Tephrosia cuernavacana*, *Acalypha subviscida*, *Stillingia zelayensis*, *Turnera ulmifolia*, *Wigandia caracasana*, *Bouvardia multiflora*, *Hyptis pectinata*, and *Verbesina Greenmanii*, and the herbs *Milla biflora*, *Thalictrum Pringlei*, *Dorstenia Drakena*, *Heliotropium limbatum*, *Zinnia angustifolia*, and *Z. linearis*. *Thalictrum Pringlei* is very common in shady woods and forms solid stands, sometimes to the exclusion of other species. *Dorstenia* is likewise characteristic of the shady parts of the forest, while *Milla biflora*, *Heliotropium limbatum*, and the two species of *Zinnia* are common in open woods and grassy meadows along with the grass, *Bouteloua filiformis*.

Several distinctly tropical trees extend up the streams to an altitude of 4,500 feet or more, but this is exceptional and in general the tropical element has entirely disappeared from the pine forest at this altitude. Above this the character of the vegetation becomes rapidly like that of the high, level plateau just below the mountain. *Pinus Montezumae* and *P. Ayacahuite* become common, and oaks, madroño, and other less frequent trees form a noticeable part of the vegetation.

#### 7. UPPER PLATEAU PINE FOREST

Much of the level part of this region has been cultivated or heavily pastured, so that the vegetation found there is mostly herbaceous. The hills, stream valleys, and barrancas, however, still contain a rich flora of trees and shrubs. On the hills are forests of pine, composed largely of *Pinus Montezumae*, but with a mixture of *P. Ayacahuite* and *P. pseudostrobus*. Intermixed in some places are several species of oak, occasionally forming a conspicuous part of the vegetation. Along the barrancas are *Prunus Capuli* (*capulin*), *Arbutus xalapensis* (*madroño*), *Fraxinus Uhdei*, *Carpinus caroliniana*, *Gilibertia arborea*, and *Oreopanax Echinops*, while near the streams are *Tilia occidentalis*, *Salix Bonplandiana*, and *Crataegus pubescens*. Conspicuous among the trees and low shrubs of this region are *Rubus adenotrichus*, *Crotalaria vitellina*, *Acalypha vagans*, *Croton calvescens*, *Coriaria thymifolia*, *Ceanothus coeruleus*,

*Lythrum vulneraria*, *Fuchsia chiapensis*, *F. fulgens*, *Tournefortia densiflora*, *Salvia longispicata*, *Solanum brachystachys*, *S. laurifolium*, *S. Cervantesii*, *Cestrum thyrsoides*, *Castilleja integrifolia*, *Viburnum Loeseneri*, *Lobelia laxiflora*, *Baccharis thesioides*, *B. ramulosa*, and *B. glutinosa*. Noticeable in this group are members of the Solanaceae, which is the most heavily represented family throughout much of this area. The commonest species, however, is a composite, *Baccharis ramulosa*, which is common in fields and open woodlands throughout the plateau between altitudes of 5,000 and 7,200 feet.

The herbaceous vegetation of the high plateau is rich and varied. One of the most characteristic genera is *Cuphea*, with many herbaceous and suffrutescent species, found in both open meadows and dense forests. In pastures and waste fields from 6,000 to 8,000 feet, *Phacelia platycarpa* is often the commonest plant. Mixed with it in the higher part of its range are *Euphorbia campestris*, *Plantago mexicana*, *Anagallis arvensis*, *Oenothera laciniata*, and *Solanum tuberosum*. In the level fields south of the village of Tancitaro, at an altitude of just 6,000 feet, the following species are all abundant: *Polygonum punctatum*, *Phaseolus heterophyllus*, *Hypericum uliginosum*, *Anagallis arvensis*, *Argemone platyceras*, *Gaura tripetala*, *Stachys agraria*, *Verbena ciliata*, *V. carolina*, *Lycianthes somniculenta*, *Lobelia fenestralis*, *Erigeron scapus*, *Conyza coronopifolia*, and *Aphanostephus ramosissimus*, while on the surrounding open slopes are also *Borreria laevis*, *B. verticillata*, *Polygala subalata*, *Ranunculus Hookeri*, *Crotalaria sagittalis*, *Cacalia Palmeri*, *Heliotropium indicum*, *Hypoxis decumbens*, and *Habenaria clypeata*. Along the edges of fields and on fences and stone walls are *Ipomoea longipedunculata* and several species of *Phaseolus*. The more open parts of the pine forest are rich in herbaceous species, among which are *Drymaria cordata*, *Oxalis lanceolata*, *Geranium aristisepalum*, *Arracacia vaginata*, *Scutellaria coerulea*, *Physalis subintegra*, *Solanum nigrum*, *Saracha procumbens*, *Onosmodium strigosum*, several species of *Viola*, and *Nemastylis versicolor*.

## 7. PEDREGAL VEGETATION

The vegetation of the volcanic hills known as the Pedregal is very different from that of the surrounding region. From a short distance away they seem to have no vegetation at all and appear as irregular gray ridges of heaped-up boulders. The most striking feature of the area under closer observation is the abundance and variety of ferns. Once actually in the area the observer is struck with the abundance of shrubs not found elsewhere in the vicinity and with the comparative abundance of oaks. The Pedregal in its most elevated parts stands nearly 500 feet above the plateau. It is an irregular series of ridges and valleys, many of them without apparent outlets, in which lie isolated units of vegetation. Each depression or valley is rich in shrubs and small trees. Among them are *Celastrus Pringlei*, *Photinia mexicana*, *Clusia Salvini*, *Rapanea ferruginea*, *Rhamnus capraefolia*, *Garrya laurifolia*, and *Eupatorium* sp. Along with these are usually a few spreading oaks, which bear a heavy epiphytic vegetation of ferns and orchids. It is interesting that, although epiphytic orchids are common on the plateau and in the mountains east and west of Cerro Tancitaro,

the only locality in which they are found on the plateau to the south is the Pedregal.

The following ferns are represented in our collections from the Pedregal. They do not indicate well the abundance of the pteridophyte flora, because only a very small area was covered, and duplicates of species already collected in other areas were not collected in many cases at all.

- |                                       |                                    |
|---------------------------------------|------------------------------------|
| 1. <i>Selaginella cuspidata</i>       | 13. <i>Notholaena candida</i>      |
| 2. <i>Asplenium fragrans</i>          | 14. <i>Notholaena nivea</i>        |
| 3. <i>Asplenium monanthes</i>         | 15. <i>Pellaea intramarginalis</i> |
| 4. <i>Asplenium praemorsum</i>        | 16. <i>Pellaea ternifolia</i>      |
| 5. <i>Cheilanthes farinosa</i>        | 17. <i>Polypodium auricum</i>      |
| 6. <i>Cheilanthes intramarginalis</i> | 18. <i>Polypodium furfuraceum</i>  |
| 7. <i>Cheilanthes lindigera</i>       | 19. <i>Polypodium lanceolatum</i>  |
| 8. <i>Cystopteris fragilis</i>        | 20. <i>Polypodium pectinatum</i>   |
| 9. <i>Dryopteris patula</i>           | 21. <i>Polypodium plebeium</i>     |
| 10. <i>Dryopteris rufa</i>            | 22. <i>Vittaria filifolia</i>      |
| 11. <i>Elaphoglossum araneosum</i>    | 23. <i>Woodsia mollis</i>          |
| 12. <i>Elaphoglossum elongatum</i>    |                                    |

#### 9. RIDGE FOREST AND LOW MOUNTAIN FOREST

The pine forests of the plateau extend up the slopes of the mountain without much change, where these slopes present no marked differences in environment from the conditions below. Since much of the mountain is cut by deep ravines and canyons, however, only the long ridges between the streams present such conditions. On these ridges the pines form a nearly solid stand up to 9,000 feet or higher, where the slopes are usually broken by cliffs above which the type of vegetation changes abruptly. Above 7,500 or 8,000 feet the pine is mixed with fir (*Abies religiosa*) in varying amounts.

#### 10. VALLEY FOREST

A. *Transition to cloud forest:* This narrow strip lies just above the level where the mountain streams empty onto the plateau. It is an area of dense forest, similar to the cloud forest in many ways, but without the heavy epiphytic flora which characterizes the latter region. The trees are mostly *Pinus Mon-tezumae* and *P. Ayacahuite*, but there are a few species which extend up from the plateau, such as *Quercus laurina* and *Tilia occidentalis*. A common species in this forest is *Alnus glabrata*, which extends from the highest parts of the open plateau along the streams to an altitude of about 8,000 feet in the cloud forest. The forest floor is covered with a dense vegetation of small trees, shrubs, and vines much as in the cloud forest.

B. *Cloud Forest:* The cloud forest as a whole is characterized by a heavy epiphytic growth of ferns, mosses, liverworts and lichens. Along the streams there is an almost impenetrable tangle of shrubs and vines, while on the steep slopes is a dense forest of pine and fir. As this forest extends upward on the diverging slopes it becomes progressively more characteristic of the forest on the ridges by reason of its decreased humidity, resulting from the stronger action of the dessicating winds. The cloud forest presents two distinctly different aspects at different altitudes as follows: (1) The lower stream valleys in which

the predominant trees are *Pinus Montezumae*, *P. Ayacahuite*, *Abies religiosa*, and *Alnus glabrata*; (2) The steep upper stretches of the valleys or canyons in which *Abies religiosa* forms almost pure stands.

(1) In the lower, mixed forest are found large trees of *Quercus laurina*, *Meliosma dentata*, and *Cornus disciflora*. The dogwood is found only above about 8,000 feet, and the *Meliosma* (*mato negro*) is localized in a fairly dense stand between 7,300 and 7,500 feet. *Quercus laurina* is fairly common throughout and reaches its upper limit at nearly 8,400 feet, at which point the pines reach their highest limit in the cloud forest. Among the shrubs which make up the thick undergrowth are *Fuchsia fulgens*, *F. microphylla*, *F. Pringlei*, *Solanum brachystachys*, *S. Cervantesii*, *Cestrum Anagyris*, *Satureja laevigata*, and *Senecio platanifolius*. The last named is the most characteristic shrub of the lower cloud forest and forms solid, impenetrable stands wherever there is a break in the forest cover. Among the vines of this area are *Cuphea Bustamanta*, *Didymaea alsinoides*, *Galium mexicanum*, *Cyclanthera dissecta*, *C. Langaei*, *Cuscuta corymbosa* var. *grandiflora*, and *Smilax* sp.

(2) Above 8,200 feet the forest of fir is for the most part so dense that little will grow in the deep shade except the mosses which cover the trunks and lower branches. In the places where shrubs and small trees will grow at all they are usually etiolated and vinelike in form. *Fuchsia microphylla*, *Cuphea gesneraeiflora*, *Salvia cardinalis*, *Salix Hartwegi*, *S. paradoxa*, *Eupatorium Mairetianum*, *Arracacia bracteata*, and species of *Quercus*, *Vernonia* and *Eupatorium* are among the shrubs and small trees found in this forest area. The large grass, *Trisetum Virletii*, is also conspicuous in the fir forest.

A list of the ferns collected in the cloud forest is as follows: *Asplenium fragrans*, *A. monanthes*, *Cystopteris fragilis*, *Notholaena nivea*, *Polypodium pectinatum*, *P. plebeium*, *P. subpetiolatum*, and *Woodsia mollis*. The mosses collected include twenty-three species from nineteen families, are recorded in the List of Genera and Species at the end of this paper. The lichens in the cloud forest are probably the same for the most part as those collected in the open forest just above and are listed in the genera and species collected.

## 11. HIGH MOUNTAIN AREA

At an altitude of 9,500 feet the dense forest ends abruptly. Above this altitude the slopes of the mountain are covered with an open forest in which there is a rich ground flora of herbs and grasses. This region may be divided into a ridge flora and a valley flora or parkland, as previously indicated. Likewise each of these shows marked differences below and above 10,000 or 10,500 feet. The parkland may be divided as follows: (1) mixed forest parkland, and (2) pine forest parkland.

The mixed forest parkland lies between 9,500 feet and about 10,000 feet. In many ways it is a zone of transition from the cloud forest to the open pine forest above. Scattered stands of fir are common, but are mixed with pine and alder (*Alnus arguta*). The alder forms pure stands of rather open character in many places, especially on moist slopes below cliffs. The trees in this area are heavily laden with epiphytic lichens and mosses, just like those in the cloud

forest. On the alders there is also the fern, *Polypodium polylepis*, which covers the trunk and branches in solid mats.

Above 10,000 feet many of the valleys are wide and cirquelike, with steep sides and gentle slopes below. In these valleys *Pinus Montezumae* and *P. Ayacahuite* reach their best development, attaining a height of one hundred feet or more, and a diameter of about three feet. Even though the forest is open, letting in abundant sunlight, the trunks are straight and branchless to a great height. Below 10,600 feet almost all of the trees are heavily infested with *Arceuthobium vaginatum*, which forms scrubby growths as much as two feet across. There is no shrubby vegetation in these valleys with the exception of *Pernetia ciliata*, which reaches a height along the streams of about two feet. Bunchgrass covers the entire area except a few places where species of *Lupinus* form stands covering several square yards. Growing between the clumps of grass are *Castilleja lithospermoidea*, *Deanea longibracteata*, *Gnaphalium oxyphyllum*, *Eryngium bromeliaefolium*, *Sisyrinchium tenuifolium*, *Stenanthium frigidum*, and a very abundant species of *Habenaria*. The grasses are for the most part *Agrostis tolucensis*, *Festuca Rosei*, *Deschampsia Liebmansi* and *Trisetum deyeuxioides*.

The ridges between the valleys, with their rocky ledges, cliffs, and steep, moist slopes furnish a very different habitat from that of the valleys. On these ridges between 9,500 and about 10,500 feet flourishes the richest and most varied flora of the mountain. On the moist slopes below cliffs, in addition to scattered stands of pine, alder and fir, are a great variety of shrubs and herbs, many of which are also found on the cliffs and ledges above. Among the shrubs should be listed *Buddleia parviflora*, *Lopezia pubescens*, *Holodiscus fissus*, *Arbutus xalapensis*, *A. spinulosa*, *Arctostaphylos angustifolia*, *A. rupestris*, *Salvia elegans*, *S. cardinalis*, *Castilleja integrifolia*, *Viburnum microphyllum*, *Bidens triplinervia*, *Liabum glabrum*, *Perymenium Berlandieri*, *Steria lucida*, and *Trigonospermum hispidulum*. The variously colored *Pentstemon campanulatus* is one of the most abundant species on these slopes, with the dark red-flowered form predominating. Growing with it are *Macromeria discolor*, *Oxalis alpina*, *Cacalia peltata*, and *Piqueria pilosa*. *Sabazia Liebmanni* is found only in the shade of alder. On the cliffs *Dahlia Merckii* is common, along with the fern, *Asplenium castaneum*. *Heuchera mexicana* was found growing on moist cliffs just below 10,500 feet. On the crests of the ridges and adjacent well drained slopes are *Cerastium nutans*, *Oxalis alpina*, *Geranium Seemannii*, *Castilleja scorzoneraefolia*, *Pentstemon campanulatus* (pink- and blue-flowered forms), *Stevia jorullensis*, *S. rhombifolia*, and *Nemastylis brunnea*, as well as various grasses found more abundantly at higher altitudes.

Above 10,500 feet the ridge flora is less varied. With increasing altitude the grasses become more prominent until at this altitude they form the largest part of the herbaceous cover. The chief species are *Festuca amplissima*, *Muhlenbergia virescens*, and *Agrostis tolucensis*. Other herbs include *Arenaria oresbia*, *Cerastium nutans*, *Draba Pringlei*, *Alchemilla procumbens*, *Oxalis alpina*, *Halenia plantaginea*, *Tauschia nudicaulis*, *Pepperomia umbilicata*, *Gnaphalium Sprengelii*, *Hieracium abscissum*, *Senecio tolucanus*, *Dahlia Merckii*, *Bidens triplinervia*, and *Stenanthium frigidum*. The only shrub at this height is *Pernetia ciliata*, growing in thick mats less than one foot in height. On exposed

ledges and cliffs are stunted trees of *Pinus Montezumae* var. *rudis* and *Juniperus tetragona*, the latter being little more than a shrub in most places. For the most part, however, the trees on Cerro Tancitaro show very little the effects of altitude or exposure. The vegetation of the peak itself does not differ from that of the surrounding ridges. There are a few pines which are less dwarfed than some in lower, less favorable situations.

The description thus far applies to the south slopes of the mountain. The north slopes were explored only down to an altitude of 10,500 feet, but in the area above this marked differences could be seen in the composition of the vegetation. First, the flora is richer in number of species on the north side and second, a number of the species growing on both slopes are much more abundant on the north slopes. Some of the species limited to the north side were found in connection with an aquatic habitat different from any on the south side, but others were growing in open parkland on slopes very similar to the same formation on the south side. Among the species apparently absent from the south side are: *Agrostis tacubayensis*, *Limnia mexicana*, *Cirsium nivale*, and *Luzula racemosa*. Among the species more abundant on the north slopes are: *Achaetogeron affinis*, *Lupinus geophilus*, *L. Aschenbornii*, *Halenia plantaginea*, and *Trisetum spicatum*.

### Discussion

In 1886 Sir Joseph Hooker made the following statement in *Biologia Centrali-Americanana*, "No country of equal area presents a richer or more varied vegetation than Mexico. Except perhaps the Javan and the Indian, no tropical flora of great extent is so well explored and so fully represented by collections; and none has been subjected to so searching an analysis, in respect to the correlations of its botanical features and the definition of its botanical regions, as has this flora under Mr. Hemsley's judicious, painstaking, and accurate methods of study." There had been a number of attempts before Hemsley's time to correlate the phytogeographical features of Mexico but, probably because of the very richness and variation of the flora, these attempts were not very successful. The various accounts were not sufficiently similar to make correlation easy and thus present a clear picture of either the vegetation of the entire country or even of the many zones incorporated in any given region. As stated by Ramírez (1898), all these accounts were accurate in one respect, in that they were based on either plant collections or personal observations of vegetation and climate. To ameliorate the situation Ramírez suggested a classification based primarily on climate. By so doing he avoided the mistakes of previous writers, who had not taken into adequate consideration the great climatic differences produced by the peculiar, rough topography of Mexico. He considered temperature and humidity to be the two most important climatic factors. He corrected the previously held idea that the vegetation of the east coast is essentially dissimilar from that of the west coast, pointing out that the climatic conditions with respect to temperature, rainfall, and humidity are very similar along both coasts, with the exception of parts of Baja California. In 1918 Ochoterena presented a classification, which he later amplified (1937), based upon the earlier classification of Ramírez, but considerably

modified. That classification is the most complete which has been made for the country as a whole. It is the purpose of the present paper to give a clear description of the vegetational zones which occur between the peak of Cerro Tancitaro and the Río Tepalcatepec, and to correlate them wherever possible with those described by other authors in other parts of the country.

The account given here is essentially one of altitudinal distribution, in an area where the altitudinal extremes are nearly 11,000 feet. Of course, there are many factors not influenced directly by altitude, or only partially influenced by it, which affect vegetational distribution, and some of them are probably more important, within certain limits, than those which are. Among these are relative humidity and light, influenced greatly by topography, and the edaphic factor of soil. One of the greatest problems in correlating phytogeographic zones with geographic and climatic zones in Mexico is that of determining which factor, or group of factors, is most important in governing the distribution of a given type of vegetation, and what it is that causes the fluctuation of these important factors. Relative humidity is probably the most important factor influencing the prevalence of certain types of plants, yet topography is often as important in controlling the relative humidity as is the increased rainfall of higher altitudes. Another factor of great importance is the type of soil or substratum and with it the conditions of drainage. This again is a result of local topography and not of altitude or (to any great extent) of general climatic conditions. Thus we may find widely different environmental conditions in one small local area or almost the same conditions in widely separated parts of the country at greatly varying altitudes. In the region under consideration we find that the presence of the mountain exerts a marked influence over the entire plateau to the south of it, causing increased cloudiness, less sunlight, and lower temperatures, compared with nearby areas at similar altitudes to the east or west. One indication of this is the low extension of the pine forest, which at Acahuato reaches down to 3,000 feet. Throughout much of southern Mexico pine forests do not extend below 6,500 feet, and even around Uruapan, forty or fifty miles to the east, the pine forest is not found much below 6,000 feet. Furthermore, there is often a transition forest of oak, or of oak and pine mixed, between the arid scrub forest and the pine forest, but above Acahuato there is no such transition, the pine forest bordering directly on the arid scrub forest. Possibly as a result of the influence of the mountain, there are other marked differences between the altitudinal location of the various vegetational zones in this region and in other parts of southern Mexico, although several of them correspond closely in composition and character with those described by Ochoterena.

The region here designated as tropical includes formations from both the "región tropical" and the "región templada" of Ochoterena. The Tropical Deciduous Forest of the valley of the Río Tepalcatepec is a part of the same type of tropical forest which extends along both coasts and reaches an altitude of four or five hundred meters in some places on the west coast. The Open Arid Scrub Forest is considered here as tropical, since there are no climatic differences between the areas covered by it and those occupied by the more mesic Tropical Deciduous Forest. It contains some species in common with the region designated by Ochoterena as the "Subregión desierta del Sur," but

it probably should not be classed as a strictly desert area and is probably a variation in many places of the following formation.

Miranda (1941) has described a formation known as *cuajiotl*, found in the "Subregión caliente del sur de la Mesa Central." The term *cuajiotl* is derived from two Nahuatl words meaning "leper tree." It is used to designate a particular type of vegetation composed of trees with scaly bark. There may be a great variation in the proportional numbers of the various species, but the principal genera represented are *Bursera*, *Pseudosmodingium*, and *Juliania*. In places there are almost pure stands of *Pseudosmodingium perniciosum*, the trees regularly and widely spaced. *Ipomoea arborescens*, *Ficus petiolaris*, *Cyrtocarpa procera*, and species of *Plumeria* and *Comocladia* are among the species of secondary importance. Undoubtedly the two formations designated by us as Homogeneous Arid Slope Vegetation and Heterogeneous Canyon and Valley Forest are both types of *cuajiotl*. They are included here in the tropical region because they are not only found under climatic conditions very similar to those of the scrub forest of the plains, but are also continuous with this forest as regards many species. Moreover, the area of *cuajiotl* in our region lies between 1,200 and 3,000 feet, whereas the associations described by Miranda all are found between 865 and 1,880 meters, or, roughly, between 2,800 and 5,000 feet.

The Subtropical Region as delimited here lies entirely within the pine forest. A few miles to the east or west it could probably be extended up to 6,000 feet, because the lower limit of the pine forest becomes progressively higher in either direction, with a corresponding upward extension of tropical forms. In the area under consideration the subtropical region is ill-defined as far as vegetation is concerned, since above 3,500 feet the continuous stand of pine is almost unbroken by other species of trees and shrubs, the best indication of climate being the scattered fig trees and banana plantations in the valleys. The high plateau can not be considered subtropical because the low temperatures, frequent frosts, and even occasional snows of winter have kept out almost entirely any forms from lower regions. This region resembles somewhat in vegetation and climate the valley of Morelia, included by Ochoterena in the "Temperate, Dry Subregion of the Southern Plains of the Central Plateau." His description of this subregion is very brief and he merely makes the statement that the four families, Leguminosae, Gramineae, Cactaceae, and Compositae are abundantly represented. The plateau region around Tancítaro is not rich in grasses and is almost devoid of cacti. It is strikingly characterized by the abundance of arborescent Solanaceae. Although in number of species this family is outnumbered by both the Compositae and Leguminosae, the singular character of the vegetation is a result, to a great extent, of the abundance of solanaceous forms.

Observers who are familiar with the rain forests of Orizaba and of other mountains farther south will realize that the limited cloud forest on Cerro Tancítaro is quite different in some respects from those of other tropical mountains. Many forms, such as tree ferns, and epiphytic orchids and bromeliads, are completely lacking, but the general character of the moist forest with its rich covering of epiphytes is the same. Shreve (1914) described the rain forest of the Blue Mountains in Jamaica as characterized by a great abundance of

epiphytic bryophytes and pteridophytes. Epiphytic orchids were few, but epiphytic bromeliads of a few species were very abundant. Likewise on Cerro Tancitaro the cloud forest is characterized by the great abundance of epiphytic bryophytes and pteridophytes, but epiphytic orchids and bromeliads are absent. Unfortunately we have no way of knowing the exact conditions of moisture in the cloud forest. The relative humidity is very high, near 100% in the summer to judge from the almost continual presence of clouds, but that it remains this high throughout the year is improbable. In considering the character of the cloud forest on Cerro Tancitaro it is necessary to remember that it is at much higher altitude than other such forests in Mexico, and that it probably represents the northernmost outlier of these forests. It is probable that fairly heavy snows fall in these valleys in winter, whereas freezing temperatures are practically unknown in other tropical rainforests.

The summit of Cerro Tancitaro presents no marked change from the lower parts of the mountain which are covered with pine forest, except that there are few young trees and the mature ones are widely spaced. The herbaceous and shrubby vegetation here resembles closely that of other high mountains along the southern edge of the plateau. The slopes north of the peak seem to have a richer flora than those sloping southward. This may be partially explicable on the grounds that they are not so high above the plateau on that side. Merriam (1890) showed that one of the main factors in the distribution of species in the same latitude and altitude was the elevation above base level, that is, the height of a given point above the plane it faces. Thus a mountain, such as Tancitaro, standing on the southern edge of a plateau, will have higher temperatures on the north side than on the south, because the effect of base level is much greater than the effect of slope exposure. The plateau on the south side of Tancitaro is not only lower than that on the north side, but is also negligible in area by comparison, and does not produce the base level effect to any extent.

### Summary

During the summers of 1940 and 1941 about sixteen hundred collections of vascular plants, representing one hundred and twenty-four families, were made in the region between Cerro Tancitaro and the Río Tepalcatepec. These collections are fairly complete for the season in which they were taken and are representative of the general character of the vegetation. On the basis of these collections and the climatological data available for the region, as well as from observations made in the field, the region is divided up into vegetational zones and each zone is described in detail. An attempt is made to correlate these zones with similar zones described by other authors for other parts of Mexico.

### List of Genera and Species

#### LICHENES

##### CLADONIACEAE

*Cladonia coccifera* (L.) No. 1, pedregal near Tancitaro, 6,000 feet.

##### PARMELIACEAE

*Parmelia cirrhata* Fries. No. 2, pedregal near village of Tancitaro, 6,000 feet; Nos. 10, 12, 13; on branches of pine, open parkland, Cerro Tancitaro, 10,500 feet.

*Parmelia furfuracea* (L.) Ach. Nos. 4, 7, 14; on pine, open parkland above 10,000 feet, Cerro Tancítaro.

*Parmelia praesignis* Nyl. Nos. 6, 17; on pine and alder, open forest and parkland above 9,500 feet, Cerro Tancítaro.

#### USNEACEAE

*Alectoria ochroleuca* (Hoffm.) Mass. No. 9, on pine, open parkland above 10,000 feet, Cerro Tancítaro.

*Usnea longissima* Ach. Nos. 3, 8, 11, 16; on pine, open parkland, Cerro Tancítaro, above 10,000 feet.

*Usnea mexicana* Wainio. No. 5, on pine, open parkland above 10,000 feet, Cerro Tancítaro.

*Usnea occidentalis* Mot. No. 15, on pine, open parkland above 10,000 feet, Cerro Tancítaro.

#### MUSCI

##### ANDREAEEACEAE

*Andreaea turgescens* Schp. No. 27, cloud forest, south slope of Cerro Tancítaro in deep canyon, 9,000 feet.

##### FISSIDENTACEAE

*Fissidens asplenoides* Hedw. Nos. 4, 28, 33, 34, 49; all growing on the steep, vertical or nearly vertical sides of deep, narrow, moist, shady barrancas near the village of Tancítaro, 6,000 to 7,000 feet.

##### DICRANACEAE

*Campylopus Chrismari* (C. M.) Mitt. No. 9, moist soil in cloud forest, Cerro Tancítaro, 9,300 feet.

*Symblepharis helicophylla* Mont. Nos. 27, 42; on rocks and logs, cloud forest, Cerro Tancítaro, 9,000 feet.

##### POTTIACEAE

*Anoectangium euchloron* (Schwaegr.) Mitt. Nos. 4, 8; barranca near the village of Tancítaro, 7,000 feet.

*Leptodontium excelsum* (Sull.) E. G. Britton; growing on soil, rocks, and tree trunks, cloud forest, Cerro Tancítaro, 9,000 to 9,500 feet.

*Leptodontium sulfureum* (C. M.) Mitt. No. 45, cloud forest on south side of Cerro Tancítaro, 9,000 feet.

##### GRIMMIACEAE

*Grimmia trichophylla* Grev. No. 27, cloud forest, Cerro Tancítaro, 9,000 feet.

*Rhacomitrium crispipilum* (Tayl.) Jaeg. Nos. 1, 6; on moist rocks, cloud forest, Cerro Tancítaro, 9,300 feet.

##### BRYACEAE

*Bryum* sp. No. 48, barranca along road to Los Reyes, near Tancítaro, 6,000 feet.

*Rhodobryum Beyrichianum* (Hornschr.) Par. No. 22, on rich soil with much organic material, dense forest along stream, Cerro Tancítaro, 8,000 feet.

##### BARTRAMIACEAE

*Breutelia tomentosa* (Sw.) Schp. Nos. 5, 15; growing in mats on rocks in cloud forest and above, 8,000 to 10,000 feet, Cerro Tancítaro.

##### ORTHOTRICHACEAE

*Macromitrium lamprocarpum* C. M. Nos. 16, 31; growing on trunks of *Quercus* *decipiens* north of the village of Tancítaro, 7,000 feet.

## RHACOPILACEAE

*Rhacopilum tomentosum* (Hedw.) Brid. No. 3, cloud forest on Cerro Tancitaro, 8,500 feet; Nos. 33, 49; moist sides of barrancas near Tancitaro Village, 6,000 to 7,000 feet.

## HEDWIGIACEAE

*Hedwigidium imberbe* (Sm.) B.S.G. No. 30, tree trunks and branches in cloud forest, Cerro Tancitaro, 8,000 feet.

## CRYPHAEACEAE

*Cryphaea patens* Hornsch. Nos. 3, 40, 44; on tree trunks in cloud forest, from 8,000 to 9,500 feet, Cerro Tancitaro.

## METEORIACEAE

*Meteoriom illecebrense* (C. M.) Mitt. No. 17, growing on trunk of oak north of Tancitaro Village, 7,000 feet; Nos. 39, 40; growing on trunks of fir and other trees in cloud forest, from 7,500 to 9,500 feet.

## NECKERACEAE

*Neckera chlorocaulis* C.M. Nos. 3, 26, 29, 39; cloud forest, mostly on fir, 8,000 to 9,500 feet, Cerro Tancitaro.

**Porotrichum Leavenworthii** E. B. Bartram, sp. nov.

Dioicum ut videtur. Gracile, sat dense caespitosum. Caules secundarii at 4 cm. alti, stipitati, superne irregulariter ramosi, stipe ad 1.5 cm. longo, foliis minutis, plerumque destructis, late triangularibus, breviter acuminatis instructo; ramis erecto-patentibus, sub-pinnato-ramosis, complanatis, obtusis. Folia late patentia, oblongo-ovata, concava abrupte et breviter acuta, circa 1.6 mm. longa, 0.9 mm. lata; marginibus erectis, superne denticulatis; costa crassa, longe infra apicem folii evanida; cellulae superiores hexagonae, c. 10  $\mu$  latae, 15  $\mu$  longae, laevissimae, inferiores sensim longiores, infimae linearis, ad 50  $\mu$  longae. Seta 9 mm. longa, superne humiliiter pustulosa; theca suberecta, ovalis, 2 mm. longa, collo breviusculo; peristomium magnum, pallidum; operculum oblique conico-rostratum, 1.5 mm. longum.

Probably dioicous, no male flowers seen. Slender, pale green plants without lustre, rather densely tufted. Secondary stems stipitate, to 4 cm. high, irregularly branched above; stipe about 1.5 mm. long, remotely and minutely foliate, stipe leaves generally worn and eroded, broadly triangular, short-acuminate; branches erect-spreading, sub-pinnately rebranched, obtuse, complanate, 2.5-3 mm. wide with leaves. Leaves widely spreading, oblong-ovate, concave, abruptly short-acute, about 1.6 mm. long and 0.9 mm. wide; margin erect, sharply denticulate above; costa strong, ending some distance below the leaf apex; upper cells hexagonal, about 10  $\mu$  wide and 15  $\mu$  long, nearly isodiametrical, smooth, gradually more elongate below, the basal cells linear, to 50  $\mu$  long. Seta slender, 9 mm. long, slightly pustulose near the apex; capsule suberect, ovoid, 2 mm. long, short-necked; peristome large, pale; operculum conic-rostrate, 1.5 mm. long, slightly oblique.

MEXICO: on tree trunks in moist shady places of cloud forest, Cerro Tancitaro, State of Michoacán, alt. 9,000 ft., July 25, 1940, William Leavenworth, no. 18 type. On trees in dense shade and wet place in cloud forest, Cerro Tancitaro, State of Michoacán, alt. 9,000 ft., July 25, 1940, William Leavenworth, no. 32.

Distinct from any of the Mexican or Central American species of the genus with which I am familiar in the slender habit, the short, broad, abruptly pointed leaves of the ultimate branches, the short slender setae, and especially the short, nearly isodiametrical upper leaf cells.

## HOOKERIACEAE

*Cyclodictyon albicans* (Hedw.) Broth. No. 46, in moist barranca near the village of Tancitaro, along the road to Los Reyes, 6,000 feet.

## THUIDIACEAE

*Thuidium delicatulum* (Hedw.) Mitt. No. 14, on marshy ground of meadow near summit of Cerro Tancítaro, growing in a solid mat, like *Sphagnum*, nearly 12,000 feet; No. 35, growing on moist soil under pine on mesa north of Tancítaro Village, 7,000 feet; No. 49, barranca one mile from Tancítaro along trail to Los Reyes, 6,000 feet.

## AMBLYSTEGIACEAE

*Campylium hispidulum* (Brid.) Mitt. var. *Sommerfeltii* (Myr.) Lindb. Nos. 4, 49; barrancas near the village of Tancítaro, 6,000 feet.

## BRACHYTHECIACEAE

*Brachythecium hastifolium* Card. No. 47, dense forest near stream, on the ground, cloud forest, Cerro Tancítaro, 8,000 feet.

*Euryhynchium praelongum* (Hedw.) Hook. No. 47, on the ground in cloud forest, Cerro Tancítaro, 8,000 feet.

## ENTODONTACEAE

*Entodon abbreviatus* (Bryol. eur.) Jaeg. No. 37, cloud forest, 8,000 feet, Cerro Tancítaro.

## HYPNACEAE

*Hypnum amabile* (Mitt.) Broth. Nos. 23, 25, 27; growing on logs and sheathing tree trunks, cloud forest, Cerro Tancítaro, 8,000 feet.

## HYLOCOMIACEAE

*Leptothymenium Ehrenbergianum* (C.M.) Fleisch. No. 27, cloud forest, Cerro Tancítaro, 8,000 feet.

## POLYTRICHACEAE

*Polytrichum alpiniforme* Card. No. 13, growing in niches in rocky ledges, Cerro Tancítaro, 10,000 feet; No. 24, on rich, moist earth in cloud forest, Cerro Tancítaro, 8,000 feet.

## FILICALES

## OPHIOGLOSSACEAE

*Ophioglossum vulgatum* L. No. 1658, open, grassy ridge in open pine forest above Acahuato, 3,200 feet.

## SCHIZAEACEAE

*Anemia hirsuta* (L.) Sw. No. 1574, dry, rocky soil on rocky ledges in canyon below Acahuato, 2,500 feet; No. 1784, common on rocks near stream, open pine woods above Acahuato, 3,500 feet.

## SALVINIACEAE

*Azolla caroliniana* Willd. No. 1476a, open swamp near Hacienda California, 1,200 feet.

## POLYPODIACEAE

*Acrostichum daneaeifolium* Langsd. & Fisch. No. 1323, plant up to twelve feet tall, growing in water one to two feet deep in pond at La Majada, 1,200 feet; common in streams and swamps of mesic deciduous forest.

*Adiantum convolutum* Fourn. No. 1263, common in shaded, moist situations seven miles southwest of Uruapan, 6,000 feet.

*Adiantum patens* Willd. No. 638, common in brownish-red soil of open pine woods, along trail from Apatzingan to Tancítaro, 5,000 feet; No. 1286, rocky pasture two miles west of Uruapan, 6,000 feet.

*Adiantum Shepherdii* Hook. No. 1621, open pine forest above Acahuato; common in rich soil on open, rocky slopes, 3,200 feet.

*Asplenium castaneum* C. & S. No. 1148, rocky ledges, open pine forest, Cerro

Tancítaro, 10,000 feet. No. 1188, Cerro Tancítaro, 10,500 feet; common on rocky ledges above 9,500 feet.

*Asplenium concinnum* H. & B. No. 1276, rocky pasture two miles west of Uruapan, along trail to Tancítaro, 6,000 feet; very common.

*Asplenium cristatum* Lam. No. 1087, shaded situation, near bottom of barranca, Cerro San Miguel, 6,700 feet.

*Asplenium fragrans* Sw. No. 332, epiphyte, growing in moss on tree trunks in dense shade; common in cloud forest, 7,500 feet.

*Asplenium monanthes* L. Nos. 327, 344, 345; the Pedregal, 6,000 feet and damp canyon on Cerro Tancítaro, 8,000 feet; common on or among rocks in shaded situations from 5,000 to 8,000 feet.

*Asplenium praemorsum* Sw. Nos. 320, 328; damp rocks in shade, the Pedregal, 6,000 feet. No. 1096, epiphytic on oak, Cerro San Miguel, 6,700 feet.

*Bommeria pedata* (Sw.) Fourn. No. 1235, *malpais* south of Uruapan, among rocks, common, 5,600 feet.

*Cheilanthes angustifolia* HBK. No. 653, open pine woods between Tancítaro and Apatzingan, 5,000 feet.

*Cheilanthes farinosa* Kaulf. Nos. 324, 559; the Pedregal, 6,000 feet; common on rocks in open or in partial shade.

*Cheilanthes intramarginalis* (Kaulf.) Hook. No. 715, the Pedregal, 6,000 feet, among rocks.

*Cheilanthes lendigera* (Cav.) Sw. No. 1029, the Pedregal, among rocks, 6,000 feet.

*Cheilanthes myriophylla* Desv. No. 1236, rocky land similar to the Pedregal, *malpais*, two miles south of Uruapan, 5,600 feet.

*Cheilanthes Kaulfussii* Kuntze. No. 1285, rocky pasture two miles west of Uruapan, along trail to Tancítaro, 6,000 feet. No. 1790, rocky cliffs at Las Barranquillas, 4,000 feet.

*Cystopteris fragilis* (L.) Bernh. No. 347, damp soil among rocks, dense forest at 8,000 feet; common.

*Doryopteris Skinneri* (Hook.) C. Chr. No. 1492, growing in partial shade on or under dry rock ledges, arid lower slopes of Cerro Apatzingan, 2,000 feet. No. 1676, shady bank of barranca, 3,000 feet; one of the few ferns commonly found on the arid slopes below 3,000 feet.

*Dryopteris Karwinskyana* (Mett.) Ktze. No. 739, open pine forest between Tancítaro and Apatzingan, 5,000 feet.

*Dryopteris patens* (Sw.) Ktze. No. 654, along stream, trail from Tancítaro to Apatzingan, 5,000 feet. No. 656, barranca, along trail from Tancítaro to Apatzingan, 5,000 feet; large fern, about four feet high, fairly common in moist, shady localities throughout plateau.

*Dryopteris patula* (Sw.) Underw. No. 321, among rocks, the Pedregal, 6,000 feet; very common in open parts of the Pedregal.

*Elaphoglossum araneosum* (Eat.) C. Chr. No. 329, among rocks in the Pedregal, partial shade, 6,000 feet.

*Elaphoglossum elongatum* (Kuntze) Moore. Nos. 567, 717, 1038; among rocks in the Pedregal, 6,000 feet; very common in the Pedregal and other rocky places in protected, shady situations.

*Elaphoglossum* sp. No. 1190, moist, black soil beside waterfall, Cerro Tancítaro, 10,500 feet; rare.

*Notholaena aurea* (Poir.) Desv. No. 1233, *malpais* south of Uruapan, 5,600 feet.

*Notholaena candida* Hook. No. 1028, the Pedregal, 6,000 feet. No. 1713, rocky ledges, arid slopes of canyon, 2,000 feet on Cerro Apatzingan; common in both situations.

*Notholaena dealbata* Kunze. No. 1271, common in shaded parts of stone walls, west of Uruapan, 6,000 feet.

*Notholaena nivea* (Poir.) Desv. No. 337, moist rocks beside stream, dense forest, Cerro Tancítaro, 7,500 feet.

*Pellaea cordata* (Cav.) J. Sm. No. 1234, *malpais* two miles south of Uruapan, 5,600 feet. No. 1275, rocky pasture west of Uruapan, along trail to Tancítaro, 6,000 feet.

*Pellaea intramarginalis* (Kaulf.) J. Sm. Nos. 1037, 1022; among rocks in the Pedregal, 6,000 feet; common.

*Pellaea ovata* (Desv.) Weatherby. No. 1003, common on stone walls along trail, near Rancho Santa Catarina, 6,000 feet.

*Pellaea sagittata* (Cav.) Link. No. 1493, very dry rock ledges, lower slopes of Cerro Apatzingan, 2,000 feet; fairly common.

*Pellaea ternifolia* (Cav.) Link. No. 309, among rocks in the Pedregal, 6,000 feet.

*Plecosorus speciosissimus* (A. Br.) Moore. No. 1146, gravelly bank near stream, Cerro Tancitaro, 10,500 feet; common but not abundant in open pine forest above 9,500 feet.

*Polypodium angustifolium* Sw. No. 1095, epiphytic on oak, Cerro San Miguel, 6,700 feet; rare.

*Polypodium angustum* (HBK) Liebm. No. 1094, epiphytic on oak, 6,700 feet; rare.

*Polypodium aureum* L. No. 1040, very common, growing on rocks in the Pedregal, 6,000 feet. No. 1239, rocky land, *malpais*, two miles south of Uruapan, 6,000 feet.

*Polypodium furfuraceum* S. & C. No. 326, ridge tops, the Pedregal, 6,400 feet. No. 517, epiphytic on oak, two miles north of village, Tancitaro, 6,500 feet. No. 736, epiphytic on oak, Rancho Santa Catarina, 6,000 feet. No. 1237, rocky land west of Uruapan, along trail to Tancitaro, 6,000 feet.

*Polypodium heteromorphum* Hook. & Grev. No. 1187, moist soil beside waterfall, open pine forest, Cerro Tancitaro, 10,500 feet; not common.

*Polypodium lanceolatum* L. No. 558, epiphytic on oak, the Pedregal, 6,000 feet.

*Polypodium pectinatum* L. No. 336, underside of overhanging rock, dense shade, cloud forest, Cerro Tancitaro, 8,000 feet. No. 516a, epiphytic on oak, open fields two miles north of village, Tancitaro, 6,500 feet.

*Polypodium plebeium* Schlecht. No. 264, epiphytic on oak, open forest north of village, Tancitaro, 6,500 feet. No. 331, the Pedregal, 6,000 feet, not common here. No. 346, on damp soil on rocks, cloud forest, Cerro Tancitaro, 8,000 feet. No. 516, epiphytic on oak, two miles north of village, Tancitaro, 6,500 feet. No. 4041, epiphytic on alder at height of 30 feet, cloud forest, Cerro Tancitaro, 7,800 feet.

*Polypodium plesiosorum* Kuntze. No. 1791, rocky cliff near Las Barranquillas, 4,500 feet.

*Polypodium plumula* H. & B. No. 1097, epiphytic on oak, open slope of Cerro San Miguel, 6,700 feet.

*Polypodium polylepis* Roem. Nos. 1215, 709, epiphytic on alder, 10,000 feet, Cerro Tancitaro; common on *Alnus arguta* between 9,500 and 10,000 feet.

*Polypodium subpetiolatum* Hook. No. 514, epiphytic on oak, two miles north of village, Tancitaro, 6,500 feet.

*Polypodium Rosei* Maxon. No. 1240, rocky *malpais* south of Uruapan, 5,600 feet.

*Pteridium aquilinum* (L.) Kuhn. No. 1106, open pine forest, Cerro San Miguel, 6,700 feet; very common throughout open pine forests from about 3,500 to 7,200 feet.

*Pteris cretica* L. No. 1069, damp, shady side of barranca, 6,700 feet.

*Tectaria trifoliata* (L.) Cav. No. 1248, wet soil, dense undergrowth, steep cliffs beside falls, La Tzararacua, seven miles southwest of Uruapan, 6,000 feet.

*Vittaria filifolia* Fée. No. 1021, growing in caverns formed by rocks, extreme shade, the Pedregal, 6,000 feet; not common.

*Woodisia mollis* J. Sm. No. 322, on rocks, the Pedregal, 6,000 feet; common. No. 363, stone wall, four miles north of village, Tancitaro, 7,000 feet. No. 714, the Pedregal, 6,000 feet; common in rocky situations and especially on stone walls, 5,000 to 7,200 feet.

*Woodwardia radicans* Smith. No. 657, barranca, trail from Tancitaro to Apatzingan, 5,000 feet; common fern in moist shady ravines and barrancas up to 6,500 feet.

#### LYCOPODIALES

##### SELAGINELLACEAE

*Selaginella cuspidata* Link. No. 325, on rocks in the Pedregal, 6,000 feet. No. 1238, *malpais* near Uruapan, 5,600 feet. No. 1568, niches in rock beside stream, Acahuato,

2,500 feet. No. 1719, dry rock ledges, Cerro Apatzingan, 2,000 feet. No. 1815, moist soil in rocky canyon above Acahuato, 3,800 feet. Nearly ubiquitous on or among rocks from 2,000 feet or lower to 7,000 feet or higher, very abundant in the Pedregal, where it lines the crevices between rocks.

#### CONIFERAE

##### PINACEAE

*Abies religiosa* (HBK.) S. & C. No. 674, tree 40 feet high, Cerro Tancítaro, 8,400 feet. No. 675, Cerro Tancítaro, 10,000 feet.

*Pinus Ayacahuite* Ehrenb. *Pino chino*. No. 272, tree 40 feet high, hill north of village, Tancítaro, 6,500 feet. No. 601, open pasture near the Pedregal, 6,000 feet. No. 1168, tree 25 feet high, Cerro Tancítaro, 10,500 feet.

*Pinus Montezumae* Lam. *Pino real*. No. 600, tree 60 feet high, cones nearly one foot in length, pasture near the Pedregal, 6,000 feet.

*Pinus Montezumae* Lam. var. *rudis* Shaw. No. 706, tree about 20 feet high, 10,000 feet; common on exposed ridges above 9,500 feet, Cerro Tancítaro.

*Pinus pseudostrobus* Lindl. No. 544, tree 50 feet high, pasture near the Pedregal, 6,000 feet; commonest tree from 3,000 feet to about 5,000 feet.

#### CUPRESSACEAE

*Cupressus lusitanica* Mill. No. 1223, edge of *malpais* south of Uruapan, 5,600 feet, possibly planted, tree 60 feet high.

*Juniperus tetragona* Schlecht. No. 672, shrubby tree about 10 feet high, cliff on Cerro Tancítaro, 10,000 feet. No. 1163a, small tree, Cerro Tancítaro, exposed rocky ledge at 10,500 feet.

#### ANGIOSPERMÆ

##### GRAMINEAE

*Aegopogon cenchroides* Humb. & Bonpl. Nos. 637, 992; common grass hanging down moist dirt banks beside trails, and in moist soil in woods, collected between 5,000 and 6,000 feet.

*Agrostis tacubayensis* Fourn. No. 1153, on moist slopes on the north side of Cerro Tancítaro, 11,000 feet; fairly common.

*Agrostis tolucensis* HBK. Nos. 1112, 1132; common grass in the open pine parkland above 10,000 feet.

*Agrostis verticillata* Vill. No. 4028, growing in a yard, Tancítaro, 6,000 feet.

*Andropogon furcatus* Muhl. Nos. 991, 986, 1047; collected along the trail east of Tancítaro, where it is common in partial shade in open pine forest, 6,000 feet.

*Andropogon saccharoides* Sw. Nos. 1580, 1587; sandbars beside stream in canyon below Acahuato, 2,000 feet; No. 1795, moist soil beside stream, Las Barranquillas, 4,000 feet.

*Aristida ternipes* Cav. Nos. 619, 1582; common in open pine woods, collected at 5,000 and 6,000 feet.

*Arundinella Berteroiana* (Schult.) Hitchc. & Chase. No. 1565, in thick mats in shade beside stream, canyon below Acahuato, 2,000 feet.

*Bouteloua filiformis* (Fourn.) Griff. No. 1607, arid slope near rim of canyon, 2,500 feet; No. 1806, open, rocky soil near stream, Las Barranquillas, 4,000 feet; very common in open pine forest from 3,000 to 4,000 feet.

*Bromus lacinatus* Beal. Nos. 627, 1078; pine forest, 6,000 to 7,000 feet, not common.

*Calamagrostis orizabae* Steud. No. 285, open pine parkland at about 11,000 feet; fairly common above 9,500 feet on Cerro Tancítaro.

*Cathartesecum erectum* Vasey & Hack. Nos. 1482, 1582a, 1610; abundant throughout the arid slopes from 1,200 to 3,000 feet.

*Cenchrus echinatus* L. Nos. 1642, 1767; cultivated fields and sandbars of streams, 3,000 feet.

*Chloris virgata* Sw. No. 1768, beside trail in open part of pine woods, 3,400 feet.

- Cynodon Dactylon* (L.) Pers. Nos. 413, 1354; common in moist soil throughout the valley, 1,000 to 1,200 feet.
- Dactyloctenium aegyptium* (L.) Richt. No. 1328, open situation beside stream, La Majada, west of Apatzingan, 1,200 feet.
- Deschampsia Liebmanniana* (Fourn.) Hitchc. No. 1175, marshy meadow on north slope of Cerro Tancitaro, 10,500 feet.
- Digitaria sanguinalis* (L.) Scop. Nos. 1520, 1586a, 1571; arid slopes and waste fields or along streams throughout the *tierra caliente*.
- Digitaria velutina* (DC.) Hitchc. No. 1794, moist soil beside stream, Las Barranquillas, 4,000 feet.
- Echinochloa colonum* (L.) Link. Nos. 483, 1458; waste fields of the *tierra caliente*, 1,200 feet.
- Eleusine indica* (L.) Gaertn. Nos. 456, 563; moist soil beside streams, from 1,000 to 6,000 feet.
- Epipactes Emersleyi* (Vasey) Hitchc. No. 1289, rocky pasture west of Uruapan, 6,000 feet, common locally.
- Eragrostis ciliaris* (All.) Link. No. 1659, arid slopes, 2,900 feet.
- Eragrostis diffusa* Buckl. No. 1569, gravel bars along stream, canyon below Acahuato, 2,000 feet; common.
- Eragrostis Elliottii* S. Wats. No. 1256, moist, shady cliff near La Cascada de Tzazaracua, southwest of Uruapan, 5,000 feet.
- Eragrostis intermedia* Hitchc. Nos. 990, 1006, 1076; fairly common in open pine woods and pastures from 6,000 to 7,000 feet.
- Eragrostis lugens* Nees. No. 4027, yard in Tancitaro, 6,000 feet.
- Festuca amplissima* Rupr. Nos. 704, 1213; common on ridges above 9,500 feet, Cerro Tancitaro, plant about four feet tall.
- Festuca Rosei* Piper. No. 1127, open pine parkland above 9,500 feet, Cerro Tancitaro.
- Festuca tolucensis* HBK. No. 1218, rocky ledges on Cerro Tancitaro, 10,000 to 11,000 feet.
- Heteropogon contortus* (L.) Beauv. No. 1611, common locally on arid slopes at 2,500 feet and also on gravel bars by stream at 2,000 feet.
- Heteropogon melanocarpus* (Ell.) Benth. No. 1807, in moist soil on side of barranca at Las Barranquillas, 4,000 feet.
- Hilaria cenchroides* HBK. Nos. 1483, 1500, 1521, 1581; common throughout arid slopes from 1,200 to 3,000 feet and found in open meadows up to 4,000 feet or higher.
- Hyparrhenia dissoluta* (Nees) Anders. No. 1614, in dense stands on gravel bar near stream, canyon below Acahuato, 2,000 feet, plants four feet high or more.
- Ixophorus unisetus* (Presl) Schlecht. Nos. 414, 415, 480, 1721; common in fields beside irrigation ditches and in moist soil generally, throughout the river valley and probably up to 3,000 feet.
- Lasiacis procerrima* (Hack.) Hitchc. No. 1255, common on moist shady cliffs near Cascada de Tzazaracua southwest of Uruapan, 5,000 feet.
- Lasiacis* sp. No. 1272, common in partial shade on stone walls west of Uruapan, 6,000 feet.
- Lasiacis* sp. Nos. 1674, 1675; common grasses, one about four feet and the other eight to ten feet long, trailing over the edge of a shady barranca, Acahuato, 3,100 feet.
- Leptochloa filiformis* (Lam.) Beauv. Nos. 500, 1331, 1374; common throughout the river valley in the arid scrub forest and in waste or cultivated fields.
- Leptochloa scabra* Nees. No. 1330, in water in pool, La Majada, west of Apatzingan, 1,200 feet.
- Microchloa Kunthii* Desv. No. 1303, common in open pasture west of Uruapan, along trail to Tancitaro, 6,000 feet.
- Muhlenbergia brevistyla* Fourn. No. 987, common locally in well-drained situations along trail between Uruapan and Tancitaro, 6,000 feet.
- Muhlenbergia dumosa* Scribn. Nos. 985, 1267; abundant locally on the sides of deep, moist barrancas and canyons, along the trail east of Tancitaro, 6,000 feet.
- Muhlenbergia Emersleyi* Vasey. No. 718, among rocks in the Pedregal, 6,000 feet.

- Muhlenbergia virescens* (HBK.) Kunth. Nos. 1110, 1217; common on Cerro Tancitaro above 10,000 feet, especially on rocky ridges.
- Opizia stolonifera* Presl. No. 1748, along trail from Apatzingan to El Capiri on the Río Tepalcatepec, forms a solid ground cover in places where there is a fairly good soil and some moisture.
- Oplismenus hirtellus* (L.) Beauv. No. 636, in rich, black mud in swamp, 5,000 feet.
- Panicum albomaculatum* Scribn. Nos. 256, 621, 622, 623, 644; common throughout the pine forest from 5,000 to 6,000 feet.
- Panicum fasciculatum* Sw. Nos. 443, 1334, 1369, 481; common throughout the river valley, usually in partial shade, 1,000 to 1,200 feet.
- Panicum hirtaule* Presl. Nos. 1335, 1371, 1453, 1484, 1584a; common throughout the arid parts of the *tierra caliente*.
- Panicum parcum* Hitchc. & Chase. No. 1484a, arid slope below Acahuato, 2,500 feet.
- Panicum purpurascens* Raddi. No. 1355, forming a solid stand in a damp field where the forest had been cleared away, La Majada, 1,200 feet.
- Panicum reptans* L. No. 482, beside irrigation ditch in open field south of Apatzingan, 1,200 feet.
- Panicum stramineum* Hitchc. & Chase. No. 442a, transition between arid and mesic forest near El Capiri on the Río Tepalcatepec, 1,000 feet.
- Paspalum conjugatum* Berg. No. 455, near water's edge along the Río Apatzingan south of Apatzingan, 1,200 feet.
- Paspalum convexum* Flügge. No. 582, fallow field near the Pedregal, 6,000 feet. No. 1585, moist soil near stream, arid canyon below Acahuato, 2,000 feet; common.
- Paspalum Humboldtianum* Flügge. No. 997, on banks along the trail west of Uruapan, 6,000 feet. No. 1649, common in moist parts of irrigated field above Acahuato, 3,200 feet.
- Paspalum Langei* (Fourn.) Nash. No. 1336, common along the edge of mesic woods, La Majada, 1,200 feet.
- Paspalum paniculatum* L. Nos. 442, 1586, 1603; moist soil near streams throughout the tropical region, up to 3,000 feet or higher.
- Paspalum plicatulum* Michx. No. 1570, beside stream in arid canyon below Acahuato, 2,000 feet; common.
- Paspalum squamulatum* Fourn. Nos. 382, 620, 647; throughout fields and open forests on the upper part of the plateau, collected at 5,000 and 6,000 feet.
- Setaria geniculata* (Lam.) Beauv. Nos. 560, 583, 584, 631, 1417, 1584, 1808; common throughout the open pine forest and in fields from 3,000 to 7,000 feet, also found along streams down to the valley.
- Setaria Liebmanni* Fourn. No. 454, common in moist soil throughout the river valley, often collected by the natives as forage for stock.
- Sporobolus Poiretii* (R. & S.) Hitchc. No. 562, in rich soil along streams near the Pedregal, 6,000 feet.
- Stipa vriescens* HBK. No. 1077, on moist banks along trail from Uruapan to Tancitaro, pine forest; fairly common.
- Trachypogon Montufari* (HBK.) Nees. No. 1284, rocky pasture west of Uruapan, 6,000 feet, not common. No. 1650, in moist parts of irrigated fields above Acahuato, 3,200 feet.
- Trisetum deyeuxioides* (HBK.) Kunth. Nos. 561, 626, 1141; found on the plateau at 6,000 feet in open pine forest where it is uncommon; on Cerro Tancitaro above 9,500 feet it becomes one of the principal grasses.
- Trisetum spicatum* (L.) Richt. No. 1159, common on Cerro Tancitaro above 10,500 feet, more abundant on north exposure.
- Trisetum Virletii* Fourn. No. 994, along trail about three miles west of Uruapan, 6,000 feet. No. 1122, six feet or more in height, Cerro Tancitaro, fir forest, 9,400 feet.
- Tripsacum lanceolatum* Rupr. Nos. 1638, 1643, 1311; well-drained ridges and rocky slopes from 3,000 to 4,000 feet; fairly common in open pine forest above Acahuato.

*Zeugites Pringlei* Scribn. Nos. 988, 1060; barranca four miles east of Tancítaro, very shady, moist location; No. 1086, barranca and adjacent pine forest on Cerro San Miguel, 6,700 feet, a very localized species but extremely abundant where found.

#### CYPERACEAE

*Bulbostylis junciformis* (HBK.) Clarke. No. 1039, among rocks, the Pedregal, 6,000 feet.

*Carex festivella* Mackenzie. No. 1171, common in moist meadow, north slope of Cerro Tancítaro, 10,500 feet.

*Carex psilocarpa* Steud. No. 1170, moist meadow, north slope of Cerro Tancítaro, 10,500 feet.

*Cyperus caracasanus* Kunth. No. 591, moist soil in open meadow near the Pedregal, 6,000 feet.

*Cyperus cyperoides* (L.) Britton. No. 1062, along trail east of Tancítaro, grassy pasture, 6,000 feet.

*Cyperus divergens* HBK. No. 298, waste field west of Tancítaro, 6,000 feet.

*Cyperus ferox* L. Rich. No. 1066, back yard in Tancítaro, moist soil, 6,000 feet.

*Cyperus flavus* (Vahl) Nees. No. 1061, grassy field along trail east of Tancítaro, 6,000 feet.

*Cyperus incompletus* (Jacq.) Link. No. 716, among rocks, the Pedregal, 6,000 feet.

*Cyperus ochraceus* Vahl. No. 1357, grassy field, moist soil, La Majada, 1,200 feet.

*Cyperus seslerioides* HBK. No. 1671, among rocks, open pine forest, 3,200 feet.

*Eleocharis acicularis* (L.) R. & S. No. 1221, submerged in water 4-6 inches deep, pond in marshy meadow, north slope of Cerro Tancítaro, 10,500 feet.

*Fimbristylis complanata* (Retz.) Link. No. 1326, in water, marshy meadow, north slope of Ceiro Tancítaro, 10,500 feet.

*Kyllinga brevifolia* Rottb. No. 376, waste field, one mile south of village, Tancítaro, 6,000 feet; No. 1812, along stream on rocky soil above Acahuato, 3,800 feet; common in open fields from 3,000 to 7,200 feet.

#### PALMACEAE

*Chamaedorea Pringlei* Wats. No. 1262, wet cliff near falls seven miles southwest of Uruapan, 6,000 feet.

#### ARACEAE

*Pistia Stratiotes* L. No. 1476, shallow, open swamp near Hacienda California, 1,200 feet.

#### LEMNACEAE

*Spirodela polyrhiza* (L.) Schleid. No. 1476b, open swamp near Hacienda California, with *Pistia*, *Azolla*, etc.

#### ERIOCAULACEAE

*Eriocaulon Benthami* Kunth. No. 659, shaded, swampy ground, open pine forest, trail from Tancítaro to Apatzingan, 5,000 feet.

#### COMMELINACEAE

*Commelina coelestis* Willd. No. 307, flowers blue, among rocks in the Pedregal, 6,000 feet.

*Commelina erecta* L. No. 1527, shaded places between rocks, canyon between Apatzingan and Acahuato, 2,000 feet, common; No. 1662, among rocks, open pine forest, 3,200 feet.

*Tinantia erecta* (Jacq.) Schlecht. No. 726, cloud forest, Cerro Tancítaro, 7,500 feet; rare.

*Tradescantia crassifolia* Cav. No. 1280, rocky meadow west of Uruapan, 6,000 feet.

*Tradescantia orchidophylloides* Bullock. No. 405, moist soil in dense shade, bank of Río Apatzingan, two miles south of town of Apatzingan; No. 1373, arid scrub forest

four miles west of Apatzingan, rich soil in shaded situations; abundant locally, 1,200 feet.

#### BROMELIACEAE

*Bromelia mucronata* Mez. No. 1451, plants four feet high, arid thorn forest near Hacienda California, 1,200 feet.

*Pitcairnia Schiedeana* Baker. No. 1027, growing among rocks, the Pedregal, not common, 6,000 feet.

*Tillandsia recurvata* L. No. 1231, epiphytic on small trees, *malpais* south of Uruapan, 5,600 feet.

*Tillandsia usneoides* L. No. 735, epiphytic on oak near Rancho Santa Catarina, 6,000 feet; abundant very locally about this altitude.

#### PONTEDERIACEAE

*Eichhornia azurea* (Sw.) Kunth. No. 411, irrigation ditch, pasture near Apatzingan, 1,200 feet. No. 1323a, shaded swamp, La Majada, 1,200 feet; common in ponds and streams throughout the river valley.

#### JUNCACEAE

*Luzula gigantea* Desv. Nos. 1130a, 1139, moist soil beside streams, open pine forest above 10,500 feet, Cerro Tancitaro.

*Luzula racemosa* Desv. Nos. 1158, 1174a; moist meadows, north slopes of Cerro Tancitaro, 10,500 feet to summit, common.

#### LILIACEAE

*Allium glandulosum* Link & Otto. No. 1302, flowers purple, pasture west of Uruapan, 6,000 feet.

*Bessera elegans* Schult. No. 501, lower slopes of Cerro Apatzingan, 2,000 feet; fairly common between 2,000 and 3,500 feet.

*Calochortus barbatus* (HBK.) Painter. No. 734, trail from Tancitaro to Uruapan, steep slope in pine-oak forest, 6,000 feet.

*Echeandia Pringlei* Greenm. No. 1508, flowers white, Cerro Apatzingan, arid slopes, 2,000 feet; common on arid slopes from 1,200 to 3,500 feet.

*Milla biflora* Cav. No. 1781, flowers white, open pine forest, 4,000 feet; very common in open pine forest between 3,500 and 4,500 feet.

*Nothoscordum fragrans* (Vent.) Kunth. No. 4002, moist soil, open, grassy hillside near the Pedregal, 6,000 feet.

*Stenanthium frigidum* (S. & C.) Kunth. No. 1135, steep slopes in open pine forest, Cerro Tancitaro, 10,500 feet; common above 10,000 feet, especially along ridges or on steep, rocky slopes on the north side of the mountain.

#### SMILACACEAE

*Smilax moranensis* M. & G. Nos. 1073, 1092, Cerro San Miguel, 6,700 feet, climbing over trees and shrubs in open forest and shady barranca; common.

#### DIOSCOREACEAE

*Dioscorea capillaris* Hemsl. No. 1685, vine twining on shrubs in open fields on edge of pine forest, 3,200 feet.

*Dioscorea lobata* Uline. No. 1469, vine climbing over shrubs in arid scrub forest west of La Majada, 1,200 feet; No. 1539, vine creeping over low vegetation, arid slope, side of canyon below Acahuato, 2,500 feet.

*Dioscorea militaris* Rob. No. 1732, vine, arid slopes of Cerro Apatzingan, 2,500 feet; not common.

*Dioscorea minima* Rob. & Seat. No. 1050, common in grazed, grassy pasture land, four miles east of Tancitaro, 6,000 feet.

*Dioscorea polygonoides* H. & B. No. 1715, vine twining over low shrubs, lower slopes of Cerro Apatzingan, 2,000 feet.

*Dioscorea* sp. No. 1020, vine, climbing over trees and shrubs, the Pedregal; common.

#### AMARYLLIDACEAE

*Agave brachystachys* Cav. No. 652, open pine woods, 5,000 feet; very uncommon in this area.

*Agave undulata* Klotsch. No. 1601, arid side of canyon below Acahuato, 2,500 feet. *Crinum erubescens* Soland. No. 1327, growing in water at edge of pool, La Majada, 1,200 feet.

*Hypoxis decumbens* L. No. 301, waste field west of village, Tancítaro, 6,000 feet; No. 537, two miles north of village, Tancítaro, 6,500 feet; No. 541, growing in open pasture, two miles north of Tancítaro; common in open pine woods and in pastures.

#### *Pancratium Leavenworthii* Standl. & Steyermark, sp. nov.

Bulbus ovoideus, ca. 4 cm. longus et 2.5 cm. latus, in collum brevem crassum contractus; folia longipetiolata, in sicco membranacea, petiolo gracillimo ca. 19 cm. longo, prope medium vix 2 mm. lato; lamina lanceolato-oblonga 15 cm. longa, 3 cm. lata, acuta vel acuminata, basi acuminata sed abrupte in petiolum contracta, subtus paullo pallidior; scapus ca. 30 cm. altus, prope medium vix 3 mm. crassus, biflorus, floribus sessilibus; valvae spatheae lanceolatae scariorae, 4 cm. longae, attenuatae, tenuiter nervosae; ovarium ca. 8 mm. longum; perianthium album, tubo gracillimo, 7 cm. longo, 1.3 mm. lato, sursum vix dilatato, segmentis linearibus tubum aequantibus, paullo ultra 1 mm. lati; filamenta gracillima, segmentis breviora; antherae apice appendiculatae, appendice excursu 3.5 mm. longo; cupula staminalis angusta, 15 mm. longa, apice 5 mm. lata.

MEXICO: Michoacán: Open grassy pastures or in part or deep shade, commonest on dirt banks among pines, common very locally, the flowers white, road from Tancítaro to Apatzingan, alt. 4,500 ft., August 17, 1940, William C. Leavenworth 651 (type in Herb. Chicago Nat. Hist. Mus.).

With the present unsettled status of most of the species of this genus, it is scarcely advisable to describe new species of *Pancratium*, but the present plant appears to be a distinct and somewhat unusual entity that we are unable to place among published species. It is noteworthy for the small leaves, the blade relatively broad and abruptly contracted into the very long petiole, and for the rather small flowers with an exceptionally small and narrow staminal cup.

*Pancratium litorale* Jacq. No. 1319, mud at edge of pool, mesic forest, La Majada, 1,200 feet. No. 1422, damp ravine in open pine forest, La Cañada, 4,000 feet.

#### IRIDACEAE

*Nemastylis brunnea* Wats. No. 680, rocky ridges, Cerro Tancítaro, 10,000 feet; very common locally.

*Nemastylis tenuis* (Baker) B. & H. No. 1265, flowers dark blue, near falls seven miles southwest of Uruapan, 6,000 feet; No. 1301, flowers purple, rocky pasture west of Uruapan, along road to Tancítaro, 6,000 feet.

*Nemastylis versicolor* Wats. No. 610, open pine forest, along trail from Tancítaro to Apatzingan, 5,000 feet; very common from 4,500 to 8,500 feet or higher.

*Sisyrinchium iridifolium* HBK. No. 305, flowers yellow, among rocks in rich loam, the Pedregal, 6,000 feet.

*Sisyrinchium tenuifolium* H. & B. Nos. 1181, 1182, open pine forest, 10,500 feet, Cerro Tancítaro. There seem to be two distinct size forms, both very common.

*Sisyrinchium Palmeri* Greenm. No. 681, flowers yellow, open pine forest, 10,000 feet.

#### ORCHIDACEAE

*Arethusa grandiflora* Wats. No. 570, flowers pink, among rocks in the Pedregal, 6,000 feet.

*Bletia campanulata* Llave & Lex. No. 390, open pine forest, 5,000 feet.

*Bletia purpurea* (Lam.) DC. No. 1799, flowers yellow to brown, rocky places near stream, Las Barranquillas, 4,000 feet.

*Bletia reflexa* Lindl. No. 299, waste field west of Tancítaro, 6,000 feet; No. 306, the Pedregal, soil among rocks, 6,000 feet; No. 732, near Santa Catarina, trail from Tancítaro to Uruapan, 6,000 feet; fairly common throughout open pine forest from 4,000 to 7,000 feet, but never abundant.

*Epidendrum chondylolobon* Rich. & Gal. No. 1017, epiphytic on oak, corolla white striped with purple, trail from Uruapan to Tancítaro, 6,000 feet; not common.

*Epidendrum venosum* Lindl. No. 1016, epiphytic on oak, flowers yellow and white, sweet-scented, trail from Uruapan to Tancítaro, 6,000 feet; localized but very abundant where found.

*Epidendrum* sp. No. 572, epiphytic on oak, the Pedregal, 6,000 feet.

*Govea superba* (Llave & Lex.) Lindl. No. 1058, among rocks, shady side of barranca, four miles east of Tancítaro, 6,000 feet.

*Habenaria clypeata* Lindl. No. 528, flowers white, open pasture above Tancítaro village, 6,500 feet; very common in woods and open fields over much of the plateau above 7,000 feet.

*Habenaria macroceratitis* Willd. No. 738, flowers green, abundant on red clay bank near Rancho Santa Catarina, 6,000 feet; very localized.

*Habenaria limosa* (Lindl.) Hemsl. No. 1142, flowers green, open pine forest, Cerro Tancítaro, 10,500 feet; very common in moist meadows and slopes above 10,000 feet.

*Malaxis carnosia* (HBK.) Schenck. No. 996, open pine forest west of Uruapan, about 6,000 feet; No. 1014, in moist soil in open situation, bank of deep barranca about two miles south of Tancítaro, 6,000 feet.

*Malaxis fastigiata* (Rchb.) Kuntze. No. 304, the Pedregal, rich soil in woods, 6,000 feet; Nos. 1,015, 4,000; pine forest near the Pedregal, rich soil, 6,000 feet; No. 1777, open pine forest above Acahuato, 4,000 feet; flowers green or pale yellow, fairly common in rich soil from 3,000 to 8,000 feet.

*Odontoglossum madrense* Rchb. f. No. 1004, epiphytic on oak near Santa Catarina, common locally, 6,000 feet.

*Pleurothallis longispicata* L. O. Williams. No. 1005, upon oak, near Rancho Santa Catarina, 6,000 feet.

#### PIPERACEAE

*Peperomia coalcomana* Trel. No. 4042, 30 feet above ground on alder, cloud forest, 7,800 feet, Cerro Tancítaro.

*Peperomia edulis* Miq. No. 557a, the Pedregal, in mats of moss on trees and rocks, common, 6,000 feet.

*Peperomia galoides* HBK. Nos. 557, 1036; the Pedregal, in mats of moss on trees and rocks, common, 6,000 feet.

*Peperomia umbilicata* R. & P. Nos. 4019, 1161, in moss on moist rocks, Cerro Tancítaro, 10,500 feet; common throughout the cloud forest and up to 11,000 feet.

*Piper acapulcense* Trel. No. 1828, shrub twelve feet high, beside stream, Acahuato, 3,000 feet.

*Piper Berlandieri* C. DC. No. 1056, shrub six feet high, deep barranca four miles east of Tancítaro, 6,000 feet.

#### SALICACEAE

*Salix Bonplandiana* HBK. No. 579, tree fifty feet high, flood plain of small stream near the Pedregal; rare.

*Salix Hartwegii* Benth. No. 1196, tree fifteen feet high, dense forest, Cerro Tancítaro, 9,000 feet; rare.

*Salix paradoxia* HBK. No. 1162, tree twenty-five feet high, open pine forest beside stream, 10,300 feet, Cerro Tancítaro; No. 1197, shrub seven feet high, dense forest, 9,000 feet; rare.

#### GARRYACEAE

*Garrya longifolia* Rose. No. 571, tree ten to twenty feet high, the Pedregal, 6,000 feet.

*Garrya laurifolia* Hartw. No. 1045, shrub six to seven feet high, quite common in the Pedregal.

## JULIANIACEAE

*Juliania adstringens* Schlecht. Nos. 1497a and b, tree ten to fifteen feet high, sometimes thirty feet, flowers dioecious, bark with milky latex; very abundant on lower slopes of Cerro Apatzingan from 1,200 to 1,400 feet, but no higher.

## FAGACEAE

*Quercus acapulcensis* Trel. No. 1104, tree 15 to 20 feet high, open pasture on lower slopes of Cerro San Miguel, 6,400 feet.

*Quercus Bourgaei* Oerst. No. 1074, tree 40 feet high, mixed forest along barranca, Cerro San Miguel, 6,700 feet; No. 1195, tree 15 feet high, dense fir forest at 9,000 feet, Cerro Tancitaro.

*Quercus calophylla* Cham. & Schlecht. Nos. 1098, 1102; trees 30 and 60 feet tall, edge of barranca, Cerro San Miguel, 6,700 feet.

*Quercus candicans* Née. No. 546, tree 70 feet high, 3 feet through (dbh), beside stream near the Pedregal, 6,000 feet.

*Quercus castanea* Née. No. 543, tree between 40 and 60 feet in height, beside stream near the Pedregal, 6,000 feet.

*Quercus crassifolia* Humb. & Bonpl. No. 4008, tree 20 to 30 feet high, in the Pedregal.

*Quercus decipiens* Mart. Nos. 261, 514a; tree up to 35 feet or more in height, common between 6,000 and 7,000 feet on the plateau, often along barrancas.

*Quercus laurina* Humb. & Bonpl. Nos. 342, 362, 701; tree 40 to 60 feet high, dense forest along streams, Cerro Tancitaro, from 7,500 to 9,000 feet.

*Quercus michoacana* Trel. No. 1099, tree 30 feet high, edge of barranca, Cerro San Miguel, 6,700 feet.

*Quercus macrophylla* Née. No. 1270, tree six feet high, usually somewhat taller, near Cascada de Tzazaracua, southwest of Uruapan, on open, well-drained slopes, common, 6,000 feet.

*Quercus* sp. No. 1044, tree ten feet high, spreading to cover an area 20 feet or more across, among rocks, Pedregal, 6,000 feet, common.

## BETULACEAE

*Alnus arguta* (Schlecht.) Spach. No. 699, tree thirty-five feet high, Cerro Tancitaro, 10,000 feet; No. 1191, beside stream, cloud forest, Cerro Tancitaro, 7,700 feet; this tree is common between 9,500 and 10,000 feet, where it forms extensive open stands on steep, wet slopes.

*Alnus glabrata* Fern. Nos. 339, 343; tree forty to fifty feet high, cloud forest beside stream, Cerro Tancitaro, 8,000 feet; common tree between 7,000 and 8,200 feet.

*Alnus jorullensis* HBK. No. 1206a; tree thirty feet high, mixed parkland, Cerro Tancitaro, 10,000 feet.

*Carpinus caroliniana* Walt. Nos. 1070, 1103; Cerro San Miguel, 6,700 feet; common in barrancas and on hillsides about this altitude, forms solid stands, reaches height of sixty feet or more.

## URTICACEAE

*Pouzolzia Palmeri* Wats. No. 1701, shrub four feet high, pine forest above Acahuato, 3,200 feet.

## ULMACEAE

*Celtis iguanaea* (Jacq.) Sarg. No. 1438, tree fifteen feet high; No. 1473, fifteen to twenty feet high, shrublike; arid thorn forest near Hacienda California, 1,200 feet, forms impenetrable thickets.

## MORACEAE

*Brosimum Alicastrum* Sw. No. 1472, tree eighty to ninety feet high, near stream but growing in arid soil, eight miles west of Apatzingan, 1,200 feet.

*Castilla elastica* Cerv. Ule. No. 1449, tree fifty feet high, mesic forest near Hacienda California, 1,200 feet.

*Dorstenia Drakena* L. No. 388, open pine woods, 4,500 feet; No. 1316, mesic forest on damp soil, La Majada, 1,200 feet; common in mesic woods from 1,000 to 4,500 feet.

*Ficus colinifolia* HBK. No. 1386, tree thirty feet high, arid scrub forest four miles west of Apatzingan, 1,200 feet.

*Ficus Goldmani* Standl. *Higuera negra*. No. 1348, tree ninety feet high, mesic forest near La Majada, 1,200 feet.

*Ficus lapathifolia* (Liebm.) Miq. Nos. 1010, 1011, tree twenty to thirty feet high, rocky pasture west of Uruapan, 6,000 feet.

*Ficus mexicana* Miq. *Higuera blanca*. No. 1338, tree seventy feet high, mesic forest, La Majada, 1,200 feet; No. 1430, tree one hundred feet or more, swampy area near Hacienda California, 1,200 feet; common tree in mesic forest.

*Ficus padifolia* HBK. *Camuchin*. No. 1343, tree seventy feet high, La Majada; No. 1439, tree eighty feet high, mesic forest near La Majada; No. 1559, tree forty feet high, growing around other trees, arid plains west of Apatzingan, 1,200 feet; commonest fig in the tropical deciduous forest.

*Ficus petiolaris* HBK. No. 1594, low, gnarled tree fifteen feet high, bark greenish-white, smooth, edge of canyon, arid slopes below Acahuato, 2,500 feet; characteristic tree of this area from 2,000 to 3,500 feet.

*Ficus Pringlei* Wats. Nos. 1511, 1626, 1682, 1691, 1830; tree ten to thirty-five feet high, common on arid slopes from 2,000 to 3,000 feet and very common in the open pine forest between 3,000 and 3,500 feet.

#### LORANTHACEAE

*Arceuthobium vaginatum* (HBK.) Eichl. Nos. 710, 1126, common on pine between 9,500 and 10,500 feet.

*Psittacanthus calyculatus* (DC.) Don. No. 255, parasitic on *Prunus Capuli*, near village, Tancitaro, 6,000 feet; common parasite on angiospermous trees, 5,000 to 7,000 feet.

*Psittacanthus Schiedeanus* (Cham. & Schlecht.) Blume. No. 1688, parasitic on *Pseudosmodingium*, arid slope below Acahuato, 3,000 feet; not common.

*Struthanthus densiflorus* (Benth.) Standl. No. 1043, parasitic on *Prunus Capuli*, near Tancitaro village, 6,000 feet.

*Struthanthus microphyllus* (HBK.) Don. No. 340, on *Alnus glabrata*, cloud forest, Cerro Tancitaro, 7,800 feet; No. 1410, on *Guettarda elliptica*, arid plains west of Apatzingan, 1,200 feet; No. 1513, growing on *Thevetia peruviana*, var. *pinifolia*, 1,300 feet.

*Struthanthus venetus* (HBK.) Blume. No. 1656, long, tangled vine, climbing on trees and shrubs, open pine forest above Acahuato, 3,200 feet.

#### ARISTOLOCHIACEAE

*Aristolochia variifolia* Duch. No. 449, vine growing in shady, mesic woods near stream one mile south of Apatzingan, 1,200 feet.

*Aristolochia Pringlei* Rose. No. 1009, climbing over low bushes west of Uruapan, along trail, open pine forest, 6,000 feet.

*Aristolochia foetida* HBK. No. 1317, mesic woods, La Majada; very common vine of mesic forest, 1,200 feet.

*Aristolochia pentandra* Jacq. No. 1496, vine, climbing over low shrubs or prostrate, flowers dark red and green, common.

#### POLYGONACEAE

*Rumex mexicanus* Meissn. No. 253, waste field, bank of barranca, near Tancitaro village, 6,000 feet.

*Polygonum punctatum* Ell. No. 368, common along edges of fields on bare soil, near Tancitaro, 6,000 feet; No. 1698, beside irrigation ditch above Acahuato, 3,200 feet.

*Podopterus mexicanus* Humb. & Bonpl. No. 1743, tree twenty feet high, along trail from Apatzingan to El Capiri, arid plain, 1,100 feet.

#### AMARANTHACEAE

*Amaranthus Berlandieri* (Moq.) Uline & Bray. No. 433, waste fields and dry, open plains around Apatzingan; very common.

*Comphrena decumbens* Jacq. No. 1297, flowers pink, pasture west of Uruapan, 6,000 feet.

*Comphrena dispersa* Standl. No. 1487, dry lower slopes of Cerro Apatzingan, 1,300 feet; common on arid slopes from 1,200 to 3,000 feet.

#### NYCTAGINACEAE

*Boerhaavia caribaea* Jacq. No. 1389, flowers magenta, sandy soil in dry arroyo, arid scrub forest west of Apatzingan, 1,200 feet.

*Boerhaavia erecta* L. No. 406, waste fields and dry, open slopes, flowers white or pinkish; very common herb throughout tropical zone.

*Mirabilis Pringlei* Weatherby. No. 1467, arid plains west of Apatzingan; not common except locally,

*Okenia hypogaea* Schlecht. & Cham. Nos. 428a, 438, 465, 1404, 1481, arid plains and waste fields around Apatzingan; one of the commonest herbs throughout the flat, arid parts of the *tierra caliente*.

#### PHYTOLACCACEAE

*Achatocarpus nigricans* Triana. Huasicuco. No. 430, tree fifteen to twenty feet high, arid plains near El Capiri, Río Tepalcatepec, 1,000 feet.

*Achatocarpus oaxacanus* Standl. No. 1746, tree ten feet high, profusely branched, spreading and twining, road to El Capiri, arid plains, 1,100 feet.

*Petiveria alliacea* L. No. 441, herb twenty to thirty inches high, semi-arid transition zone near Río San Antonio at junction with Río Tepalcatepec, 1,000 feet.

*Stegnosperma scandens* (Lunan) Standl. No. 1394, vine growing on trees, edge of dry arroyo, arid scrub forest west of Apatzingan, 1,200 feet.

#### AIZOACEAE

*Trianthema Portulacastrum* L. No. 436, arid scrub forest near Río Tepalcatepec, 1,000 feet; No. 1407, arid plains near La Majada, 1,200 feet; common herb of arid plains and waste lands of river valley.

#### POTULACACEAE

*Limnia mexicana* Rydb. No. 708, marshy meadow, Cerro Tancítaro, 11,200 feet; apparently rare.

*Talinum triangulare* (Jacq.) Willd. No. 434, partial shade in arid scrub forest near El Capiri, Río Tepalcatepec, 1,000 feet; common.

#### CARYOPHYLLACEAE

*Arenaria oresbia* Greenm. Nos. 280, 1140, 1145, 1150, open pine forest, Cerro Tancítaro; common on moist rocky ledges from 9,500 feet to the summit.

*Arenaria lanuginosa* (Michx.) Rohrb. No. 1083, vine, common in moist soil in deep barranca, Cerro San Miguel.

*Arenaria moehringioides* (M. & S.) B. & H. No. 1283, rocky pasture west of Uruapan, 6,000 feet; usually growing in underbrush where other plants support it.

*Arenaria reptans* Hemsl. Nos. 1111, 1113, open grassy slopes above 9,500 feet, Cerro Tancítaro.

*Cerastium nutans* Raf. Nos. 689, 1119, open pine forest, partial shade, very common; No. 1079, Cerro San Miguel, 6,700 feet, open pine woods; No. 4039, cloud forest, Cerro Tancítaro, 8,000 feet.

*Cerastium molle* Benth. No. 278, open pine forest, Cerro Tancítaro, 11,000 feet.

*Drymaria cordata* (L.) Willd. No. 595, moist, shaded situation beside stone wall, near the Pedregal, 6,000 feet.

*Drymaria villosa* Schlecht. & Cham. No. 525, growing in water in aqueduct, above Tancitaro, 6,300 feet; No. 1293, open rocky pasture west of Uruapan, 6,000 feet; No. 1295, shade of stone walls, west of Uruapan, common, 6,000 feet.

#### RANUNCULACEAE

*Ranunculus Donianus* Pritzel. No. 1169, marshy meadow, 10,500 feet, Cerro Tancitaro.

*Ranunculus Hookeri* Schlecht. Nos. 251, 257, 4030; near Tancitaro, 6,000 feet; common in open throughout plateau and into cloud forest above 8,000 feet.

*Thalictrum guatemalense* C. DC. & Rose. No. 1232, *malpais* south of Uruapan; growing among rocks.

*Thalictrum Pringlei* Wats. No. 989, trail from Uruapan to Tancitaro, near Santa Catarina, 6,000 feet; No. 395, open pine forest above Acahuato, 4,500 feet; No. 1823, common in open pine forest above Acahuato, sometimes in pure stands, 3,500 to 4,000 feet.

*Thalictrum pudicum* Standl. & Boivin. Rhodora 46:434. 1944. No. 1013, open mossy ground, edge of deep barranca, near the Pedregal, 6,000 feet; rare; this collection the type of the new species.

*Thalictrum sessilifolium* Boivin. No. 250, west of Tancitaro, on edge of arroyo, 6,600 feet; herb 5 to 7 feet high.

#### MENISPERMACEAE

*Cissampelos Pareira* L. No. 1266, near falls seven miles southwest of Uruapan, 6,000 feet.

#### ANNONACEAE

*Annona Cherimola* Mill. *Chirimoya*. No. 1228, *malpais* south of Uruapan, 6,000 feet; common in pastures of vicinity.

*Annona reticulata* L. No. 1312, tree thirty feet high, mesic forest, damp soil, La Majada, 1,200 feet; bark tough, fibrous, used as substitute for rope.

*Annona longiflora* Wats. No. 1638, tree fifteen feet high, open pine forest above Acahuato, 3,200 feet; also known as *Chirimoya*.

#### LAURACEAE

*Persea americana* Mill. No. 1632a, tree twenty-five feet high, cultivated, Acahuato, 3,000 feet.

*Phoebe effusa* Meissn. No. 1071, tree twenty feet high, growing in barranca, Cerro San Miguel; fairly common.

#### HERNANDIACEAE

*Gyrocarpus americanus* Jacq. No. 1427, tree twenty-five feet high, mesic woods near Hacienda California, 1,200 feet; common species of mesic forests in parts of valley, reaching a height of fifty feet.

#### PAPAVERACEAE

*Argemone platyceras* Link & Otto. No. 705, flowers white, common to abundant in fields at 6,000 to 7,000 feet.

*Bocconia arborea* Wats. No. 1227, tree up to thirty feet high, usually lower, *malpais* south of Uruapan, 6,000 feet.

#### CAPPARIDACEAE

*Capparis angustifolia* HBK. *Oliva*. No. 426, tree fifteen feet high, fruits when split open bright orange and very conspicuous; common on flat plains near Río Tepalcatepec, 1,000 feet.

*Capparis flexuosa* L. No. 1322, tree fifteen feet high, mesic forest, La Majada, 1,200 feet.

*Forchhammeria pallida* Liebm. No. 1471, tree fifty feet high, dark, smooth bark, arid-mesic transition, near stream, west of Apatzingan, 1,200 feet; not common.

*Polanisia viscosa* (L.) DC. No. 1424, common on dry waste land around Apatzingan, 1,200 feet.

#### CRUCIFERAE

*Draba Pringlei* Rose. Nos. 276, 1138; Cerro Tancitaro, rocky ledges, 10,000 feet to peak, more abundant at higher altitudes.

*Eruca sativa* Mill. No. 578, waste field near the Pedregal, common, 6,000 feet.

*Lepidium virginicum* L. No. 581, waste field near the Pedregal, 6,000 feet.

*Romanschulzia arabiformis* (DC.) Rollins. Nos. 1207, 4034; cloud forest, plant up to five feet high, flowers white; rare from 8,200 to 9,000 feet, abundant in open, very steep slopes and cliffs from 9,000 to 9,500 feet.

#### SAXIFRAGACEAE

*Heuchera mexicana* Schaffn. No. 290, moist cliffs above 9,500 feet; rather rare.

#### ROSACEAE

*Alchemilla procumbens* Rose. Nos. 283, 1085, 1088, 1144; Cerro Tancitaro; very common in open pine forest above 9,500 feet, especially on ridges, more abundant at higher altitudes.

*Alchemilla sibbaldiaeifolia* HBK. No. 1178, common on moist slopes, north side of Cerro Tancitaro, 10,800 feet.

*Alchemilla subalpestris* Rose. No. 1219, growing submerged in pools of marshy meadow, north side of Cerro Tancitaro, 10,500 feet.

*Crataegus pubescens* (HBK.) Steud. *Tejocote*. Nos. 556, 573; near the Pedregal, 6,000 feet; common tree on plateau from 5,000 to 7,000 feet, reaches height of thirty feet.

*Holodiscus fissus* (Lindl.) Schneid. No. 676a, shrub, rocky ridge, Cerro Tancitaro, 10,000 feet.

*Licania arborea* Seem. Nos. 452, 1448, tree up to fifty or sixty feet, common in mesic forests of river valley, 1,200 feet.

*Photinia mexicana* (Baill.) Hemsl. Nos. 1024, 1041, shrub or small tree up to fifteen feet high, fruits red and edible; common among rocks in the Pedregal, 6,000 feet.

*Prunus Capuli* Cav. *Capulín*. No. 366, tree up to sixty feet high; common along barrancas from 5,000 to 7,200 feet.

*Rubus adenotrichus* Schlecht. No. 532, shrub up to twelve feet high; common on plateau from 5,000 to 7,000 feet.

#### KRAMERIACEAE

*Krameria secundiflora* DC. No. 1832a, vine, arid plains near the foot of Cerro Apatzingan, apparently rare.

#### LEGUMINOSAE

*Acacia angustissima* (Mill.) Kuntze. Nos. 1401, 1749, 1800, tree twenty feet high, arid scrub forest west of Apatzingan, 1,200 feet.

*Acacia cymbispina* Sprague & Riley. *Huisache*. No. 477, tree ten to twenty feet high, flowers yellow; one of the commonest trees in the arid scrub forest, 1,200 feet.

*Acacia macrantha* H. & B. No. 441, tree twenty to thirty feet high, arid plains near El Capiri, Río Tepalcatepec, 1,000 feet.

*Acacia pennatula* (S. & C.) Benth. Nos. 1628, 1775; scrubby tree ten to fifteen feet high, with wide spreading crown; common in open pine forest from 3,000 to 4,000 feet.

*Acacia riparia* Benth. Nos. 408, 421, 421a; tree fifteen to thirty feet high, flowers white; common throughout arid scrub forests, especially near streams.

*Apoplanesia paniculata* Presl. Nos. 1463, 1503, 1755; tree fifteen to twenty feet high; common throughout arid parts of tropical zone from 1,000 to 3,000 feet.

*Bauhinia longiflora* Cav. No. 1347a, tree twelve to fifteen feet high, often low, spreading and shrublike, mesic forest, La Majada, 1,200 feet.

*Brogniartia podalyrioides* HBK. No. 502, shrub up to five feet high, flowers purple, found between 2,800 and 3,500 feet; not common.

*Caesalpinia platyloba* Wats. Nos. 424, 1380, 1466; tree five to twenty feet high; very common in arid scrub forest throughout valley, 1,000 to 1,200 feet.

*Caesalpinia pulcherrima* (L.) Sw. Nos. 403, 1365, 1377; shrub six to twelve feet high, showy orange flowers; common in arid parts of tropical zone, 1,000 to 3,000 feet.

*Calliandra callistemon* (Schlecht.) Benth. Nos. 1418, 1625, 1639, low shrub, usually one to two feet high, flowers scarlet; common in open pine forest from 3,000 to 4,000 feet.

*Calliandra densifolia* Rose. Nos. 1362, 1412, tree ten to twelve feet high; common in thick scrub forest of arid plains.

*Calliandra Houstoniana* (Mill.) Standl. No. 389, open pine forest, trail from Tancitaro to Apatzingan; very common about 4,000 to 5,000 feet.

*Calliandra strigillosa* (Britt. & Rose) Standl., comb. nov. *Anneslia strigillosa* Britt. & Rose, N. Amer. Fl. 23:71. 1928. No. 999, shrub up to five feet high; common in pine forest four miles west of Uruapan, 6,000 feet.

*Cassia laevigata* Willd. No. 586, shrub ten to fifteen feet high, field near Tancitaro, 6,000 feet.

*Cassia rotundifolia* Pers. No. 1306, rocky pasture, two miles west of Uruapan, 6,000 feet.

*Cassia Skinneri* Benth. No. 1661, tree twelve feet high, arid slopes above 2,000 feet; very localized.

*Cassia Tora* L. No. 448, flowers yellow, up to two feet high, fields near Apatzingan, 1,200 feet.

*Cassia uniflora* Mill. No. 493, open pasture one mile south of Apatzingan, common.

*Cologania erecta* Rose. No. 385, common in open pine woods from about 4,000 to 5,000 feet.

*Cologania racemosa* Rose. No. 602, common in rich soil along stream near the Pedregal, 6,000 feet.

*Crotalaria angulata* Mill. No. 4006, field near the Pedregal, 6,000 feet.

*Crotalaria longirostrata* H. & A. Nos. 266, 291, up to three feet high, abundant locally in open fields from 5,000 to 7,000 feet.

*Crotalaria sagittalis* L. Nos. 297, 518; common in fallow fields from 5,000 to 7,000 feet.

*Crotalaria vitellina* Ker. No. 616, open pine forest, 5,000 feet; No. 1450, roadside near Hacienda California, edge of mesic woods, 1,200 feet; common.

*Desmodium plicatum* C. & S. No. 1291, shrub four feet high, open, rocky pasture west of Uruapan, 6,000 feet; No. 1651, open pine forest above Acahuato, 3,200 feet; shrub about four feet high, common.

*Desmodium strobilaceum* Schlecht. No. 615, twining vine, flowers pink, open pine forest along trail from Tancitaro to Apatzingan, 5,000 feet; No. 1421, damp ravine, pine forest, La Cañada, 4,000 feet.

*Diphysa floribunda* Peyr. Nos. 1512, 1705; steep arid slopes of canyons below Acahuato, 2,000 to 2,500 feet; fairly common on arid slopes up to 3,000 feet.

*Enterolobium cyclocarpum* (Jacq.) Griseb. No. 1457, tree eighty feet high, with large, spreading crown, open field near stream, Hacienda California; common near streams up to 4,000 feet. Grows, when planted, up to 6,000 feet.

*Eriosema pulchellum* (HBK.) Don. No. 1819, flowers yellow, common in open pine forest, 3,000 to 4,000 feet.

*Erythrina americana* Mill. Colorín. No. 1399, tree eight feet high, arid scrub forest near La Majada, 1,200 feet; common in arid parts of the *tierra caliente* up to 3,000 feet, reaches height of eight to ten feet. Seeds formerly used by Indians as source of poison for arrows.

*Haematoxylon Brasiletto* Karst. No. 1498, shrub or small tree, arid slopes of Cerro Apatzingan, 2,000 feet.

*Indigofera Palmeri* Wats. No. 1730, shrub six to eight feet high, steep, arid slopes above canyon, 2,000 feet.

*Inga spuria* H. & B. No. 445, tree forty feet high, mesic forest along Río San Antonio near El Capiri, 1,000 feet.

*Lonchocarpus* sp. No. 1549, tree forty feet high, arid slopes below Acahuato, 2,500 feet.

*Lupinus elegans* HBK. No. 668, plant ten feet high, flowers purple, spruce forest at about 9,000 feet, fairly common in more open parts; No. 1080, tree twelve feet high, flowers white, open pine forest, Cerro San Miguel, 6,700 feet, not common; No. 4035, five to seven feet high, mountain meadow, 9,500 feet, Cerro Tancitaro.

*Lupinus Aschenbornii* Schauer. No. 1157, flowers light blue, open pine forest near summit, mostly on north slope, Cerro Tancitaro, 11,000 feet.

*Lupinus geophilus* Rose. No. 274, flowers blue, near summit of Cerro Tancitaro, above 11,000 feet.

*Lupinus montanus* HBK. No. 1128, open pine forest, Cerro Tancitaro, very common from 9,500 feet to the summit.

*Lupinus persistens* Rose. Nos. 282, 1136, 1177; Cerro Tancitaro, common in open pine forest to summit; up to four feet high, forming solid stands in places, above 3,500 feet.

*Lysiloma microphylla* Benth. Nos. 1390, 1391, 1500, 1543, 1750; tree ten to twenty feet high, flowers white; very common throughout arid parts of the *tierra caliente* up to 2,000 feet.

*Mimosa albida* Humb. & Bonpl. No. 1007, dry, rocky places, common just west of Uruapan, 6,000 feet.

*Mimosa distachya* Cav. No. 459, shrub four to eight feet high, flowers pale lavender, common on arid plains, 1,000 to 1,200 feet.

*Mimosa Galeottii* Benth. No. 365, tree ten feet high, flowers white, field one mile south of Tancitaro, 6,000 feet; rare.

*Mimosa spirocarpa* Rose. No. 1752, shrub twelve feet high, growing beside irrigation ditches near Apatzingan, 1,200 feet.

*Mimosa Xanti* Gray. No. 1478, shrub six feet high, arid slopes, 2,500 feet.

*Phaseolus heterophyllus* H. & B. No. 373, fallow fields around Tancitaro, 6,000 feet; common.

*Phaseolus acutifolius* Gray. No. 614, climbing vine, flowers pink, open pine forest, 5,000 feet.

*Phaseolus formosus* HBK. No. 550, climbing over shrubs, rich soil, edge of stream near the Pedregal, 6,000 feet.

*Phaseolus* sp. No. 1530, vine climbing over low shrubs in partial shade, arid canyon below Acahuato, 2,500 feet.

*Piptadenia platycarpa* (Rose) Macbr. No. 1351, tree fifteen feet high, mesic woods.

*Piscidia piscipula* (L.) Sarg. No. 1491, tree twenty feet high, open arid slopes below Acahuato, fairly common, 1,200 to 3,000 feet.

*Pithecellobium dulce* (Roxb.) Benth. No. 1455, mesic woods west of La Majada, 1,200 feet; No. 1824, stream valley above Acahuato, 3,200 feet, common; tree up to thirty-five or forty feet high, spreading.

*Pithecellobium lanceolatum* (HBK.) Benth. No. 1320, 1345, La Majada, near streams; No. 1440, near swamp, Hacienda California; tree twenty to thirty feet high, common in mesic forests of valley.

*Pithecellobium velutinum* B. & R. No. 1739, tree twenty-five to thirty feet high, arid plains, trail from Apatzingan to El Capiri, 1,000 feet; common.

*Prosopis juliflora* (Sw.) DC. No. 1428, spreading tree thirty feet high, near Hacienda California; common throughout arid plains from 1,000 to 1,200 feet, usually in low areas.

*Rhynchosia nigropunctata* Wats. No. 1652, common vine in open pine forest, 3,000 to 5,000 feet.

*Tamarindus indica* L. No. 1456, tree eighty feet high, open field near stream; common tree in mesic situations from 1,000 to 1,200 feet.

*Tephrosia cuernavacana* (Rose) Macbr. Nos. 628, 1789; shrub up to three feet high, rocky cliffs at Las Barranquillas, 4,000 feet.

*Tephrosia toxicaria* (Sw.) Pers. No. 1624, herb up to four feet high, open pine forest, 3,200 feet.

*Trifolium amabile* HBK. No. 529, flowers white, common in open pine woods, north of Tancitaro village at 6,500 feet.

*Trifolium mexicanum* Hemsl. No. 564, open woods near the Pedregal, 6,000 feet; fairly common.

*Zornia diphylla* (L.) Pers. No. 1820, flowers yellow, common in open pine forest from 3,000 to 4,000 feet.

#### OXALIDACEAE

*Oxalis albicans* HBK. Nos. 1051, 1052; vine growing four to six feet long, twining over bushes in fields and barrancas four miles east of Tancitaro, 6,000 feet.

*Oxalis alpina* Rose. Nos. 315, 4025; very common, growing among rocks, on cliffs and ridges near summit in sun or shade, Cerro Tancitaro, 9,500 feet to summit.

*Oxalis lanceolata* (Small) Knuth. No. 267, common, growing in detritus of pine needles, pine woods from 5,000 to 7,200 feet.

#### GERANIACEAE

*Geranium aristisepalum* H. E. Moore. Nos. 393, 609; common in open pine forests from 5,000 to 6,000 feet on the southern part of the plateau.

*Geranium Seemanii* Peyr. No. 693, rocky ridges above 9,500 feet, Cerro Tancitaro, fairly common.

#### LINACEAE

*Linum mexicanum* HBK. No. 635, trail from Tancitaro to Apatzingan, open pine forest, about 5,000 feet.

#### ERYTHROXYLACEAE

*Erythroxylon Pringlei* Rose. Nos. 1378, 1499; small tree or shrub fifteen to twenty feet high, plains and lower arid slopes, fairly common, 1,000 to 2,500 feet.

*Erythroxylon mexicanum* HBK. No. 1592, tree fifteen feet high, growing in shade beside stream, canyon below Acahuato, 2,000 feet.

#### ZYGOPHYLLACEAE

*Guaiacum Coulteri* Gray. Guayacán. Tree twenty to thirty-five feet high, common throughout arid plains.

*Kallstroemia Rosei* Rydb. No. 439, spreading herb, moist soil near pond, El Capiri, 1,000 feet.

*Kallstroemia glabrata* Rydb. Nos. 492, 495; spreading herb, flowers yellow, common in open pastures and waste land about Apatzingan, 1,200 feet.

*Kallstroemia maxima* (L.) T. & G. Hierba de paloma. Nos. 1414, 1423; spreading herb common in open pastures and waste land around Apatzingan.

*Kallstroemia brachystylis* Vail. No. 1489, arid lower slopes of Cerro Apatzingan, 1,400 feet, not common.

*Tribulus cistoides* L. Nos. 474, 497, common weed in waste fields and pastures around Apatzingan, sometimes so abundant as to give a yellow appearance to entire pastures.

#### SIMARUBACEAE

*Recchia mexicana* M. & S. No. 453, small tree, bank of Río Apatzingan, in open situation, 1,200 feet.

#### BURSERACEAE

*Bursera bicolor* (Willd.) Engler. Copal. Nos. 1531, 1694, tree fifteen to thirty feet high, common on steep, arid slopes up to 3,000 feet, also found on plains.

*Bursera bipinnata* (S. & M.) Engler. Copal. Nos. 1241, 1290, tree eight to ten feet high, common on rocky land around Uruapan, 6,000 feet.

*Bursera confusa* (Rose) Bullock. No. 1277, tree ten feet high, smooth, reddish bark, brilliant orange-red when cut, rocky pasture west of Uruapan, 6,000 feet; No. 1515, tree twelve feet high, steep side of canyon below Acahuato, 2,500 feet.

*Bursera fagaroides* (HBK.) Engler. Nos. 1518, 1547, 1708, 1765a; tree ten to twenty feet high, bark smooth, pale green, peeling papery and reddish, aromatic but disagreeable odor, very common on arid slopes between 1,200 and 3,000 feet.

*Bursera glabrifolia* (HBK.) Engler. Nos. 1690, 1695, tree fifteen to twenty feet high, open pine forest above Acahuato, 3,200 feet.

*Bursera grandifolia* (Schlecht.) Engler. Nos. 1396, 1523, 1546, 1740, 1764; tree fifteen to thirty feet high, smooth, dark gray bark, common throughout arid parts of tropical zone, 1,000 to 3,000 feet.

*Bursera jorullensis* (HBK.) Engler. Nos. 1273, 1464, 1514, 1711, 1760; tree ten to twenty feet high, common throughout lower arid tropical zone, especially on slopes between 1,200 and 2,000 feet.

*Bursera sessiliflora* Engler. No. 1825, tree fifteen feet high, open pine forest, Las Barranquillas, 4,000 feet; common between 3,000 and 4,000 feet.

*Bursera Simaruba* (L.) Sarg. *Papelillo*. No. 1461, tree fifty feet high, beside stream, thick mesic forest, eight miles west of Apaztingan, 1,200 feet.

*Bursera subtrifoliolata* (Rose) Standl. No. 1596, tree ten feet high, smooth, reddish bark, steep, arid side of canyon, 2,500 feet.

*Bursera Tecomaca* (DC.) Standl. No. 1526, tree fifteen feet high, smooth, reddish bark, arid side of canyon, 2,500 feet.

*Bursera trifoliolata* Bullock. Nos. 1385, 1468, 1742; tree twenty to forty feet high, bark smooth, dark green, peeling in papery, reddish scales, arid plains, 1,000 to 1,200 feet; not common.

*Bursera trimera* Bullock. No. 1761, tree up to fifteen feet high, very common on top of arid hill east of Apaztingan, 1,500 feet.

#### MELIACEAE

*Trichilia hirta* L. Nos. 471, 1313, 1387; shrub or tree eight to sixty feet high, larger trees with crown of branches at top, bark smooth, red, borders of streams and mesic woods throughout river valley.

#### MALPIGHIAEAE

*Bunchosia biocellata* Schlecht. No. 1358, tree ten feet high, mesic forest near La Majada, 1,200 feet.

*Byrsinima crassifolia* (L.) DC. *Changunga* or *Nanche*. Nos. 1609, 1648, 1737, 1832; small tree up to twenty feet high, very common on arid slopes between 2,500 and 3,000 feet, extending up into pine forests to 3,500 feet.

*Heteropteris laurifolia* (L.) Juss. Nos. 1602, 1723; shrub five to ten feet high, often spreading, flowers yellow, canyons below Acahuato, near water, 2,500 feet.

*Heteropteris Palmeri* Rose. No. 1535, shrub eight to ten feet high, canyon below Acahuato, 2,000 feet.

*Malpighia Galeottiana* Juss. *Maca*. Nos. 429, 439a; tree twenty to thirty feet high, arid plains near El Capiri on the Rio Tepalcatepec, 1,000 feet.

*Malpighia mexicana* Juss. Nos. 1375, 1724, 1754; tree ten to fifteen feet high, fairly common in arid scrub forest and on arid slopes up to 2,500 feet.

#### POLYGALACEAE

*Polygala glochidiata* HBK. No. 1281, open meadows west of Uruapan, 6,000 feet, common.

*Polygala longipes* Blake. No. 643, suffrutescent, open pine forest between Tancitaro and Apaztingan, 1,400 feet; No. 1501, arid slopes on Cerro Apaztingan, 1,400 feet.

*Polygala rivinifolia* HBK. No. 1803, open pine forest, 3,000 to 4,000 feet.

*Polygala subalata* Wats. No. 300, common in open meadows and fallow fields around Tancitaro, 6,000 feet.

*Monnieria Schlechtendaliana* Dietr. No. 712, shrub, flowers blue, beside stream in open, 7,000 feet.

*Monnieria xalapensis* HBK. No. 4014, shrub six feet high, beside stream, 7,000 feet.

#### EUPHORBIACEAE

*Acalypha grisea* Pax & Hoffm. No. 1718, shrub, arid sides of canyon, 2,000 feet.

*Acalypha setosa* A. Rich. No. 1363, arid scrub forest, four miles west of Apaztingan, common in partial shade or full sun, 1,200 feet.

*Acalypha subviscida* Wats. Nos. 399, 1645, 1780; shrub up to four feet high, very common in open pine forest from 3,000 to 5,000 feet or higher.

*Acalypha vagans* Cav. var. *genuina* M. Arg. No. 605, shrub about four feet high, trail from Tancitaro to Apatzingan, open pine forest, 5,000 feet.

*Croton calvescens* Wats. No. 603, shrub up to four feet high, pasture near the Pedregal, common, 6,000 feet.

*Croton flavescens* Greenm. No. 1545, shrub three to four feet high, steep, arid slopes, 1,400 feet; No. 1550, shrub, arid slopes, 1,400 feet; No. 1725, shrub eight feet high, open pine forest, 3,200 feet.

*Croton lobatus* L. No. 494, open fields one mile south of Apatzingan, 1,200 feet; common on dry plains throughout the *tierra caliente*.

*Croton niveus* Jacq. No. 1409, tree ten feet high, scrub forest near La Majada; fairly common tree in arid scrub.

*Euphorbia campestris* C. & S. No. 248, field north of Tancitaro, 6,500 feet.

*Euphorbia graminea* Jacq. No. 608, open pine forest, about 5,000 feet; common between 4,000 and 5,000 feet.

*Euphorbia hirta* L. No. 1342, mesic forest at La Majada, 1,200 feet; No. 1655, open pine forest, 3,200 feet, common.

*Euphorbia hyssopifolia* L. Nos. 1506, 1509; arid slopes in arroyo, Cerro Apatzingan, 1,300 feet.

*Euphorbia potosina* Fern. No. 512, arid slopes at base of Cerro Apatzingan, 1,300 feet; very common.

*Euphorbia Schlechtendalii* Boiss. Nos. 1529, 1544; shrub eight to twelve feet high, arid slopes and canyons, about 1,500 feet.

*Euphorbia umbellulata* Engelm. Nos. 511, 1486, arid slopes, Cerro Apatzingan, 1,300 feet; common.

*Jatropha angustidens* (Torr.) Muell. Arg. *Malo hombre*, *Ortiga*. No. 461, near Río Apatzingan, south of the town; common throughout the valley.

*Jatropha tubulosa* Muell. Arg. *Malo hombre*. No. 1416, arid plains near La Majada; one of the commonest plants in arid scrub zone.

*Manihot aesculifolia* (HBK.) Pohl. No. 1444, mesic to arid forest near swamp, Hacienda California, 1,200 feet.

*Manihot angustiloba* (Torr.) Muell. Arg. No. 1548, shrub five feet high, edge of barranca, arid slopes, 1,400 feet.

*Manihot caudata* Greenm. No. 541, vine climbing on small trees, bank of Río Apatzingan, south of town of Apatzingan.

#### *Manihot mobilis* Standl., sp. nov.

Frutex 2.5 m. altus, interdum subscandens, omnino glaber, ramulis crassiusculis, vetustioribus brunneis; folia inter minora, longipetiolata, petolis gracilibus inaequalibus 2-8 cm. longis; lamina 5-10 cm. longa et aequilata, fere ad basin 5-3-loba, membranacea, glabra, subtus paullo pallidior, lobo terminali late obovato vel elliptico-obovato 2-4 cm. lato, apice acuta usque rotundata, saepe subacuminata vel acute acuminato-apiculata, integro, lobis lateralibus conformibus sed brevioribus, lobis infimis parvis vel rarius subnulis, 1-2 cm. tantum longis, reflexis, oblongis vel lineari-oblongis, apice acutis usque rotundatis; stipulae minimae vel nullae; inflorescentiae terminales vel laterales laxe pauciflorae 5 cm. longae vel breviores, pedicellis floriferis 5-8 mm. longis, crassiusculis, adscendentibus, fructiferis usque ad 4 cm. longis; perianthium masculum campanulatum ca. 1 cm. longum et fere aequilatum, extus intusque glabrum, lobis brevibus late ovatis; floris feminei discus crassus 3 mm. latus; ovarium globoso-ovale obscure costatum; capsula (imperfecta) ovali-globosa ca. 17 mm. alta.

MEXICO: Michoacán: Thorn forest between Apatzingan and La Majada, alt. 1,200 ft., a climbing vine, August 13, 1941, William C. Leavenworth and H. Hoogstraal 1556 (type in Herb. Chicago Nat. Hist. Mus.). Canyon below Acahuato, shrub 8 ft. high, on arid hillside with scrub forest, 2,500 ft., August 14, 1941, Leavenworth & Hoogstraal 1532.

This clearly is not referable to any of the species of *Manihot* cited from Mexico and Central America in the recent account of the genus by Croizat (Journ. Arnold

Arb. 23:216. 1942). It is noteworthy for the small leaves with entire divisions. Possibly it is only a form of *M. mexicana* I. M. Johnston, but material referred to that species by Croizat exhibits such great variation that it seems probable that the specimens will have to be realigned when ampler material has been assembled.

***Manihot tomatophylla* Standl., sp. nov.**

Arbor 9-metralis, omnino glabra, ramulis crassis, vetustioribus fusco-brunneis; folia majuscula, petiolo gracili 7-17 cm. longo; lamina membranacea, 8-12 cm. longa et aequilata, profunde fere ad basin 5-loba, lobis panduriformibus, 3.5-4.5 cm. latis, apice dilatatis et truncatis, breviter mucronatis, paullo supra mediam profunde constrictis, integris, prope basin valde angustatis; pedicelli fructiferi usque at 4 cm. longi; capsula subglobosa ca. 2 cm. alta et aequilata, apice late rotundata, manifeste angulata.

MEXICO; Michoacán: Bank of small dry arroyo near La Majada, a tree 30 ft. high with milky sap, common, alt. 1,200 ft., August 9, 1941, William C. Leavenworth & H. Hoogstraal 1402 (type in Herb. Chicago Nat. Hist. Mus.).

For separation of the Mexican species of this group more stress seems to have been placed on leaf form than any other character. By its leaves the present species is easily recognized, for they are manifestly unlike those of any other species of North America, their lobes conspicuously panduriform but otherwise entire, and all of them truncate or nearly so at the apex.

*Phyllanthus micrandrus* Muell. Arg. No. 1413, shrub seven feet high, in shade in thick woods, arid scrub forest near La Majada.

***Phyllanthus perpusillus* Standl., sp. nov.**

Herba pusilla annua erecta usque ad 6.5 cm. alta, inferne simplex, superne ramulos 2-4 emittens, omnino glabra, caule ca. 0.4 mm. crasso, ramulis teretibus vel subteretibus, 1.5-3.5 cm. longis, laxis, patentibus vel adscendentibus, internodiis inferioribus elongatis, superioribus brevibus; stipulae scariosae, subulatae vel lanceolatae, petiolis subaequales; folia breviter petiolata tenuiter membranacea, petiolo usque 1 mm. longo; lamina elliptica usque ovali-elliptica vel saepe obovato-elliptica, 5-8 mm. longa, 2.5-5 mm. lata, apice rotundata, basi rotundata usque cuneato-acuta, subtus paullo pallidior, penninervia, nervis lateralis utroque latere ca. 3, obscuris vel saepe obsoletis; flores monoeci, masculis ex axillis superioribus ortis, brevissime pedicellatis, singulis vel 2-3-fasciculatis, sepalis 4 ca. 1 mm. longis albidis; stamna 2, filamentis tota longitudine in columnam connatis; antherae didymo-globosae, transverse birimosae; flores feminei in axillis solitarii, pedicellis crassiusculis petiolis paullo longioribus, sepalis 6, obovatis, apice rotundatis et apiculatis, scariosis, 1-costatis, ad costam viridescentibus, paullo ultra 1 mm. longis; capsula depresso-globosa, 2 mm. lata vel paullo ultra, apice subtruncata, laevis; semina laevia fusco-brunnescentia.

MEXICO: Michoacán: Rocky pasture 2 miles west of Uruapan, common, tiny when mature, alt. 6,000 ft., August 2, 1941, William C. Leavenworth & H. Hoogstraal 1282 (type in Herb. Chicago Nat. Hist. Mus.).

If the several plants collected are normal, they average much smaller than in any other Mexican species of *Phyllanthus*. The general appearance is that of small individuals of *P. lathyroides* HBK., but that has different flower details, and also has leaves that are normally larger, variously oblong, and with a conspicuous lateral venation of more numerous nerves.

*Stillingia zelayensis* (HBK.) Muell. Arg. No. 1821, shrub three to four feet high; common in open pine forest from 3,300 to 4,000 feet and probably higher.

ANACARDIACEAE

*Cyrtocarpa procera* HBK. *Antiquipus*. Nos. 1372, 1465, 1747, 1758; tree thirty to forty feet high, spreading crown, bark gray, smooth or warty with age; common on arid plains and slopes up to 3,000 feet.

*Mangifera indica* L. No. 1613, tree thirty-five feet high, near stream in bottom of arid canyon, 2,500 feet; No. 1632, tree forty feet high, cultivated, Acahuato, 3,000 feet.

*Comocladia mollissima* HBK. No. 1551, shrub or small tree up to seven or eight feet high, arid slopes between 1,200 and 3,000 feet, very poisonous to the touch.

*Pseudosmodingium perniciosum* (HBK.) Engl. Nos. 1706, 1710, 1757; tree reaching a height of thirty feet, smooth, red, papery bark, wide-spreading habit; very common throughout the arid tropical zone, poisonous to the touch.

*Rhus terebinthifolia* Schlecht. & Cham. Nos. 1699, 1798; shrub four feet high, open pine forest from 3,200 to 4,000 feet.

*Rhus Toxicodendron* L. No. 1817, growing on moist bank of barranca, Las Barranquillas, 4,000 feet, only specimen seen.

*Spondias purpurea* L. Nos. 1540, 1657, 1714, 1679; tree up to thirty feet high, smooth, gray bark, arid slopes and open pine forest from 1,200 to 3,500 feet.

#### CELASTRACEAE

*Celastrus Pringlei* Rose. No. 1023, shrub reaching height of five or six feet but spreading widely, ten feet or more; common among rocks at the Pedregal, 6,000 feet.

#### SAPINDACEAE

*Cardiospermum Corindum* L. No. 440, vine climbing on trees and shrubs, near El Capiri on Río Tepalcatepec, 1,000 feet.

*Dodonaea viscosa* (L.) Jacq. Nos. 1635, 1829; shrub four to ten feet high; very common in meadows of open pine forest at about 3,200 feet.

*Serjania* (sterile). No. 1388, arid scrub forest west of Apatzingan, 1,200 feet.

*Thouinidium decandrum* (HBK.) Radkl. No. 1376, tree eight feet high, arid scrub forest west of Apatzingan, 1,200 feet; No. 1597, tree fifteen feet high, cliffs along edge of arid canyon, 2,500 feet.

#### SABIACEAE

*Meliosma dentata* (Liebm.) Urb. No. 1089, tree forty to fifty feet high, growing in shaded barranca, Cerro San Miguel, 6,700 feet; No. 727, trees growing in solid stand along stream, damp canyon in cloud forest, 7,500 feet.

#### BALSAMINACEAE

*Impatiens Balsamina* L. No. 1634, common on moist rocks and stone walls, Acahuato, 3,000 feet.

#### RHAMNACEAE

*Ceanothus coerulescens* Lag. No. 522, shrub up to five feet high, open pine forest north of Tancitaro, 7,000 feet; found throughout the plateau above 5,000 feet, but not common.

*Colubrina heteroneura* (Griseb.) Standl. Nos. 437, 476, 1604, 1605, 1733; tree ten to twenty feet high, sometimes weak-stemmed and trailing over other trees; common throughout arid scrub forest and found less commonly on slopes up to 2,500 feet.

*Colubrina macrocarpa* (Cav.) Don. No. 1811, shrub four feet high, pine forest from 3,300 to 4,000 feet.

*Rhamnus capreaefolia* Schlecht. No. 1031, tree fifteen feet high, the Pedregal, 6,000 feet.

*Zizyphus sonorensis* Wats. *Corungoro*. Nos. 428, 469, 1400, 1452, 1738; tree fifteen to fifty feet high, common throughout arid plains and extending into mesic forest in places.

#### VITACEAE

*Cissus sicyoides* L. No. 1538, vine, climbing over small trees in full sun, arid slopes, 1,500 feet.

*Vitis tiliifolia* Humb. & Bonpl. No. 1727, large vine, climbing over trees, arid slopes, 2,500 feet.

#### TILIACEAE

*Heliocharpus occidentalis* Rose. No. 1525, tree ten to fifteen feet high, arid canyon between Acahuato and Apatzingan, about 2,000 feet.

*Muntingia Calabura* L. No. 419, tree fifteen to twenty feet high, flowers white, near Rancho El Capiri on Río Tepalcatepec, arid scrub, 1,000 feet.

*Tilia occidentalis* Rose. Nos. 721, 4012; tree reaching height of fifty feet, along streams near the Pedregal, 6,000 feet; common along streams from 6,500 to 7,200 feet, where it is usually twenty to thirty-five feet high.

*Triumfetta brevipes* Wats. Nos. 618, 1771; shrub two to four feet high, flowers creamy yellow, open pine forest up to 5,000 feet.

#### MALVACEAE

*Anoda cristata* (L.) Schlecht. Nos. 487, 1368, 1346; common herb throughout the low tropical zone, both arid and mesic situations.

*Kosteletzkyia sagittata* Presl. No. 1321, growing in mud near stream, mesic forest, La Majada, 1,200 feet.

*Kosteletzkyia hastata* Presl. No. 1350, up to three feet high, stinging hairs, fairly common in mesic woods, La Majada, 1,200 feet.

*Sida acuta* Burm. No. 597, flowers yellow, shrubby plant growing in open fields near the Pedregal, 6,000 feet.

*Sida angustifolia* Lam. No. 1697, shrub three feet high, flowers creamy yellow, open pine forest, 3,200 feet.

#### STERCULIACEAE

*Guazuma ulmifolia* Lam. Nos. 1678, 1716; tree ten to twenty-five feet high, arid slopes below Acahuato, 1,200 to 3,000 feet; found throughout tropical zone.

*Melochia pyramidata* L. Nos. 496, 1425; common throughout arid tropical zone.

#### GUTTIFERAE

*Calophyllum brasiliense* var. *Rekoi* Standl. No. 1462, mesic forest, beside stream, Hacienda California, 1,200 feet.

*Clusia Salvini* Donn. Smith. No. 1025, small tree up to fifteen feet high, common among rocks in the Pedregal, 6,000 feet.

*Hypericum uliginosum* HBK. No. 1063, common in fields around Tancítaro, 6,000 feet.

#### ELATINACEAE

*Elatine triandra* Schkuhr. No. 1220, growing submerged in a shallow pool in two to four inches of water, Cerro Tancítaro, 10,500 feet.

#### COCHLOSPERMACEAE

*Amoreuxia palmatifida* M. & S. No. 503, arid slopes at base of Cerro Apatzingan, 1,200 to 1,400 feet, abundant but apparently quickly transitory.

#### VIOLACEAE

*Hybanthus attenuatus* (Humb. & Bonpl.) Schulze. No. 1245, *malpais* south of Uruapan, 5,600 feet; No. 1359, arid scrub forest, among rocks, four miles west of Apatzingan, 1,200 feet.

*Hybanthus riparius* (HBK.) Standl. No. 402, rich, moist soil beside Río Apatzingán, two miles below the town, 1,200 feet.

*Viola humilis* HBK. Nos. 263, 4010; shaded slopes and ravines, open pine forest around Tancítaro, not abundant, 6,000 to 7,000 feet.

*Viola Pringlei* Rose & House. No. 697, pine woods, Cerro Tancítaro, 7,200 feet.

*Viola prunellifolia* HBK. No. 531, open pine woods around Tancítaro; fairly common, 6,000 to 7,000 feet.

#### FLACOURTIACEAE

*Xylosma celtastrinum* (HBK.) Kuntze. Nos. 988, 1019; shrub six feet high, leaves glossy, common in damp woodlands adjoining the Pedregal, 6,000 feet.

## TURNERACEAE

*Turnera ulmifolia* L. Nos. 624, 1250, 1627; common in open pine forest from 3,000 to 5,000 feet.

## PASSIFLORACEAE

*Passiflora mexicana* Juss. Nos. 1507, 1516; vine, climbing on small trees and shrubs, arid slopes, 1,400 feet.

*Passiflora viridiflora* Cav. No. 1717, on rocky ledge in dense shade; not common, arid slopes, 1,600 feet.

## CACTACEAE

*Acanthocereus pentagonus* (L.) Britt. & Rose. No. 1519d, on arid plains in scrub forest, about eight miles west of Apatzingan; common and abundant throughout many parts of the arid scrub forest.

*Opuntia* sp. No. 1519a, a large plant, up to 15 feet in height, very common and conspicuous on arid slopes from 1,200 to 1,400 feet.

*Pachycereus pecten-aboriginum* (Engelm.) Britt. & Rose. No. 1519b, large plant, up to thirty feet or more in height, common throughout most of the river valley, except in the tropical deciduous forest.

*Selenicereus vagans* (K. Brandeg.) Britt. & Rose. No. 1519c, clambering over rocks on the arid slopes and in canyons between 1,200 and 3,000 feet.

## BEGONIACEAE

*Begonia Balmisiana* Ruiz. Nos. 254, 540; flowers pink or white, moist sides of barrancas, in heavy brown loam, near Tancitaro, 6,000 feet; common throughout plateau from 4,000 to 7,200 feet.

*Begonia gracilis* Kunth. No. 1274, rocky pasture west of Uruapan, 6,000 feet; No. 1770, open pine forest, 3,500 feet; common.

## LYTHRACEAE

*Cuphea appendiculata* Benth. Nos. 606, 1785; herb or shrub, up to four feet high, usually eighteen to twenty-four inches, flowers purple; common in open pine forest from 4,000 to 5,000 feet.

*Cuphea Bustamanta* Llave & Lex. Nos. 4018, 4033; vinelike shrub, shady parts of ravine near stream, cloud forest, Cerro Tancitaro, 8,000 feet.

*Cuphea Bustamanta* var. *reipublicae* (Rob. & Seat.) Koehne. No. 335, trailing vine, dense shade, cloud forest, Cerro Tancitaro, 8,000 feet.

*Cuphea imberbis* Rose. No. 1268, *malpais* and rocky fields south of Uruapan, 6,000 feet; common.

*Cuphea jorullensis* HBK. No. 243, common in open pastures, 6,000 to 7,200 feet.

*Cuphea laminuligera* Koehne. No. 1578, arid slopes below Acahuato, 2,500 feet.

*Cuphea lanceolata* Ait. No. 293, creeping herb, flowers purple; common locally in pastures, 6,000 feet.

*Cuphea lobophora* Koehne. No. 513, slopes below Acahuato, 2,000 feet.

*Cuphea micropetala* HBK. var. *hirtella* Koehne. No. 1620, beside irrigation ditch, open field above Acahuato, 3,200 feet.

*Cuphea Palmeri* Wats. No. 1533, arid canyon between Acahuato and Apatzingan, 2,000 feet.

*Cuphea ternata* Peyr. No. 4003, grassy hillsides near the Pedregal, 6,000 feet.

*Cuphea Walsoniana* Koehne. No. 1251, dry slopes in open pine woods, near Cascada de Tzararacua, seven miles southwest of Uruapan.

*Cuphea Wrightii* Gray. No. 587, grassy meadow near the Pedregal, 6,000 feet; flowers purple, common; No. 1593, rocky ledges, arid canyon, 2,000 feet, rare; No. 1722, Cerro Apatzingan, flowers pink and white, 2,000 feet; No. 1792, open pine forest, Las Barranquillas, flowers purple, 4,000 feet.

*Lythrum vulneraria* Schrank. Nos. 258, 520, 642, shrub four to six feet high, very strict habit, shady situations in open pine forest, 5,000 to 7,000 feet.

## MYRTACEAE

*Eugenia cf. origanoides* Berg. No. 1447, small tree, mesic-arid transition forest near Hacienda California.

*Psidium Guajava* L. *Guayaba*. No. 1294, tree twelve feet high, *malpais* south of Uruapan, 5,600 feet, common; No. 1637, tree ten to twelve feet high; fairly common along edge of pine forest above Acahuato, mostly in open fields, 3,200 feet.

## ONAGRACEAE

*Epilobium mexicanum* DC. No. 1172, marshy meadow north side of Cerro Tancitaro, 10,500 feet; common very locally.

*Fuchsia chiapensis* Brandeg. No. 302, shrub two to ten feet high, the Pedregal, 6,000 feet; No. 641, shrub five feet high, near stream in open pine woods, 5,000 feet; common in zone of open pine woods from 5,000 to 7,000 feet or higher.

*Fuchsia arboreascens* Sims. No. 1257, shrub seven feet high, flowers pink, wet cliffs at Tzararacua, 6,000 feet.

*Fuchsia fulgens* DC. Nos. 303, 1018; shrub, usually four to six feet high, very common in the Pedregal; also growing elsewhere on stone walls, trees, logs, etc., in damp situations from 6,000 to 7,500 feet.

*Fuchsia microphylla* HBK. Nos. 661, 4032, 1206; shrub three to ten feet high, becoming drooping and vinelike, flowers pink; common in upper cloud forest in dense shade from 8,000 to 9,500 feet; also found on steep cliffs among dense vegetation at 11,000 feet.

*Fuchsia minimiflora* Hemsl. No. 1059, compact shrub less than one foot high, flowers pink and white, edge of barranca four miles east of Tancitaro, 6,000 feet.

*Fuchsia Pringlei* Rob. & Seat. Nos. 356, 723; shrub four to eight feet high, flowers white, cloud forest along stream, 7,500 feet.

*Gaura tripetala* Cav. No. 294, waste field west of Tancitaro, along trail to Los Reyes, 6,000 feet.

*Jussiaea suffruticosa* L. No. 490, small shrub beside irrigation ditch, open field south of Apatzingan, 1,200 feet.

*Jussiaea repens* L. var. *peploides* (HBK.) Griseb. No. 491, moist soil beside irrigation ditch, open field, south of Apatzingan, 1,200 feet.

*Lopezia pubescens* HBK. No. 575, rich soil, the Pedregal, 6,000 feet; No. 676, very abundant on open, steep hillsides just above cloud forest limit, 9,500 feet, localized.

*Lopezia racemosa* Cav. Nos. 1114, 1186; suffrutescent shrub or herb, open, rocky ridges, Cerro Tancitaro, 9,500 feet.

*Oenothera mexicana* Spach. No. 4024, open meadows above 7,000 feet, Cerro Tancitaro.

*Oenothera rosea* Ait. No. 378, open pastures one mile south of Tancitaro, 6,000 feet.

*Oenothera laciniata* Hill. No. 244, fallow and waste fields and pastures, 6,000 to 8,000 feet; common.

## ARALIACEAE

*Aralia humilis* Cav. No. 1684, shrub ten feet high, open pine forest, 3,200 feet; No. 1797, shrub four feet high, Las Barranquillas, 4,000 feet.

*Gilibertia arborea* (L.) March. No. 1072, tree thirty feet high, open pine forest on Cerro San Miguel, 6,700 feet.

*Oreopanax Echinops* (S. & C.) Planch. & Decaisne. No. 1107, tree ten to fifteen feet high, spreading, fairly common in barrancas, Cerro San Miguel, 6,700 feet.

## UMBELLIFERAE

*Apium leptophyllum* (DC.) F. Muell. No. 359, cloud forest, shade, 8,000 feet.

*Arracacia bracteata* C. & R. No. 1199, four feet high; fairly common in cloud forest above 8,200 feet.

*Arracacia vaginalata* C. & R. Nos. 268, 4011; growing in detritus of pine needles or on bare soil, open pine forest at 6,000 to 7,000 feet; common.

*Coulterophytum Holwayi* Rose. Nos. 566, 1032; small tree eight to twelve feet high, the Pedregal among rocks, 6,000 feet; common.

*Deanea longibracteata* C. & R. No. 1131, common on Cerro Tancitaro, above 9,500 feet, especially on rocky ridges.

*Donnellsmithia peucedanoides* (HBK.) Math. & Const. No. 1772, herb three to five feet high, open pine forest, 3,400 feet.

*Eryngium bromelialefolium* Delar. Nos. 673, 1163; very common throughout open pine forest and mountain meadows above 9,500 feet.

*Eryngium Carlinae* Delar. No. 4016, mountain meadow, 7,800 feet; not common.

*Hydrocotyle umbellata* L. No. 1442, in shallow water in swamp, Hacienda California, 1,200 feet.

*Prionosciadium thapsoides* (DC.) Mathias. No. 1495, seven feet high, lower slopes of Cerro Apatzingan, 1,400 feet.

*Tauschia nudicaulis* Schlecht. No. 284, in open pine parkland near summit, common.

*Cornus disciflora* DC. No. 1091, tree fifteen to twenty feet high, deep barranca, Cerro San Miguel, 6,700 feet; No. 1192, tree fifty feet high, forest along stream, Cerro Tancitaro, 8,200 feet; fairly common.

*Cornus disciflora* DC. var. *floccosa* (Wang.) Standl. No. 334, tree about forty feet high, forest near stream, Cerro Tancitaro, 8,000 feet.

#### CLETHRACEAE

*Clethra lanata* Mart. & Gal. No. 1049, shrub eight feet high, barranca four miles east of Tancitaro, 6,000 feet.

#### MONOTROPACEAE

*Monotropa coccinea* Zucc. No. 1184, dense cloud forest along stream, Cerro Tancitaro, 7,800 feet.

#### ERICACEAE

*Arbutus spinulosa* M. & G. No. 692, shrub one to two feet tall, open ridge, Cerro Tancitaro, 10,000 feet.

*Arbutus xalapensis* HBK. No. 569, tree twenty to twenty-five feet high, the Pedregal, 6,000 feet, common on plateau in rocky places; No. 1164, shrub two feet high, rocky ridge, Cerro Tancitaro, 10,500 feet.

*Arctostaphylos angustifolia* (Klotzsch) Hemsl. No. 1194, shrub four to six feet high, common on exposed ridges, 9,000 to 9,500 feet, Cerro Tancitaro.

*Arctostaphylos rupestris* Rob. & Seat. No. 585, tree ten feet tall, the Pedregal, 6,000 feet, not common; No. 667, shrub up to eight feet tall, exposed ridges, Cerro Tancitaro, 9,000 to 9,500 feet.

*Pernetia ciliata* (S. & C.) Small. Nos. 669, 1134; low shrub, sometimes up to two feet high, along streams and on exposed ridges, Cerro Tancitaro, above 9,500 feet.

#### THEOPHRASTACEAE

*Jacquinia pungens* Gray. *Pinicua*. No. 422, tree six to ten feet tall, arid plains near El Capiri, 1,000 feet; found throughout the arid scrub forest, common locally.

#### MYRSINACEAE

*Ardisia revoluta* HBK. No. 1599, shrub ten feet high, growing among rocks beside stream, in shade, arid canyon below Acahuato, 2,000 feet.

*Parathesis serrulata* (Sw.) Mez. No. 1068, barranca four miles east of Tancitaro, 6,000 feet.

*Rapanea ferruginea* (R. & P.) Mez. No. 1026, shrub six to eight feet high, the Pedregal, 6,000 feet.

#### PLUMBAGINACEAE

*Plumbago pulchella* Boiss. No. 1305, up to three feet high, rocky pastures west of Uruapan, 6,000 feet.

## PRIMULACEAE

*Anagallis arvensis* L. No. 370, flowers salmon-colored, common in waste and fallow fields throughout the plateau, 6,000 feet and higher.

## SAPOTACEAE

*Bumelia persimilis* Hemsl. Nos. 1558, 1393; tree fifteen to twenty feet high, arid scrub forest west of Apatzingan, 1,200 feet.

*Calocarpum mammosum* (L.) Pierre. No. 1459, tree forty feet high, mesic forest near stream, near Hacienda California, 1,200 feet.

*Sideroxylon Capiri* (A. DC.) Pittier. *Capiri*. Nos. 1382, 1432, 1454, 1474; tree up to sixty feet or more in height, common in mesic forest throughout tropical zone. In times of revolution the peasants are said to have lived almost entirely on the fruits of this tree.

## EBENACEAE

*Diospyros aequoris* Standl. No. 1728, small tree, arid slopes, 2,400 feet; not common.

*Diospyros Ebenaster* Retz. *Zapote negro*. No. 1689, tree sixty feet high, Acahuato, 3,000 feet; No. 1433, tree sixty feet high, mesic forest near Hacienda California; common tree in mesic forest.

*Diospyros Martineziana* Standl., sp. nov.

Frutex vel arbor 2-4.5 m. alta, ut videtur dense ramosa, ramulis densissime pilosotomentosis, internodiis brevibus vel brevissimis; folia parva, brevissime petiolata, chartacea et vulgo subrigida, petiolo vix ad 2 mm. longo pilosulo-tomentoso; lamina ambitu variabilis, orbicularis usque rotundo-ovalis vel interdum late obovato-elliptica, 1.5-4 cm. longa, 1.5-3 cm. lata, apice late rotundata usque obtusa, basi rotundata usque obtusa, utrinque dense molliter pilis ochraceis vel pallidioribus pilosa, nervis venisque subtus prominentibus, irregulariter reticulatis; flores trimeri, in axillis fasciculati vel cymosuti, brevissime pedicellati, pedicellis densissime hispidulis, crassiusculis; calyx profunde tribulus, extus dense pilosulo-tomentosus, intus dense sericeus, in alabastro 5 mm. longus, lobis late ovatis subacutis erectis.

MEXICO: Michoacán, Acahuato, open meadow above 2,500 ft., Municipalidad Apatzingan, a shrub with white flowers, August 20, 1941, William C. Leavenworth & H. Hoogstraal 1735 (type in Herb. Chicago Nat. Hist. Mus.). Dry arroyo, arid slope above Apatzingan, 2,000 ft., a shrub 7 ft. high, Leavenworth & Hoogstraal 1490. Above Apatzingan, arid slope with scattered trees, tree 15 ft. high, Leavenworth & Hoogstraal 1494. Above Apatzingan, arid slope with scattered trees, alt. 2,000 ft., 15 ft. high, Leavenworth & Hoogstraal 1502.

This plant is referable to the genus *Maba*, if that is separated from *Diospyros*, but at present most authors are in agreement in uniting *Maba* with *Diospyros*. Among the rather numerous Mexican species in the genus, the present one is rather well marked by its small and chiefly rounded or broadly oval leaves, very densely pubescent on both surfaces.

## OLEACEAE

*Fraxinus Uhdei* (Wenzig) Lingelsheim. *Fresno*. No. 1042, tree up to sixty feet high, common along barrancas around Tancitaro, 6,000 feet.

## LOGANIACEAE

*Buddleia parviflora* HBK. Nos. 691, 1204, 1118; shrub four to eight feet high, rocky ridges and steep slopes, 9,500 to 10,000 feet.

*Spigelia scabrella* Benth. *Maravilla*. No. 1261, fairly common on slopes in open pine-oak woods around the Cascada de Tzararacua, 6,000 feet.

## GENTIANACEAE

*Halenia plantaginea* (HBK.) Griseb. Nos. 277, 1154, 1133; common on slopes of Cerro Tancitaro above 10,500 feet, mostly near summit and on north slope.

## APOCYNACEAE

*Haplophyton cimicidum* A. DC. Nos. 1397, 450; small shrub up to two feet high, fairly common in scrub forest but usually in partial shade where conditions are somewhat mesic.

*Plumeria rubra* L. f. *acutifolia* (Poir.) Woodson. No. 1519, tree twenty-five feet high, flowers white with yellow center, milky sap, soft wood, large pith; fairly common on cliffs above and canyons from 1,200 to 2,500 feet.

*Rauvolfia hirsuta* Jacq. No. 1352, shrub four to five feet high, common on open, arid plains.

*Rauvolfia hirsuta* var. *glabra* (Muell. Arg.) Woodson. No. 475, shrub up to five feet high, flowers white, fruit red; common on open, arid plains, 1,200 feet.

*Thevetia peruviana* (L.) Pers. var. *pinifolia* Standl. & Steyermark, var. nov.

Frutex vel arbustula 3-4.5 m. alta, formae typicae speciei similis; folia alterna vel proprie apices ramulorum dense congesta, anguste linearia, subrigida, patentia vel adscendenta, plerumque 7-13 cm. longa, vix ultra 1 mm. lata, marginibus arcte revolutis, supra glabra nitida, subtus sparse denseve hirtella vel glabrata.

MEXICO: Michoacán: Trail from Apatzingan to Tancítaro, fairly common on the desert up to 2,500 ft., August 7, 1940, William C. Leavenworth 505 (type in Herb. Chicago Nat. Hist. Mus.). Above Apatzingan, common but localized as to altitudinal distribution, on arid slope with scattered trees, 2,000 ft., August 13, 1941, Leavenworth & Hoogstraal 1477. Bank of Río Apatzingan, 2 miles south of Apatzingan, fairly common on open plains, 1,200 ft., August 5, 1940, Leavenworth 463.

At first glance this plant seems to be wholly distinct from the common *Thevetia peruviana*, the very numerous, often crowded, long and spreading leaves being strongly suggestive of pine needles and of very different aspect from the relatively wide leaves of the usual form of *T. peruviana*. We should be inclined to treat the tree of the present collection as a distinct species, since it has foliage characters as good as those on which some other species of *Thevetia* are separated, but there are at hand two collections having leaves which, although much narrower than is normal in *T. peruviana* are nevertheless wider than in the type of var. *pinifolia*, attaining a width of 3 to 4 mm. These two collections, which may be referred to this variety, are the following: MEXICO: Guerrero: Vicinity of Acapulco, E. Palmer 27. Rocky headlands between Acapulco and Pie de la Cuesta, in 1935, L. H. MacDaniels 244.

*Tabernaemontana amygdalifolia* Jacq. No. 1340, tree fifteen feet high, mesic forest, La Majada, 1,200 feet.

*Vallesia glabra* Cav. Nos. 427, 1349; shrub twelve to fifteen feet high, sprawling over trees and shrubs; common in thick scrub forest where there is a transition to mesic conditions.

## ASCLEPIADACEAE

*Asclepias curassavica* L. Nos. 486, 1347; common throughout arid plains and cultivated and waste fields of the *tierra caliente*.

*Asclepias glaucescens* HBK. No. 410, open field south of Apatzingan, 1,200 feet.

*Asclepias neglecta* Hemsl. Nos. 1633, 1783; fairly common in open pine forest from 3,000 to 4,000 feet.

*Asclepias setosa* Benth. No. 398, open pine forest, about 4,500 feet.

*Asclepias ovata* M. & G. No. 1105, open pasture at foot of Cerro San Miguel, 6,300 feet; fairly common.

*Gonolobus jaliscensis* Rob. & Greenm. No. 1244, vine, woody at base, *malpais* south of Uruapan, 5,600 feet.

*Gonolobus congestus* Dcne. No. 1683, twining on shrubs, open pine forest, 3,200 feet; fairly common.

*Marsdenia propinqua* Hemsl. No. 1431, vine climbing on small trees in thick thorn forest near Hacienda California; very common.

*Mellichampia ligulata* (Benth.) Vail. No. 1693, twining over shrubs, open pine forest, 3,200 feet.

## CONVOLVULACEAE

*Cuscuta applanata* Engelm. No. 418, growing on herbs along stream, El Capiri, 1,000 feet.

*Cuscuta corymbosa* var. *grandiflora* Engelm. No. 702, growing on lupines, Cerro Tancitaro, 8,400 feet; common on a variety of hosts in cloud forest up to 8,500 feet.

*Evolvulus alsinoides* L. Nos. 1663, 1672; common in open pine forest, 3,000 to 4,000 feet.

*Ipomoea arborescens* (Humb. & Bonpl.) Don. No. 1765, tree thirty feet high, bark pale green and smooth, arid slopes below Acahuato, 2,800 feet.

*Ipomoea longipedunculata* Hemsl. No. 260, stone walls along fields south of Tancitaro, 6,000 feet; very common, covering stone walls from 5,000 to 7,000 feet.

*Ipomoea mutabilis* Lindl. No. 1075, climbing on small trees to height of thirty feet, flowers bright orange-red, Cerro San Miguel, 6,700 feet.

*Ipomoea Seleri* Millsp. No. 444, climbing over bushes and small trees, arid scrub near El Capiri, 1,000 feet.

*Ipomoea suffulta* Don. No. 1618, vine, prostrate or climbing over low shrubs, open pine forest, 3,200 feet.

*Ipomoea tyrianthina* Lindl. No. 1288, rocky pasture west of Uruapan, 6,000 feet.

*Jacquemontia azurea* (Desv.) Choisy. No. 1665, edge of cultivated field above Acahuato, 3,200 feet.

## LENNOACEAE

*Lennoa madreporioides* L. & L. No. 1406, flowers lavender, common locally in arid locations from 1,000 to 3,000 feet.

## HYDROPHYLACEAE

*Phacelia platycarpa* (Cav.) Spreng. No. 265, very common herb in fields from 6,000 to 7,000 feet, forms almost continuous cover in isolated mountain meadows at 7,800 feet.

*Wigandia caracasana* HBK. No. 1668, shrub ten feet high, near stream, open pine forest, 3,200 feet; found up to altitudes of 5,000 feet or more.

## BORAGINACEAE

*Cordia dentata* Poir. Tamboro. No. 1403, tree thirty feet high, very common in arid scrub forest, 1,200 feet.

*Cordia brevispicata* M. & G. No. 1243, *malpais* near Uruapan, 5,600 feet, common; No. 1681, shrub five to fifteen feet high; common in well-drained, rocky locations around Acahuato, 2,800 to 3,500 feet.

*Cordia eleagnoides* DC. Cueramo. Nos. 1379, 1561, 1753, 1759; tree fifteen to thirty feet high, very common throughout arid tropical zone, from Río Tepalcatepec to 3,000 feet.

*Cynoglossum Pringlei* Greenm. No. 552, damp soil in oak woods, the Pedregal, 6,000 feet.

*Heliotropium fallax* I. M. Johnston. No. 1505, arid slopes, Cerro Apatzingan, 1,400 feet.

*Heliotropium fruticosum* L. var. *erectum* (Macbr.) I. M. Johnston. No. 507, arid slopes, 1,300 to 2,000 feet; common.

*Heliotropium indicum* L. No. 498, up to two feet high, open pasture south of Apatzingan, 1,200 feet.

*Heliotropium limbatum* Benth. Nos. 400, 1687, common in open meadows in pine woods, 3,200 to 4,500 feet.

*Heliotropium mexicanum* Greenm. No. 1623, up to two feet high, common in open pine forest, 3,200 feet.

*Heliotropium phyllostachyum* Torr. No. 1367, arid scrub forest four miles west of Apatzingan, 1,200 feet; common.

*Lithospermum discolor* Mart. & Gal. No. 568, woods near the Pedregal, 6,000 feet.

*Macromeria discolor* Benth. Nos. 286, 4017; common in moist soil below cliffs, usually in shade, Cerro Tancitaro, 9,500 to 10,000 feet; also found in cloud forest down to 8,000 feet.

*Macromeria exserta* Don. No. 1773, open pine forest north of Acahuato, 3,400 feet.  
*Onosmodium strigosum* Don. Nos. 317, 545, 599, 1774; open meadows in pine forest, 3,500 to 6,000 feet; common throughout its range, but not abundant.

*Tournefortia densiflora* M. & G. No. 252, shrub four to seven feet high, common along edges of fields and barrancas on plateau, 6,000 feet.

#### VERBENACEAE

*Lantana Camara* L. No. 1278, shrub four feet high, rocky pasture west of Uruapan, 6,000 feet.

*Lippia nodiflora* (L.) Michaux. Nos. 1356, 1441, 1325; growing in swampy fields or water throughout the river valley.

*Priva lappulacea* (L.) Pers. No. 1329, damp soil, La Majada, 1,200 feet.

*Priva mexicana* (L.) Pers. No. 1619, open pine forest, 3,200 feet.

*Stachytarpheta jamaicensis* (L.) Vahl. No. 479, moist soil near stream, south of Apatzingan, 1,200 feet.

*Verbena carolina* L. Nos. 269, 295; open fields, 6,000 to 7,000 feet; very common, especially in the streets of Tancítaro among the paving stones.

*Verbena ciliata* Benth. No. 292, prostrate, creeping plant; very common in fallow fields of plateau, 6,000 feet.

*Verbena neomexicana* (Gray) Small. No. 508, arid slopes, Cerro Apatzingan, 1,400 feet.

*Vitex Hemsleyi* Briq. No. 1707, tree fifteen feet high, arid slopes above canyon, 2,000 feet; common up to 3,000 feet.

*Vitex mollis* HBK. Nos. 1591, 1726, 1766; tree twenty-five to thirty-five feet high; common on arid slopes from 1,500 to 3,000 feet.

#### LABIATAE

*Hyptis albida* HBK. No. 1598, shrub ten feet high, spreading, beside stream in arid canyon, 2,000 feet.

*Hyptis pectinata* (L.) Poit. No. 1804, shrub four feet high, open pine forest, 3,500 feet; common.

*Lepechinia spicata* Willd. No. 588, the Pedregal, 6,000 feet; No. 617, along path in open field four miles south of Tancítaro, 6,000 feet.

*Salvia cardinalis* Epling. No. 1117, shrub four feet high, common just above the border of the cloud forest, on moist, open ridges, Cerro Tancítaro, 9,500 to 10,000 feet.

*Salvia elegans* Vahl. Nos. 354, 1115; shrub two to four feet high, common on ridges just above cloud forest, Cerro Tancítaro, 9,500 to 10,000 feet and higher.

*Salvia gesneraeiflora* Lindl. & Paxt. Nos. 353, 660, 660a; shrub reaching a height of twelve or fifteen feet, cloud forest and open ridges above, Cerro Tancitaro, 8,500 to 10,000 feet; common.

*Salvia glechomaefolia* HBK. No. 607, along trail from Tancítaro to Apatzingan, open pine forest, about 5,000 feet.

*Salvia Grahamii* Benth. No. 1001, shrub, flowers salmon-pink, open pine forest west of Uruapan, 6,000 feet.

*Salvia longispicata* M. & G. Nos. 349, 547; plant two to five feet high, common along the borders of fields and open woods, from 5,000 to 8,000 feet or higher.

*Salvia mexicana* L. No. 4045, plant two to three feet high, open parts of cloud forest, 7,500 to 9,000 feet.

*Salvia aff. nervata* Moq. No. 394, open pine forest near trail from Tancítaro to Apatzingan, 5,000 feet; common.

*Salvia nigriflora* Epling. No. 1269, common in pine forest west of Uruapan, 6,000 to 6,500 feet.

*Salvia prunelloides* HBK. No. 1000, along trail to Tancítaro, open pine forest west of Tancitaro, 6,000 feet.

*Salvia Agnes* Epling. No. 4036, blue flowers, tuberous root as large as medium-sized potato, cloud forest, Cerro Tancitaro, 9,000 feet.

*Satureja laevigata* Standl. No. 1183, shrub seven feet high, cloud forest in dense shade, Cerro Tancítaro, 9,100 feet; common.

- Scutellaria caerulea* M. & S. Nos. 311, 696, 1053; common in barrancas and damp, shady woods from 5,000 to 7,200 feet.
- Stachys agraria* C. & S. Nos. 372, 1067; very common in fields south of Tancítaro, 6,000 feet.
- Stachys boraginoides* C. & S. Nos. 313, 521; common in rich, damp soil in woods, 6,000 to 7,000 feet.
- Stachys coccinea* Jacq. No. 1324, moist soil, shade, beside stream, La Majada, 1,200 feet.

## SOLANACEAE

- Capsicum baccatum* L. Nos. 458, 1339; shrub two to three feet high, mesic woods along stream, 1,200 feet.
- Capsicum stramoniifolium* (HBK.) Standl. No. 1259, shrub, fruit red, dense undergrowth, *malpais* south of Uruapan, 5,600 feet.
- Cestrum Anagyris* Dunal. No. 358, shrub ten to twelve feet high, dense undergrowth in cloud forest, 8,000 feet.
- Cestrum thyrsoidem* HBK. No. 538, shrub up to ten feet high, very common on plateau around Tancítaro, 6,000 feet.
- Datura innoxia* Mill. No. 409, pasture one mile south of Apatzingan, 1,200 feet.
- Datura pruinosa* Greenm. No. 1615, common in open parts of arid plains around Apatzingan, 1,200 feet.
- Lycianthes Andrieuxii* (Dunal) Bitter. No. 1008, open pine forest west of Uruapan, trail to Tancítaro, 6,000 feet.
- Lycianthes lenta* (Cav.) Bitter. No. 1315, vine, climbing over small trees up to fifteen or twenty feet, mesic forest, La Majada.
- Lycianthes somniculenta* (Kuntze) Bitter. Nos. 386, 526, pine forest from 4,500 to 7,200 feet; not abundant.
- Nicotiana Tabacum* L. No. 420, open field beside Río San Antonio, near El Capiri, 1,000 feet.
- Physalis ixocarpa* Brot. No. 1408, scrub forest four miles west of Apatzingan, 1,200 feet; No. 1769, rocky, well drained soil, open pine woods, 3,300 feet; No. 1787, moist soil beside stream, Las Barranquillas, 4,000 feet; not common.
- Physalis pubescens* L. No. 1381, arid scrub forest west of Apatzingan, 1,200 feet; not common.
- Physalis subintegra* Fern. Nos. 271, 1057; common in pastures and open pine forest to 7,000 feet; No. 1310, oak forest, road from Uruapan to Apatzingan, 4,000 feet.
- Physalis viscosa* L. No. 519, moist soil in pine woods, 6,500 feet; common locally.
- Saracha procumbens* (Cav.) R. & P. Nos. 598, 729; herb four to five feet high, common in woods near the Pedregal, 6,000 feet.
- Solanum appendiculatum* Dunal. No. 1084, moist soil in deep barranca, Cerro San Miguel, 6,700 feet.
- Solanum brachystachys* Dunal. Nos. 249, 355, 553; tree up to twelve feet high, flowers white; common on plateau, 6,000 to 7,000 feet.
- Solanum Cervantesii* Lag. Nos. 351, 698; shrub or small tree ten to fifteen feet high, common along barrancas on plateau and extending up to 8,000 feet in cloud forest on Cerro Tancítaro.
- Solanum cornutum* Lam. No. 1353, branching herb, shrublike in form, four to five feet high, mesic, open field near La Majada, 1,200 feet; Nos. 1415, 1384; low herbs, one to three feet high, arid scrub forest west of Apatzingan; common locally.
- Solanum deflexum* Greenm. No. 473, moist soil, sunny situation near El Capiri, 1,000 feet; No. 1279, open pasture, west of Uruapan, 6,000 feet; No. 1344, moist soil, sunny situation, La Majada, 1,200 feet.
- Solanum demissum* Lindl. No. 1212, flowers purple, common in rich soil in open and partial shade, 7,000 feet.
- Solanum Galeotti* Dunal. No. 312, vine climbing on small trees, the Pedregal, 6,000 feet.
- Solanum hirtum* Vahl. No. 1779, shrub four feet high, open pine forest, 4,000 feet; rare.

*Solanum laurifolium* Mill. No. 259, shrub four to seven feet high, flowers lavender, fruit yellow-orange; common in open fields of plateau up to 7,000 feet; No. 1224, shrub five feet high, *malpais* south of Uruapan, 5,600 feet.

*Solanum longipedicellatum* Bitter. No. 1054, barranca four miles east of Tancitaro, 6,000 feet; No. 4021, cloud forest along streams, Cerro Tancitaro.

*Solanum nigrum* L. Nos. 352, 361, 592, 4020; herb up to five feet high, flowers white; common in damp woods on plateau and up to 8,200 feet in cloud forest.

*Solanum polytrichum* Rydb. No. 548, the Pedregal, 6,000 feet.

*Solanum torvum* Sw. No. 1247, shrub four feet high, *malpais* south of Uruapan, 5,600 feet.

*Solanum umbellatum* Mill. No. 1246, shrub four feet high, *malpais* south of Uruapan, 5,600 feet.

*Solanum verbascifolium* L. No. 1434, tree twelve to fifteen feet high, near Hacienda California, thick scrub forest, 1,200 feet.

*Solanum verrucosum* Schlecht. No. 379, open field one mile south of Tancitaro, 6,000 feet.

#### SCROPHULARIACEAE

*Bacopa Monnierii* (L.) Wetst. No. 1435, growing in water, mesic woods near Hacienda California, 1,200 feet; common.

*Bacopa procumbens* (Mill.) Greenm. No. 524, damp soil, open pasture, north of Tancitaro, 6,500 feet.

*Bacopa rotundifolia* (Michx.) Wetst. No. 1475, growing in outlet of swamp near Hacienda California, 1,200 feet.

*Buchnera pusilla* HBK. No. 1736, arid canyon, 2,000 feet.

*Calceolaria mexicana* Benth. Nos. 724, 4023; growing among rocks beside stream, Cerro Tancitaro, 7,500 to 8,200 feet.

*Castilleja integrifolia* L. Nos. 533, 665, 1210; shrub about four feet high, open pastures and slopes from 6,000 to 10,000 feet; more common in upper part of range from 9,500 to 10,000 feet.

*Castilleja lithospermoides* HBK. Nos. 664, 683, 684, 1174; common in open pine forest and rocky ridges from 9,500 feet to summit, Cerro Tancitaro.

*Castilleja scorzoneraeifolia* HBK. Nos. 275, 1125; common in open pine forest and rocky ridges from 9,500 to summit, Cerro Tancitaro.

*Castilleja tenuiflora* Benth. No. 1680, shrub two to four feet high, open pine forest, 3,200 feet.

*Conobea pusilla* B. & H. No. 1712, herb common in niches in rock along side of canyon, 1,400 to 2,000 feet.

*Lamourouxia multifida* HBK. No. 1116, steep slope below rocky ridge, Cerro Tancitaro, 9,500 feet.

*Limosella americana* Glück. No. 1221a, growing submerged in two to four inches of water, marshy meadow, north slope of Cerro Tancitaro, 10,500 feet.

*Mimulus glabratus* HBK. *Hierba de golpe*. Nos. 247, 527; growing in wooden aqueduct in water, two miles north of Tancitaro, 6,500 feet.

*Pentstemon campanulatus* Willd. Nos. 666, 677, 678, 685; rocky ridges and steep slopes below cliffs, 9,500 to 10,500 feet; very common.

*Russelia floribunda* HBK. No. 1534, herb or small shrub, flowers scarlet, moist soil in niches in rock near stream, arid canyon, 2,000 feet.

#### BIGNONIACEAE

*Crescentia alata* HBK. No. 1595, tree fifteen to thirty-five feet high, occasional on arid slopes below Acahuato up to 2,500 feet; very common on arid plains east of Apatzingan.

*Meloa populifolia* (DC.). Bur. No. 1360, vine climbing over low trees, flowers yellow, arid scrub forest four miles west of Apatzingan, 1,200 feet.

*Taebebia pentaphylla* (L.) Hemsl. No. 1445, tree thirty-five feet high, mesic to arid forest near Hacienda California.

*Tecoma stans* (L.) HBK. No. 1720, tree eight feet high, spreading, arid canyon, 2,000 feet.

## PEDALIACEAE

*Sesamum orientale* L. No. 464, open fields south of Apatzingan, 1,200 feet.

## MARTYNIACEAE

*Martynia annua* L. Nos. 1405, 1664, common throughout the *tierra caliente*, from 1,000 to 4,000 feet, especially along roadsides, in waste fields, etc.

*Martynia arenaria* Engelm. No. 485, irrigated field south of Apatzingan.

## GESNERIACEAE

*Achimenes flava* Morton. No. 1253, shallow soil on rock ledges, near Cascada de Tzazaracua, seven miles southwest of Uruapan, 6,000 feet.

*Achimenes antirrhina* (DC.) Morton. No. 1309, flowers scarlet, growing on moist rock in oak forest, road from Uruapan to Apatzingan, 4,000 feet.

*Achimenes longiflora* DC. No. 1573, flowers purple, growing in niches in rock near stream, arid canyon, 2,300 feet.

*Achimenes patens* Benth. No. 1616, flowers purple; common on moist stone walls, Acahuato, 3,000 feet.

## LENTIBULARIACEAE

*Pinguicula caudata* Schlecht. No. 396, growing on black, crumbling rock in a damp barranca near Cañada, about 4,000 feet; apparently very localized as to substrata and moisture conditions, also found in deep canyons between Tancítaro and Uruapan at 6,000 feet.

## ACANTHACEAE

*Barleria micans* Nees. No. 1577, shrub one to two feet high, growing in sand beside stream in arid canyon, 2,000 feet.

*Dyschoris ovata* (Cav.) Kuntze. No. 613, open pine forest, 5,000 feet.

*Elytraria squamosa* (Jacq.) Lindau. No. 1536, rocky ledge in shade, arid canyon, 2,000 feet; rare.

*Ruellia nudiflora* (Engelm. & Gray) Urban. Nos. 407, 1383, common throughout arid scrub forest, 1,200 feet.

## PLANTAGINACEAE

*Plantago hirtella* HBK. Nos. 310, 316; rich alluvial soil along stream near the Pedregal, 6,000 feet.

*Plantago mexicana* HBK. No. 515, fields throughout the plateau, 6,000 feet; common.

## RUBIACEAE

*Balmea Stormae* Martínez. No. 1229, tree 18 feet high, flowers dark purple, growing in rocky land south of Uruapan, known as *malpais*, 5,600 feet.

*Borreria laevis* (Lam.) Griseb. Nos. 308, 319, 594, 4001; common herb, growing on open, grassy slopes or in fields throughout the higher parts of the plateau, 6,000 to 7,000 feet.

*Borreria suaveolens* Mey. No. 4004, grassy hillside near the Pedregal, 6,000 feet.

*Borreria verticillata* (L.) Mey. Nos. 246, 648; common in open fields and on open slopes throughout the plateau, 6,000 to 7,000 feet.

*Bouvardia chrysanthia* Mart. No. 323, rocky, steep slope in the Pedregal, 6,200 feet.

*Bouvardia laevis* M. & G. No. 1252, shrub, common in *malpais* south of Uruapan, 5,600 feet.

*Bouvardia multiflora* (Cav.) Schult. No. 1801, shrub two to three feet high, common in the pine forest from 3,000 to 4,000 feet.

*Crusea coccinea* DC. Nos. 350, 694, 1082; vine, flowers scarlet, growing in deep barrancas, along streams, and in shady, damp situations up to 7,000 feet.

*Cephalanthus salicifolius* H. & B. No. 1593, shrub or small tree, growing in or near water, common along the Río Apatzingan up to 3,000 feet or higher.

*Chiococca alba* (L.) Hitchc. No. 1796, tree fifteen feet high, edge of stream, Las Barranquillas, 4,000 feet.

*Dedpea tenuiflora* Benth. No. 1264, shrub three to four feet high, near the Cascada de Tzararacua, southwest of Uruapan, 6,000 feet.

*Didymaea alsinoides* (S. & C.) Standl. Nos. 338, 730, 1185; probably the commonest vine of the dense fir forest above 8,200 feet, usually prostrate and creeping but may be climbing on rocky ledges or trees and shrubs, 7,800 to 9,000 feet or higher.

*Diodia teres* Walt. No. 1654, rocky soil, open pine forest above Uruapan, 3,200 feet.

*Galium Aschenbornii* Schauer. No. 1622, shaded, rocky ledge in barranca, Acahuato, 3,000 feet.

*Galium mexicanum* HBK. Nos. 663, 1124; vine climbing on small trees, Cerro Tancitaro, 9,300 feet.

*Guettarda elliptica* Sw. No. 1411, tree fifteen feet high, arid scrub forest four miles west of Apatzingan, 1,200 feet; No. 1677, shrub ten feet high, growing in shade on the side of a barranca, along trail from Apatzingan to Tancitaro, 3,200 feet.

*Hamelia xorullensis* HBK. No. 1420, shrub three feet high, damp ravine, La Cañada, 4,000 feet; No. 1564, tree fifteen feet high, growing beside stream in a canyon below Acahuato, 2,000 feet; No. 1644, shrub seven feet high, open pine forest, 3,200 feet.

*Hintonia latiflora* (M. & S.) Bullock. No. 1553, tree eighteen feet high, flowers greenish-white, sweet-scented, arid scrub forest near La Majada, west of Apatzingan, 1,200 feet; only one specimen seen.

*Psychotria microdon* (DC.) Urb. No. 401, tree ten to fifteen feet high, growing beside the Río Apatzingan two miles south of Apatzingan, 1,200 feet.

*Psychotria papantlensis* (Oerst.) Hemsl. No. 1460, dense mesic forest near Hacienda California, 1,200 feet.

*Randia echinocarpa* M. & S. Crucillo. Nos. 1398, 1537, 1763, small tree or shrub up to fifteen feet high, trunks twisted and twining; very common throughout arid parts of the tropical zone, 1,000 to 2,500 feet.

*Randia laetevirens* Standl. Crucillo. No. 1429, shrub four to five feet high, thick transition forest near Hacienda California, 1,200 feet.

*Randia malacocarpa* Standl. No. 467, tree six to ten feet high, mesic forest near Río Apatzingan, two miles south of Apatzingan, 1,200 feet.

*Randia Nelsonii* Greenm. Nos. 1470, 1517, 1555; tree twenty to thirty-five feet high, common in arid scrub and transition scrub forests, becoming very common on arid slopes from 1,200 to 2,000 feet.

*Randia Watsonii* Rob. No. 470, shrub four to six feet high, growing in the thick transition scrub forest near the Río Apatzingan, two miles south of Apatzingan; common in arid scrub forest.

*Richardia scabra* L. No. 1292, rocky pasture land west of Uruapan, 6,000 feet; common.

#### CAPRIFOLIACEAE

*Viburnum Loeseneri* Graebner. No. 523, shrub five feet high, open pine forest north of Tancitaro, 6,500 feet; No. 646, tree ten to fifteen feet high, growing beside stream near trail from Tancitaro to Apatzingan, pine forest, 5,000 feet.

*Viburnum microphyllum* (Oerst.) Hemsl. No. 671, tree ten to fifteen feet high, rocky ridge on Cerro Tancitaro at about 9,500 feet; rare.

#### VALERIANACEAE

*Valeriana scorpioides* DC. No. 1254, herb, flowers white, *malpais* south of Uruapan, 5,600 feet; common in open situations.

#### CUCURBITACEAE

*Cyclanthera dissecta* Naud. No. 565, in partial shade, the Pedregal, 6,000 feet.

*Cyclanthera Langaei* Cogn. No. 728, vine climbing on trees and shrubs in cloud forest, Cerro Tancitaro, 8,000 feet.

*Cyclanthera pedata* Schrad. Nos. 357, 4037; vine climbing on trees and shrubs in damp cloud forest near stream in dense undergrowth, 8,000 feet.

*Maximowiczia tripartita* (Naud.) Cogn. No. 1437, climbing on small trees to a height of fifteen feet, dense transition scrub forest near Hacienda California, 1,200 feet.

*Melothria scabra* Naud. Nos. 1617, 1831; climbing over rocks on open ridges above Acahuato, 3,200 feet.

*Momordica Charantia* L. No. 417, vine climbing over small trees, flowers yellow, fruit bright orange, tuberculate, bright red inside, bank of Río San Antonio near Rancho El Capiri.

#### LOBELIACEAE

*Lobelia fenestralis* Cav. Nos. 369, 1793; very common herb in fields south of Tancítaro, 6,000 feet; one specimen found beside stream at 4,000 feet.

*Lobelia laxiflora* HBK. Nos. 348, 4015, 4038; shrub five to fifteen feet high, flowers orange-red, very conspicuous, fairly common but not abundant from the altitude of 6,000 feet or lower to above 8,500 feet; usually grows in fields or in the partial shade along the borders of fields and woods, but plants were found growing in dense shade of the cloud forest.

#### COMPOSITAE

*Achaetogeron affinis* Gray. Nos. 279, 1156, 1176; Cerro Tancítaro, common on open, grassy slopes above 10,500 feet, very abundant on the north slope of the mountain.

*Ageratum corymbosum* Zucc. No. 1813, flowers light blue, on the rocky side of a barranca, near Las Barranquillas, 3,800 feet.

*Aphanostephus ramosissimus* DC. Nos. 375, 384; open fields south of Tancítaro, 6,000 feet; common.

*Archibaccharis hirtella* (DC.) Heering. No. 1090, moist soil, deep barranca, Cerro San Miguel, 6,700 feet.

*Astranthium purpurascens* (Rob.) Larsen. No. 649, near the trail from Tancítaro to Apatzingan, 5,000 feet.

*Baccharis glutinosa* Pers. No. 580, shrub ten feet high, forming dense thickets along the edges of a field beside the Pedregal, 6,000 feet.

*Baccharis heterophylla* HBK. No. 1046, shrub six feet high, common along streams near the Pedregal, 6,000 feet.

*Baccharis ramulosa* (DC.) Gray. No. 535, small shrub, very common in pastures from 6,000 to 7,000 feet. The branches are used by the Indians for sweeping.

*Baccharis thesioides* HBK. No. 1786, shrub three feet high, open pasture near stream, Las Barranquillas, 4,000 feet; a common shrub in pastures and open woods up to 7,000 feet or higher.

*Bidens aequisquama* (Fern.) Sherff. No. 333, flowers purple, open meadow north of Tancítaro, 6,500 feet; No. 612, three to four feet high, open pasture along trail from Tancítaro to Apatzingan, 5,500 feet; not common.

*Bidens ostruthiooides* (DC.) Sch. Bip. Nos. 662, 1081, 4022, 4031; vine, flowers yellow, common in spruce forest and above to 10,000 feet, Cerro Tancítaro, also common in pine forest on Cerro San Miguel.

*Bidens Pringlei* Greenm. No. 1242, flowers white, *malpais* south of Uruapan, 5,600 feet; not common.

*Bidens triplinervia* HBK. Nos. 679, 1120; flowers yellow, common on rocky ridges on Cerro Tancítaro from 9,500 feet nearly to the summit.

*Brickellia paniculata* (Mill.) Rob. Nos. 1646, 1700; shrub two to six feet high, open pine forest above Acahuato, 3,200 feet.

*Cacalia Palmeri* Greene. Nos. 539, 542a, 639; flowers white; common in open pastures from 6,000 to 7,200 feet.

*Cacalia peltata* HBK. Nos. 1167, 1214; Cerro Tancítaro, common in moist soil in the cloud forest along streams and on rocky ridges up to 10,000 feet.

*Calea urticaefolia* (Mill.) DC. No. 1827, shrub three to five feet high, common in pine forest from 3,200 to 3,800 feet.

*Cirsium jorullense* (HBK.) Spreng. Nos. 700, 1179, 1166; plant usually two to four

feet high, flowers magenta, common on rocky ridges, found occasionally in open park-land, Cerro Tancitaro, 9,500 to 10,500 feet or higher.

*Cirsium acantholepis* (Hemsl.) Petrak. No. 4026, about three feet high, cloud forest, 8,000 feet.

*Cirsium nivale* (HBK.) Sch. Bip. No. 1180, flowers purple but heads appearing white from the dense tomentum of the involucle, plants one to two feet tall, found only on the north side of Cerro Tancitaro, from about 11,000 feet to near the summit; common.

*Conyza coronopifolia* HBK. No. 377, open field one mile south of Tancitaro, 6,000 feet.

*Cosmos carvifolius* Benth. No. 998, pine forest, near Rancho Santa Catarina, 6,000 feet.

*Cosmos parviflorus* HBK. No. 371, open field, one mile south of Tancitaro, 6,000 feet.

*Cosmos sulphureus* Cav. No. 1641, very common in cultivated fields near Acahuato, 3,200 feet.

*Dahlia coccinea* Cav. Nos. 590, 640; plants four to six feet high, flowers brilliant orange-red, moist, shady woods, usually among rocks, often growing on stone walls; common from 3,200 up to 7,200 feet or higher, but never abundant.

*Dahlia Merckii* Lehm. Nos. 273, 688, 1130; common in clefts of rocky, wet cliffs on Cerro Tancitaro, above 9,500 feet.

*Eclipta alba* (L.) Hassk. No. 489, growing in muck in an irrigation ditch, Apatzingan, 1,200 feet.

*Erigeron Karvinskianus* DC. No. 314, shady places in the Pedregal, 6,000 feet; No. 1055, growing on an overhanging dirt bank in a moist baranca four miles east of Tancitaro; common, 6,000 feet.

*Erigeron scaposus* DC. No. 534, waste field north of Tancitaro, 6,500 feet.

*Eupatorium Aschenbornianum* Schauer. No. 1160, flowers white, involucle pinkish, open ridges, above 9,500 feet, Cerro Tancitaro.

*Eupatorium Mairelianum* DC. Nos. 1193, 1200, 1203; shrub up to fifteen feet high, branches long and drooping, common in cloud forest from 8,200 to 9,500 feet, Cerro Tancitaro.

*Galeana pratensis* (HBK.) Rydb. No. 1296, open pasture west of Uruapan, very common, 6,000 feet; No. 1630, open pine forest and rocky fields above Acahuato, 3,200 feet.

*Galinsoga ciliata* (Raf.) Blake. No. 1299, open pasture west of Uruapan, 6,000 feet; very common.

*Gnaphalium attenuatum* DC. No. 1064, growing abundantly in moist soil in yard at Tancitaro, 6,000 feet.

*Gnaphalium oxyphyllum* DC. No. 1149, Cerro Tancitaro, cliff, 11,000 feet; common in open, grassy parkland and on rocky cliffs up to the summit.

*Gnaphalium spathulatum* Lam. No. 1173, in marshy meadow, north side of Cerro Tancitaro, 10,500 feet; not common.

*Gnaphalium Sprengelii* Hook. & Arn. No. 1152, common on rocky ledges near peak, 11,000 feet, Cerro Tancitaro.

*Guardiola tulocarpa* Gray. No. 1686, shrub four feet high, flowers white; common in open pine forest, 3,200 feet.

*Helenium ooclinium* Gray. No. 488, open pasture south of Apatzingan, 1,200 feet.

*Helioëpsis annua* Hemsl. No. 462, mesic forest near Rio Apatzingan, south of Apatzingan, 1,200 feet.

*Helioëpsis parviceps* Blake. No. 1370, common herb in open woods, yellow heads with black center, semi-desert scrub 4 miles west of Apatzingan, 1,200 feet.

*Heterotheca subaxillaris* (Lam.) Britt. & Rusby. No. 262, common locally in pastures throughout plateau, 6,500 feet; known locally as *árnica*.

*Hieracium absissum* Less. No. 596, the Pedregal, 6,000 feet; No. 1137, open pine forest, Cerro Tancitaro, above 9,500 feet; fairly common.

*Jaegeria macrocephala* Less. No. 1137, creeping herb in swamp, pine forest, 5,000 feet.

*Jaegeria hirta* (Lag.) Less. No. 1300, open pasture west of Uruapan, 6,000 feet.

*Liabum glabrum* Hemsl. No. 670, shrub eight to ten feet tall, Cerro Tancitaro, about 9,500 feet.

*Melampodium americanum* L. Nos. 387, 1298, 1567, 1589; common on arid slopes from 1,200 to 3,000 feet, and in open pine forest up to about 4,000 feet.

*Melampodium divaricatum* (L. Rich.) DC. Nos. 374, 457, 1333, 1337; common herb in the mesic forests of the river valley, found throughout the pine forest up to the plateau at 6,000 feet.

*Melampodium linearilobum* DC. No. 1480, arid slopes from 1,200 up to 2,500 feet; common locally.

*Melampodium oblongifolium* DC. No. 1631, open pine forest, 3,200 feet.

*Melampodium sericeum* Lag. No. 1653, open, rocky pastures above Acahuato, 3,200 feet; common.

#### *Pectis imitans* Standl., sp. nov.

Perennis erecta fere 30 cm. alta, basi lignescens, ubique sat dense ramosa, densiuscula foliata, caulis gracilibus rigidis teretibus glabris, interdum purpurascens; folia numerosa, anguste linearia, rigidiuscula, adscendentia, plerumque 1.5-3 cm. longa, 0.5 mm. lata, apice pungenti-setulosa, prope basin utroque latere setoso-ciliata, glabra, 1-nervia, utroque latere linea singula glandularum parvarum manifestarum onusta; capitula parva numerosa, terminalia et lateralia, pedicellis filiformibus glabris erectis 3-4 cm. longis; phyllaria 5 glabra ca. 5 mm. longa, oblongo-spathulata, acuta vel obtusa, vix ciliata; flores ca. 6, phyllariis 2-2.5 mm. longiores; corollae filiformi-tubulosae 4-4.5 mm. longae glabrae, lobis brevibus; flores disci steriles; achaenia vulgo 3, turbinato-linearia, ca. 3 mm. longa, glabra; pappi setae 5-6, filiformes, basi vix dilatatae, 4 mm. longae, erectae.

MEXICO: Michoacán: Arid sides of canyon below Acahuato, Municipaldad Apatzingan, alt. 2,500 ft., common, the flowers yellow, August 15, 1941, William C. Leavenworth & H. Hoogstraal 1563 (type in Herb. Chicago Nat. Hist. Mus.).

This plant does not fall satisfactorily into Rydberg's key to the species of *Pectis* in *North American Flora*. There it would, apparently, run at once to *P. imberbis* Gray, a more northern species with much larger flower heads, and very different in habit. It is excluded from the other arm of the key, which contains most of the species of the genus, by the very slender pappus setae, which scarcely can be considered as "squamefiae" in any sense of that word. The plant is well marked by its half-shrubby habit, from a hard woody base, and by the very slender, stiff, exceptionally narrow leaves, which have a conspicuous row of numerous close glands along each side.

#### *Pectis Leavenworthii* Standl., sp. nov.

Herba perennis, e radice lignescente nascens, caulis prostratis vel asdescendentibus, usque ad 23 cm. longis, rigidiusculis, simplicibus vel sparse erecto-ramosis, sat dense foliatis, interdum purpurascens, internodis plerumque foliis brevioribus, dense puberulis vel hispidulis; folia patentia rigidiuscula, linearis-oblonga vel linearis-lanceolata, plerumque 1.5-2 cm. longa, 3-4 mm. lata, apice obtusa vel subrotundata et setifera, basi utroque latere setis paucis elongatis pallidis aucta, canescens, glabra, 1-nervia, costa utrinque prominente, marginibus cartilagineo-incrassatis atque pallidis; capitula terminalia, longipedicellata, singula, pedicellis usque ad 5 cm. longis erectis, dense albo-puberulis; phyllaria 5, late spatulato-obovata, 7-9 mm. longa, ciliata, pallida, glabra, apice subtruncata vel rotundata, marginibus scariosis saepè purpureo tinctis, sparse glandulosa; flores radiiferi 5, ligulis anguste oblongis, ca. 1 cm. longis, floribus disci paucis, corollis 5-6 mm. longis, glabris; achaenia nigrescentia, anguste columnaria, 4-4.5 mm. longa, dense puberula; squamellae pappi florum disci 2, spatulato-oblongae, apice rotundatae vel obtusissimae, albidae.

MEXICO: Michoacán: Arid slope above Apatzingan, herb with yellow flowers, alt. 2,000 ft., August 13, 1941, William C. Leavenworth & H. Hoogstraal 1485 (type in Herb. Chicago Nat. Hist. Mus.). Above Apatzingan, 2,000 ft., common, August 7, 1940, Leavenworth 509.

The closest relative of the present species is *Pectis propetas* Greenm., described from Zacatecas and collected also in Guerrero. That is described as an annual, and differs

in having the stems pubescent only in lines, rather than densely puberulent on all sides, much shorter rays, and lance-acuminate pappus scales.

*Pectis liniifolia* L. No. 1504, arid slopes of Cerro Apatzingan, about 1,300 feet; common.

*Pectis prostrata* Cav. No. 1307, rocky pasture two miles west of Uruapan, 6,000 feet.

*Perymenium Berlandieri* DC. No. 1208, shrub eight or ten feet high, open cliff, Cerro Tancitaro, 9,500 feet, not common; No. 1660, tree ten feet high, open pine forest above Acahuato, 3,200 feet.

*Perymenium flexuosum* Greenm. Nos. 611, 1802; pine forest at 3,500 and 5,000 feet.

*Pinaropappus roseus* Less. No. 383, open field one mile south of Tancitaro, 6,000 feet.

*Piqueria pilosa* HBK. Nos. 289, 694a, 703, 1209, 4043; found in open situations from the plateau at 7,000 feet up to 10,000 feet or higher on Cerro Tancitaro; commonest on damp slopes below cliffs at about 10,000 feet.

*Piqueria trinervia* Cass. No. 245, open pasture north of Tancitaro, 6,500 feet.

*Porophyllum nutans* Rob. & Greenm. Nos. 1552, 1572; shrub four or five feet tall; common on steep, arid slopes of canyons, 1,500 to 2,500 feet.

*Sabazia Liebmanti* Klatt. No. 682, growing in shaded situations under alder, moist slopes below cliffs, Cerro Tancitaro, 10,000 feet.

*Sabazia sarmentosa* Less. No. 392, open pine forest, about 4,500 feet.

*Salmea Palmeri* Wats. Nos. 1647, 1696, 1702; shrub three to five feet high, common on open, rocky hillsides above Acahuato, 3,200 feet.

*Sclerocarpus uniserialis* (Hook.) B. & H. Nos. 1522, 1575; common on arid slopes from 2,000 to 3,000 feet.

*Senecio calcarius* HBK. No. 1151, common on well drained cliffs from 10,500 feet to summit, Cerro Tancitaro.

*Senecio platanifolius* Benth. No. 1205, shrub eight feet high, very common in the cloud forest beside streams on Cerro Tancitaro from 7,000 to 10,000 feet. In the lower part of its range it often reaches a height of fifteen or twenty feet and forms solid, dense stands wherever the tree cover allows enough light to come through.

*Senecio salignus* DC. Nos. 341, 589; shrub or small tree six to twelve feet tall, flowers yellow, fairly common along the borders of fields from 6,000 feet or lower up to 8,000 feet.

*Senecio Sanguisorbae* DC. Nos. 650, 722; herb up to twelve feet high, abundant locally in marshy places and beside streams up to 7,300 feet.

*Stevia jorullensis* HBK. No. 1216, rocky ledges, Cerro Tancitaro, 10,000 feet; common.

*Stevia lucida* Lag. Nos. 690, 1121, 1201, 1202, 1211; shrub two to twelve feet high, common on rocky ledges from 9,500 to 10,000 feet or higher, Cerro Tancitaro.

*Stevia rhombifolia* HBK. No. 1129, rocky ledge, 10,500 feet, Cerro Tancitaro; No. 1670, open slopes above Acahuato, 3,200 feet; No. 1822, pine forest, 3,500 feet, common.

*Tragoceros Schiedeanus* Less. No. 435, arid scrub forest near Rancho El Capiri, 1,000 feet.

*Tridax procumbens* L. Nos. 504, 1479; very common on open, lower slope of Cerro Apatzingan, about 1,500 feet.

*Trigonospermum hispidulum* Blake. No. 549, plant about four feet tall, the Pedregal, 6,000 feet.

*Trixis hyposericea* Wats. No. 1524, shrub four feet high, arid canyon below Acahuato, 1,500 feet.

*Trixis longifolia* Don. No. 1734, shrub two feet high, open arid slopes from 2,500 to 3,000 feet.

*Verbesina Greenmannii* Urban. No. 1225, shrub fifteen feet high, *malpais* south of Uruapan, 5,600 feet; No. 1782, shrub ten feet high, pine forest above La Presa, 3,600 feet; fairly common from 3,000 to 5,000 feet or higher.

*Verbesina tetraptera* DC. Nos. 1667, 1805; herb up to four feet high, open, rocky slopes above Acahuato, 3,200 feet.

*Vernonia Deppeana* Less. No. 1230, tree five feet high, *malpais* south of Uruapan, 5,600 feet.

*Zexmenia crocea* Gray. No. 1692, shrub three to four feet tall, flowers brilliant orange, open slopes above Acahuato, 3,200 feet.

*Zexmenia helianthoides* (DC.) Gray. No. 1669, shrub two to three feet high, open pine forest above Acahuato, 3,200 feet.

*Zexmenia hispida* (DC.) Gray. No. 1576, shrub about two feet high, arid slopes, 2,500 feet.

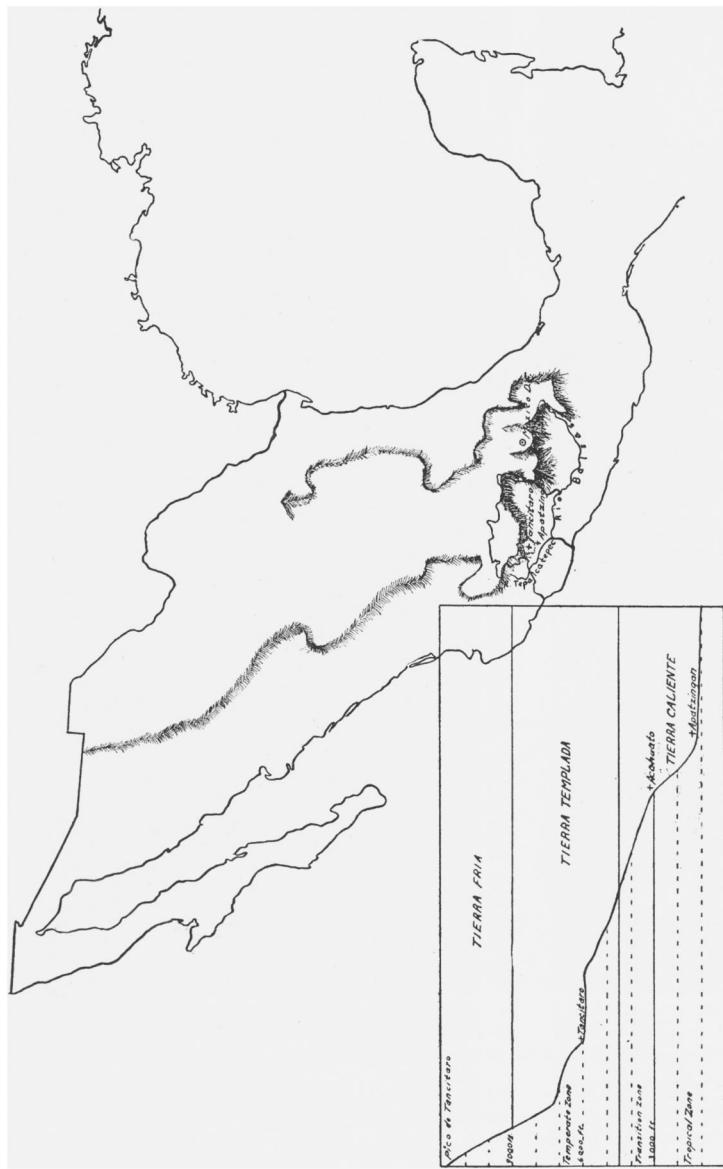
*Zinnia angustifolia* HBK. No. 1818, open pine forest, 3,500 feet; fairly common.

*Zinnia linearis* Benth. No. 391, open pine forest, 4,000 feet.

*Zinnia maritima* HBK. Nos. 510, 1488, 1579; open, arid slopes from 1,200 to 3,000 feet; very common.

#### ACKNOWLEDGMENTS

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Map showing the position of the Tanc.-Apatz Region to the rest of Mexican and to the Mesa Central.

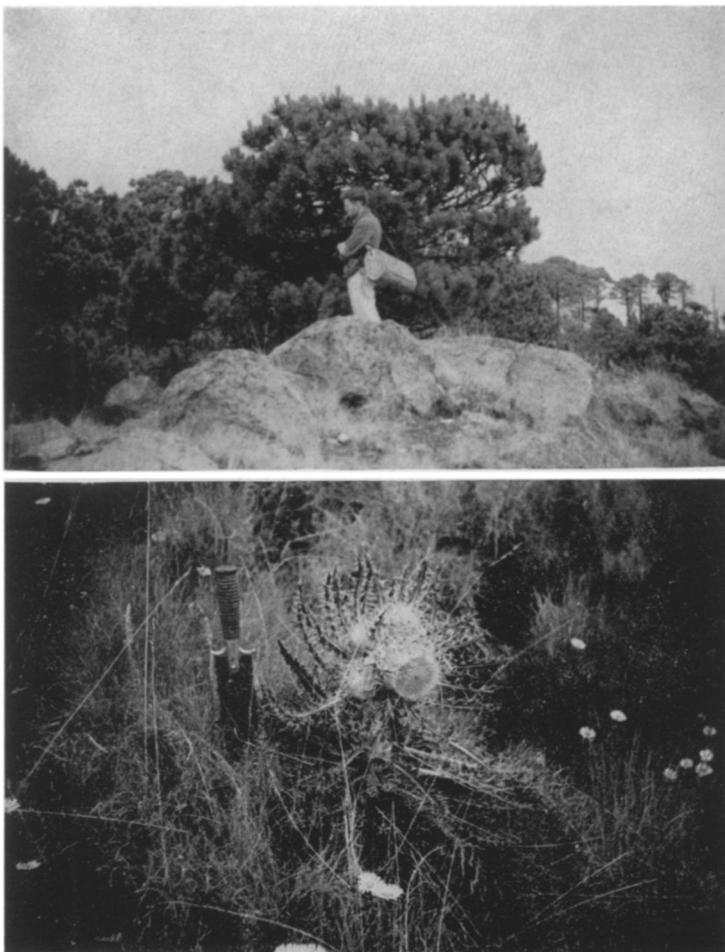


Fig. 1 (upper).—The summit of Cerro Tancitaro. Notice that although the pines in the foreground are slightly dwarfed, those in the distance show no effect of the altitude.

Fig. 2 (lower).—On the grassy slopes just below the peak *Cirsium nivale* is found in abundance. With it can be seen *Achaetogeron affinis*, *Habenaria limosa*, *Muhlenbergia virescens*, and another grass.

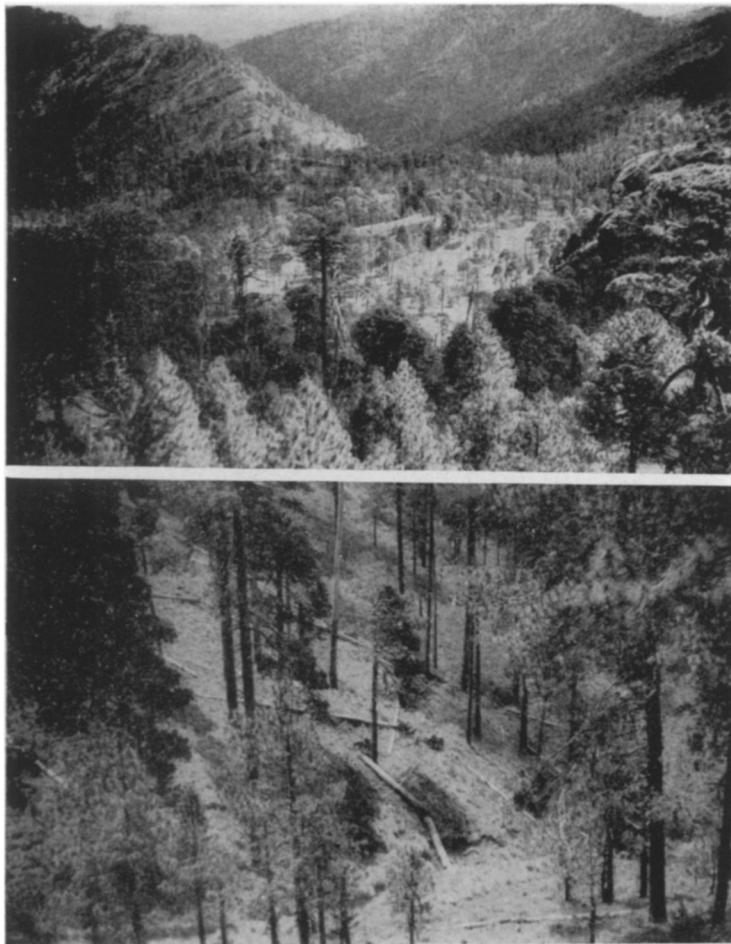


Fig. 3 (upper).—Looking northward from a ridge near the summit. The open pine parkland shown in this scene covers almost the entire mountain above an altitude of about 9,500 feet.

Fig. 4 (lower).—Near the head of a stream valley at 10,500 feet. This view, taken from the camp, shows the open character of the pine parkland at close range.



Fig. 5 (left).—A stand of alder at 9,800 feet. *Alnus arguta* is common on moist slopes above 9,500 feet, where it forms an important constituent of the mixed forest parkland. Above about 10,000 feet it is replaced entirely by pine. Fig. 6 (right).—Immediately above the cloud forest many of the trees are heavily covered with epiphytes, mostly lichens and ferns. The alder shown here was growing at an elevation slightly above 9,500 feet.

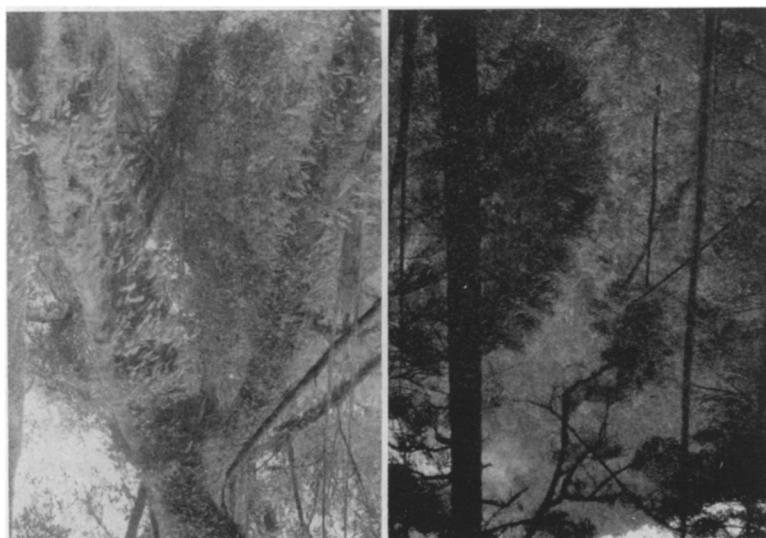


Fig. 7 (right).—Cloud forest at 9,000 feet. *Abies religiosa* forms solid stands on the

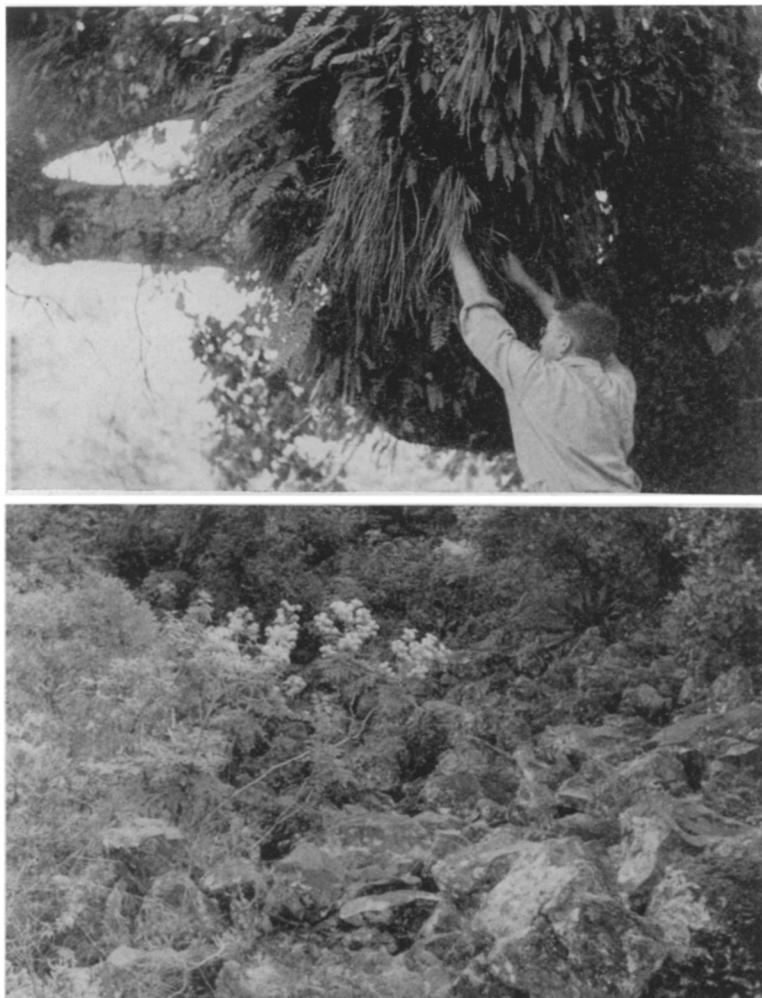


Fig. 9 (upper).—*Polypodium angustifolium* growing on *Quercus calophylla*, Cerro San Miguel, 6,700 feet. Most of the larger oaks on the plateau bear some epiphytic pteridophytes, but they lack the heavy bryophytic covering characteristic of the trees in the cloud forest.

Fig. 10 (lower).—A protected basin in the Pedregal, an extensive region of upturned volcanic rocks. The fern at the left is *Polypodium aureum*, the small tree with white flowers, *Coulterophytum Holwayi*, and the shrub on the extreme right, *Clusia Salvini*.

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steep sides of valleys at this elevation. A few shrubs and herbs grow in the dense shade of the fir forest, but lichens and mosses are the most conspicuous element of the vegetation. Fig. 8 (left).—A view of the cloud forest at 7,800 feet. At this elevation the trees are heavily festooned with hepaticas, mosses, and ferns. The trees here are *Meliosma dentata* and *Quercus laurina*.



Fig. 11 (upper).—A view of the open pine forest east of Tancítaro, at an elevation of about 6,000 feet. The parts of the plateau which are not under cultivation are covered for the most part by a similar open type of forest.

Fig. 12 (lower).—The lower limit of the pine forest, at 3,000 feet. In the right and left foreground are specimens of *Annona longiflora* and in the slopes below can be seen the upper limit of the arid scrub forest. In the background is the Sierra Madre del Sur.

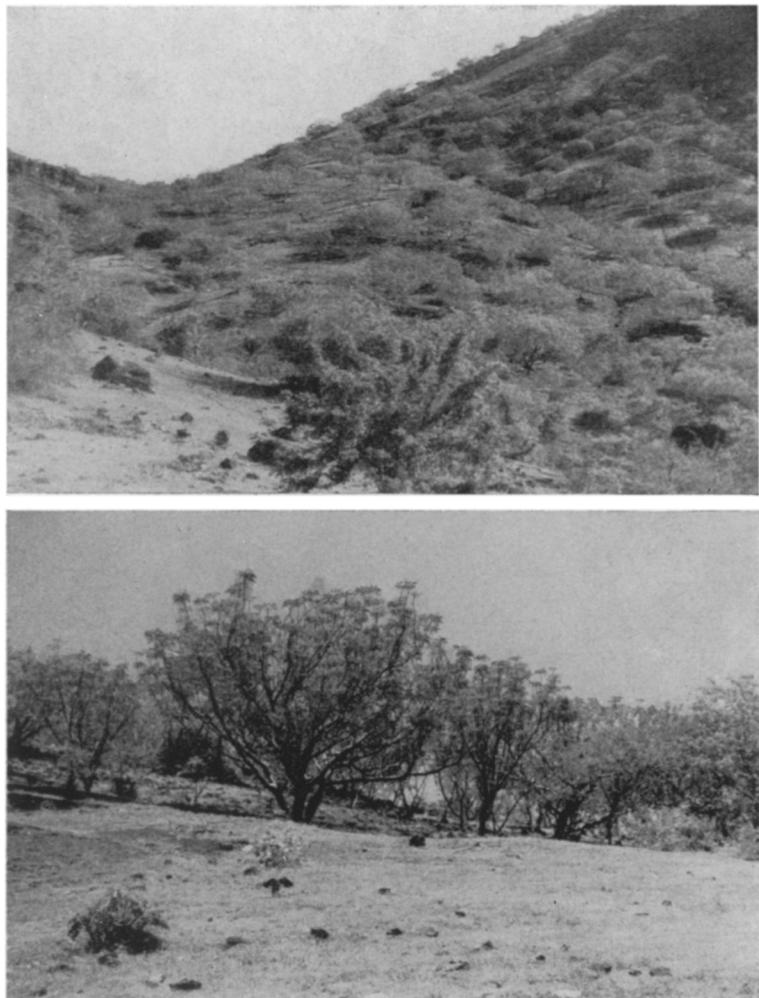


Fig. 13 (upper).—The homogeneous character of parts of the forest on the arid slopes below 3,000 feet is shown in this photograph. The trees in the background are almost entirely *Pseudosmodingium perniciosum*.

Fig. 14. (lower).—A closer view of the same type of forest as the above. *Pseudosmodingium perniciosum* in an almost solid stand on Cerro Apatzingan, 1,400 feet.

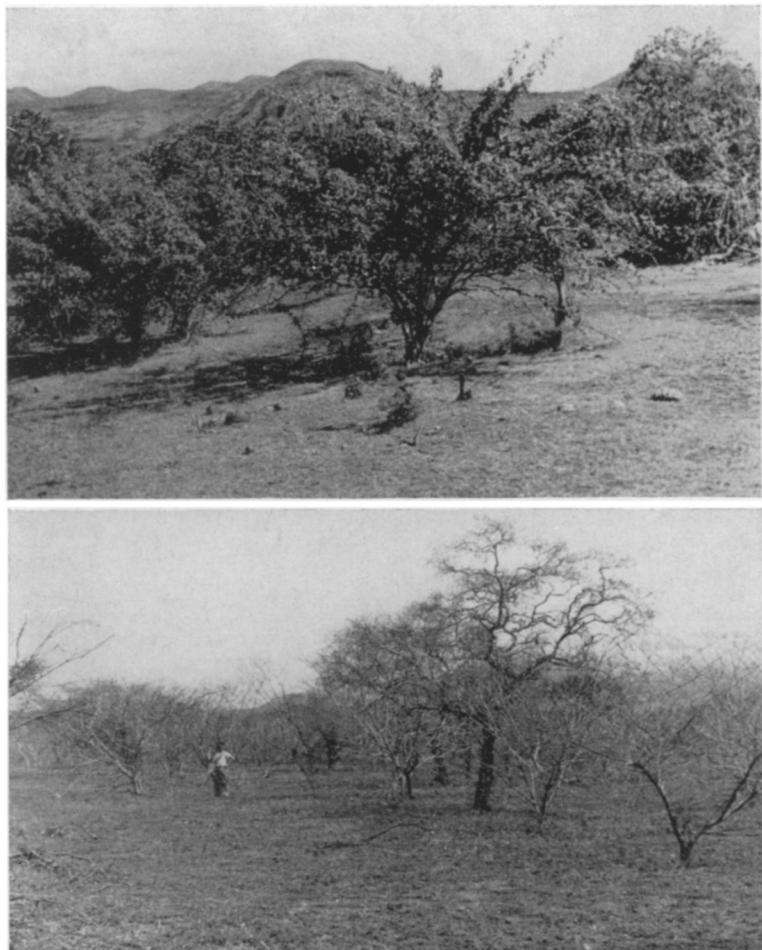


Fig. 15 (upper).—View of the open arid scrub forest near Apatzingan. The trees in the foreground are *Randia echinocarpa*.

Fig. 16 (lower).—The arid scrub forest near Rancho El Capiri on the Río Tepalcatepec. The trees here are almost entirely *Acacia cymbispina*. The large one to the right is *Zizyphus sonorensis*, one of the most widespread species in the arid scrub forest.

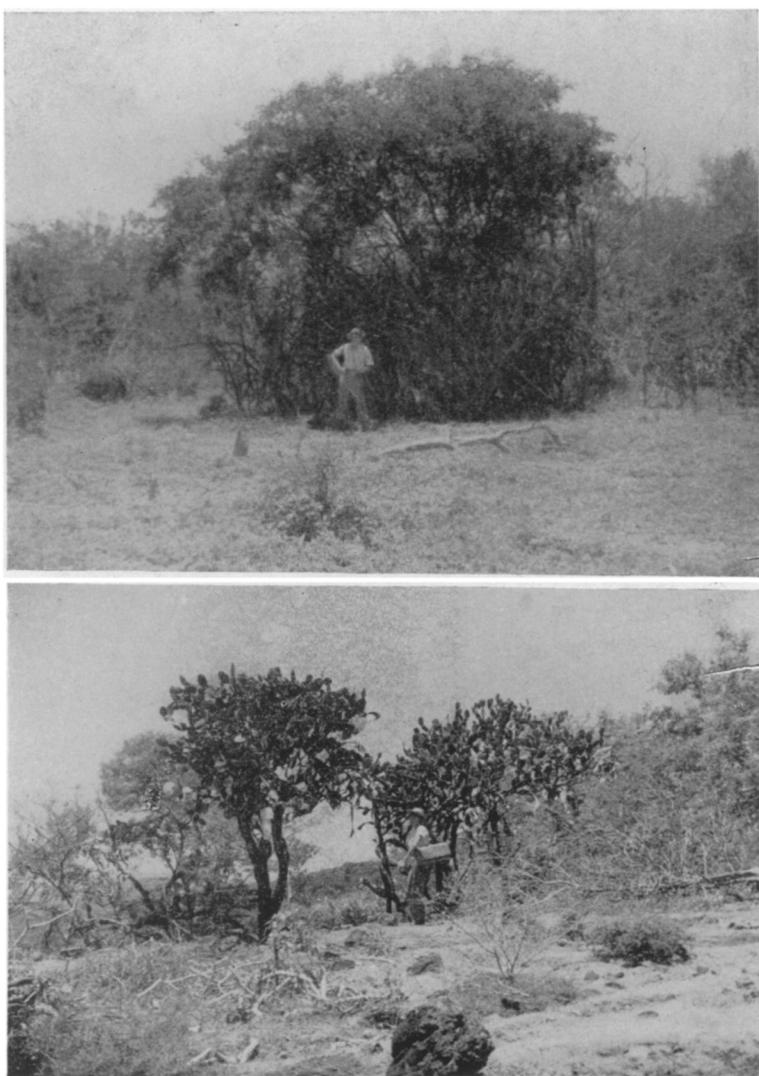


Fig. 17 (upper).—A colony of *Acanthocereus pentagonus*. This cactus, often associated with *Pachycereus pecten-aboriginum*, is common locally throughout the arid scrub forest, particularly in the vicinity of the river.

Fig. 18 (lower).—This giant *Opuntia* is a prominent species of the arid slopes between 1,200 and about 1,400 feet. It is abundant on the lower slopes of Cerro Apatzingan, where this photograph was taken.

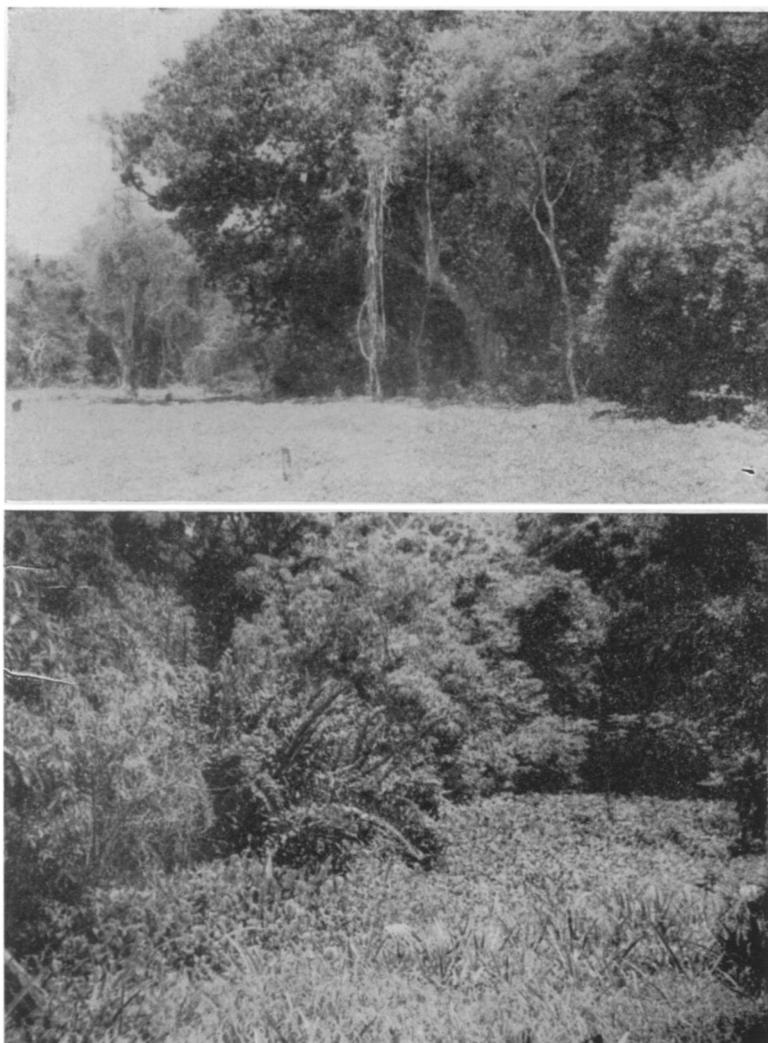


Fig. 19 (upper).—Tropical deciduous forest south of Apatzingan. Near the streams or in low areas where there is an adequate supply of ground water flourishes a forest of large mesic species, among them *Sideroxylon*, *Calocarpum*, *Trichilia*, *Brosimum*, and several species of *Ficus*.

Fig. 20 (lower).—A swamp in the thick tropical deciduous forest near La Majada. Where low-lying areas are not yet drained, flourish the remnants of once impenetrable swamps. The large fern on the left is *Acrostichum danaeifolium*, *Eichhornia azurea* forms a solid mat on the surface of the water, and around the edge (foreground) is *Pancratium littorale*.