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**II**

**THE FLORA OF THE REVILLAGIGEDO ISLANDS**

BY

IVAN M. JOHNSTON

*Gray Herbarium of Harvard University*

The four Revillagigedo Islands, Socorro, San Benedicto, Roca Partida and Clarion, are a group of scattered and apparently distinct peaks projecting from deep water several hundred miles off the west coast of Mexico. In origin they are chiefly if not exclusively volcanic. They lie along lat. 19° N and are spread out over 200 miles of ocean from east to west. They are arid, uninhabited, and only rarely visited, and are the most isolated and remote bits of land claimed by Mexico.

As the exploration of the equally remote islands off the west coast of South America has yielded such interesting botanical results, it is most surprising that the Revillagigedos, the most promising and remote islands off the west coast of Mexico and Central America, have never had a detailed floristic study. The floristic literature concerning the islands is most fragmentary and scattered. It consists chiefly of two short, very incomplete lists that were published over 30 years ago. With the increased interest that has since developed in insular floras and in the problems they present in plant dispersal, there has come a distinct need for a detailed enumeration and analysis of the flora of the Revillagigedos. I am, accordingly, presenting in this paper a critically prepared catalogue of the insular species





and have given such data as bear upon the floristic relationships and origin of the flora of the islands. While more collecting must be done on the islands, particularly upon Socorro, and especially during the rainy season, before the flora is completely known, I believe that the data I have been able to present here are sufficient to give a reasonably good general idea of the island-flora and of its relationship to the flora of the continent.

### BOTANICAL EXPLORATION

Although the islands were discovered in 1533 [cf. McLellan, *Science*, n. s., 62: 172 (1925)], the first recorded botanical work done upon them appears to have been that of George Barclay, botanist on the "Sulphur", who collected on Clarion December 29, 1839. In Capt. Belcher's *Narrative of the Voyage of the Sulphur*, 1: 349 (1843), are found the first comments on the flora of the islands by any one of botanical experience. Concerning Clarion Island [Barclay was unable to land on Socorro] Captain Belcher remarks:— Mr. Barclay notices, "*Argyrea rosea* [*Ipomoea halierca*], and a species of ruta [*? Tribulus*], run along the sand, the former extending upwards of 25 feet in length. *Cassia pendula* [*? Calliandra*], *Guilandina bonducella* [*Caesalpinia crista*], and a species of tetranthera [*? Irisine*], are among the plants which I found upon higher ground. *Convolvulus purpurea* [*Ipomoea cathartica*], and two species of phaseolus [*Phaseolus atropurpureus* and *? Canavalia apiculata*], are abundant in the ravines; and a species of euphorbia [*E. anthonyi*], like the species heterophylla, and prickly pears [*Opuntia* sp.], cover the ground in many places, and form a kind of stage for the leguminous plants to run upon." These notes are obviously from Barclay's manuscript journal, a portion of which I have seen, thanks to the kindness of Captain Ramsbottom of the British Museum of Natural History. The only other species mentioned in his journal are *Sophora tomentosa* and *Dodonaea viscosa*. The plants collected during the 1836-42 cruise of the "Sulphur" were studied by George Bentham and treated in his well known *Botany of the Voyage of the Sulphur*, which was published in 1844 and 1845. A search through this volume



has failed to disclose a single reference to Clarion Island or the Revillagigedos. It is quite possible that Barclay's Clarion collections were among those he mentions in his journal, under June, 1837, as having been ruined by damp storage on board ship. If his specimens are still extant they may be preserved in the herbarium of the British Museum of Natural History.

The real beginning of the botanical exploration of the islands occurred in 1889 with the visit of the "Albatross". Anchorages were made at Sulphur Bay, Clarion Island, March 4-5; at Braithwaite Bay, Socorro Island, March 8-9; and along the east side of San Benedicto Island on March 10. Botanical collections were made on Clarion and Socorro by Charles H. Townsend, the ornithologist of the voyage. These were studied by Vasey and Rose and formed the basis of their paper, Proc. U. S. Nat. Mus. 13: 145-149 (1890), entitled "Plants collected in 1889 at Socorro and Clarion Islands, Pacific Ocean." This remains the longest paper that has yet been published on the insular flora and the only one to date devoted exclusively to it. Twelve species were reported from Clarion and 19 from Socorro. Townsend did get to the crest of the main ridge of Clarion, but from his notes and collections it is obvious that his botanizing on Socorro was confined to the lower slopes near the sea. Consequently, his collections lack the distinctive plants of the islands, the numerous endemics growing on the higher slopes of Socorro. His most interesting discoveries were *Teucrium townsendii* on Clarion, and *Perityle socorrosensis* on Socorro. He did obtain material of the endemic species of *Borreria*, *Ipomoea*, *Euphorbia*, *Eri-geron* and *Stenophyllus*, but this was neither sufficient nor good enough to be described by Vasey and Rose. The complete first set of Townsend's collections is in the U. S. National Herbarium. A good set of duplicates is to be found in the Gray Herbarium. His specimens were not numbered.

It was not until 1897, when the islands were visited by the "Wahlberg", that the really distinctive features and the riches of the Revillagigedo flora were discovered. This schooner, fitted for exploration and in charge of A. W. Anthony, the ornithologist, spent more than a month among the islands. Over two weeks, early in May, were devoted to a visit to Socorro where three anchorages were made, "two on the south side and one in a little bay on the north". Well over a week



was spent on Clarion at anchor in Sulphur Bay. Three different stops were made at San Benedicto, with the anchorages all being made on the southeast side of the island. The botanizing on the islands was done by A. L. Stockton, a young nephew of Katherine Brandegee. His collections were the first made on San Benedicto and the first obtained on the middle slopes of Socorro. Many of the endemic species of the latter island were consequently first collected by him. Stockton's collections were turned over to T. S. Brandegee for study and distribution. The direct result was the appearance in December, 1898, of a paper by Brandegee, *Erythea* 7: 1-9, entitled "New Species of Plants from Mexico", in which 11 new species were described from the islands, 8 of them being from Socorro alone. A year and a half later Brandegee, *Zoe* 5: 19-28 (1900), published his paper entitled, "Voyage of the *Wahlberg*", the last two pages of which contain bare lists giving the species then known from each of the Revillagigedo Islands. This list has remained the most complete exposition of the flora to date. In it, 5 species are attributed to San Benedicto, 27 to Clarion and 41 to Socorro.

Although Stockton collected the specimens, it should be noted that they were distributed and were cited in Brandegee's papers under Anthony's name. Duplicates of these collections have been distributed widely, in all cases, except the original collection of *Nicotiana stocktoni*, with only Anthony's name on the label. Consequently in the present paper I have followed the labels and have attributed the collections to Anthony. It is difficult to estimate the size of the total collection. Certain specimens, probably those of which a goodly number of duplicates were obtained, were distributed in numbered sets accompanied by completely printed labels. There is, however, certainly an equally large, if not larger number of collections that are unnumbered, and which have hand-written labels. These probably represent those collections of which very few or no duplicates were obtained. Notes I have assembled show that the numbered collections were allotted as follows, 369-372 for San Benedicto, 375-401 for Socorro, and 403-417 for Clarion. Of the total series of numbers, 369-417, I have not seen 373, 374, 402 nor 407. Number 394 has been applied to both *Zanthoxylum* and *Coreopsis* and number 405 to both *Lepidium* and *Canavalia*. Number 371, *Stenophyllus*, has ap-



peared on labels transposed as 317. I have record of 25 unnumbered collections not represented in the numbered series. No doubt there are others that I have not encountered. As my records stand, however, Stockton's botanizing resulted in 6 collections from San Benedicto, 25 from Clarion and 41 from Socorro. The labeling of the collection seems to be prevailingly reliable. In fact, the only questionable labeling is that on the original collection of *Nicotiana stocktoni*. This species is given as from Socorro although I suspect it really came from Clarion. Though Brandege lists *Scaevola* from Socorro, the specimens that he distributed are labeled as from Clarion. In this case I believe the label is correct. The full set of the Stockton collections is preserved in the herbarium of the University of California. The first set of duplicates of Stockton's plants is in the Gray Herbarium.

The next event in the botanical exploration of the islands was the visit there, between May 14 and July 9, 1903, of an expedition sent out by the California Academy of Sciences. The botanical collecting on the expedition was done by Fredrick E. Barkelew. His collections were being studied by Alice Eastwood when they were destroyed, along with her notes, in the San Francisco disaster of 1906. Fortunately, however, duplicates of Barkelew's collections had been sent out previously to various institutions in the United States. The best sets are now at the University of California and in the Gray Herbarium.

The expedition spent May 14-26 anchored off San Benedicto, from May 27 to July 2 exploring Socorro, and July 6-8 visiting Clarion. A letter to Joseph R. Slevin from Rollo H. Beck, head of the expedition, kindly forwarded me by Dr. Evermann, gives the following details of the botanist's activities:—"A young man named Barkelew collected some specimens and my notes contain the following: Ensenada, April 30, 1903, 100 specimens; San Martens Is., May 3, few plants; San Benedicto, May 15, 6 species taken; Socorro, May 27 to July 2, Barkelew found about 70 species; Clarion, July 6 and 8, quite a few flowers." It is especially to be noted that the expedition did visit Clarion, that Barkelew did collect there, and that the dates, May 27-July 3, 1903, written in on many labels of Barkelew's collections, properly apply only to the visit to Socorro.



While Barkelew's collections contain a goodly number of species not previously obtained on the islands—for he appears to have been the first to botanize on the higher slopes of Socorro—their value is greatly lessened by the very questionable geographic data that accompany at least some of his specimens. His specimens are attributed on the printed labels only to Socorro and San Benedicto. I have seen none of his collections labeled as from Clarion, although he is known to have collected there. I am, however, quite certain that some of the specimens, given as from Socorro, are mislabeled and came in fact from Clarion. The clearest cases seem to be *Caesalpinia* (no. 207), *Ipomoea* (no. 245), *Sophora* (no. 246), *Melochia* (no. 247), *Phaseolus* (no. 248) and *Cressa* (no. 252). Doubtless there are other similar cases of confusion which I have not detected. A collection of *Dodonaea* (no. 188) labeled as from San Benedicto is also questionable. That shrub is not otherwise known from San Benedicto, a fact which seems significant when it is realized that Barkelew does not have collections from Socorro and Clarion where it is a conspicuous plant.

I have assembled all the data I could, regarding Barkelew's collections. This indicates that his Revillagigedo collections fall in the gamut of numbers 169-252. I have seen a few collections that are unnumbered. The numbers 169-176 are all associated with plants attributed to San Benedicto. The remaining ones seen by me, except the *Dodonaea* (no. 188) which I have mentioned, are all labeled as from Socorro. I have not seen the specimens associated with the following numbers: 185, 186, 195, 209, 212, 213, 219, 226, 234, 235, 237-41 and 249-251.

The most recent explorations of the Revillagigedos were those made by the California Academy of Sciences in 1925. During this expedition, anchorages were made at Sulphur Bay, Clarion Island, from April 26 to May 1; at Braithwaite Bay, Socorro Island, from May 2-11; and on the east side of San Benedicto on May 12. A detailed account of the expedition, with maps, has been given by Hanna, Proc. Calif. Acad. Sci., ser. 4, 15: 29-66 (1926). The botanist was Herbert L. Mason. Forty-four collections (nos. 1550-1593) were made on Clarion, 83 (nos. 1596-1678) on Socorro, and 9 (nos. 1680-1688) on San Benedicto. Mason reached the summit of



Socorro and appears to have made the first botanical collections ever obtained there. His collections are reported upon for the first time in the present paper. The first set and all type-specimens in his collections are deposited in the Herbarium of the California Academy of Sciences. A set of duplicates has been presented to the Gray Herbarium, by the California Academy of Sciences.

Although several large collections have been made in the Revillagigedo Islands they still remain a promising field for further botanical work. Each succeeding exploration has discovered additional undescribed species and has found more continental species not previously reported for its flora. Further collecting, especially on Socorro and particularly on its higher slopes, will doubtless add more species, especially if carried on, not in the dry months of May and June as previously, but in the growing season during the period of occasional showers from August to December. Careful and extensive collecting at a favorable time will probably show that we now know only about 75%, or even less, of the total insular flora.

While the discovery of each species additional to the recorded flora of the islands is of some scientific interest and is a source of personal satisfaction for the collector, the most important botanical work now awaiting attention on the islands concerns not species so much as the vegetation and the living plant. The past collectors on the islands have been quite satisfied in making a single collection of each species found on each of the islands. No attempt has been made to make repeated collections either to show variation of the plants or their distribution on particular islands. There is almost nothing on record regarding the abundance, habits, stature, habitats, associates, flower-color, etc., of the various plants of the islands. Few, if any, notes have been made which would permit the botanists who have not visited the islands to visualize the living plant and see it in relation to its environment. The plant ecology of the islands is an untouched subject.

Future collecting on the islands promises not only the discovery of heretofore unrecorded species and presents the opportunity for much needed and valuable observation on the habits of the species and their ecological relations, but offers,



in addition, the chance to check critically in the field the list of species now reported from the several islands. Each of the islands has a rather distinctive flora. This has been here and there obscured by questionable records, traceable, no doubt, to mislabeling that has resulted from a mixing of collections from different islands. Not only should collectors maintain the most scrupulous accuracy in the data for their own specimens, but they can, by their notations that certain records could not be verified despite alert and continued watchfulness on the islands, give us more basis to doubt these questionable records and eventually permit us to disregard them as almost certainly false.

### SOCORRO AND ITS FLORA

Socorro, the largest of the Revillagigedos, is roughly quadrangular in shore-line with a long axis, lying NW to SE, of about 9<sup>1</sup> miles in length. Its width varies from about 7 miles at the NW end to about 4 miles at the SE. The island contains approximately 50 square miles. The topography is simple, the land sloping from the shore prevailingly upward towards the center of the island. Socorro is, hence, a broadly conical peak. Its summit is 1130 meters above the sea. In structure the island appears to be entirely volcanic, the central peak, in fact, being a small quiescent volcano that has been reported in eruption as late as 1848. Such volcanic activity, however, does not appear to have been of a devastating nature, at least for a good many centuries. The biota of the island indicates a considerable antiquity.

The island is situated at about lat. 18° 50' N and long. 111° 00' W. It lies about 260 miles S by W from the tip of the peninsula of Lower California and about 320 miles WSW from Cape Corrientes (in Jalisco), the most westerly point on the mid-section of the Pacific coast of the Mexican mainland. From Maria Madre, the largest of the Tres Marias Islands, it lies 310 miles away SW by W. The land nearest to Socorro is the island of San Benedicto which lies only about

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<sup>1</sup> Since the only surveys of the islands have been by navigators and the best maps, consequently, are navigation charts, I have given distances in and about the islands in nautical miles (roughly 6080 ft. or 1853 meters). All other measurements are in the metric system.



25 miles away to the NNE. The small barren, bird-rock, Roca Partida, lies over 80 miles away W by N. Clarion Island, the most remote member of the archipelago, is situated about 220 miles away to the westward. Socorro is separated from the close-lying San Benedicto by ocean depths of over 2900 meters. To the north and east of these two islands, however, and separating them from the peninsula and mainland of Mexico, are depths of over 3000 meters. To the west, between Socorro and Clarion, depths of 3600 meters are recorded. South and west of the archipelago the ocean is more than 4000 meters deep.

The climate of Socorro is an arid one and, except for the rare and local torrential storms that visit most desert areas, the precipitation is scanty. The upper slopes of the island, however, are favored with another source of moisture. These upper slopes, two to three times higher than those on the other Revillagigedos, reach into the strata of clouds borne on the trades and are thus benefited not only by a somewhat increased humidity and protection from the sun but to a greater or lesser extent by actual moisture obtained from the clouds. The only mesophytic flora on the islands, which have a prevailing xerophytic one, is found on these fog-brushed higher slopes of Socorro.

Concerning even the general features of the vegetation on Socorro there has been very little written. Anthony, Auk ser. 2, 15: 312 (1898), states that "The greater part of the island is covered with a very dense growth of underbrush, the weather side (north and northwest exposures) being especially thickly covered, making travel, except in favored spots, well nigh impossible. Trees are abundant on the weather side of the island but on the south and east sides they are mostly confined to cañons, and were smaller than on the north slopes. They were nowhere seen over forty or fifty feet in height, though usually covering considerable area with their broad spreading branches". The large trees mentioned are probably *Ficus cotinifolia*.

In Hanna's account, Proc. Calif. Acad. Sci., ser. 4, 15: 49-58 (1926), of the ascent of Mt. Evermann, the central peak of Socorro, there are passages which give more details concerning the vegetation and the physical features of the island. The party started from Braithwaite Bay at the south-



ern end of the island and ascended the peak from the eastern side. Dr. Hanna writes, "We set out northwest at first, up a small rocky gulch to escape as much as possible the stiff brush of the lowlands. This took us to a series of bare red hills which we crossed toward the mountain. Several gullies and ridges were crossed with great difficulty on account of the heavy brush. This was excessively fatiguing and half an hour after we left the beach all of us were drenched with perspiration. . . . On the way across the red hills (foothill section) we were impressed by some areas which were entirely barren of vegetation and at first we were at a loss for an explanation. Some parts were covered with dead brush, all flattened on the ground and pointing in the same direction. This indicated the action of water and we decided that the small section of the island had been visited by a great cloudburst at some previous time but probably subsequent to 1903. This supposition was fully proved next day when we found a box cañon leading down from the area to the sea. This was scoured out completely to bed rock while in front on the mouth there was an enormous quantity of boulders piled up. Such downpours as this must be of rare occurrence on Socorro because evidence elsewhere was lacking; in fact, most of the cañons indicated the passage of very insignificant quantities of water at any season. . . . About 11 a. m. we passed out of the zone of brush on the lower slopes of Mt. Evermann and entered the cañons which were densely forested with many kinds of strange trees. The traveling here was much easier and, to all of us, far more interesting. The trees were teeming with bird life, and the "Bumelia" trees afforded great quantities of delicious fruit, which we ate with relish. . . . One of the trees with white bark like a sycamore was about 40 feet high, one foot in diameter and bore long spikes of cream-white flowers. The fruit was about half an inch in diameter, pale green in color, and was not eaten by birds; therefore, we did not try it. The forests in the cañons were so dense that sunlight rarely penetrated to the ground; hence mosses, lichens, ferns and orchids were abundant on the trees and branches. Some of the Bumelia fruit trees were fully 50 feet high and although the larger trunks were irregular in growth they were at least five feet in diameter. What appeared to be canes of a species of blackberry grew to the extreme length of 200 feet but it had neither



fruit nor flowers and the identification could not be made with certainty. There was almost no underbrush in these cañons but the ridges and "hog-backs" were practically impassable, we learned through bitter experience during the afternoon. . . . Early in the evening, as the fogs of the mountain top closed in, we made our camp at the head of a heavily timbered cañon, and a fortunate choice this was, indeed. The fog passed over at each side and below us, but our camp was dry. This was a great relief because we had no bedding and the night was cold. A fire was kept up most of the night and we were fairly comfortable. The camp was made at an elevation, indicated by our barometer, as 2300 feet, seemingly an insignificant climb but the excessive heat and heavy brush wore us down. The temperature was only 82° to 88°F. during the day but it seemed much warmer than that. . . . After breaking camp [next morning] we climbed the obsidian ridge ahead of us, 200 feet and into the fog. Then we realized how fortunate we had been to select a dry camp site. The vegetation all about was drenched with the mist, yet there was not a drop of water to drink. . . . Evidently sheep frequent the open, brush-free summit because well beaten trails lead away in every direction. Some charred brush was found nearby in a position which indicated that a fire had passed through. Probably this was a remnant of the fire started by [the castaway] Grayson and which led to his rescue. He spoke of its having spread far and wide over the mountain-side before he was out of sight on his homeward journey. Even today the south side of the mountain is remarkably free of brush and is principally grown over with grass and some cactus. . . . From the top we were able to study the best means of approaching the mountain and found it unquestionably to be from Grayson's Cove. . . . Wooded cañons are absent on the south side [of the island] but are abundant on the north, east and west. Between them brush-covered ridges radiate outward like spokes in a wheel. . . . Careful search was made from the top in every direction for evidence of water but not a sign could be seen. To the eastward in one cañon there was a dry lake bed which unquestionably does contain a small amount of water during the rainy season. Up to this time we had thought there might be some reason for the supposition of Captain Colnett that a fresh-water lake existed on the island "because of the teal ducks"



found flying down to the sea. But with the unobstructed view we had we were thoroughly convinced that no permanent lake now exists on the island. It is barely possible that this dry lake bed did hold water throughout the year at the time of Capt. Colnett's visit and has silted up in the meantime. From what we saw of the erosion produced by a cloudburst on the east side of the island it seems entirely possible for a small lake to be entirely filled with sediment in one rainstorm."

The complete list of the flora of Socorro, with indications of the occurrence of the species on Clarion and San Benedicto, and a summary of their range off the archipelago, is given in the following tabulations:

NAME	San Benedicto	Clarion	DISTRIBUTION AND REMARKS
1. <i>Polystichum muricatum</i> .....	.....	.....	Guerrero to Costa Rica
2. <i>Asplenium potosinum</i> , var.....	.....	.....	San Luis Potosi
3. <i>Asplenium formosum</i> .....	.....	.....	Nayarit to Costa Rica; West Indies
4. <i>Adiantopsis radiata</i> .....	.....	.....	Vera Cruz to Guatemala; West Indies
5. <i>Pteridium caudatum</i> .....	.....	.....	Nayarit to Salvador; West Indies
6. <i>Polypodium polypodioides</i> .....	.....	.....	Sinaloa southward; West Indies
7. <i>Polypodium pulchrum</i> .....	.....	.....	Colima to Costa Rica
8. <i>Cheilanthes peninsularis</i> , var.....	.....	×	Endemic
9. <i>Psilotum nudum</i> .....	.....	.....	Jalisco southward; West Indies
10. <i>Eragrostis ciliaris</i> .....	.....	.....	Lower California southward; West Indies
11. <i>Jouvea pilosa</i> .....	.....	.....	Lower California to Nicaragua
12. <i>Sporobolus purpurascens</i> .....	.....	.....	Vera Cruz to Costa Rica; West Indies
13. <i>Aristida pansa</i> .....	.....	×	Arizona and Texas to San Luis Potosi
14. <i>Paspalum longum</i> .....	.....	.....	Endemic
15. <i>Setaria geniculata</i> .....	.....	.....	Lower California southward; West Indies
16. <i>Cenchrus myosuroides</i> .....	×	.....	Lower California to Puebla; West Indies
17. <i>Sorghastrum nutans</i> .....	.....	.....	Lower California to Guatemala
18. <i>Heteropogon contortus</i> .....	.....	.....	Lower California southward; West Indies
19. <i>Cyperus ligularis</i> .....	.....	.....	Tres Marias Islands southward; West Indies
20. <i>Cyperus duripes</i> .....	×	×	Endemic
21. <i>Cyperus</i> aff. <i>brunneus</i> .....	.....	.....	Central America, so. Mexico, West Indies
22. <i>Stenophyllus nesioticus</i> .....	×	?×	Endemic
23. <i>Pleurothallis unguicallosa</i> .....	.....	.....	Endemic
24. <i>Cattleya aurantiaca</i> .....	.....	.....	Michoacan to Costa Rica
25. <i>Epidendrum rigidum</i> .....	.....	.....	Oaxaca to Costa Rica; West Indies
26. <i>Peperomia chrysolepida</i> .....	.....	.....	Endemic
27. <i>Peperomia socorronis</i> .....	.....	.....	Endemic



NAME	San Benedicto	Clarion	DISTRIBUTION AND REMARKS
28. <i>Ficus cotinifolia</i> .....	.....	.....	Lower California to Costa Rica
29. <i>Phoradendron townsendi</i> .....	.....	.....	Endemic
30. <i>Aristolochia brevipes</i> .....	×	.....	Lower California to Oaxaca
31. <i>Boerhaavia caribaea</i> .....	.....	×	Lower California southward; West Indies
32. <i>Portulaca pilosa</i> .....	.....	×	Lower California southward; West Indies
33. <i>Rubus</i> sp.....	.....	.....	Affinities in southern Mexico
34. <i>Prunus capuli</i> .....	.....	.....	Lower California to Guatemala
35. <i>Calliandra socorroensis</i> .....	.....	×	Endemic
36. <i>Calliandra</i> sp.....	.....	.....	Affinities in western Mexico
37. ?? <i>Casalpinia crista</i> .....	.....	×	Record questionable
38. ?? <i>Sophora tomentosa</i> .....	.....	×	Record questionable
39. <i>Canavalia apiculata</i> .....	.....	×	Sinaloa to Colima
40. <i>Phaseolus lunatus</i> .....	.....	.....	Nayarit to Nicaragua; West Indies
41. ?? <i>Phaseolus atropurpureus</i> ...	.....	×	Record questionable
42. <i>Rhynchosia minima</i> .....	.....	.....	Lower California southward; West Indies
43. <i>Tribulus cistoides</i> .....	.....	×	Lower California southward; West Indies
44. <i>Zanthoxylum insulare</i> .....	.....	.....	Tres Marias Islands, West Indies and South America
45. <i>Bursera nesopola</i> .....	.....	.....	Endemic
46. <i>Croton masonii</i> .....	.....	.....	Endemic
47. <i>Acalypha umbrosa</i> .....	.....	.....	Endemic
48. <i>Hippomane mancinella</i> .....	.....	.....	Oaxaca southward; West Indies
49. <i>Euphorbia incerta</i> .....	.....	.....	Lower California to Tres Marias Islands
50. <i>Euphorbia anthonyi</i> var.....	×	.....	Endemic
51. <i>Ilex socorroensis</i> .....	.....	.....	Endemic
52. <i>Cardiospermum halicacabum</i> ..	.....	×	Lower California southward; West Indies. The Clarion plant is glabrate
53. <i>Dodonaea viscosa</i> .....	?	×	Lower California southward; West Indies
54. <i>Meliosma nesites</i> .....	.....	.....	Endemic
55. <i>Rhamnus discolor</i> .....	.....	.....	Oaxaca to Costa Rica
56. <i>Triumfetta socorrensis</i> .....	.....	.....	Endemic
57. <i>Abutilon californicum</i> .....	.....	.....	Lower California
58. <i>Sida rhombifolia</i> .....	.....	.....	Lower California southward; West Indies
59. <i>Sida nesogena</i> .....	.....	.....	Endemic
60. <i>Gossypium hirsutum</i> .....	.....	.....	Sinaloa southward; West Indies
61. ?? <i>Melochia pyramidata</i> .....	.....	×	Record questionable
62. <i>Waltheria americana</i> .....	.....	×	Lower California southward; West Indies
63. <i>Hypericum eastwoodianum</i> ...	.....	.....	Endemic
64. <i>Opuntia</i> sp.....	.....	?×	No specimens seen
65. <i>Conocarpus erecta</i> .....	.....	.....	Lower California southward; West Indies
66. <i>Psidium galapageium</i> .....	.....	.....	Galapagos Islands
67. <i>Psidium socorrense</i> .....	.....	.....	Endemic
68. <i>Oreopanax xalapense</i> .....	.....	.....	Oaxaca to Costa Rica



NAME	San Benedicto	Clarion	DISTRIBUTION AND REMARKS
69. <i>Bumelia socorrensis</i> .....			Endemic
70. <i>Forestiera rhamnifolia</i> .....			Vera Cruz; West Indies
71. <i>Metastelma</i> sp.....			Affinities Mexican
72. <i>Ipomoea triloba</i> .....			Lower California southward; West Indies
73. <i>Ipomoea pes-caprae</i> .....	×	×	Lower California southward; West Indies
74. ?? <i>Ipomoea cathartica</i> .....		×	Record questionable
75. ?? <i>Ipomoea halierea</i> .....		×	Record questionable
76. ?? <i>Cressa truxillensis</i> .....		×	Record questionable
77. <i>Cordia brevispicata</i> .....			Lower California to Salvador
78. <i>Tournefortia hartwegiana</i> .....			Lower California to Oaxaca
79. <i>Heliotropium curassavicum</i> ....		×	Lower California southward; West Indies
80. <i>Verbena litoralis</i> .....			Lower California southward; West Indies
81. <i>Lantana involucrata</i> .....			Lower California southward; West Indies
82. <i>Teucrium affine</i> , var.....			Endemic
83. <i>Sphacele hastata</i> .....			Lower California and Hawaii
84. <i>Physalis</i> sp.....			Affinities in so. Mexico and Central America
85. <i>Solanum madrense</i> .....			Sonora to Nicaragua
86. <i>Nicotiana nesophila</i> .....			Endemic
87. ?? <i>Nicotiana stocktoni</i> .....		×	Record questionable
88. <i>Cestrum pacificum</i> .....			Endemic
89. <i>Elytraria squamosa</i> .....			Lower California southward; West Indies
90. <i>Chiococca alba</i> .....			Lower California southward; West Indies
91. <i>Guettarda insularis</i> .....			Endemic
92. <i>Borreria nesiotica</i> .....		×	Endemic
93. <i>Galium mexicanum</i> .....			Sinaloa to Guatemala
94. ?? <i>Scævola plumierii</i> .....		×	Record questionable
95. <i>Vernonia littoralis</i> .....			Endemic
96. <i>Eupatorium pacificum</i> .....			Endemic
97. <i>Brickellia peninsularis</i> , var....		×	Endemic
98. <i>Erigeron socorrensis</i> .....			Endemic
99. <i>Gnaphalium attenuatum</i> .....			Jalisco to Costa Rica
100. <i>Coreopsis insularis</i> .....			Endemic
101. <i>Perityle socorrensis</i> .....	×	×	Endemic
102. <i>Viguiera deltoidea</i> , var.....			Lower California

There has, thus, been a total of 102 species reported from Socorro. Of these, however, I hold that 9 (*Caesalpinia*, *Sophora*, *Phaseolus*, *Melochia*, *Ipomoea* spp., *Cressa*, *Nicotiana* and *Scaevola*) have been included because of error in labeling the specimens. Excluding these 9, the statistics for the remaining 93 unquestioned members of the flora are as follows:



30 spp. (31%) occur also in Lower California. Of this group only 3 (*Abutilon*, *Sphacele* and *Viguiera*) do not occur as well in Sonora or Sinaloa.

41 spp. (44%) occur also in the coastal states of the Mexican mainland north of southern Colima. Only 2 of this number do not also occur still further south.

13 spp. (14%) of the non-endemics do not occur in Lower California or from Sonora to Colima. The names and the ranges of these are:

*Polystichum muricatum* . . . Guerrero, Vera Cruz, Chiapas to Costa Rica

*Asplenium potosinum*, var. San Luis Potosi

*Adiantopsis radiata* . . . . . Vera Cruz and Yucatan to Guatemala; West Indies

*Sporobolus purpurascens* . . Vera Cruz to Costa Rica and West Indies

*Aristida pansa* . . . . . Arizona and Texas to San Luis Potosi

*Cyperus* aff. *brunneus* . . . Southern Mexico, Central America and West Indies

*Cattleya aurantiaca* . . . . . Michoacan, Oaxaca, Yucatan to Costa Rica

*Epidendrum rigidum* . . . . . Oaxaca and Vera Cruz to Costa Rica; West Indies

*Hippomane mancinella* . . . Oaxaca and Vera Cruz and south; West Indies

*Rhamnus discolor* . . . . . Oaxaca to Costa Rica

*Psidium galapageium* . . . . Galapagos Islands

*Oreopanax xalapense* . . . . Oaxaca to Costa Rica

*Forestiera rhamnifolia* . . . Vera Cruz; West Indies

34 spp. (36%) occur also in the West Indies.

5 spp. (5%) not identified.

31 spp. (33%) are endemic to the Revillagigedos. Of these,

23 are restricted to Socorro,

1 is restricted to Socorro and San Benedicto,

4 are restricted to Socorro and Clarion,

3 are restricted to Socorro, San Benedicto and Clarion.

## SAN BENEDICTO AND ITS FLORA

San Benedicto Island, lat. 19° 20' N, long. 110° 49' W, is the most northern and eastern of the Revillagigedos, and, excluding Roca Partida, the most barren of the group. Lying over 30 miles north of Socorro, it is separated from that island by depths of over 2900 meters. In shape it is elongate, being 3 miles long and averaging about a half-mile in width. It is a bold volcanic island rising very abruptly from the sea. The southern half of the island consists of an ash-cone, 297 meters high. The northern half is a plateau, 200 meters high,



largely built of lavas. No water is known on the island. Due, no doubt, to the scanty rains and the poverty of the soil and its porous nature, the flora of San Benedicto is a small one. The species reported from the island are as follows:

NAME	Socorro	Clarion	DISTRIBUTION AND REMARKS
1. <i>Eragrostis diversifolia</i> .....	.....	.....	Sinaloa and Colima
2. <i>Cenchrus myosuroides</i> .....	×	.....	Lower California to Puebla; West Indies
3. <i>Cyperus duripes</i> .....	×	×	Endemic
4. <i>Stenophyllus nesioticus</i> .....	×	?×	Endemic
5. <i>Aristolochia brevipes</i> .....	×	.....	Lower California to Oaxaca
6. <i>Euphorbia anthonyi</i> , var.....	×	.....	Endemic
7. ?? <i>Dodonaea viscosa</i> .....	×	×	Record questionable
8. <i>Ipomoea pes-caprae</i> .....	×	×	Lower California southward; West Indies
9. <i>Teucrium affine</i> , var.....	.....	.....	Endemic
10. <i>Erigeron crenatus</i> .....	.....	.....	Endemic
11. <i>Perityle socorrosensis</i> .....	×	×	Endemic

The most conspicuous member of the flora is the *Cenchrus*. It is said to be very common on the flats and other accessible areas where its extensive, head-high growths and its abundant burs, not only impede travel but make it very disagreeable. The only other plant present in any conspicuous abundance is the *Euphorbia*. Large slopes on the island are barren or have only a very meagre vegetation.

Excluding from consideration the *Dodonaea*, which I believe was erroneously attributed to the island, the statistics regarding the flora of San Benedicto are as follows:

3 spp. (33%) occur also in Lower California. These occur likewise in Sonora or Sinaloa.

4 spp. (40%) occur also in the coastal states of the Mexican mainland north of southern Colima; only one (*Eragrostis*) does not range further south.

None of the non-endemic species is absent from the region between Lower California and southern Colima.

2 spp. (20%) occur also in the West Indies.

6 spp. (60%) are endemic to the Revillagigedos. Of these,

2 are restricted to San Benedicto.

1 is restricted to San Benedicto and Socorro,

0 is restricted to San Benedicto and Clarion,

3 are restricted to San Benedicto, Socorro and Clarion.



The flora of San Benedicto has a very close and strong affinity with that of Socorro and was probably largely if not entirely derived from it. Of all the species found on the island only the *Eragrostis* is unknown from Socorro or does not have an immediate endemic relative there. This *Eragrostis* is known off San Benedicto only from a few collections in Sinaloa and Colima. It seems very strange that it could have reached San Benedicto, where it is common, and not also have attained Socorro. I shall be surprised if it is not eventually found on that island.

### CLARION AND ITS FLORA

Clarion Island, lat.  $18^{\circ} 22' N$ , long.  $114^{\circ} 44' W$ , is the most western of the Revillagigedo group and the most isolated. It lies over 200 miles to the west and slightly south of Socorro and is surrounded by ocean depths of over 3600 meters. In shape it is roughly oblong, having a length of about 5 miles and a width of about 2 miles. It is divided by elevated passes into three distinct hills, the highest one, that at the west end of the island, having an altitude of 335 meters. The eastern and western ends of the island are rough and precipitous. The northern side consists of a series of perpendicular, rocky cliffs, about a hundred meters in height, which culminate in the principal ridge of the island. From this ridge the land slopes, rapidly at first and then more gradually, to a plain which stretches from the foot of the hills to the sea in the neighborhood of the two sand beaches on the south side of the island. Black and brown basalt and red scoria are the most evident rocks. The hills are rounded by erosion and show few cañons of any size. Over most of the island there is a deep reddish brown soil that suggests antiquity. Undoubtedly erosion now takes place very slowly; the rainfall is slight but the island is well covered with vegetation.

According to Townsend, Proc. U. S. Nat. Mus. 13: 132 (1890), "The central portion [of the island] is a plateau about 1,000 feet high, with a few elevations perhaps 500 feet higher. It is mostly overgrown with long grass, head high, through which the pedestrian flounders helplessly; the slopes of the lesser elevations are clearer, with scattered bushes and



low, scrubby trees. I was not able to reach the plateau until after two hours of laborious struggle through the wilderness of cactus that covers its southern slopes, cutting nearly every yard of the way with a sharp *machete*. No other members of the party attempted it. Cactus renders all the lower portions of the island practically impassable. The island is probably without fresh water, although a small lagoon near the south beach contained slightly brackish water at the time of our visit there in March. Southerly gales would probably drive sea water into the lagoon and for a time at least render this wretched supply entirely worthless". Anthony, Auk ser. 2, 15: 312 (1898), describes it similarly,—“A few low trees or shrubs, the largest not over ten feet in height, are scattered along the main plateau, and in a few places reach the level ground that lies between the mesa and the coast on the south side. Nearly the entire flat between the mesa and the beach is covered with a dense growth of cactus (*Platopuntia*) over which has grown a mass of vines. Passage through this belt is only accomplished with diligent and constant use of the brush knife. A short distance from the beach were found two small shallow ponds which contain water during the rainy season only, but as the high tides evidently wash over the barriers and flood them with sea water it is doubtful if they are ever otherwise than brackish. At the time of our visit, in May, they had been dry for some months and no water was found anywhere on the island.”

The most notorious plant on Clarion, as the above quotations show, is the uncollected, unidentified, and probably unnamed species of *Opuntia* that forms the extensive, spiny thickets in a broad zone on the plain along the south side of the island. Interspersed among the large patches of this cactus are the two milky-juiced, shrubby Euphorbias, *E. anthonyi* var. and *E. californica*, and the thorny shrubs of *Zanthoxylum fagara*. The resulting spiny, thorny, and offensively milky barrier that is formed is entangled and overgrown by the vines of the brightly blue-flowered morning-glories, *Ipomoea cathartica* and *I. halierca*. The north slopes along the crest of the island are overgrown with *Cyperus duripes*, which forms the very coarse, rank, dense, grass-like growths noted by Townsend. *Tribulus*, because of its conspicuous yellow corollas, *Canavalia*, because of its large pods, and *Ipomoea pes-caprae*,



because of its very elongate stems, are the conspicuous plants along the beaches. The small brackish pools back of the beaches near Sulphur Bay are notable for the only occurrence on the islands of *Scirpus robustus* var., *Sapindus saponaria*, *Sida hederacea* and *Cressa truxillensis*. *Caesalpinia crista*, *Sophora tomentosa* and *Scaevola plumierii* occur near the beach on the south shore. These well known tropical American strand-shrubs or -trees are also not otherwise known in the archipelago. From the point of view of distribution and the problems they present in dispersal, the *Sophora* and the *Scaevola* rank among the most interesting plants on the island.

The complete list of the Clarion plants, with indications of their occurrence on Socorro and San Benedicto, and a summary of their range off the archipelago, is given in the following table:

NAME	Socorro	San Benedicto	DISTRIBUTION AND REMARKS
1. <i>Cheilanthes peninsularis</i> , var. . . . .	×	....	Endemic
2. <i>Sporobolus argutus</i> . . . . .	....	....	Lower California to Salvador
3. <i>Aristida pansa</i> . . . . .	×	....	Arizona and Texas to San Luis Potosi
4. <i>Erichloa acuminata</i> . . . . .	....	....	Lower California to Oaxaca
5. ? <i>Stenophyllus nesioticus</i> . . . . .	×	×	Endemic
6. <i>Cyperus duripes</i> . . . . .	×	×	Endemic
7. <i>Scirpus robustus</i> , var. . . . .	....	....	Lower California and Sonora northward
8. <i>Commelina virginica</i> . . . . .	....	....	Lower California southward; West Indies
9. <i>Irisine celosia</i> . . . . .	....	....	Lower California southward; West Indies
10. <i>Boerhaavia caribaea</i> . . . . .	×	....	Lower California southward; West Indies
11. <i>Sesuvium portulacastrum</i> . . . . .	....	....	Lower California southward; West Indies
12. <i>Portulaca pilosa</i> . . . . .	×	....	Lower California southward; West Indies
13. <i>Lepidium lasiocarpum</i> . . . . .	....	....	Lower California and Sinaloa northward
14. <i>Calliandra socorrensis</i> . . . . .	×	....	Endemic
15. <i>Cæsalpinia crista</i> . . . . .	?	....	Sinaloa southward; West Indies
16. <i>Sophora tomentosa</i> . . . . .	?	....	West Indies; tropics of Old World
17. <i>Canavalia apiculata</i> . . . . .	×	....	Sinaloa to Colima
18. <i>Phaseolus atropurpureus</i> . . . . .	?	....	Lower California to Salvador
19. <i>Galactia striata</i> . . . . .	....	....	Tres Marias Islands southward; West Indies
20. <i>Tribulus cistoides</i> . . . . .	×	....	Lower California southward; West Indies
21. <i>Zanthoxylum fagara</i> . . . . .	....	....	Lower California southward; West Indies
22. <i>Euphorbia californica</i> . . . . .	....	....	Lower California to Sinaloa
23. <i>Euphorbia anthonyi</i> , var. . . . .	....	....	Endemic



NAME	Socorro	San Benedicto	DISTRIBUTION AND REMARKS
24. <i>Cardiospermum halicacabum</i> ...	×	....	Lower California southward; West Indies. The Socorro plant is pubescent
25. <i>Sapindus saponaria</i> .....	....	....	Lower California southward; West Indies
26. <i>Dodonaea viscosa</i> .....	×	?	Lower California southward; West Indies
27. <i>Karwinskia humboldtiana</i> .....	....	....	Lower California to Guatemala
28. <i>Sida hederacea</i> .....	....	....	Lower California and Sonora northward
29. <i>Melochia pyramidata</i> .....	?	....	Lower California southward; West Indies
30. <i>Waltheria americana</i> .....	×	....	Lower California southward; West Indies
31. <i>Opuntia</i> sp.....	?	....	No specimens seen
32. <i>Ipomoea pes-caprae</i> .....	×	×	Lower California southward; West Indies
33. <i>Ipomoea cathartica</i> .....	?	....	Oaxaca to West Indies
34. <i>Ipomoea halierca</i> .....	?	....	Endemic
35. <i>Cressa truxillensis</i> .....	?	....	Lower California northward; also, Peru, Chile
36. <i>Heliotropium curassavicum</i> ....	×	....	Lower California southward; West Indies
37. <i>Teucrium townsendii</i> .....	....	....	Endemic
38. <i>Physalis angulata</i> .....	....	....	Central America; West Indies
39. <i>Nicotiana stocktoni</i> .....	?	....	Endemic
40. <i>Borreria nesiotica</i> .....	×	....	Endemic
41. <i>Scaevola plumierii</i> .....	?	....	Lower California, Galapagos, West Indies
42. <i>Brickellia peninsularis</i> , var.....	×	....	Endemic
43. <i>Perityle socorrosensis</i> .....	×	×	Endemic

Accepting the *Stenophyllus* as a member of the flora—although the record may be questionable—and disregarding some extremely doubtful records from Socorro, the statistics for the flora of Clarion are as follows:

23 spp. (53%) occur also in Lower California; of these only one (*Scaevola*) does not occur in Sonora or Sinaloa.

26 spp. (60%) occur also in the coastal states of the Mexican mainland north of southern Colima; only 5 of these do not occur still further south.

4 spp. (9%) of the non-endemic flora are not in the area between Lower California and southern Colima. These are,

*Aristida pansa*.....Arizona and Texas to San Luis Potosi

*Sophora tomentosa*....West Indies, northern South America, Old World

*Ipomoea cathartica*...Oaxaca, Yucatan, Central America, West Indies

*Physalis angulata*....Central America, West Indies



20 spp. (46%) occur also in the West Indies.

1 sp. (*Opuntia*) not identified.

11 spp. (26%) are endemic to the Revillagigedos. Of these,

4 are restricted to Clarion,

4 are restricted to Clarion and Socorro,

0 is restricted to Clarion and San Benedicto,

3 are restricted to Clarion, Socorro and San Benedicto.

## GENERAL FLORISTICS

By those whose interest in an insular flora is limited to a listing of its species, and who do not care for the distributional problems involved, the flora of the Revillagigedos would be characterized as of Mexican origin; and, upon noting that most of the insular species also occur in Lower California or in western Mexico, or commonly even in both these areas, it might be dismissed by them as having been transported by ocean-currents and winds from the east and northeast. Such a perfunctory characterization of the relationships and origins of the Revillagigedo flora does cover certain obvious facts and does account rather well for the larger part of the flora. It ignores, however, complications presented by a relatively small group of species and so passes over those problems which make the study of insular florulas of particular interest and which usually proves them to have had a much more involved history than was first apparent. It has seemed well, therefore, to give a detailed consideration and analysis of the distribution and affinities of the Revillagigedo flora. From the facts which I present it will be realized that the flora is much more than a chance gathering of species washed up by currents or blown in on the trades. It seems in fact to have been built up of widely distributed species, many of them probably rather recent arrivals on wind or wave, around a small relic flora derived from an old land-mass, perhaps now marked only by the islands, or from a continental connection, now long destroyed.

As now known, the vascular flora of the Revillagigedo Islands consists of 121 species and subspecies. Of this total, 5 are as yet unidentified. The 116 identified kinds, for convenience of discussion, may be said to consist of 37 endemic and 79 non-endemic species and subspecies. The 79 non-



endemics may be grouped and their distribution summarized as follows:

42 spp. (53%) occur also in Lower California; of these only 4 are not found also in Sonora or Sinaloa. These are:

*Abutilon californica* . . . Socorro and Lower California

*Sphacele hastata* . . . . . Socorro, Lower California, Hawaii

*Scaevola plumierii* . . . . . Clarion, Lower California, Galapagos,  
West Indies

*Viguiera deltoidea*, var. . Socorro and Lower California

59 spp. (75%) occur also in the coastal states of the Mexican mainland north of southern Colima; only 6 of these do not range further south.

16 spp. (20%) do not occur in the coastal states from Colima to Lower California. Of this group 8 occur also in the West Indies. Of the total 16 there are the following exclusive groupings,

7 spp. range from the Pacific states of so. Mexico into Central America. These are, *Polystichum*, *Cattleya*, *Epidendrum*, *Hippomane*, *Rhamnus*, *Oreopanax* and *Ipomoea*. Of these, 2 reach the West Indies.

3 spp. range from the Atlantic states of so. Mexico into Central America. These are *Adiantopsis*, *Sporobolus* and *Cyperus*. All extend into the West Indies.

1 sp. comes from San Luis Potosi (*Asplenium*).

1 sp. ranges from Arizona and Texas to San Luis Potosi (*Aristida*).

1 sp. ranges from Central America into the West Indies (*Physalis*).

1 sp. ranges through the West Indies into Vera Cruz (*Forestiera*).

1 sp. ranges in the West Indies, northern South America and the tropics of the Old World (*Sophora*).

1 sp. comes from the Galapagos Islands (*Psidium*).

63 spp. (80%) occur also in southern (Pacific and Atlantic) Mexico south of Colima, of which,

11 spp. do not reach north to Colima, and

5 spp. do not reach south into Central America.

49 spp. (63%) occur in the Pacific states of southern Mexico (south of Colima), of which,

7 spp. do not reach north to Colima and

3 spp. do not reach south into Central America.

55 spp. (70%) occur in Central America, all of which extend into continental Mexico and all but 11 of which extend into the West Indies.

46 spp. (58%) occur also in the West Indies.

A study of the above summary shows that 63 of the species and varieties, or 80% of the non-endemic flora of the archipelago, occur also on the peninsula of Lower California or in the coastal states of the Mexican mainland north and east of the islands; in other words on the nearest continental masses. Of this group, 38 of the species occur also in the West Indies



and hence range widely and have demonstrated their ability to cross ocean barriers. Since wind and ocean-currents are favorable, it seems, consequently, not improbable that some, if not all, of this group of species, may have gained the islands from the continent across the intervening ocean.

There remain, however, 16 species, or 20% of the non-endemic flora, which do not occur in the Pacific states of Mexico north of Colima. Of this number, *Cyperus*, *Hippomane* and *Ipomoea* are present in southern Mexico and are also widely distributed in the West Indies. Their presence on our islands is no cause for surprise. The *Hippomane*, particularly, being a seaside tree, is generally recognized as using ocean-currents in its dissemination. The others, with means less clear, have demonstrated their faculties for reaching islands. In a similar class is the *Physalis*. This is a weedy plant, distributed widely in the West Indies, but apparently rare on the continent. The four species just mentioned worry us little as to just how they attained our islands, for they seem capable of doing it, as they have shown in their success at similar tasks elsewhere. Of the remaining 12, out of the total 16 non-endemic species not present in western or peninsular Mexico, all present much more difficult and even quite imposing problems in distribution. The *Psidium* shows direct relations with the Galapagos Islands. The *Aristida* has relations in the interior of northern Mexico reminiscent of the relationships shown by the very striking insular endemic species of *Teucrium* and *Nicotiana*. The *Sophora*, not otherwise known on the Pacific side of America, is a widely distributed shore-plant of the West and East Indies. As a well known sea-disseminated plant it must have come from the West Indies, somehow crossing Central America, or from Polynesia across the Pacific on the Reverse Equatorial Drift to land on Clarion Island. There finally remain among the puzzling non-endemics, 3 ferns, 2 orchids and the *Sporobolus*, *Rhamnus*, *Oreopanax* and *Forestiera*. These latter 9 seem to indicate West Indian, southern Mexican or Central American affinities best discussed in connection with the endemic flora of the island.

The endemic flora of the Revillagigedos, as stated above, consists of 37 species and subspecies, or 31% of the entire identified flora of the archipelago. There are no endemic genera nor are any of the species sufficiently aberrant to have



merited even special subgeneric recognition. Most of the endemic species, however, are very distinct from the relatives off the islands, some of them to such a degree that their precise specific relationships are quite obscure. The list of the insular endemics, with an indication of their occurrence among the islands and some notes on their relationships, is given in the following table:

NAME	Socorro	San Benedicto	Clarion	RELATIONSHIP
1. <i>Cheilanthes peninsularis</i> , var. <i>insularis</i> .....	×	....	×	Peninsular
2. <i>Paspalum longum</i> .....	×	....	....	Caribbean
3. <i>Cyperus duripes</i> .....	×	×	×	Relations obscure; probably Mexican
4. <i>Stenophyllus nesioticus</i> .....	×	×	?×	Relations obscure; West Indian or Central American
5. <i>Pleurothallis unguicallosa</i> ....	×	....	....	West Indian
6. <i>Peperomia chrysolepida</i> ....	×	....	....	Southern Mexican and northern Central American
7. <i>Peperomia socorronis</i> .....	×	....	....	As above
8. <i>Phoradendron townsendi</i> ....	×	....	....	Weak species; relations from Nayarit to Central America and West Indies
9. <i>Calliandra socorrensis</i> .....	×	....	×	Weak species; relations in western Mexico
10. <i>Bursera nesopola</i> .....	×	....	....	Weak species; relations peninsular
11. <i>Croton masonii</i> .....	×	....	....	Relations very obscure, probably southern Mexican or Central American
12. <i>Acalypha umbrosa</i> .....	×	....	....	Peninsular
13. <i>Euphorbia anthonyi</i> .....	×	×	....	Relations obscure; probably Mexican
14. <i>Euphorbia anthonyi</i> , var. <i>clarionensis</i> .....	....	....	×	As above
15. <i>Ilex socorroensis</i> .....	×	....	....	West Indian
16. <i>Meliosma nesites</i> .....	×	....	....	Costa Rican
17. <i>Triumfetta socorrensis</i> .....	×	....	....	Relations obscure; probably southern Mex- ican or Central American
18. <i>Sida nesogena</i> .....	×	....	....	Weak species; western Mexican
19. <i>Hypericum eastwoodianum</i> ..	×	....	....	Relations very obscure; probably southern Mexican or Central American
20. <i>Psidium socorrense</i> .....	×	....	....	Relations on Socorro and Galapagos Islands
21. <i>Bumelia socorrensis</i> .....	×	....	....	Relations obscure; Mexican
22. <i>Ipomoea halierea</i> .....	?	....	×	Southern Mexican
23. <i>Teucrium townsendii</i> .....	....	....	×	Northern and eastern Mexican
24. <i>Teucrium affine</i> .....	×	....	....	As above



NAME	Socorro	San Benedicto	Clarion	RELATIONSHIP
25. <i>Teucrium affine</i> , var. <i>dentosum</i> .....		×	.....	As above
26. <i>Nicotiana nesophila</i> .....	×	.....	.....	Northeastern Mexican
27. <i>Nicotiana stocktoni</i> .....	?	.....	×	As above
28. <i>Cestrum pacificum</i> .....	×	.....	.....	Weak species; relative from Nayarit to Central America
29. <i>Guettarda insularis</i> .....	×	.....	.....	Weak species; relatives from Sinaloa to Colima, Yucatan and West Indies
30. <i>Borreria nesiotica</i> .....	×	.....	×	Relations obscure; tropical American
31. <i>Vernonia littoralis</i> .....	×	.....	.....	Guatemalan and southern Mexican
32. <i>Brickellia peninsularis</i> , var. <i>amphithalassa</i> .....	×	.....	×	Peninsular
33. <i>Eupatorium pacificum</i> .....	×	.....	.....	Southern Mexican
34. <i>Erigeron socorrensis</i> .....	×	.....	.....	Relations very obscure; Mexican or even Galapagean
35. <i>Erigeron crenatus</i> .....	.....	×	.....	As above
36. <i>Coreopsis insularis</i> .....	×	.....	.....	Southern Mexican
37. <i>Perityle socorrensis</i> .....	×	×	×	Peninsular

A study of this enumeration of the insular endemics shows that 5 of them (*Cheilanthes*, *Bursera*, *Acalypha*, *Brickellia* and *Perityle*) have relations on the peninsula of Lower California and that an additional 5 (*Phoradendron*, *Calliandra*, *Sida*, *Cestrum* and *Guettarda*) have relations in western Mexico. None of these 10 (27% of the total endemics) are exceptionally strong species, the most of them in fact being weak species and worthy of scarcely more than the rank of endemic insular varieties. The two species and the variety of *Teucrium* form a distinctive island group most nearly related to forms now occurring in northern and eastern Mexico and adjacent United States. The two species of *Nicotiana* are also immediately related and form a very distinct island group related most closely to habitually very dissimilar plants of northeastern Mexico.

The 15 plants just mentioned are northern or eastern in affinities. The remaining 22 are of uncertain relationship or are southern, Galapagean or West Indian in affinities. Of these there are 6 (*Peperomia* spp., *Ipomoea*, *Vernonia*, *Eupa-*



*torium* and *Coreopsis*) which have clear relationships in southern Mexico or Central America. The *Meliosma* is evidently related to a Costa Rican species. Three species, *Paspalum*, *Pleurothallis* and *Ilex*, have clear West Indian affinities. The *Psidium* is related to one common to the Galapagos and the Revillagigedos. The two curious shrubby species of *Erigeron* may also show a Galapagean relationship or may belong with four plants (*Cyperus*, *Euphorbia* sp. et var. and *Bumelia*) that have puzzling and obscure, although probably Mexican, affinity. To conclude the grouping of the endemics there are 5 very well-marked species, *Stenophyllus*, *Croton*, *Triumfetta*, *Hypericum* and *Borreria*, which, while of puzzling relationship, can at least be said to have no relations north or east of the islands. Their relations are no doubt obscure ones in southern Mexico or Central America.

With the exception of the species of *Nicotiana* and *Teucrium*, whose relations, it should be recalled, are not on the peninsula, or on the west coast of Mexico nearest the islands, the insular species of northern and eastern affinity are much less differentiated than those having their relatives on the continent to the southward or in the West Indies. Those endemics with close relatives on the peninsula and on the adjacent Mexican mainland are, I believe, more recent arrivals and, hence, younger than those much more differentiated species that have southern affinities. The southern types and those with affinities in northeastern Mexico are the old elements in the flora.

The data just given indicate the floristic relations of the Revillagigedos with the continent. A brief consideration should now be given to the relations with other islands and archipelagos. Those nearest the Revillagigedos are the Tres Marias Islands which rise from depths of less than a 1000 meters only 50-60 miles off the coast of Nayarit and to the northwest of Cape Corrientes in Jalisco. The most recent enumeration of the flora [Eastwood, Proc. Calif. Acad. Sci. ser. 4, 18: 442-468 (1929)], lists 324 vascular plants, of which only 19 are considered endemic. Although some of the species are peculiar to the islands and to the adjacent mainland, most of them are widely distributed in the American tropics. There are only 23 species common to the Tres Marias and the Revillagigedos, practically all of them being widely dispersed tropi-



cal ones. Only *Zanthoxylum insulare* is of any particular phytogeographic significance. This plant is known only from Socorro, Maria Madre, Jamaica and from northern and western South America. It represents, I believe, one of the old elements in our flora. There is absolutely no indication that the Tres Marias were ever directly connected with the Revillagigedos.

North of the Revillagigedos and far off the coast of Lower California lie Alijos Rock, a barren bird rock, and Guadalupe Island [cf. Eastwood, loc. cit. 394-420], an island with distinctly Californian, rather than tropical affinities. Clipperton Island, lat.  $10^{\circ} 17' S$  and long.  $109^{\circ} 13' W$ , far to the south of the Revillagigedos, is a low coral islet quite devoid of higher plants [cf. Snodgrass & Heller, Proc. Wash. Acad. Sci. 4: 501-504 (1902)]. Cocos Island, lat.  $5^{\circ} 32' N$  and  $87^{\circ} 00' W$ , well to the west of Panama, is a small, wet tropical island with a rank vegetation. Its known flora consists of about 100 species,<sup>2</sup> of which about 10 are endemic. The only species known to be common to Cocos and the Revillagigedos are *Setaria geniculata*, *Caesalpinia crista* and *Ipomoea pes-caprae*. They are all widely dispersed tropical species, two of them being strand plants.

There are about 21 species of the Revillagigedo flora present in the Galapagos Islands. Practically all of them are widely-ranging, more or less weedy, tropical species. The only noteworthy plants are *Psidium galapageium* and *Scaevola plumierii*. The significance of their distribution is quite obscure. Possibly the Socorro and the Galapagos *Psidium* have been derived from a common, now extinct ancestral stock on the mainland, but even so the reasons for the sole persistence of the unmodified descendants on the far separated Revillagigedos and Galapagos is still a problem. The West Indian *Scaevola plumierii* is known on Pacific shores only at the tip of the peninsula of Lower California, on Clarion Island, and in the Galapagos. The shrubby *Erigeron* species of the Revillagigedos much suggest those of the Galapagos but I suspect that the similarity is due to similar responses of related mainland stocks to a similar insular climate.

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<sup>2</sup> Based upon a consideration of the list given by Stewart, Proc. Calif. Acad. Sci. ser. 4, 1: 375-404 (1912), and upon a manuscript flora of the island kindly made available to me by Prof. B. L. Robinson.



From the facts given, it becomes obvious that the Revillagigedos do not have a flora that has a strong affinity with that of any other island or archipelago. The species shared with other islands are overwhelmingly of the widely distributed, weedy, tropical sort. The Revillagigedos and the Galapagos islands, although very distantly separated, do share several species that suggest a relation of the floras. The climate on both archipelagos is arid. This common possession of a dry insular climate may, possibly, offer a partial explanation for the occurrence of those species which suggest a direct floristic relation between the archipelagos. In any case I do not believe that they have ever been directly connected by land.

### ORIGINS OF THE FLORA

There are two theories used in accounting for the composition of isolated insular floras. One maintains that winds, ocean currents and animals are completely effective in populating such islands with plants; the other that these means are at most only partially effective, and that consideration of all elements in insular floras generally indicates that they have had a previous period of migration and usually also of change and development on contiguous land-masses which have now disappeared. The former, or oceanic theory, accepts most island floras as rather recent, and treats of them in a geography in which ocean depths and shore lines are essentially as they are found today. The latter, or continental theory, tends to give insular floras considerable age, and looks for their early history in a time when the surface features of the earth were somewhat different from what they are at present. It involves the change from elevated land to deep ocean-bottom and frequently tends to ignore the geologists in its frantic effort to build land-bridges or continents for the overland dispersal of certain species which the opposing theory blithely leaves for hurricanes, tidal waves and well-fed but misdirected birds. These contrasting theories can be and are pushed to incautious extremes by their sponsors, extremes that show very clearly the great divergence of opinion that exists regarding the abilities of most plants to disseminate successfully over broad tracts of ocean. It is, however, this lack of general agreement, this challenge of an unsolved problem, that gives the study of in-



sular floras its particular fascination. Eventually we may hope to have a consensus of opinion regarding the means by which ordinary flowering plants have generally reached remote islands. This, however, can only be attained after a minute inquiry into the composition of a great number and variety of insular florulas, and only after a final judicial consideration of the implications involved in each. The floristics of the Revillagigedos are, hence, partial data for an unsolved botanical problem. Deductions and speculations based upon them not only aid us in the attempt to determine the probable history of the island and its flora, but may also give some clues to the efficacy of the debated means of plant dispersal.

As ocean currents and over-sea winds have played at least a minor role in populating most isolated archipelagos, it is desirable to examine into these forces and to determine, if possible, what part they have played in forming the flora of the Revillagigedos.

These islands are situated at the east end of the great North Equatorial Drift and are hence bathed by waters coming from the north as well as by some from the south. The well known Californian Current comes southeastward along the coast of Lower California and continues in large part to about the latitude of our islands, where under the force of the northeast trade winds it turns and becomes the beginning of the North Equatorial Drift. An eastern portion of the Californian Current tends to continue down the coast of the Mexican mainland. This latter part, strongest in the spring, is generally weak. When subjected to the southerly winds prevailing off Central America and southern Mexico in the summer, it tends to become uncertain or even reversed. There results a weak, seasonal, northwestern movement of water off Central America and southern Mexico that has sometimes been called the Mexican Drift. At its height it is uncertain and complicated by eddies. It is never so strong nor so clearly directed as the Californian Current is to the north of the islands. As far as can be determined, it pushes weakly northward towards the vicinity of the Revillagigedos only during the summer months and hence would be a factor in the northward dispersal of potential island plants only, if at all, during that brief period of the year. The Californian Current, being stronger and continuous, however, offers a possible, perennial means of trans-



port from Lower California and from the Mexican mainland lying immediately off to the east and northeast. I have no doubt that it has carried strand plants from that quarter, and possibly some of the plants from the coastal plains as well.

Data regarding the directions of winds in the region about the Revillagigedos are only of the most general sort. These are consistent, however, in attributing to the region winds prevailing from the northeast, north and northwest, and show that only in summer is there even a noteworthy proportion of breezes from the south or southeast. The islands are frequently visited also by the small but very violent cyclonic storms that harry the west coast of Mexico. Although accompanied by extremely violent winds these hurricanes are probably of no aid in plant dispersal since they originate at sea (usually at about lat.  $15^{\circ}$  N) and moving northwestward either parallel the coast, or move from the sea northeastward over the land. They might aid in the dissemination of plants within the archipelago, but would be vastly more effective in transporting island plants to the mainland, rather than *vice versa*. It seems, therefore, that if winds are to be considered as a means of dispersal that the emphasis must be placed on the trades from the north and northeast, for these, like the ocean currents, would place the sources of dissemination for potential island plants on continental areas nearest the islands and in exactly those areas which now have the greatest number of species in common with the islands.

Although 80% of the non-endemic flora present on the islands also occur to the north and east on the nearest continental masses, in exactly those areas in which the plants could have taken advantage of the most favorable currents and winds for transportation to the islands, and even although 27% of the endemic flora on the islands find their closest relatives in exactly the same region in which their ancestors may have had offered similar facilities for transportation, it does not necessarily follow that these species must all have come by currents or wind, or that, granting this, that the remainder of the flora must have reached the islands by similar trans-oceanic means. I am willing to admit that perhaps a good half of the non-endemic flora has reached the islands from across the ocean and, with little doubt, from the nearest parts of the continent. As will be explained, however, I believe that even



some of the widely distributed non-endemic species may have reached the islands by other than oceanic means. The species which I am inclined to admit as most probably of transoceanic dissemination are chiefly the widely spread weedy ones, and particularly those broadly distributed in the West Indies where their range shows that they can get over ocean barriers and from island to island most successfully. There have, no doubt, been even some of the characteristic western Mexican species that have been able to follow these weedy types and also reach the islands.

After admitting, however, that a large proportion of the flora may have gained the islands across the ocean from the nearest land, there still remain some species whose presence on the islands is not so easily accounted for. These species are chiefly from Socorro. They include the most differentiated of the island endemics and most of such types as the epiphytes, the shade-loving mesophytes and the forest-trees. These plants either do not occur or do not have their immediate or even close relatives on the adjacent parts of the continent. Their affinities, such as can be determined, are much more distant, lying in southern Mexico, in Central America, or in the West Indies. They are characteristically plants of middle altitudes inland, away from the sea, and are not suitable for oceanic dispersal. They are not weedy types. Several of them very clearly have their nearest relations far away in the West Indian Region, while others, off the islands, are known only from east (on the wetter side) of the continental divide. Some of them grow in the mountains from Vera Cruz and Oaxaca south into Central America. One has its relations in Costa Rica. The most striking of these plants and the ones which indicate this southern affinity most clearly are *Polystichum*, *Adiantopsis*, *Asplenium*, *Sporobolus*, *Paspalum*, *Cattleya*, *Epidendrum*, *Pleurothallis*, *Peperomia* spp., *Rubus*, *Rhamnus*, *Ilex*, *Meliosma*, *Oreopanax*, *Forestiera*, *Vernonia* and *Eupatorium*. Also to be associated with these just mentioned, since they are probably of the same floristic group, are those very distinct endemics of quite uncertain, although general southern relationship such as, *Stenophyllus*, *Cyperus*, *Euphorbia*, *Croton*, *Triumfetta*, *Hypericum*, *Psidium*, *Bumelia*, *Ipomoea*, *Borreria*, *Erigeron* spp., and *Coreopsis*. These latter species in their strong differentiation, which quite obscures their precise



relationship among their congeners, suggest antiquity. They form a remarkable contrast with those endemics which have immediate affinities on the adjacent continent and which, in still having their relationships with their parents obvious and in not having developed any strong specific traits, show themselves to be of rather recent origin. Those species with clear but geographically distant, southern relationships and those with obscure general southern affinity are quite different from the weedy types or from the obviously peninsular or north-western Mexican forms which might have reached the island by wind or waves. The lack of means of these species of southern affinity for contact with their scattered relatives, the distance by which they are now separated from them, and the notable degree in which some of them have become differentiated from their relatives on the mainland, suggest that they reached the islands long ago when alignments of land and the climatic conditions were quite different from those of the present time. In fact, I believe they represent an old floristic element and are relics of an early, now impoverished mesophytic, or even humid flora that formerly existed on or near the present islands.

A theory involving a relic flora on the islands assumes an effective, probably a complete, land route for the migration of the island flora in the distant past, subsequent isolation permitting marked development and change in plastic species, and finally decimation of the flora through physiographic changes and in more recent history through competition with more adaptable immigrants. This theory would demand a body of land which would either include all our present islands or would lie at least contiguous to the present island of Socorro and have continental connections off to the east or southeast. Practically all of the possible plant-relics are restricted to Socorro. This I believe is a topographic accident and that there is not necessarily any phytogeographic significance in their lack on the smaller and less lofty Clarion and San Benedicto. Like much of western North America the climate of the Revillagigedos is doubtless becoming more arid. Its larger size, greater moisture and diversity of conditions over Clarion and San Benedicto are probably the prime reasons why the relics have found a final haven on Socorro. It is only in the protected cañons and on the moist upper slopes of Socorro that



stenoclimatic relics of an earlier mesophytic flora could be expected to persist.

There being a suspicion that a large land-mass formerly occupied the general vicinity of the Revillagigedos, it is natural that evidence either for or against it should be sought in bathymetric data. Depth-measurements in this part of the Pacific are not so numerous as could be wished for, but are sufficient to give us the general idea of the submarine topography which we need. A study of the 3000-meter depth-contour shows that it lies generally well within 100 miles of the shore along practically the whole west coast of Mexico and Central America. It crosses the mouth of the Gulf of California in a northwest-southeast line that continues the prevailing trend of the peninsular and central and southern Mexican coast-lines. Although the 3000-meter contour may follow the coast line rather closely, the 4000-meter contour does not. In fact it departs from it most conspicuously. Coming down from the north the 4000-meter line, passing well to the seaward of Guadalupe Island (lat.  $29^{\circ} 00' N$ ) and a little west of Alijos Rock (lat.  $24^{\circ} 57' N$ ), continues south until southwest of Clarion<sup>3</sup> where it swings well eastward to nearly 100 miles southeast of Socorro. It then sweeps northeastward to within 100 miles of the Tres Marias Islands where it abruptly doubles back and continues southeastward within 100 miles of the Mexican coast. About opposite Acaapulco, however, this depth-line swerves abruptly southwestward, away from the coast and towards the open sea. The Revillagigedos Islands, accordingly, lie on a large submarine plain (3000-4000 meters deep) situated just to the west and south of Lower California and on one separated from the coast of Central America and middle and southern Mexico by a vast tract of very deep water.

Concerning this great submarine plain upon which the Revillagigedos are located, there are a number of significant features. Its western limits are quite independent of continental shore lines. The largest part of it is that southern portion containing the islands. Its southern corner lies over 600

<sup>3</sup> The charts indicate that soundings of 130-145 meters depth have been made around lat.  $20^{\circ} N$  and long.  $120^{\circ} W$ , some 300 miles WNW of Clarion. This is the Allaire Bank. Its position, which falls roughly in the east-west axis of the Revillagigedos, suggests that it might be a far westerly peak of the archipelago which is now submerged. It is separated from Clarion by depths of over 4000 meters.



miles to the west of Jalisco on the Mexican mainland. The southern border of the plain appears to parallel the general east-west axis of the archipelago. This border and axis, if projected eastward, would strike about the state of Jalisco and, perhaps not as a mere coincidence, tend to line up with the southern margin of the Mexican plateau. The northern swing of the 4000-meter line between Socorro and the Tres Marias lines up with the trough of the Gulf of California. In short, it seems from these bathymetric data that the Revillagigedo Islands might well represent peaks of a submerged land-mass which formerly extended east and west and connected with the Mexican mainland in Jalisco or Colima and that in the diastrophism that formed the Gulf of California it was separated from the mainland and subsequently sunk.

Such a theory is quite consistent with what is known of the geological history of the western states of Mexico. Deposits show that the most active part of this coast has been that in and around the Gulf of California. The peninsula of Lower California has been particularly active, having had periods of extensive subsidence and flooding in the Eocene, the Miocene and the Pliocene. At the close of the Tertiary the peninsula and the adjacent areas were subjected to tremendous fracturing and down-faulting. Except that the Isthmus of Tehuantepec subsided and was covered by the sea in late Miocene and early Pliocene, the area in the coastal states of Mexico south of Nayarit has been above the sea since the beginning of the Tertiary and for all we know perhaps has even extended further to the westward. Mountain-making forces were active at the close of the Tertiary in our coastal area and were particularly energetic in Jalisco where a line of great upheavals on an east-west axis now forming the south end of the Mexican plateau, brought high land near the coast and probably caused the hump on the coast line that is terminated by Cape Corrientes. At present the whole coast seems to be rising.

The Revillagigedos lie, accordingly, to the south of an unstable region where tectonic forces have been active over a long period and to the west of land that has, over the same period, continued above the sea and may possibly have even extended further west. As evidenced by the paralleling of the northwest-southeast coast lines of the mainland and the two shores of the peninsula the islands are separated from the con-



continent by several great lines of probably late Tertiary faulting. In alignment they strongly suggest a continuation of the line of Tertiary uplift and vulcanism that determines the southern end of the Mexican plateau. In fact, the site of the Revillagigedos may well represent a portion of the continental margin, much less stable than the peninsula to the north, that was elevated and connected with middle western Mexico during the relatively quiet history of that section in mid-Tertiary and some that was subsequently disconnected and finally entirely subsided when crustal equilibria were disturbed by mountain-making forces on the mainland and by the tremendous upheavals and down-faultings that shaped the peninsula and Gulf of California at the close of the Tertiary. What is more, this theory not only accounts for important details in plant and animal distribution, but also accounts particularly well for the granitic rocks of Roca Partida, the central islet of the Revillagigedos, and accommodates readily the continental origin that has been suggested for them by Hanna, *Science* n. s. 62: 491-2 (1925) and *Pan Amer. Geologist* 48: 17 (1927).

Assuming, if not actually accepting the theory, that there was formerly a large mass of land rising from the waters in which the Revillagigedos are now located, one naturally wonders what connection, if any, it may have had with the peninsula of Lower California. The fact that the present archipelago has a long axis that presents a very broad angle to that of the peninsula and one more in line with certain structural axes on the mainland suggests that they belong to different oreogenic systems and have had different histories and hence, perhaps no direct land connection. Plant distribution, however, gives additional evidence. The large number of species common to the peninsula and the islands are chiefly of the widely distributed weedy types efficient in oceanic dispersal. The insular plants conspecific with otherwise strictly peninsular species are xerophytic ones, as are also the weakly differentiated insular endemics of peninsular affinities and, like them, give every evidence of recent arrival, probably by oceanic means. The relic flora on the islands is a mesophytic or even a moist tropical one of southern affinity and shows no species, with the possible exception of the *Sphacele*, in common with the peninsula. Had there been some, it seems inconceivable that they would fail to persist in the conditions, much more favorable



than on the islands, found in the moist meadows and cañons of the mountains at the peninsula-tip, a region which has not been submerged in Tertiary or more recent times. The *Sphacele* which grows on the summit of Socorro and in the higher parts of the mountains of southernmost Lower California does seem to be an exception. It is an old species with only distant relatives, and one which had no doubt wandered far before it made its last stand in three such strangely selected localities as Hawaii, Socorro and the tip of Lower California. I am inclined to believe, however, that it reached the island and peninsula from a common source on the mainland that has now disappeared. It might, of course, have reached the island from Lower California over the sea, but in any case I do not believe it was by a direct overland route. Such a theory falls of its own weight when attempts are made to explain how only this plant and no others of many species give any evidence of having availed themselves of such an opportunity for advantageous migration. The evidence from plant distribution, therefore, seems to be definitely against the assumption of any former bridging connection of the peninsula with the vanished land mass to the south.

As there are good reasons for believing that the old land mass that preceded the present Revillagigedos could not have been connected with the peninsula of Lower California its connections with the continent must have been through the mainland of Mexico. Indeed, I believe we may visualize it, in times before the extensive diastrophism of the Pliocene, as projecting westward from what is now the states of Jalisco and Colima, or possibly from even somewhat further south. It was at this period when a moister climate permitted the more northern and western extension of the floras now found on the mountain slopes of Vera Cruz, Oaxaca and Chiapas and in Central America and the West Indies, that the land mass must have received directly the first members of the flora and fauna<sup>4</sup> which now linger, more or less modified and in de-

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<sup>4</sup> A number of the land-snails on the islands, like the plants have affinities in southern Mexico. The only native land vertebrates on the islands, two lizards (*Uta* spp.) and a snake (*Masticophis* sp.), are clearly related to species, not in lower California, but in the coastal states of the mainland of western Mexico. The lizards have relatives in Jalisco and Colima and northward. Ortenburger, Mem. Univ. Michigan Mus. 1: 144 (1928), in his monograph of the racers definitely concludes that the island snake is immediately derived from one now occurring along the coast from Sonora to Guerrero and possibly Michoacan.



pleted numbers on the crests of the isolated, ocean-ringed, volcanic peaks which now form the Revillagigedos. It was on this old land mass, after its separation from the mainland, that the strongly differentiated insular endemics were able to develop in isolation, and so eventually change. With them, no doubt, were some of the widely distributed weedy species which, having arrived early, probably had no need to demonstrate their abilities for oceanic dispersal in order to reach the islands. The subsidence and diminishing of the land and the trend towards increasing aridity which followed the Tertiary must have been very destructive to the original flora and fauna. Inadaptable stenoclimatic species must have disappeared in large numbers. Even today, indeed, the margin by which many of the island species are able to persist must be very slight. A reduction, for example, of half the height of Socorro would probably result in a reduction, in similar proportion, of the number of species in the entire archipelago. What is more, the reduction would be in those moisture-requiring species which are chiefly old elements in the flora. The islands today are dominated by those species of the older flora which were plastic enough to develop successful xerophytic forms and by the adaptable immigrants which have arrived from over the sea in more recent times. The future flora, if conditions continue with the same trend, will doubtless be made up chiefly of the weedy, readily dispersed, successful plants of wide distribution and will become more and more of an oceanic type.

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The value of this paper and the pleasure I have had in preparing it have been greatly enhanced by the very friendly and extremely helpful responses I have had to my requests for assistance. I am consequently very grateful to those I have mentioned above. It is a pleasure to again, now publicly, acknowledge my appreciation of and gratitude for the valued assistance they have given me.

## INTRODUCTION TO THE CATALOGUE

In the following catalogue I have enumerated and discussed each species of vascular plant known from the Revillagigedo Islands. The determinations of all species have been carefully verified and the nomenclature, when necessary, revised. For all species and subspecies first described from the islands I have given complete synonymy. For the widely distributed species, however, I have given synonyms only when convenience or when precision required it. Under the proper species I have listed all names, whether correct or not, that have been applied to the island flora. References to every mention of Revillagigedo plants that I have encountered in floras or monographs have also been included. Special care has been given to this bibliographic work and I believe that few



if any of the rare references to the Revillagigedo flora have been missed. The nomenclature used is in accord with the International Rules. In the decapitalization of certain specific names and in the omission of the Latin diagnosis for new species I have departed from the prevailing and what I consider the best botanical practice. This was reluctantly done in order to conform with the editorial policies of the Academy.

I have cited all collections examined. These include all but a small percentage of those ever made on the islands and represent all the species ever reported from them. My concern has been, of necessity, chiefly with the problems of distribution, relationship and taxonomy of the species. I regret most keenly that I have been able to give so little regarding the selection of habitats, ecological relations, variations, abundance, growth-habit, flower-color, etc. of the various plants of the islands. Very little is known about these interesting and important details, since, in the excitement of pursuing plant-kinds, the collectors on the islands, who should have assembled such data, have usually forgotten to observe and make note of the vegetation. I have given notes on the general distribution of most species. Emphasis in these notes has been given to the range in Mexico, Central America and the West Indies and particularly to those sections of these areas which might be significant in determining the original source of the island plant. No attempt has been made to state the complete range of species extending into South America or the Old World.



## CATALOGUE OF THE SPECIES

## PSILOACEÆ

1. *Psilotum nudum* (L.) Griseb.

*Psilotum nudum* Griseb. Abh. Ges. Wiss. Göttingen 7: 278 (1857).

Collected by Barkelew (no. 218) on Socorro. Widely distributed in the tropics.

POLYPODIACEÆ<sup>5</sup>2. *Polystichum muricatum* (L.) Fée

*Polystichum muricatum* Fée, Gen. Fil. 278 (1852).

Growing in the forested cañons towards the summit of Socorro where it has been collected by Mason (nos. 1630, 1677). It has a stout trunk-like base, 2.5-3 dm. tall and forms a widely spreading plant 9-12 dm. high. Barkelew (no. 227) also collected it on Socorro. The island plants seem much more fibrillose on the under surface of the pinnae than in most material from the mainland. The species ranges from southern Mexico through Central America to Venezuela and occurs, also, in Jamaica and Haiti.

3. *Asplenium formosum* Willd.

*Asplenium formosum* Willd. Sp. Pl. 5: 329 (1810).

Material of this species was collected by Mason on Socorro on the north-facing wall of a cañon near Grayson Cove (no. 1615) and among rocks, in soil and on tree-trunks in shaded places or on north-facing rock wall from 300-1200 meters alt. on the east slope of the island (no. 1631). The insular material collected differs from the typical form in its brown rachis and rather less divided pinnae, in these respects approaching *A. carolinum* Maxon of the Galapagos Islands, although lacking the second row of sori characteristic of that species. *Asplenium formosum* is very widely distributed in the American tropics.

<sup>5</sup> The determinations and the systematic and distributional notes for this family have been contributed by Mr. C. A. Weatherby.



#### 4. *Asplenium potosinum* Hieron., var. *incisum* Hieron.

*Asplenium potosinum*, var. *incisum* Hieron. Hedwigia 60: 248 (1919).

Collected on a dry stream bank in the fog-belt near the summit of Socorro by Mason (no. 1670). Barkelew (no. 215) also obtained the variety on the island. It has heretofore been known only from the Mexican state of San Luis Potosi. The insular material seems quite typical. The species is a critical segregate of that variable and puzzling assemblage that formerly passed as *A. lunulatum*, a group that ranges in Central America, in southern and eastern Mexico, the West Indies, etc.

#### 5. *Adiantopsis radiata* (L.) Fée

*Adiantopsis radiata* Fée, Gen. Fil. 145 (1852).

Present in the dense forests near the summit of Socorro, where it was found growing in soil along dry stream beds by Mason (no. 1632). The species is known from the West Indies, eastern and southern Mexico and from Venezuela to Paraguay. It is either absent or very rare on the Pacific Coast.

#### 6. *Pteridium caudatum* (L.) Maxon

*Pteridium caudatum* Maxon, Proc. U. S. Nat. Mus. 23: 631 (1901).

Collected on Socorro by Barkelew (no. 216) and Mason (no. 1662). Mason reports that it is very common on the higher parts of the island. It grows 3-15 dm. tall in the brush but in the forests has stipes 2 m. long and attains a total height of 4.5-6 m. The species occurs in Florida, the West Indies, tropical Mexico and Central America.

#### 7. *Polypodium polypodioides* (L.) Watt

*Polypodium polypodioides* Watt, Canad. Nat. ser. 2, 13: 158 (1867).

Collected by Mason (no. 1642) near the summit of Socorro, where it occurred as a climbing epiphyte on mossy tree-trunks both in dense forest and in more open formations. Barkelew (no. 236 in pt.) also found it on the island. The species is very widely distributed in the warmer parts of America.



### 8. *Polypodium pulchrum* Mart. & Gal.

*Polypodium pulchrum* Mart. & Gal. Mém. Acad. Brux. 15: 41, t. 8, f. 2 (1842).

Growing in soil and on tree-trunks in the shade of the forests near the summit of Socorro where it was obtained by Mason (no. 1633). Barkelew (no. 236 in pt.) also collected it on the island. This species ranges from central Mexico south to Costa Rica. It is a close segregate of the wide spread *P. plumula* H. & B., distinguished principally by its broad and usually pale rhizome-scales, and perhaps is no more than a variety of that species.

### 9. *Cheilanthes peninsularis* Maxon, var. *insularis* Weatherby

*Cheilanthes peninsularis*, var. *insularis* Weatherby, Amer. Fern Journ. 21: 25 (1931). *C. wrightii* of Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1891); Brandg. Zoe 5: 28 (1900).

This variety is endemic to the archipelago. It has been collected on Socorro by Townsend, Anthony (sine no.) and Mason (no. 1616). Mason's collection, which is the type material, came from a very dry north facing rock wall above Grayson Cove at an altitude of about 300 m. It has also been found by Mason (no. 1571) on Clarion, where he reports it as locally abundant in the brush just below the crest of the hills. Typical *C. peninsularis* is confined to central and southern Lower California.

## GRAMINEÆ

### 10. *Eragrostis ciliaris* (L.) Link

*Eragrostis ciliaris* Link, Hort. Berol. 1: 192 (1827).

Collected by Barkelew (no. 224) and Mason (no. 1640) on Socorro. The latter got it on a mud-wash on the plateau. It is very widely distributed in the tropics.

### 11. *Eragrostis diversiflora* Vasey

*Eragrostis diversiflora* Vasey, Contr. U. S. Nat. Herb. 1: 285 (1893); Hitchc. Contr. U. S. Nat. Herb. 17: 365 (1913).

Collected on San Benedicto by Anthony (sine no.), Barkelew (no. 172) and Mason (nos. 1681, 1681a). Mason reports that it is common there in scattered bunches. Off the island it is known only from a very few collections in Sinaloa and Colima.



12. *Jouvea pilosa* (Presl) Scribn.

*Jouvea pilosa* Scribn. Bull. Torr. Bot. Cl. **23**: 143 (1896); Hitchc. Contr. U. S. Nat. Herb. **17**: 384 (1913).

This species frequents the coastal sands from southern Lower California south to Nicaragua. It has been collected on Socorro by Barkelew (no. 183) and Mason (no. 1610).

13. *Sporobolus argutus* (Nees) Kunth

*Sporobolus argutus* Kunth, Enum. Pl. 1: 215 (1833).

Growing on beach-sand and about a vernal pool near Sulphur Bay on Clarion where it was collected by Mason (no. 1569). Widely distributed in the warmer parts of America.

14. *Sporobolus purpurascens* (Sw.) Hamilton

*Sporobolus purpurascens* Hamilton, Prodr. Ind. Occ. 5 (1825).

Collected near the craters at the summit of Mt. Evermann by Mason (no. 1663). The species has a very disrupted range, being known only from southeastern United States, Cuba, Jamaica, Mexico (Vera Cruz), Guatemala, Costa Rica and several South American countries. The determination has been verified by Mrs. Chase.

15. *Aristida pansa* Woot. & Standl.

*Aristida pansa* Woot. & Standl. Contr. U. S. Nat. Herb. **16**: 112 (1913).

A common plant on the middle slopes of the south side of Clarion, where it was collected by Mason (no. 1586). It also grows on Socorro, Mason (no. 1649) having collected it on the grassy alluvial flats near Benner Cove. The material from Clarion has been determined by Prof. Hitchcock. He reports that although it shows some minor differences from the continental plant that these are not sufficiently important to justify the treating of the insular plant as distinct. *Aristida pansa* is otherwise known only from Arizona, New Mexico, Texas, Durango and San Luis Potosi. It represents, therefore, the only non-endemic member of the Revillagigedo flora that has a distribution suggestive of the specific relationships of the endemic island species of *Nicotiana* and *Teucrium*.



16. **Eriochloa acuminata** (Presl) Kunth

*Eriochloa acuminata* Kunth, Enum. Pl. 1: 72 (1833).

Collected by Anthony (sine no.) and Mason (nos. 1581, 1587) on Clarion where it is reported as a common grass. It grows from sea-level to the crest of the island but is especially common and covers large areas near the summit. The species is practically confined to Mexico. It ranges from Chihuahua and southeastern California southward, chiefly on the Pacific slope, to Oaxaca. Determined by Mrs. Chase.

17. **Paspalum longum** Chase, n. sp.

A robust perennial in large clumps; culms simple, erect, about 8 dm. or more tall, overtopped by the leaves, subcompressed, glabrous; nodes glabrous, none exposed; sheaths elongate, overlapping, the lower pinkish, papillose-pilose along the margin toward the summit, otherwise very smooth, rounded on the back, with tawny prophylla as much as 1 dm. long, the upper sheaths subcompressed; ligule firm-membranaceous, 3mm. long, with long stiff hairs back of it; blades erect-ascending, folded toward the base and narrowed to the width of the sheath, flat or nearly so above, 7-10 dm. long, 8-10 mm. wide, with a long-attenuate, subinvolute tip, the midnerve thick throughout, the upper surface and margin of the blades scabrous, the lower surface smooth, the margin at the base papillose-ciliate with long hairs, the blade much exceeding the panicle; panicle tawny, short-exserted or partly included, the rather slender compressed axis 12-18 cm. long; racemes 9-13, nodding or loosely curled in age, the lower 8-12 cm. long; rachis about 1 mm. wide, densely pubescent at base and minutely so on the upper surface throughout, the margin scabrous; spikelets in pairs on angled pedicels, rather crowded, 2.8-2.9 mm. long, 2 mm. wide, depressed plano-convex and slightly unsymmetrical, broadly ovate-elliptical, obtuse to subacute; glume and sterile lemma equal, rather thin and fragile, very minutely papillose under a lens, 3-nerved; fruit about 2.5 mm. long and 1.6 mm. wide, obovate-elliptic, stramineous, minutely papillose-striate.

*Type*: No. 186603, Herb. Calif. Acad. Sci., collected May 7, 1925, by H. L. Mason (no. 1648) on a grassy flat north of Benner Cove, Socorro Island.



"This species belongs in the group *Virgata*. In the three overmature specimens examined (all Mason's no. 1648), the leaves are much longer than the culm. In this the species differs from all the others of the group. It appears to be most allied to *Paspalum arundinaceum* Poir. of the Greater Antilles, Guatemala [Atlantic side], and French Guiana. From that it differs in the very thick midnerves of the blades, the slightly larger, flatter spikelets and in the fragile texture of the sterile lemma and palea. A cotype is in the U. S. National Herbarium, no. 1449808."

18. ***Setaria geniculata* (Lam.) Beauv.**

*Setaria geniculata* Beauv. Ess. Agrost. 51 and 178 (1812).

Growing at the edge of hot springs in the craters near the summit of Mt. Evermann, where material in very mature condition was collected by Mason (no. 1664). A variable species ranging very widely in the warmer parts of America.

19. ***Cenchrus myosuroides* HBK.**

*Cenchrus myosuroides* HBK. Nov. Gen. et Sp. 1: 115, t. 35 (1816); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1890); Brandg. Zoe 5: 27, 28 (1900); Hitchc. Contr. U. S. Nat. Herb. 17: 268 (1913); Hitchc. & Chase, Contr. U. S. Nat. Herb. 22: 53 (1920).

Collected on San Benedicto by Anthony (no. 370), Barkeley (no. 171) and Mason (no. 1682). Mason notes that it is common there on flats and on crater-bottoms where it forms meadow-like growths 15 dm. tall. On Socorro the species has been collected by Townsend, Barkeley (no. 202) and Mason (no. 1604). Mason notes that it grows 9-24 dm. tall on Socorro and that it is common there both on the alluvial deposits near sea-level and on the adjacent hillsides. The species is very widely distributed in the warmer parts of America.

20. ***Sorghastrum nutans* (L.) Nash**

*Sorghastrum nutans* Nash in Small, Fl. Southeast. U. S. 66 (1903); Hitchc. Contr. U. S. Nat. Herb. 17: 211 (1913).

Collected on Socorro by Anthony (no. 401). The species extends from the United States into Mexico where it has been collected at various points on the west coast.



## 21. *Heteropogon contortus* (L.) Beauv.

*Heteropogon contortus* Beauv. ex R. & S. Syst. 2: 836 (1817); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1890); Brandg. Zoe 5: 28 (1900); Hitchc. Contr. U. S. Nat. Herb. 17: 212 (1913).

On Socorro this species has been collected by Townsend and by Mason, the latter obtained it above Grayson Cove (no. 1619) and near Cape Rule at the south end of the island (no. 1647). Mason notes that the species covers much of the upper half of the mountain on the west side of the island. The species is very widely distributed in the warmer parts of America.

### CYPERACEÆ

## 22. *Cyperus ligularis* L.

*Cyperus ligularis* L. Amoen. Acad. 5: 391 (1759).

Collected by Mason (no. 1678) on Socorro on a low flat at the east point of Braithwaite Bay. Widely distributed in tropical America, on the Pacific coast extending north at least to the Tres Marias.

## 23. *Cyperus duripes* Johnston, n. sp.

A coarse plant springing from a short hard rhizome that becomes over a centimeter thick; leaves numerous, stiffish, ascending, apparently equalling or surpassing the inflorescence; leaf-bases becoming as much as 3 cm. broad, brownish, eventually breaking down into numerous fine brownish fibers; leaf-blades becoming 8-16 mm. broad, firm, not transversely lineate, lucent above, opaque beneath, margins finely very weakly and obscurely denticulate, revolute, vascular strands fine, numerous and crowded; culms 4-10 dm. tall, towards the summit smooth sulcate and decidedly angulate; base of culms very woody, obscurely trigonous, usually covered with brown fibers, commonly developing some strict coarse buds or immature shoots; leaves of involucre 9-12, becoming 1-4 dm. long, similar to the cauline ones in texture, etc.; rays of inflorescence 9-12, unequal, 15-30 mm. long, bearing a single spike or a very crowded group of 2-3 or even a congested secondary umbel of 3-7 spikes; spikes cylindrical, dark brown, the terminal principal ones ca. 8 mm. thick and 1-1.5 cm. long, the



lateral ones shorter and proportionately stouter, sessile and usually divergent; spikelets numerous, congested, ca. 4 mm. long, ca. 1 mm. broad, turgid but somewhat laterally compressed; basal persistent glumes sessile, 1.5-2 mm. long; fructiferous glumes 2, elliptical-oblong, 3.5-4 mm. long, ca. 12-ribbed, brown-dotted; anthers 1.7-2 mm. long, ca. 0.3 mm. broad, base retuse, apex contracted into a subulate appendage 0.5 mm. long; style 1-1.4 mm. long, producing 3 branches 2-2.4 mm. long; mature fruit unknown.

*Type:* No. 200908, Herb. Univ. Calif., collected May 25, 1897, by A. W. Anthony (sine no.) on **Clarion Island**.

Anthony's collection above cited, which shows the inflorescence and flowers, is clearly the same species as the sterile material collected on Clarion by Mason (no. 1590). According to Mason the plant forms great rank growths in loose soil on the north slopes along the crest of the island. Material collected on Socorro by Anthony (no. 400) is conspecific. An immature specimen by Barkelew (no. 173), labeled as from San Benedicto, is probably the same. The species is endemic to the islands. It is to be noted, however, that the material from Socorro and San Benedicto tends to have simple umbels, is decidedly less robust and seems to be less conspicuously lignescent and hence, perhaps, might be separable from the Clarion form. The new species belongs to the section *Mariscus* and to the general group of *C. ligularis* although evidently distinct from that particular species. Its exact relations are obscure. From *C. ligularis* it differs in its fewer flowered pale spikelets, in its very much firmer foliage, which is lucent above, has much less scabrid margins and lacks evident cross-partitions, and finally in its very woody more or less fibrous culm-bases and rhizomes. It is a plant on hillsides, not of coastal marshes.

#### 24. *Cyperus* aff. *brunneus* Sw.

Overly mature specimens of a species suggesting in gross habit *C. brunneus* Sw. and one probably closely related to it, have been collected on Socorro by Barkelew (no. 196) and Mason (no. 1651). The latter obtained it on sea-cliffs near Benner Cove. The spikelets seem to be stouter and have more closely imbricated scales, but otherwise the Socorro plant is



very like the West Indian material of *C. brunneus*. A few collections of that species have been made in southern Mexico.

25. ***Scirpus robustus* Pursh, var. *paludosus* (Nels.) Fernald**

*Scirpus robustus*, var. *paludosus* Fernald, *Rhodora* 2: 241 (1900).

Growing on the margins of pools behind the dunes on Clarion where it has been collected by Mason (no. 1580). The plant grows 1-2.5 dm. tall. The variety is known from north-western Mexico and western United States.

26. ***Stenophyllus nesioticus* Johnston**

*Stenophyllus nesioticus* Johnston, Univ. Calif. Pub. Bot. 7: 438 (1922). *Fimbristylis* sp. Brandg. *Zoe* 5: 27-28 (1900); ? Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1890).

Collected on San Benedicto by Anthony (no. 317, type; 371) and Mason (no. 1687), on Socorro by Barkelew (no. 225) and Mason (no. 1650), and, if the label is to be fully trusted, also on Clarion by Anthony (sine no.). Mason found it occasional in scattered patches in a cañon on San Benedicto. On Socorro it grew on sea-cliffs and travertine deposits at Benner Cove. The collections from San Benedicto and Clarion are quite similar, having the spikes in a dense head as originally described. The material from Socorro, however, frequently develops spikes 6-15 mm. long. In their arrangement these can be described only as umbellate. I assume that the specimens from Socorro, reported by Vasey & Rose, loc. cit., as *Fimbristylis*, are probably this form. Townsend's specimens, however, could not be located in the National Herbarium. *Stenophyllus nesioticus* is related to *S. junciformis* (HBK.) Britt., and related forms of the West Indies and Central America. Although the precise relationship is not clear, it can be said that they are not Mexican.

COMMELINACEÆ

27. ***Commelina virginica* L.**

*Commelina virginica* L. Sp. Pl. ed. 2, 1: 61 (1762). *Tradescantia* sp. Brandg. *Zoe* 5: 27 (1900).

An immature specimen obtained on Clarion by Anthony (sine no.) is apparently referable to this very wide-spread and variable species.



## ORCHIDACEÆ

28. *Pleurothallis unguicallosa* Ames & Schweinf.

*Pleurothallis unguicallosa* Ames & Schweinf. Proc. Biol. Soc. Wash. **43**: 195 (1930).

An epiphytic species found in the forests on the higher portions of the east slope of Socorro by Mason (no. 1628, type). The species is endemic. Its closest relative is *P. wilsoni* Lindl., a species known only from Cuba, Jamaica, Haiti, Porto Rico, and Guadeloupe in the West Indies.

29. *Cattleya aurantiaca* (Batem.) P. N. Don

*Cattleya aurantiaca* P. N. Don, Florist Journ. 185 (1840); Ames & Schweinf. Proc. Biol. Soc. Wash. **43**: 195 (1930).

Found by Mason (no. 1643) growing on branches of *Bumelia* on the east slope of Socorro. Otherwise known only from southern Mexico south to Costa Rica.

30. *Epidendrum rigidum* Jacq.

*Epidendrum rigidum* Jacq. Enum. Pl. Carib. 29 (1760).

Collected on Socorro by Barkelew (no. 233). Ranging from southern Florida and eastern Mexico southward into northern South America. Apparently unknown from the Pacific slope of Mexico, Salvador or Guatemala. I am indebted to Mr. Schweinfurth for the determination of this and the two preceding orchids.

## PIPERACEÆ

31. *Peperomia chrysolepida* Trelease, n. sp.

A rather small creeping- or stoloniferous-assurgent forking succulent herb; stems slender, 1-2 mm. thick, rooting from many nodes, terete, usually branching from the rooted nodes, glabrescent; leaves about 4 at a node, round- or subquadrate- or ovate-elliptical, obtuse at both ends, 7-15 mm. long, 5-8 mm. wide, glabrous, glossy, trinerved, impressed punctulate; petiole 1-2 mm. long, more or less puberulent; spike terminal, 2-3 cm. long, ca. 2 mm. thick, rachis with anastomosing hairy ridges; peduncle slender, scarcely 1 cm. long, short hispid; bracts round-peltate, orange-dotted; ovaries subovoid, attenuate; stigma apical.



*Type:* No. 3999023, Herb. U. S. Nat. Mus., collected in 1903 by F. E. Barkewlew (no. 228) on **Socorro Island**.

Found growing in moss on trees in the forests on the upper slopes of Socorro by Mason (no. 1629). Concerning this and the following species Prof. Trelease writes, "Neither of them, so far as I can see, is identical with any published species, but both are closer to Mexican and Guatemalan species than to anything else I know; neither is very closely comparable with South American forms; and both are endemic American types (even though the Old World *reflexa* seems to contradict this idea)."

### 32. *Peperomia socorronis* Trelease, n. sp.

A moderate sized caespitose, somewhat branched erect glabrous, epiphytic herb; stems 2-3 mm. thick, somewhat scurfy-exfoliating, 1-2 dm. tall; leaves alternate, elliptic, sub-acute at both ends, 2-3 cm. broad, 3-6 cm. long, drying thin but dull and 3-5(-7)-nerved, glabrous; petioles scarcely 5 mm. long; spikes terminal or occasionally also from the upper axils, some 2 mm. thick and 10 cm. long, rather loosely flowered; peduncles 10-15 mm. long; bracts round-peltate; berries sub-globose, slightly mucronate; stigma subapical.

*Type:* No. 186616, Herb. Calif. Acad. Sci., collected May 8, 1925, by H. L. Mason (no. 1653), near the summit of **Mt. Evermann, Socorro Island**.

Growing on tree-trunks, chiefly in decaying knot-holes, in moist forests at the lower edge of the fog-belt where it obtains moisture from the fog sufficient to carry it through the dry season. It occurs associated with *P. chrysolepida*. Both species are endemic to Socorro.

## MORACEÆ

### 33. *Ficus cotinifolia* HBK.

*Ficus cotinifolia* HBK. Nov. Gen. et Sp. 2: 49 (1817); Standley, Contr. U. S. Nat. Herb. 20: 19 (1917). *F. tecolutensis* of Brandg. Zoe 5: 28 (1900).

Collected on Socorro by Anthony (no. 395), Barkewlew (no. 178) and Mason (no. 1607). According to Mason the plant forms a tree becoming 6 m. in height and 15-30 m. in spread.



Aerial roots are commonly produced. It occurs scattered over slopes where it forms conspicuous dark green masses among the dense pallid growth of *Croton*. On drier flats, along with *Psidium* and *Zanthoxylum*, it is the dominant tree in somewhat of a forest community. Because of the shade offered by the broad spread and dense foliage of the trees of this species, they are favorite gathering places for the numerous sheep that run wild on the island. The species ranges widely in Mexico. On the Pacific Coast it extends from Lower California and Sonora south into Central America.

#### LORANTHACEÆ

##### 34. *Phoradendron townsendi* Trelease

*Phoradendron townsendi* Trelease, Gen. Phoraden. 112, t. 162 (1916); Standley, Contr. U. S. Nat. Herb. 23: 226 (1922). *Ph. rubrum* of Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1890); Brandg. Zoe 5: 27 (1900).

Known definitely only from Socorro where it has been collected by Townsend (type), Anthony (sine no.), Barkelew (no. 177), and Mason (nos. 1620, 1622). Mason reports that it is parasitic on *Dodonaea* and *Guettarda*, and that it is particularly common on the west side of the island. The species is a very critical one. I believe it is rather doubtfully separable from that one of the Mexican mainland which Trelease has treated chiefly as *Ph. commutata* Trel., but which I suspect might well be accepted as *Ph. rubrum* (L.) Griseb. In short, I have accepted *Ph. townsendi* as a very questionable endemic. In any case, however, the plant has very close relatives in southern Mexico, adjacent Central America, and in the West Indies.

#### ARISTOLOCHIACEÆ

##### 35. *Aristolochia brevipes* Benth.

*Aristolochia brevipes* Benth. Pl. Hartw. 15 (1839); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1890); Brandg. Zoe 5: 27 (1900).

Collected on San Benedicto by Anthony (fide Brandg. loc. cit.), Barkelew (no. 169) and Mason (no. 1680). The last mentioned found it trailing on ash-slopes on the north side of the island. Townsend, Anthony (sine no.), and Barkelew (no.



193) found it on Socorro. The species frequents dryish situations and has been collected in most parts of Mexico, although most often in the northwestern parts.

#### AMARANTHACEÆ

##### 36. *Iresine celosia* L.

*Iresine celosia* L. Syst. ed. 10, 2: 1291 (1759).

A weak, slender suffruticose plant found by Mason (no. 1565) growing through the brush on Clarion where he reports it as common. The inflorescence on the Clarion specimens is more compact, the stems more distinctly fruticulose and the root stronger and more persistent than is usual in this species. I believe these to be mere ecological responses in this variable species. It is widely distributed through the warmer parts of America.

#### NYCTAGINACEÆ

##### 37. *Boerhaavia caribaea* Jacq.

*Boerhaavia caribaea* Jacq. Obs. Bot. 4: 5, t. 84 (1771). *B. ixodes* Standley, Contr. U. S. Nat. Herb. 13: 423 (1911). *Boerhaavia* sp. Brandg. Zoe 5: 27 (1900).

Of this extremely variable and very widely distributed species, collections have been made on Socorro by Anthony (sine no.), Barkeley (no. 205) and Mason (nos. 1603, 1674). It is said to be rather common on the island. Mason (no. 1592) also collected it on the summit ridge of Clarion.

#### AIZOACEÆ

##### 38. *Sesuvium portulacastrum* L.

*Sesuvium portulacastrum* L. Syst. ed. 10, 2: 1058 (1759); Brandg. Zoe 5: 27 (1900)

This succulent plant grows in brackish marshes or in localities near the sea throughout most of the American tropics. It is rare or at least is very rarely collected along the west coast of Mexico. It has been collected on Clarion by Anthony (sine no.) and Mason (no. 1576). The latter found it growing along the beach and on the cliffs above it.



## PORTULACACEÆ

39. *Portulaca pilosa* L.

*Portulaca pilosa* L. Sp. Pl. 445 (1753); Vasey & Rose, Proc. U.S. Nat. Mus. 13: 146-7 (1890); Brandg. Zoe 5: 27 (1900).

Collected on Socorro and Clarion by Townsend. Mason (no. 1584) found it on Clarion and only along the hills east of Sulphur Bay, where it occurs on the slopes from beach to crest. In his collections the plant has formed a very loosely branched suffruticose caudex. The leaves are very fleshy and obtuse, being rather compressed botuliform in shape. The material from Socorro represents a much more slender and apparently less persistent plant. The differences, however, are probably ecological in origin. The species ranges widely in the American tropics.

## CRUCIFERÆ

40. *Lepidium lasiocarpum* Nutt.

*Lepidium lasiocarpum* Nutt. ex T. & G. Fl. No. Amer. 1: 115 (1838); Brandg. Zoe 5: 27 (1900).

This herb has been collected on Clarion by Anthony (no. 405) and Mason (no. 1589). Mason notes that it grows in crevices on shaded cliffs and along the summit ridge of the island. The species grows in western United States and northern Mexico.

## ROSACEÆ

41. *Rubus* sp.

Material representing this genus was obtained by Mason (no. 1654) in cañons towards the summit of Socorro. The plant represented is a large shrub with stems that often climb to a height of 15 m. The collections lack flowers, fruit and even an old inflorescence. They appear to represent, however, a species related to those of southern Mexico and adjacent Central America. As far as can be judged from imperfect material, the closest relation seems to be *R. schiedianus* Steud.



42. *Prunus capuli* Cav.

*Prunus capuli* Cav. Anal. Hist. Nat. Madrid 2: 110 (1800).

Collected by Mason (no. 1635) on the east slope of Socorro where it forms large bushy pyramidal trees 3-5 m. tall. The material from Socorro generally has the leaf-blades a little more prominently toothed and proportionately somewhat broader than in the common continental form but otherwise seems quite like it. The species is found from Lower California and Sonora southward through Central America to Peru.

## LEGUMINOSÆ

43. *Calliandra socorrensis* Johnston

*Calliandra socorrensis* Johnston, Contr. Gray Herb. 70: 71 (1924). *Anneslia socorrensis* Britt. & Rose, No. Am. Fl. 23: 64 (1928). *Calliandra* spp. Brandg. Zoe 5: 27 (1900).

Two unnumbered collections of this plant were made on Socorro by Anthony. One, with leaflets 10-19 mm. long, probably came from a sheltered locality, the other, with leaflets 3-11 mm. long, from a more exposed situation. The latter collection was made the type. Mason has collected on Clarion (no. 1566) a plant obviously conspecific with these from Socorro. It is given as a shrub about a meter tall. The specimens of it are distinctly shrubby and in this regard much suggest the type, which probably also came from a shrub of similar size. No flowers of this species have ever been collected. Its fruits are known only from legumes that are old and battered. All the specimens have uniformly 2-yoked pinnae, each of which bears 4-6(-7) leaflets. The species is related to *C. formosa* (Kunth) Benth., and particularly to those forms of it that Britton & Rose, loc. cit. 68, have referred to *Anneslia gracilis* (Mart. & Gal.) Britt. & Rose. The relation of the island plant to that of western Mexico is very close. It stands as a questionable endemic. Only when good collections of it have been obtained will it be possible to decide its status definitely. I should not be surprised if it proves to be no more than an insular phase of *C. formosa*.



44. *Calliandra* sp.

A shrub collected by Mason (no. 1661) in the thickets near the crest of Socorro. It grows 15 dm. tall. The collections are fragmentary, consisting of only a few leafy twigs and some old fruits, but are sufficient to prove it different from *C. socorroensis*, the larger leaves having 3 pairs of pinnae each bearing 9-12 leaflets. It is closely related to and perhaps is no more than an island form of the widely ranging and very variable *C. portoricensis* (Jacq.) Benth. The leaflets are 3-6 mm. broad and 1-1.5 cm. long and hence are rather broad for the species.

45. *Caesalpinia crista* L.

*Caesalpinia crista* L. Sp. Pl. 380 (1753). *Guilandina socorroensis* Britt. & Rose, No. Am. Fl. 23: 338 (1930). *C. bonducella* of Brandg. Zoe 5: 27 (1900).

Collected on Clarion by Anthony (no. 417) and Mason (no. 1567), whence probably also came the collection by Barkelew (no. 207) that has been labeled as from Socorro. Barkelew's collection is the type of *Guilandina socorroensis*. Except that the island plant is somewhat less thorny than is usual in the species, it is quite like the common forms of this pantropic strand-plant. In stipules and bracts it is in no way aberrant. It will be noticed, furthermore, that the description of these structures given by Britton & Rose in their key is not in agreement with that found in their formal diagnosis. The latter is correct. The island plant is obviously a mere trivial form of *C. crista*. Mason notes that it is a straggling shrub, branched from the base and becoming 6-12 dm. tall. On the Pacific side of America the species ranges from Sinaloa in Mexico south to Ecuador. It is known from the Tres Marias, Revillagigedo, Cocos and Galapagos islands.

46. *Sophora tomentosa* L.

*Sophora tomentosa* L. Sp. Pl. 373 (1753); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 146 (1890); Brandg. Zoe 5: 27 (1900); Standley, Contr. U. S. Nat. Herb. 23: 435 (1922).

This pantropic strand-plant, generally distributed in the West Indian region, is known from the Pacific side of America only from the Revillagigedos. It has been collected



on Clarion by Townsend, Anthony (no. 404) and Mason (no. 1562). The collection made by Barkelew (no. 246) and labeled as from Socorro is probably another example of the confused data in his set of plants. I believe that Barkelew's collection also came from Clarion. Mason reports that the plant is rather common on Clarion, growing in the dense brush near the ocean, along the beach and on the low hills directly behind it. It is a shrub from a woody base and grows 2-12 dm. tall.

#### 47. *Canavalia apiculata* Piper

*Canavalia apiculata* Piper, Contr. U. S. Nat. Herb. **20**: 566 (1925). *Erythrina* sp. Vasey & Rose, Proc. U. S. Nat. Mus. **13**: 146 (1890); Brandg. Zoe **5**: 27 (1900). *C. obtusifolia* of Brandg. Zoe **5**: 27 (1900).

A very close relative and perhaps no more than a phase of the pantropic strand-plant, *C. maritima* (Aubl.) Thon., which it apparently replaces on the west coast of Mexico. Off the continent it has been collected only on Clarion where it has been obtained by Townsend, Anthony (no. 405) and Mason (No. 1552). It is abundant on Clarion growing along the beach and well up on the slopes. Mason noted, but did not collect it, at Grayson Cove on Socorro.

#### 48. *Phaseolus lunatus* L.

*Phaseolus lunatus* L. Sp. Pl. 724 (1753).

Collected on Socorro by Mason (no. 1668) who reports it as abundant and as draping profusely the bushes near the summit of the island. The species is very widely dispersed through tropical America.

#### 49. *Phaseolus atropurpureus* DC.

*Phaseolus atropurpureus* DC. Prodr. **2**: 395 (1825). *Phaseolus* sp. Vasey & Rose, Proc. U. S. Nat. Mus. **13**: 146 (1890); Brandg. Zoe **5**: 27 (1900).

Collected on Clarion by Townsend, Anthony (no. 414) and Mason (no. 1550). The collection made by Barkelew (no. 248), labeled as from Socorro, probably also came from Clarion. According to Mason the plant is found everywhere on Clarion, either trailing on the ground or climbing over



rocks. It is most abundant, however, along the beaches and on the lower hills just behind them. The species occurs in most parts of Mexico and extends into northern Central America.

50. *Rhynchosia minima* (L.) DC.

*Rhynchosia minima* DC. Prodr. 2: 385 (1825); Brandg. Zoe 5: 27 (1900).

Known on the islands only from a collection made on Socorro by Anthony (sine no.). The species is very widely distributed through tropical America, extending northward to southern Lower California, Sonora, Texas and Florida.

51. *Galactia striata* (Jacq.) Urban

*Galactia striata* Urban, Symb. Ant. 2: 320 (1900).

Specimens, showing leaves and ripe fruit, of what is almost certainly this species were collected by Mason (no. 1563) on Clarion. The plant is reported as a very abundant vine that had almost completely dried up and gone in late April when the specimens were taken. *Galactia striata* grows on the Tres Marias and is widely distributed in southern Mexico, Central America and the West Indies.

ZYGOPHYLLACEÆ

52. *Tribulus cistoides* L.

*Tribulus cistoides* L. Sp. Pl. 387 (1753); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 146-7 (1890); Brandg. Zoe 5: 27 (1900).

Collected on Socorro by Townsend, Anthony (no. 393), and Barkelew (no. 200), and on Clarion by Townsend, Anthony (no. 410), and Mason (no. 1554). On Clarion Mason notes that it is abundant near the sea, growing on beaches, dunes and sea cliffs. The species is very widely distributed through the warmer parts of America.

RUTACEÆ

53. *Zanthoxylum fagara* (L.) Sargent

*Zanthoxylum fagara* Sargent, Gard. & Forest 3: 186 (1890). *Z. pterota* HBK.; Brandg. Zoe 5: 27 (1900).

Collected on Clarion by Anthony (fide Brandg. loc. cit.) and Mason (no. 1575). A tough thorny shrub which on



Clarion is usually scattered, although at times forms almost impenetrable thickets. The species is very widely distributed in the warmer parts of America, mostly in semiarid situations.

#### 54. *Zanthoxylum insulare* Rose

*Zanthoxylum insulare* Rose, No. Am. Fauna 14: 79 (1899); Wilson, No. Am. Fl. 25: 189 (1911); Standley, Contr. U. S. Nat. Herb. 23: 534 (1923). *Zanthoxylon* sp. Brandg. Zoe 5: 27 (1900).

This species has been found on Socorro by Anthony (no. 394), Barkelew (no. 187), and Mason (no. 1636). Mason found it on the east slope of the island and reports that it is a climbing shrub with leaves that are dark and glossy green above and lighter colored beneath. The leaflets on the Socorro material occur in 5-9 pairs. The most common numbers, however, are 7-9. The species has been found only in Jamaica, Tres Marias Islands, and Socorro, and in northern and western South America. It is perhaps too closely related to *Z. culantrillo* HBK., a species which ranges from Central America to Peru and which in turn is rather close to certain species of Brazil.

### BURSERACEÆ

#### 55. *Bursera nesopola* Johnston, n. sp.

A small tree 2.5-6 m. tall; twigs red-brown, somewhat lucent, at first very sparsely and obscurely pubescent but later becoming quite glabrous; leaves usually clustered at the ends of branches or short lateral spurs, simple; blade elliptical or oblong-ovate, 2-3.8 cm. long, 1.5-2.3 mm. wide, chartaceous, apex obtuse, base obtuse to obliquely shallow-cordate, margin finely crenate, midrib evident, producing 6-7 evident parallel veins on each side, secondary venation usually obscure; upper leaf-surface slightly vernicose, sparsely and usually obscurely hispidulous, slightly glandular; lower leaf-surface more conspicuously (usually brownish) hispidulous, particularly on the veins and midrib, paler, opaque, somewhat glandular; petiole about one-fourth length of blade, 5-10 mm. long, hispidulous, unwinged; inflorescence slender, surpassing the leaves, 3-5 cm. long, loosely 3-7-flowered, racemose, finely pubescent; pedicels ascending, 3-5 mm. long; calyx sparsely hispidulous, ca. 2 mm.



thick at base, lobes erect cuneate 1.5-2 mm. long; petals elliptical ovate, 2-2.5 mm. long, 1.3 mm. wide, sparsely hispidulous outside; filaments subulate, ca. 0.8 mm. long, glandular-pulverulent; anthers ca. 1 mm. long; ovary glabrous; submature fruit obliquely and somewhat irregularly obovoid or pyriform, 7-9 mm. long, glabrous.

*Type:* No. 186618, Herb. Calif. Acad. Sci., collected May 3, 1925, by H. L. Mason (no. 1609), at Benner Cove on Socorro Island.

This species, which Mason found occurring as scattered trees on drier slopes at the south end of Socorro, is obviously related to *B. rhoifolia* (Benth.) Johnston, a plant widely distributed over the southern parts of Lower California and adjacent Sonora. It differs from the peninsular relative in having a very much sparser rather obscure pubescence, subvernicate upper leaf-surfaces, and very elongate inflorescences.

#### EUPHORBIACEÆ

##### 56. *Croton masonii* Johnston, n. sp.

Shrub 3-25 dm. tall; bark rough, deciduous; twigs pallid, copiously stellate-tomentose, eglandular, the trichomes consisting of a well developed erect or ascending axis and numerous short appressed radiate branches; leaves ovate to lance-ovate, 1.5-3.5 times as long as broad, 2.5-7 cm. long, 1.5-4 cm. broad, broadest below the middle, not at all lobed, palmately 5-costate at base although practically pinnate in venation, lacking laminar or petiolar glands, base rounded or somewhat truncate, apex acute or acuminate, margin denticulate, upper surface with impressed ribs and veins and green or somewhat grayish with a fine stellate pubescence, under surface densely white stellate-tomentose with prominent ribs and primary veins and prominent secondary veins; petiole 5-20 mm. long, a fifth to a sixth the length of the blade, pallid with a stellate tomentum; stipules subulate, caducous, pallid and tomentose, 3-5 mm. long; inflorescence usually terminating short leafy branchlets, racemose, usually 6-12 cm. long, a centimeter or less thick, bisexual, rarely branched towards the base; bracts linear, 3-5 mm. long; *staminate flowers* usually 25-70 in each raceme; pedicels 3-5 mm. long; buds subglobose ca. 2 mm. thick, white



stellate tomentose; calyx cut two-thirds to base into 5 triangular-ovate lobes; petals 5, surpassing the calyx, ca. 3.5 mm. long, ca. 1.3 mm. wide, oblanceolate, obtusish, inner face evidently simple-villous especially below the middle, outer face somewhat stellate; stamens 10-15, ca. 3 mm. long, villous especially towards the base; glands 5 on the edge of the villous receptacle opposite the sepals; *pistillate flowers* 1-20, replacing the staminate flowers towards the base of the racemes, subsessile; buds angulate, ovoid with an obtuse or truncate apex, ca. 2.5 mm. long, stellate-tomentose inside and out; petals represented by glands or very rarely with one or more developing and becoming 1.5-2 mm. long and linear with a lacerate or villous margin; calyx lobed to well beyond the middle, the sinus somewhat plicate; calyx-lobes 5, somewhat oblong, thickish, acute, decidedly accrescent and persistent at maturity, becoming 4-5 mm. long and evidently embracing the fruit; ovary ovoid-globose, ca. 1.5 mm. thick, densely stellate; capsule 3-celled, 6-8 mm. long, stellate tomentose, apex obtuse or truncate; styles 3, each 2 mm. long and parted to the base, the divisions each forked at their middle, stellate on the outer face; seeds 4-5 mm. long.

*Type:* No. 186600, Herb. Calif. Acad. Sci., collected May 5, 1925, by H. L. Mason (no. 1637) on the east slope of Socorro Island.

This very distinct endemic of Socorro has the general facies of the widely distributed Mexican *C. cortesianus* HBK., but differs not only in such details as having the upper surface of the palmately ribbed leaves stellate rather than glabrous but also in the striking and important development of having the calyx of the female flowers persistent, strongly accrescent and eventually quite embracing the fruit. In fact the persistent, conspicuously accrescent calyces of *C. masonii* distinguish it quickly and decisively from all but a very small number of the American species of this large genus, none of which seem very closely related to it. Although the relations of the island plant are obscure, in general they seem to be with the species of southern Mexico and adjacent Central America. The plant grows in dense pure stands over all the south slope of Socorro, extending from sea-level up to the plateau where its upper limit is abruptly marked. It forms almost impenetrable thickets



over large areas and was one of the most trying plants for the members of the recent expedition since it was necessary to fight a passage through its stands in order to get anywhere on the island from the anchorage. Collections of it have been made on Socorro by Anthony (sine no.), Barkelew (no. 180) and Mason (no. 1637). It is reported as "*Croton* sp." by Brandegee, *Zoe* 5: 27 (1900).

#### 57. *Acalypha umbrosa* Brandg.

*Acalypha umbrosa* Brandg. *Erythea* 7: 7 (1898) and *Zoe* 5: 27 (1900); Standley, *Contr. U. S. Nat. Herb.* 23: 630 (1923); Pax & Hoffm. *Pflanzenr.* [Heft 85] *Fam.* 147, pt. 16, pg. 124 (1924).

Known only from Socorro where it has been collected by Anthony (no. 375, type), Barkelew (no. 206), and Mason. Mason obtained it (no. 1623) near Grayson Cove, where on the burned-over area it formed a common small bush 4.5-6 dm. tall, and later (no. 1660) recollected it near the summit of the island. The species seem to be polygamodioecious. Most of the material seems to have axillary inflorescence consisting of a few pistillate flowers borne on the peduncle of the dense elongate spike of staminate flowers. Although this condition seems to prevail, I found that some specimens (in one case a single branch of a prevailingly staminate specimen) tend to be predominately if not exclusively pistillate. These forms have axillary spikes of 10-25 pistillate flowers and, apparently late in the season, develop a distinctly terminal pistillate spike also. A similar variation on the arrangement of the pistillate and staminate flowers is to be observed in *A. californica* Benth. That latter species, which is chiefly peninsular, is probably the closest relation of *C. umbrosa*.

#### 58. *Hippomane mancinella* L.

*Hippomane mancinella* L. *Sp. Pl.* 1191 (1753); Brandg. *Zoe* 5: 28 (1900); Standley, *Contr. U. S. Nat. Herb.* 23: 649 (1923).

Collected on Socorro by Anthony (no. 388), and Mason (no. 1625). At Grayson Cove the tree is said to be locally abundant and to form a small grove back of the shore. There are many interesting and conflicting reports regarding the



poisonous qualities of this plant, cf. Standley, loc. cit. Mr. Mason's observations in this connection are of some interest. The plant has been reported as producing very severe dermatitis. The poisonous qualities of its fruit have been repeatedly emphasized. Dermatitis was produced on a member of the Academy expedition who came in contact with the juice of a crushed leaf. The wood, however, was used as fuel and the shade of the trees was enjoyed, yet no other case of dermatitis developed. Sheep were noted to eat the leaves and parakeets to break open the fruits and eat the seeds. With this example some of the party ate the seeds and found them to have a flavor suggestive of that of black walnuts. The species frequents coasts and is widely distributed in the West Indian region. Along the Pacific Coast it is known from Socorro and the Galapagos Islands and on the mainland from southernmost Mexico to Ecuador.

59. ***Euphorbia californica* Benth.**

*Euphorbia californica* Benth. Bot. Voy. Sulphur 49 (1844); Brandg., Zoe 5: 27 (1900).

Collected on Clarion by Anthony (no. 413), and Mason (no. 1564). Mason notes that it is a rather succulent shrubby plant 5-10 dm. tall, scattered abundantly in the brush over the island. It was in leafless condition the last of April when he collected it. The plant also grows in the coastal region of Sinaloa, Sonora, and southern Lower California.

60. ***Euphorbia incerta* Brandg.**

*Euphorbia incerta* Brandg. Proc. Calif. Acad. Sci. ser. 2, 3: 171 (1891) and Zoe 5: 27 (1900).

Collected on Socorro by Townsend, Anthony (no. 399), and Barkelew (no. 244). The species is known only from a relatively few scattered stations. It has been collected in the general vicinity of La Paz, Lower California, and at Mazalan, Sinaloa, and on the Tres Marias and Revillagigedo islands. It appears to grow chiefly, if not exclusively, in sands along the sea shore.



61. *Euphorbia anthonyi* Brandg.

*Euphorbia anthonyi* Brandg. Erythea 7: 7 (1898) and Zoe 5: 27 (1900); Standley, Contr. U. S. Nat. Herb. 23: 602 (1923). *E. clarionensis* Brandg. Erythea 7: 7 (1898) and Zoe 5: 27 (1900). *Chamaesyce deppeana* Millsp. Pub. Field Mus., Bot. 2: 409 (1916); Johnston, Contr. Gray Herb. 68: 87 (1923).

Although there has been some attempt in the past to distinguish specifically the material from each of the islands in the archipelago, my attempts to do so have been quite unsuccessful. There do appear to be certain tendencies that are correlated with certain islands, but these seem too indefinite or too trivial to justify, certainly at this time, the dignifying of them by specific recognition. I have accordingly placed all the material from the islands, of this general relationship, under *E. anthonyi*. Specimens have been collected on Clarion by Townsend, Anthony (no. 406, type of *E. clarionensis*), and Mason (no. 1556); on San Benedicto by Anthony (no. 369, type of *E. anthonyi*), Barkelew (no. 174), and Mason (no. 1688); and on Socorro by Townsend, Barkelew (nos. 204, 204a), and Mason (nos. 1600, 1671). The collections from Clarion and San Benedicto show little variation and seem very much alike except that those from Clarion have distinct narrow white petaloid appendages on the involucre-glands, whereas those from San Benedicto quite lack them. As the material from Socorro also lacks appendaged involucre-glands, the form from Clarion may for convenience be distinguished as *E. anthonyi* var. *clarionensis* (Brandg.), comb. nov. The material assembled from Socorro is very variable. Some of it (Barkelew 204 and Mason 1600) is as robust and has quite the same habit as that from San Benedicto. The Socorro plants, however, tend to be more slender, possibly in response to more favorable conditions found on that island. Some of these forms (Townsend, Barkelew 204a and Mason 1671) approach in habit the fruticulose forms of *E. hypericifolia* L. Indeed I am inclined to believe that *E. anthonyi*, which is endemic to the archipelago, was probably derived from that species or some other closely related one belonging to the same plexus of puzzling ill defined species. These latter are found throughout the warmer parts of America.

It is to be hoped that future collectors on the islands will watch this *Euphorbia* for variations and that they will prepare



more than a single collection from each island. Our knowledge of its habit of growth and of its selection of habitats is very meagre. Mason notes that on Clarion it is "common among the brush" and that it assumes "shrubby proportions away from the sea" and becomes prostrate along the beach. On San Benedicto he reports it as a common shrubby prostrate plant. Nothing is noted regarding its habit, habitats, abundance or variation on Socorro.

#### AQUIFOLIACEÆ

##### 62. *Ilex socorroensis* Brandg.

*Ilex socorroensis* Brandg. Univ. Calif. Pub. Bot. 4: 90 (1910); Standley, Contr. U. S. Nat. Herb. 23: 675 (1923).

The type of this very distinct endemic was collected on Socorro by Barkelew (no. 179). Mason (no. 1634) found the species on the east slope of Socorro where it becomes arborescent, reaches 6 m. in height and forms dense thickets. The flowers are given as white and 4-5-merous. The species has no obvious relations in Mexico or Central America and seems, in fact, to be rather evidently related to *I. repanda* and its immediate relatives in the West Indies.

#### SAPINDACEÆ

##### 63. *Cardiospermum halicacabum* L.

*Cardiospermum halicacabum* L. Sp. Pl. 366 (1753). *C. palmeri* Vasey & Rose, Proc. U. S. Nat. Mus. 13: 147 (1890); Brandg. Zoe 5: 27 (1900).

Of this widely distributed and very variable vine of the tropics a glabrous form has been collected on Clarion by Mason (no. 1591) and a densely pubescent form has been collected on Socorro by Townsend, Anthony (no. 379), Barkelew (no. 203), and Mason (no. 1645). The pubescent form of Socorro is similar to plants of the peninsula and of the mainland of Mexico that have been referred to *C. palmeri* Vasey & Rose, and to *C. corindum* L. These plants I believe are mere phases of the variable and very widely ranging *C. halicacabum*. It is interesting, however, that Socorro and Clarion have different forms. The plants on these islands are



quite similar in leaf-outline, shape of fruit, etc. They differ merely in that one is densely pubescent, almost velvety, whereas the other is quite glabrous.

#### 64. *Sapindus saponaria* L.

*Sapindus saponaria* L. Sp. Pl. 367 (1753). *Sapindus* sp. Vasey & Rose, Proc. U. S. Nat. Mus. **13**: 146 (1890); Brandg. Zoe **5**: 27 (1900).

Collected on Clarion by Townsend, Anthony (sine no.), and Mason (no. 1561). Mason reports that it grows there behind the beach about a vernal pool and that it forms a large thicket used by the Blue-faced Booby as nesting sites. As many as ten nests were frequently found in a single plant. It is the largest shrub on the island growing to a height of 2-3 m. The species is widely distributed in the warmer parts of America.

#### 65. *Dodonaea viscosa* Jacq.

*Dodonaea viscosa* Jacq. Enum. Pl. Carib. 19 (1760); Vasey & Rose, Proc. U. S. Nat. Mus. **13**: 146, 148 (1890); Brandg. Zoe **5**: 27 (1900).

This shrub, which is very widely distributed in the warmer parts of America, has been collected on Socorro by Townsend, Anthony (no. 390), and Mason (no. 1621) and on Clarion by Townsend, Anthony (no. 412), and Mason (nos. 1551, 1577). A collection by Barkelew (no. 188), labeled as from San Bendicto, probably also came from Clarion or Socorro. According to Mason the shrub grows on Clarion at the summit of sea-cliffs where its dark green color makes it a very conspicuous plant against the prevailing gray color of the mass of the vegetation on the island.

### SABIACEÆ

#### 66. *Meliosma nesites* Johnston, n. sp.

Tree becoming 20 m. tall; branchlets pale, terete, sparsely brownish hispidulous and somewhat glandular, becoming glabrate; axillary buds brown with a dense pubescence; leaves alternate, firmly chartaceous; blades oblanceolate, 10-18 cm. long, 3-6 cm. broad, broadest above the middle and then con-



tracted towards both ends, glabrous or very sparsely and obscurely pubescent along the veins and in the vein-axils beneath, apex acuminate, base cuneate, margin somewhat crisped but quite entire, upper surface dark green; beneath paler, somewhat lustrous, midrib prominent and producing 9-13 veins on each side, veins prominent, arcuately ascending, arching to 2-4 mm. from the leaf-margin, tertiary and even finer veining evident and reticulate; petioles 8-11 mm. long, upper half slender, glabrous, smooth and very narrowly winged, lower half coarse thickened, paler and somewhat pubescent; panicle axillary, 5-13 cm. long, sparsely and divaricately branched, sparsely brownish-hispidulous and somewhat glandular, lower branches 5-15 or becoming as much as 25 mm. long; pedicels ca. 1 mm. long; sepals 1-1.5 mm. long, glandular-ciliate, orbicular-ovate, apex obtuse with a rounded tip, base broad and somewhat auriculate, the 3 inner sepals slightly the largest and broadest; petals and androecium unknown; disk cupulate, ca. 0.6 mm. high, bearing 5-10 oblong glandular teeth, closely investing the lower three-fifths of the ovary; ovary 2-celled, studded with short appressed glandular hairs; style ca. 1.5 mm. long, about once and a half the length of the ovary; fruit purple, on pedicels 2-4 mm. long; carpels obliquely subglobose, ca. 12 mm. in diameter, usually only one developing from each flower, becoming glabrous.

*Type:* No. 186617, Herb. Calif. Acad. Sci., collected May 5, 1925; by H. L. Mason (no. 1627) on the east slope of Socorro Island.

This species is most closely related to *M. idiopoda* Blake of Costa Rica, from which it differs in its more elongate leaves, sparse spreading pubescence on the stems and leaves, better developed and deeper floral disk, long style, and glandular-strigose ovary. Along with *M. idiopoda* it finds its relatives in the Costa Rican *M. glabrata* (Liebm.) Urban and *M. tonduzii* Donn. Sm. and in the north Panamanian *M. panamensis* Standley. *Meliosma nesites* is, accordingly, an outlying member of a group that centers in Costa Rica. A few species of the genus extend from the Caribbean islands and from Central America into the extreme southern parts of Mexico. These Mexican species, however, do not appear to be immediately related to our island plant.



## RHAMNACEÆ

67. *Rhamnus discolor* (Donn. Sm.) Rose

*Rhamnus discolor* Rose, Contr. U. S. Nat. Herb. 8: 51 (1903).

To this species of Central America and southernmost Mexico I refer material collected by Mason (no. 1667) on rocky forested slopes near the summit of Socorro. This material is very similar to that of the type-collection of *R. discolor* made in Guatemala, the chief differences being that the island plants have glabrate stems, slightly larger leaves that are glabrous above, slightly larger flowers, and decidedly hairy ovaries. The continental plants of *R. discolor*, however, are very variable in these as well as other characters so that the Socorro plants fall well within the gamut of variation well known and now accepted for the species.

68. *Karwinskia humboldtiana* (R. & S.) Zucc.

*Karwinskia humboldtiana* Zucc. Abh. Akad. Wiss. München 2: 351 (1832);  
Brandg. Zoe 5: 27 (1900).

Collected on Clarion by Anthony (sine no.), and Mason (no. 1588). The latter notes that it is a large shrub or small tree, up to 4.5 m. tall. The species is a variable one and is found in most parts of Mexico.

## TILIACEÆ

69. *Triumfetta socorrensis* Brandg.

*Triumfetta socorrensis* Brandg. Erythea 7: 1 (1898) and Zoe 5: 27 (1900);  
Standley, Contr. U. S. Nat. Herb. 23: 745 (1923).

An endemic of Socorro originally collected and described from material obtained by Anthony (no. 378). The only other collections are by Barkelew (no. 197) and Mason (no. 1672). The latter obtained it near Grayson Cove where he notes that it is abundant in the area burnt over by the castaway Grayson. The plant is a shrub 1-1.5 m. tall. The species is a very distinct one. Its immediate relationships are quite uncertain although they lie probably with some of the species of southern Mexico or northern Central America.



## MALVACEÆ

70. *Abutilon californicum* Benth.

*Abutilon californicum* Benth. Bot. Voy. Sulphur 8 (1844).

A rather mature specimen from Socorro collected by Barkelew (no. 184) seems to be referable to this Lower Californian species.

71. *Sida hederacea* (Dougl.) Torr.

*Sida hederacea* Torr. ex Gray, Mem. Am. Acad. Sci. ser. 2, 4: 23 (1849).

Forming large grayish patches about a dried pool back of the beach on Clarion where it was found by Mason (no. 1558). Widely distributed in saline or alkaline soils in western United States but somewhat less commonly in Mexico where it extends, apparently through the eastern parts of that country, south to Oaxaca. On the Pacific coast of Mexico it is rare or absent for I have seen no material from south of Lower California.

72. *Sida rhombifolia* L.

*Sida rhombifolia* L. Sp. Pl. 684 (1753).

Collected by Barkelew (no. 232) on Socorro. The species is generally distributed through the warmer parts of America.

73. *Sida nesogena* Johnston, n. sp.

Slender strictly branched shrub up to 8 dm. tall; stems sparsely stellate, copiously short glandular-villous; leaves ovate to lance-ovate, 1.5-3.5 cm. long, 10-18 mm. wide, palmately 5-costate, densely glandular-stellate, even velvety when young, irregularly serrate, frequently somewhat 3-lobed, paler beneath, apex acute or somewhat acuminate, base rounded or cordate; petioles 5-15 mm. long, slender, sparsely stellate, glandular-villous; flowers axillary, solitary or grouped in short-pedunculate few-flowered cymose clusters, borne along the upper parts of the stem and together forming an elongate leafy panicle 1-2 dm. long; mature calyx glandular-villous, 4-5 mm. long, angulate, cut to beyond the middle; lobes ascending, acute to shortly acuminate; corollas orange-yellow;



carpels 5, nearly 3 mm. long, inner face reticulate and glabrous; back of carpels convex, thickened on the margins and down the middle, obscurely glandular, armed (particularly along the thickened midpart) with short coarse antrorse usually falcate hairs; sterile parts of carpels obliquely ovate or narrowly deltoid, well developed, not united, armed with numerous short stiff antrorse hairs, apex acute or obtusish, not beaked; seeds dark brown, smooth, glabrous, ca. 1.3 mm. long.

*Type*: No. 186605, Herb. Calif. Acad. Sci., collected May 4, 1925, by H. L. Mason (no. 1613) among brush and coarse grass at about 160 m. alt. in the hills back of Grayson Cove, Socorro Island.

This species, which is known only from the overly mature collection cited above, is related to both *S. glutinosa* Commers. and *S. glabra* Mill. From *S. glutinosa* it differs in having unappendaged carpels, orange-yellow corollas, and an indument on stems, pedicels, petioles and calyces which is almost exclusively glandular-villous and only sparsely stellate. From *S. glabra* it differs in its conspicuous and quite copious glandular indument, and coarsely short-hairy carpels. On the whole I am inclined to believe that *S. nesogena* is closest to *S. glabra*, particularly to the form from western Mexico described as *S. alamosana* Wats. The island plant, however, differs so strikingly in the amount, kind and distribution of its pubescence that I am quite unwilling to assign it to that species even as a variety. The carpels of *S. nesogena* are provided with short stout antrorse hairs. I have found no similar development in either *S. glabra* or *S. glutinosa*.

#### 74. *Gossypium hirsutum* L.

*Gossypium hirsutum* L. Sp. Pl. ed. 2, 975 (1763). *G. barbadense* of Brandg. Zoe 5: 27 (1900).

A collection of this cotton, showing flowers and fruit, has been made on Socorro by Anthony (sine no.). The species is widely distributed in tropical America. It is cultivated but is not uncommon in the wild or semi-wild state. Nothing being on record regarding the conditions under which Anthony collected it on Socorro, I have questionably accepted it as part of the indigenous flora rather than a recent man-assisted adventive.



## STERCULIACEÆ

75. *Melochia pyramidata* L.

*Melochia pyramidata* L. Sp. Pl. 674 (1753); Brandg. Zoe 5: 27 (1900).

Material of this species has been collected on Clarion by Anthony (no. 408) and Mason (no. 1560) and, if we are to believe the label, also on Socorro by Barkelew (no. 247). Mason found it growing abundantly along the bottoms of dry gulches. The species is very widely distributed in the tropics.

76. *Waltheria americana* L.

*Waltheria americana* L. Sp. Pl. 673 (1753); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 146-7 (1890); Brandg. Zoe 5: 27 (1900).

Collected on Socorro by Townsend, Anthony (no. 381), Barkelew (no. 222) and Mason (no. 1646). On Clarion collections have been obtained by Townsend, Anthony (sine no.) and Mason (no. 1557). On Socorro Mason obtained his material at Bathurst Bay and notes that the plant is of "general distribution on the west side of the island where mixed vegetation prevails". He notes that on Clarion it is abundant on sea-cliffs and that a less common depressed form is prevalent on the beach. The species is generally distributed in Mexico and in other warmer parts of the World.

## GUTTIFERÆ

77. *Hypericum eastwoodianum* Johnston, n. sp.

A glabrous perennial becoming much branched and decidedly fruticose, 2-5 dm. tall, usually rather strict; stems erect or ascending, at first green and quadricostate but with age becoming more or less terete and developing a smooth russet bark that on the oldest parts becomes broken and rough; leaves decidedly elongate, 6-12 times as long as broad, except below the inflorescence usually 2 or more times the length of the internodes, margins revolute, upper surface green and under high magnification regularly papillate-tessellate, under surface glaucous, sparsely pellucid-punctate and with an evident midrib but no veins, apex acute or obtusish, blade contracted in the lower third of its length to a rather narrow sessile base,



the larger leaves on the main stems becoming 2.5-3 cm. long and 3-6 mm. wide but those on the twigs and younger parts (which form most of the foliage) 1-2 cm. long and ca. 2 mm. wide although appearing narrow because of their revolute margins; inflorescence terminal, a dichasial cyme with ascending or even strictly ascending branches, simple or less commonly compound, 5-30-flowered; peduncles 1-2 cm. long; bracts linear, acute, 5 mm. long or less; pedicels slender, strictly ascending, 2-4 mm. long; sepals at anthesis ca. 4 mm. long, strictly ascending, herbaceous, more or less evidently 3-7-nerved, slightly unequal, larger ones broadly oblanceolate or oblong, acute, ca. 1.5 mm. wide, in age somewhat accrescent and becoming as much as 5 or even 6 mm. long; petals oblanceolate, ca. 6 mm. long or possibly a little longer, apex rounded; stamens free, 40-50; ovary at anthesis ovoid-ellipsoid, 2 mm. long, surmounted by 3 slender styles ca. 1.5 mm. long; capsule attenuate, 4-4.5 mm. long, scarcely if at all surpassing the calyx.

*Type*: No. 186606, Herb. Calif. Acad. Sci., collected May 4, 1925, by H. L. Mason (no. 1614) from sheltered places on cliff-faces at Grayson Cove, **Socorro Island**.

This species has been collected also on Socorro by Barkelew (no. 229). The exact relations of this insular endemic are uncertain. It falls into the subsection *Spachium* of Keller, E. & P. Nat. Pflanzenf. ed 2, 21: 181-2 (1925), and in the group in his synopsis numbered  $\alpha\beta III 2^{\times\times}$ . It is particularly well marked by its very short, scarcely if at all exerted capsules, shrubby habit and abundant foliage. These characters and its more abundant stamens separate it from *H. canadense* L., *H. chilense* Gay and *H. caespitosum* C. & S., to which it works out in the key to the section *Brathys* given by Keller, Bull. Herb. Boiss. ser. 2, 8: 180 (1908). The specific distinctness of this plant of Socorro was long ago recognized by Miss Alice Eastwood, as shown by the unpublished manuscript name under which Barkelew's collections have been distributed. The name she selected, however, is no longer available since it has appeared in botanical literature applied to a very different plant of Corsica. I find it hence eminently fitting as well as a great pleasure to associate the name of my kind and very good friend with this well marked species.



## CACTACEÆ

78. *Opuntia* sp. vel spp.

Although one of the flat-jointed species of this genus is the most notorious plant of Clarion, where its abundant growth makes almost impassable large areas on the south side of the island, no specimens of it have been collected and preserved for study. The same species or one of similar habit is also known from Socorro. On the latter island, however, the cactus patches are apparently less extensive. Accounts of Socorro have scarcely any mention of them. No cactus has been reported from San Benedicto. While the island *Opuntias* may represent species known from Lower California or the Mexican mainland, it is more probable that they represent one or more endemic species that are, hence, undescribed and unnamed. It is to be hoped that future collectors on the islands will obtain good specimens of these conspicuous plants. The slabs of the cactus if split longitudinally may be dried like an ordinary plant. Needless to say flowers and fruit should also be preserved. Good photographs of the whole plant and of a flowering slab would materially assist in making the determination in this excessively large and difficult genus.

## COMBRETACEÆ

79. *Conocarpus erecta* L.

*Conocarpus erecta* L., Sp. Pl. 176 (1753); Brandg. Zoe 5: 27 (1900).

Collected on Socorro by Anthony (no. 397) and Barkelew (no. 242). This widely dispersed American strand-tree ranges on the Pacific coast from southern Lower California south to Ecuador and the Galapagos Islands.

## MYRTACEÆ

80. *Psidium galapageium* Hook. f.

*Psidium galapageium* Hook. f., Trans. Linn. Soc. London 20: 224 (1847).

Doubtfully to this species, which has been considered endemic to the Galapagos Islands, I refer material collected near Grayson Cove on Socorro by Mason (no. 1676). It is a tree 3-9 m. tall, growing on the forest border scattered in groves



of *Ficus* and *Bumelia*. The lanceolate or oblanceolate leaves are 3-5.5 cm. long and 11-19 mm. broad and are acute at both ends. Both surfaces are minutely brownish pilose. The twigs are also brownish pilose, usually rather copiously so and slightly glandular. The Galapagos plants are rather variable in the amount and distribution of their pubescence but some forms are exceedingly similar to the Socorro plants in this regard. In most of the Galapagos material the leaves are slightly less elongate. The leaf-texture, however, is quite similar to that found in our plants. The length position and indument of the peduncles, the size shape and position of the flower-buds, as well as the apically slightly free sepal-tips are quite alike in both the Socorro and Galapagos specimens. Unless both the Galapagos and Socorro plants represent insular modifications of some small-flowered, small-leaved continental plant that I have failed to recognize, I see no other course than to indicate a direct specific relationship between the guavas of these far-separated archipelagos. No pubescent, small-flowered, small-leaved species of *Psidium* has been reported from Mexico or Central America.

Probably conspecific with Mason's collections are those made on Socorro by Anthony (no. 396) and Barkelew (sine no.). Their material is very much more mature. There are completely developed fruits but no buds or flowers. The foliage is matured and partly deciduous. As far as can be compared the collections of Anthony and Barkelew differ from those of Mason chiefly in having the indument on the firmer leaves almost all deciduous, a difference which is almost certainly associated with their advanced state of maturity.

#### 81. *Psidium socorrense* Johnston, n. sp.

Shrub 3-12 dm. tall; branches subterete, rather copiously brownish short-pilose; leaves ovate-oblong to ovate-elliptic, about twice as long as broad, 4-5.5 cm. long, 15-30 mm. broad, pellucidly punctate, distinctly brownish pilose on the midrib and veins but elsewhere sparsely pubescent, apex acute or short acuminate, base rounded or obtuse, margins slightly revolute, above dark green with weakly impressed veins, secondary venation obscure, petioles usually ca. 5 mm. long; peduncles ascending, solitary in the axils, one-flowered, 1-1.5



cm. long, brownish pilose; flower buds becoming 9 mm. long, ca. 4.5 mm. thick, subsessile; bracteoles 2, linear, 3-4 mm. long, ca. 0.5 mm. wide, caducous; calyx before anthesis completely closed, the apex apiculate; sepals concave, suborbicular, ca. 5 mm. long, subcoriaceous, inner surface distinctly glandular strigose, the tips not free in the bud; petals white, concave, obovate, 5-6 mm. long, 4 mm. wide, prominently gland-dotted, apex rounded, margin more or less definitely antrorse-ciliate; stamens 3-4 mm. long, glabrous; anthers 0.75 mm. long; staminal disk puberulent; style ca. 5 mm. long, below the middle sparsely appressed long-villous; stigma small; ovary pubescent, 3-celled; fruit glabrate, purple, obovoid or globular ovoid, 13-15 mm. long, 11-12 mm. thick, producing several seeds in each cell; seeds angular and compressed, ca. 5 mm. long.

*Type:* No. 186614, Herb. Calif. Acad. Sci., collected May 5, 1925, by H. L. Mason (no. 1639) on the east slope of Socorro Island.

This interesting shrub is very closely related to *P. galapageium* and perhaps may be only a phase of it differing in its much broader leaves, slightly less dense eglandular indument, villous style, more definitely ciliate petals and distinctly united sepal tips. In *P. galapageium* the tips of the sepals in the mature bud are distinctly free, but in *P. socorrense* they are united to form a terminal mucronate tip for the unopened bud. According to Mason *P. socorrense* is abundant in pure open stands on the plateau of Socorro. It seems to be confined to level areas.

#### ARALIACEÆ

#### 82. *Oreopanax xalapense* (HBK.) Decsne. & Planch.

*Oreopanax xalapense* Decsne. & Planch. Rev. Hort. ser. 4, 3: 108 (1854).

Collected on Socorro by Barkelew (no. 230) and Mason (no. 1626). Mason reports that it is a slender tree 3-4.5 m. tall growing in a forested valley near the summit of Mt. Evermann. The plant grows in the shade of larger trees. Off the island it is known in southern Mexico (Jalisco) and south into Guatemala.



## SAPOTACEÆ

83. *Bumelia socorrensis* Brandg.

*Bumelia socorrensis* Brandg. Zoe 5: 106 (1901); Standley, Contr. U. S. Nat. Herb. 23: 1118 (1924). *Bumelia* sp. Brandg. Zoe 5: 27 (1900).

Collected on Socorro by Anthony (sine no.; type), Barkelew (no. 190) and Mason (no. 1638). Mason notes that it is a large beautiful dark-green tree 6-12 m. tall. It grows scattered on rocky outcrops near the summit of the island but gets its best development along the forest border. The flowers are white and fragrant. The fleshy dark blue drupes have a slightly milky juice and are very sweet and palatable. They are a source of food for thousands of birds on the island, being particularly relished by the parakeets and pigeons. The affinities of the species are quite uncertain.

## OLEACEÆ

84. *Forestiera rhamnifolia* Griseb.

*Forestiera rhamnifolia* Griseb. Cat. Pl. Cub. 169 (1866).

Material, representing either this species or a very closely related endemic one, has been collected on Socorro by Barkelew (no. 220) and Mason (no. 1657). It is said to be a small tree and to grow near the summit of the island. Barkelew's collections are sterile and Mason's have only blighted fascicles of staminate flowers. As far as comparisons can be made, however, the Socorro plant seems quite inseparable from *F. rhamnifolia*, a species known only from the West Indies and from a collection on the mainland near Vera Cruz, Mexico. The plant consequently belongs with *Adiantopsis*, *Paspalum*, *Sporobolus*, *Pleurothallis* and *Ilex* as part of the clear-cut Caribbean element in the Socorro flora. It is to be hoped that the next collector on the island will make particular effort to procure good flowering and fruiting material of this very interesting plant.

## ASCLEPIADACEÆ

85. *Metastelma* sp.

Apparently referable to this genus is a collection made on Socorro by Barkelew (no. 217). The material, however, is ex-



cessively mature having lost not only all flowers and fruit but almost all its leaves as well. Until better material is collected the identity of the species must remain unknown. In gross habit the plant suggests various species of Mexico.

#### CONVOLVULACEÆ

##### 86. *Ipomoea triloba* L.

*Ipomoea triloba* L. Sp. Pl. 161 (1753).

Collected by Mason (no. 1644) at Bathurst Bay on Socorro. The plant grew near the beach in a cactus patch where it was protected from the ravages of sheep. The material is very mature, but except that the peduncles are shorter than is common in the species, seems to be clearly referable to *I. triloba*. The species is widely distributed in warmer parts of America.

##### 87. *Ipomoea pes-caprae* (L.) Sweet

*Ipomoea pes-caprae* Sweet, Hort. Suburb. Lond. 35 (1818).

This pan-tropic strand-plant has been collected on Socorro by Anthony (sine no.), Barkelew (no. 194) and Mason (no. 1673). The latter found it at Grayson Cove where it is said to be not uncommon. On San Benedicto, Mason (no. 1686) found it only on the north slope of the island and well up on the ridge. On Clarion he (no. 1559) found it common on the beaches and developing stems 10-15 m. in length. The plant is very widely distributed on beaches through most of the tropics. On the Pacific side of America it extends from Lower California and Sonora south to Ecuador. It occurs on all the islands off that coast.

##### 88. *Ipomoea cathartica* Poir.

*Ipomoea cathartica* Poir. Encyc. Suppl. 4: 633 (1816); Brandg. Zoe 5: 27 (1900).

*Ipomoea* sp. Vasey & Rose, Proc. U. S. Nat. Mus. 13: 146 (1891).

One of the conspicuous plants on Clarion where it has been collected by Townsend, Anthony (no. 403 in pt.) and Mason (no. 1568). Most of the collected material represents the glabrous form of this variable species. Anthony's collection,



however, which consists of a mixture of *I. halierca* and *I. cathartica*, shows (at least in the specimens at the Gray Herbarium) two forms of the latter, i. e. the common glabrous form as well as a strigose form (or possibly even a hybrid-cross with *I. halierca*) not obtained by other collectors on the island. There yet remains for consideration a collection made by Barkelew (no. 245). At the Gray Herbarium and the National Herbarium this is also a mixture consisting of *I. halierca* and the ordinary glabrous form of *I. cathartica*. It is labeled as from Socorro. As both of these species are common and very conspicuous plants on Clarion where Barkelew is known to have collected and since neither of them has been collected by others on Socorro, I am of the opinion that these morning glories, along with a number of other collections of Barkelew, really came from Clarion and were somehow mislabeled. Mason notes that *I. cathartica* is common throughout the brush on the island. The corolla is given as being bright blue when fresh.

89. *Ipomoea halierca* Johnston, n. sp.

A strong perennial; stems trailing or clambering, only weakly twining, the older parts becoming shrubby, the younger leafy stems pallid with a dense almost velvety indument of soft spreading or antrorse hairs 0.5-1 mm. long; leaves alternate; petioles ca. 2 mm. thick, 2-5 cm. long, very densely and antrorsely villous; leaf-blades very firm and thickish, decidedly cordate, entire or rarely shallowly and broadly 3-lobed, 3-5 cm. broad, 3.5-6 cm. in greatest length, evidently 8-10 palmate-nerved, covered with a dense and more or less distinctly velvety indument of soft pallid somewhat appressed hairs, usually with a silky luster particularly beneath, apex broadly acute and frequently somewhat acuminate, base rounded off abruptly into the conspicuous open ca. 1 cm. deep sinus; peduncles axillary, 1.5-6 cm. long, villous, simple and umbellately 1-4-flowered or frequently umbellately branched with umbellately 1-3-flowered secondary peduncles, erect or ascending, 5-30 mm. long; bracts firm, oblanceolate, 0.7-1.5 cm. long, caducous; pedicels erect, 8-20 mm. long; sepals broadest just above the base, firm or subherbaceous,



somewhat canescent with a fine short soft appressed pubescence; three outer sepals lanceolate to quite broadly lanceolate, 5-10 mm. wide, 15-20 mm. long, acute or acuminate; two inner sepals narrowly lanceolate, 3-4 mm. wide, equalling or slightly shorter than the outer ones; corolla blue, drying rose-purple, funnel-form, 6-7.5 cm. long and with a limb about as broad, glabrate or sparsely short-pilose outside, glabrous within; lobes semicircular, ca. 3 cm. broad; tube short, included in the calyx, ca. 6 mm. long, ca. 4 mm. thick at the base, ca. 6-7 mm. thick at summit; throat well developed, gradually expanded; filaments affixed in the tube, strongly ciliate at the base, unequal, the two longest 2-2.5 cm. long; anthers ca. 4 mm. long, affixed in the sinus of their deeply sagittate base; capsules 3-celled, glabrous, strongly depressed, 8-9 mm. long, ca. 1.2 mm. thick, surmounting the strongly reflexed calyx-lobes; seeds dull black, very obscurely puberulent.

*Type:* No. 186610, Herb. Calif. Acad. Sci., collected April 26, 1925, by H. L. Mason (no. 1553) back of the beach near Sulphur Bay, **Clarion Island**.

This species has been collected also on Clarion by Anthony (no. 403, in pt.). In addition to this, there is a collection by Barkelew (no. 245, in pt.). The Barkelew collection is labeled as from Socorro, but as I have intimated in the discussion under *I. cathartica*, I am of the opinion that it actually came from Clarion. On Clarion, according to Mason, the plant grows above the beaches and climbs over bushes and cactus and is very showy because of its large blue flowers. The species is treated in the monograph by House, *Annals N. Y. Acad. Sci.* 18: 201 (1908), as *I. villosa* R. & P., the collections of Anthony and Barkelew being cited under that name. I am unable to agree with House, however, that our island plant is referable to *I. villosa*, a species based upon material collected in the Amazon head-waters of north-central Peru. Although it is perhaps generally related to them, I am also unable to place it with the Hawaiian *I. insularis* Choisy, the Australian *I. congesta* R. Br. or the Brazilian *Pharbitis rosea* Choisy, the species which House cites as synonyms of *I. villosa*.



R. & P. The material from the Revillagigedos is distinguished by its coarse weakly twining habit, rather heavy leaf-texture, very copious soft velvety more or less lucent indument, its oblanceolate bracts, etc. I am inclined to believe that *I. halierca* is probably derived from *I. mutabilis* Lindl. of southern Mexico, a species which differs in its more slender more twining habit, narrower more attenuate sepals, and narrower as well as longer bracts, in addition to having leaves which are copiously pubescent only beneath.

#### 90. *Cressa truxillensis* HBK.

*Cressa truxillensis* HBK. Nov. Gen. et Sp. 3: 119 (1819). *C. insularis* House, Bull. Torr. Bot. Cl. 33: 315 (1906). *C. cretica* of Brandg. Zoe 5: 27 (1900).

Collected on Clarion by Anthony (no. 409) and Mason (no. 1582) and, if his label is to be trusted, on Socorro by Barkelew (no. 252). Mason obtained it at Sulphur Bay where it grew on the dried bed of a vernal pool from which it extended out onto the dunes. The species ranges from western United States south to northern Sinaloa and the tip of Lower California and then reappears in Peru and Chile.

#### BORAGINACEÆ

#### 91. *Cordia brevispicata* Mart. & Gal.

*Cordia brevispicata* Mart. & Gal. Bull. Acad. Brux. 11<sup>2</sup>: 331 (1844). *C. socorrensis* Brandg. Erythea 7: 5 (1898) and Zoe 5: 27 (1900).

This shrub has been collected on Socorro by Townsend, Anthony (no. 384, type), Barkelew (no. 182) and Mason (no. 1599). Mason's material was collected on slopes near the bottom of a cañon near Benner Cove. He notes that, except on the south side of the island, where it was confined to cañon-bottoms, the shrub is a common one on the brushy slopes. The species is generally distributed in dryish situations over most of western Mexico extending from Lower California to Salvador.



## 92. *Tournefortia hartwegiana* Steud.

*Tournefortia hartwegiana* Steud. Nom. Bot. ed. 2, 2: 693 (1841).

Collected on Socorro by Barkelew (no. 191) and Mason (no. 1602). Mason collected his material at Benner Cove and notes that the corollas are white when fresh and that they darken quickly when bruised. It was found on north-facing hills in rather dry situations and was not uncommon. The species ranges from Lower California and Sonora south to Oaxaca.

## 93. *Heliotropium curassavicum* L.

*Heliotropium curassavicum* L. Sp. Pl. 130 (1753); Brandg. Zoe 5: 27 (1900).

Collected on Socorro by Anthony (no. 398) and Barkelew (no. 243) and on Clarion by Mason (no. 1570). On Clarion it was found forming a distinct zone of vegetation about the bed of a vernal pool back of the beach. The species is very widely distributed in saline or alkaline soils throughout most of tropical and subtropical America.

### VERBENACEÆ

## 94. *Verbena litoralis* HBK.

*Verbena litoralis* HBK. Nov. Gen. et Sp. 2: 276, t. 137 (1818).

Obtained on Socorro by Anthony (no. 380), Barkelew (no. 231) and Mason (no. 1612). The last mentioned found it near Grayson Cove where it was an annual or biennial 3-10 dm. tall and had bluish white flowers. The species is very widely distributed in the warmer parts of America.

## 95. *Lantana involucrata* L.

*Lantana involucrata* L. Amoen. Acad. 4: 319 (1756); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1890); Brandg. Zoe 5: 27 (1900).

Known on the islands only from a collection made on Socorro by Townsend. This shrub is widely distributed in tropical America.



## LABIATÆ

96. *Teucrium townsendii* Vasey & Rose

*Teucrium townsendii* Vasey & Rose, Proc. U. S. Nat. Mus. **13**: 146 (1890);  
Brandg. Zoe **5**: 27 (1900).

This species, endemic to Clarion, was the first of the peculiar Revillagigedo *Teucria* to be described. It was first collected by Townsend but subsequently has been obtained by Anthony (no. 416) and Mason (nos. 1573, 1583). The latter collected two forms, an erect one on the hills west of Sulphur Bay (no. 1573) and a prostrate and more succulent one "due to maritime exposure" on the summit of the hill just east of Sulphur Bay (no. 1583). Although good corollas were not collected their color is noted as white.

The species of *Teucrium* on the Revillagigedos are close and critical ones. The final treatment of them must await the time when carefully collected flowering material has been obtained from all the islands. At present we must judge them by their gross habit, vegetative characters, and fruiting structures. While a study of these seems to indicate the presence of a recognizable form on each of the three islands it has not yielded any particularly reliable diagnostic characters nor any that are quite decisive. Consequently it seems not improbable that future study will show the relations among the several insular forms is varietal rather than specific. However, until the flowering material needful for the solution of this matter has been assembled, it seems best to follow past usage and continue to recognize the Clarion and Socorro plants as distinct species.

The island species of *Teucrium* are clearly insular derivatives of the variable *T. cubense* L., a species which ranges in northern and eastern Mexico, the West Indies and southern parts of the United States, and which on Cedros Island, off the middle of western Lower California, has given rise to *T. glandulosum* Kellogg, another insular species much suggesting our plants. Although the Revillagigedo species seem most like the one on Cedros Island, I believe that the similarity is due, not to immediate relationship but merely to



similarity in responses of the same stock to isolation under an equitable arid insular climate. Our plants have departed much more from *T. cubense* than has the plant on Cedros. *Teucrium cubense* is apparently absent from the southern half of Lower California and Sonora and from the states of western Mexico to the south.

#### 97. *Teucrium affine* Brandg.

*Teucrium affine* Brandg. Erythea 7: 6 (1898) and Zoe 5: 27 (1900).

This species is known only from the type-collection made on Socorro by Anthony (no. 385). Good flowering material has not been obtained. It differs from *T. townsendii* in its much more slender, more elongate leaves, its generally more slender and loosely branched habit and in its perhaps slightly smaller less rugose nutlets the summit of which produces longer and more conspicuous trichomes.

#### 98. *Teucrium affine* Brandg., var. *dentosum* Johnston, n. var.

Lower than typical *T. affine* and having leaves that are usually quite evidently toothed and nutlets that are quite lacking in apical trichomes.

*Type:* No. 186607, Herb. Calif. Acad. Sci., collected May 11, 1925, by H. L. Mason (no. 1685) on **San Benedicto Island**.

Collections of this endemic form of San Benedicto have been made by Barkelew (no. 170) and Mason (no. 1685, type). No material in good flower was obtained. It is obviously most closely related to *T. affine* of Socorro, having the loose habit and narrow leaves of the species. In lacking trichomes at the apex of its nutlets the variety differs from both the Socorro and Clarion plants.

#### 99. *Sphacele hastata* Gray

*Sphacele hastata* Gray, Proc. Am. Acad. 5: 341 (1862).

Very mature material of what most certainly seems to be this species was collected by Mason (no. 1658) in openings in the forest near the summit of Socorro. The collector notes it



as a "foul smelling" plant 3-12 dm. tall. It is an extremely interesting addition to the known flora of the archipelago. It appears to be quite like the plant from the mountains of the Cape Region of Lower California which Brandegee, Proc. Calif. Acad. Sci. ser. 2, 3: 164 (1891), accepted as *S. hastata*. Previous to Brandegee's discovery, the species, which is a very distinct and well marked one, was considered endemic to the mountains of Maui, one of the Hawaiian Islands, and of particular interest since it was the only extra-American member of its genus. The species has been accepted as one of the American elements in the Hawaiian flora. No doubt seems to have been cast on its natural occurrence on Maui. Brandegee seems to have thought that the species might have been introduced through the agencies of man into Lower California from Hawaii since there were a few ranches in the mountains not far from the places in which he found the plant. It seems extremely improbable, however, that the horticultural enthusiasm of the owners of these small montane cattle-ranches would be sufficiently developed to warrant us in assuming that this rankly smelling bush from the mountains of a mid-Pacific island was deliberately introduced as an ornamental by them. Brandegee reported it from two mountain ranges. Observations made forty years later by Jones, Contr. W. Bot. 15: 152 (1929), show the plant still to persist in the same region and to be still a conspicuous member of the flora there. With the discovery of *S. hastata* on the rarely visited Socorro Island and particularly on its summit, which is very difficult of access, I believe that we may now accept it as indigenous in America, for certainly the human factor is quite eliminated in accounting for its presence on Socorro. I believe that we have in the peninsular and new insular station remnants of a past, more general dispersal of the species in America, where it almost certainly evolved, and consequently relics of the original American stock that produced the seeds which, by some fortuitous circumstance, were transported to the Hawaiian Islands.





## SOLANACEÆ

100. *Physalis angulata* L.

*Physalis angulata* L. Sp. Pl. 183 (1753). *P. aequata* of Brandg. Zoe **5**: 27 (1900).

Collected on Clarion by Anthony (no. 411). A species widely distributed in the tropics of the World. In America known only from southeastern United States, the West Indies, Central America and South America.

101. *Physalis* sp.

Collected on Socorro by Townsend and reported by Vasey & Rose, Proc. U. S. Nat. Mus. **13**: 148 (1890), as possibly representing the Lower Californian *P. glabra* Benth. I do not believe it is related to the peninsular species. The relations of the plant seem to be, in a general way, among the native small-flowered species of Central America and southern Mexico, although not particularly close to any of them. When adequate material of this plant is collected I believe it will prove to be an insular endemic. Except that the leaves are quite cordate at the base and have the broad blades noticeably repand it might pass as the very glabrous form of *P. lagascae* var. *glabrescens* Schulz, Urb. Symb. Ant. **6**: 147 (1909), which has been cited from Mexico. The island plant is an interesting one and it is to be hoped that complete and generous collections will be obtained of it.

102. *Solanum madreense* Fernald

*Solanum madreense* Fernald, Proc. Am. Acad. Sci. **35**: 558 (1900).

Growing on the dry rocky slopes along the forest border near the summit of Socorro. Mason (no. 1659) notes that it is a shrub 5-45 dm. tall and that it is not common. The flowers are given as large and white. The specimens collected are in mature fruit and agree closely with *S. madreense*, a species which ranges, primarily on the Pacific slope, from Sonora south into Central America.



103. *Nicotiana nesophila* Johnston, n. sp.

Plant with a grayish indument of short soft hairs, only moderately viscid; stems 3-8 dm. long, erect or ascending, usually simple, tending to be somewhat woody towards the base; leaves gradually but distinctly reduced up the stem, ovate to elliptical, apex broadly acute to somewhat obtuse, base obtuse to broadly acute and more or less oblique, margins coarsely and irregularly crenate and occasionally even irregularly lobulate, usually somewhat crisped; petioles half or almost as long as the blades, slender, margined for their length by inconspicuous (0.5-1 mm. wide) wings which are distinctly dilated (to 1-2 mm. width) just above the petiole-base and then continue as herbaceous decurrent (1-1.5 mm. wide) leaf-bases for a few centimeters down the stem; lower leaves with blades 7-12 cm. long and 4-6.5 cm. broad, borne on slender petioles 5-8 cm. long; upper leaves (produced just below the inflorescence) 2-3 cm. long and 1-2 cm. broad, borne on petioles 1-2 cm. long; inflorescence terminal, copiously flowered, loosely branched, a short-cylindrical or obconic panicle 6-9 cm. thick; bracts linear to lance-linear, 5-15 mm. long, 1-2 mm. broad; calyx at anthesis cylindrical, 8-10 mm. long, 2.5-3 mm. thick, abruptly rounded at the base, more or less definitely 10-costate, lobes erect linear 2 mm. long; pedicels 1-4 mm. long, erect; calyx at maturity slightly accrescent but greatly distended by the ovoid fruit, borne on thickened erect or ascending pedicels that are 3-10 mm. long; corolla ca. 5 cm. long; tube very slender, 3-4 times the length of the calyx, 3.5-4 cm. long, 1.5-2 mm. thick; throat ca. 3 mm. thick, ca. 5 mm. long; limb white, broadly funnelform, ca. 2 cm. in diameter, with 5 broad lobes 4-5 mm. long, sinus broad and open; filaments affixed in the throat, ca. 0.7 mm. long, glabrous; anthers ca. 2 mm. long, included in the throat; stigma clavate, strongly compressed; style and ovary glabrous; capsule ovate, 5-6 mm. thick, 8-10 mm. long, almost completely invested by the distended calyx-tube, 2-celled, 2-valved; seeds very numerous, ca. 0.5 mm. long, roughened with fine narrow contorted anastomosing ridges and consequently distinctly but irregularly alveolate.



*Type:* No. 186608, Herb. Calif. Acad. Sci., collected May 3, 1925, by H. L. Mason (no. 1596) in alluvial sands at mouth of a valley near Benner Cove, **Socorro Island**.

This very distinct species has been collected also on Socorro by Barkelew (no. 199). It is obviously related to *N. stocktoni* Brandg. of the Revillagigedos but differs decisively in its much less viscid indument of paler shorter hairs, in its inconspicuously rather than very conspicuously winged petioles, and in its narrower more elongate leaf-blades which are obtuse or broadly acute rather than strongly cordate or reniform at the base. The new species has also more strongly crenate leaf-margins. Although the relationship of the two island plants is clear, their relations outside of the archipelago are quite obscure. In many details, however, they suggest *N. repanda* Willd. and particularly so in the form of the corolla. That species is a small annual with a quite different inflorescence, habit, indument, etc., etc. It ranges in Texas and northeastern Mexico.

#### 104. *Nicotiana stocktoni* Brandg.

*Nicotiana stocktoni* Brandg. *Erythea* 7: 6 (1898) and *Zoe* 5: 27 (1900). *N. clarionensis* Clausen, *Zeitschr. f. ind. Amstamm.- u. Vererbungslehre*, Supplementband 1: 549 (1928); East, *Bibliogr. Genetica* 4: 249 and 251 (1928), nomen.

This remarkable species, first obtained on Anthony's expedition, was based upon material labeled as collected by Stockton (no. 382) on Socorro Island. Collections, however, which match in detail those obtained by Stockton have been obtained by Mason (no. 1585) from among the rocks of an old lava flow on the landward side and towards the summit of the hills just east of Sulphur Bay on Clarion. As both Barkelew and Mason have collected the distinct, although closely related *N. nesophila* on Socorro and since it seems rather unlikely that two such closely related species could resist hybridization and retain so successfully their identity on a single island, I believe that Stockton probably obtained the original material of *N. stocktoni* on Clarion rather than on Socorro as has been accepted. If this is the case, then *N. nesophila* is endemic to Socorro and *N. stocktoni* to Clarion. Future collectors on the



islands should watch the tobaccos closely with the object of ascertaining whether or not the two species occur on a single island and if not the identity of the species characteristic of each island. Mason reports that *N. stocktoni* was rare on Clarion. He found only a single colony. In this, the plants were not abundant although they were reproducing well, since numerous seedlings were observed.

According to a letter received from Prof. R. E. Clausen, the material which he studied and reported upon under the name of *N. clarionensis* was some raised from seed obtained on Clarion by Mason. As Mason's plants from Clarion have been directly compared in detail with the type-specimens of *N. stocktoni* and found to be unquestionably conspecific, the name *N. clarionensis* consequently falls into the synonymy of Brandegee's species. The binomial, *N. clarionensis*, has appeared only in genetical literature, and there only as a bare name. Dr. Clausen writes that his work on the plant has indicated a close relationship with *N. repanda*, as shown by the fact that the diploid chromosome number is 24 in both, that they produce fully fertile  $F_1$  hybrids and that nearly, if not completely regular conjugation and distribution of chromosomes occurs in the  $F_1$  hybrids.

#### 105. *Cestrum pacificum* Brandg.

*Cestrum pacificum* Brandg. *Erythea* 7: 6 (1898) and *Zoe* 5: 28 (1900); Standley, *Contr. U. S. Nat. Herb.* 23: 1281 (1924).

The type of this species was collected on Socorro by Anthony (no. 391) where subsequent collections have been made by Barkelew (no. 221) and Mason (no. 1652). Mason notes that it is a large shrub or small tree becoming 8 m. in height. It grows in the forested area near the summit of the island and is not very common. The berries are purple. The island plant is very closely related to *C. lanatum* Mart. & Gal. which ranges from Nayarit southward into Central America, and may be no more than an insular phase of that species with shorter corollas.



## ACANTHACEÆ

106. *Elytraria squamosa* (Jacq.) Lindau

*Elytraria squamosa* (Jacq.) Lindau, Anal. Inst. Fis. Geogr. Costa Rica 8: 299 (1896). *E. tridentata* Vahl; Vasey & Rose, Proc. U. S. Nat. Mus. 13: 149 (1890); Brandg. Zoe 5: 27 (1890).

Collected on Socorro by Townsend, Anthony (no. 392) and Mason (no. 1641). The last mentioned reports that it is frequent on the plateau of the island in rather barren soils. It is a very widely distributed plant in the American tropics and reaches north to Arizona, Texas and Florida.

## RUBIACEÆ

107. *Chiococca alba* (L.) Hitchc.

*Chiococca alba* (L.) Hitchc. Rep. Mo. Bot. Gard. 4: 94 (1893).

With some doubt I refer to this widely distributed species material collected on Socorro by Barkelew (no. 201) and Mason (no. 1611). Barkelew's collections are sterile, while Mason's are in mature fruit and have what seems to be blighted buds. These buds suggest that the corolla is decidedly shorter and stouter, and has much less elongate lobes than in the continental plants. Hence it is that good flowering material of the island plant must be obtained before its precise relation with *C. alba* can be determined. We can, however, confidently state that its closest relations are with that species. Mason notes that the plant on Socorro frequents shady cañons and dense forests where it often ascends trees even to a height of 20 m. and from them hangs in festoons clear to the ground. The corollas are noted as being white and as rapidly fading to brown or black. *Chiococca alba* is very widely distributed in the warmer parts of America. Along the Pacific coast it ranges north to Sonora and southern Lower California.

108. *Guettarda insularis* Brandg.

*Guettarda insularis* Brandg. Univ. Calif. Pub. Bot. 10: 416 (1924). *G. elliptica* of Standley, Contr. U. S. Nat. Herb. 23: 1384 (1926).

Endemic to Socorro where it has been collected by Anthony (no. 377), Barkelew (no. 179) and Mason (no. 1608). It is given as a shrub or small tree 1-6 m. tall and as frequenting



cañons on dry slopes and the forest border on moister ones. The bark is smooth and "at length deciduous in patches". The fruit is a fleshy drupe with a purple exocarp and with a thick bony ellipsoidal or decidedly obovoidal endocarp 12-14 mm. long and 7-8 mm. thick. The species is obviously related to *G. elliptica* Sw., a species to which Standley has reduced it, but appears to have larger corollas and much larger and more elongate fruit. *Guettarda elliptica* is primarily a West Indian species but has been reported by Standley from Mexico where it is given as occurring in Yucatan and from Sinaloa to Colima. The affinities of our island species are consequently to the westward, on the mainland of Mexico.

#### 109. *Borreria nesiotica* Robinson

*Borreria nesiotica* Robinson, Proc. Am. Acad. Sci. **45**: 409 (1910). *Spermacece*  
sp. Vasey & Rose, Proc. U. S. Nat. Mus. **13**: 146, 148 (1890);  
Brandg. Zoe **5**: 27 (1900).

A very well defined species which is known only from Socorro and Clarion islands. The type, which was collected by Anthony, is labeled as from "Socorro or Clarion Is." Barkelew (no. 208) obtained it on Socorro, while Mason (nos. 1572, 1574) found it only on Clarion. Townsend got it on both islands. The corolla, according to Mason's notes, is white or pink. The immediate relationships of the species are quite obscure. Robinson compared it with *B. verticillata* (L.) Mey. but it seems no more closely related to that species than to *B. laevis* (Lam.) Griseb., a species which it also resembles in habit. Both of the species mentioned are widely distributed in tropical America.

#### 110. *Galium mexicanum* HBK.

*Galium mexicanum* HBK. Nov. Gen. et Sp. **3**: 337 (1819).

Collected on Socorro by Anthony (no. 386), Barkelew (no. 210) and Mason (no. 1655). Mason obtained his material near the summit of the island and notes it as a "climbing perennial". On the mainland the species ranges from central Mexico southward into northern Central America. Although Anthony's collections have been distributed bearing an un-



published herbarium name by Brandege, it, like the other collections from the island, falls readily into the species to which I have referred it.

#### GOODENIACEÆ

##### 111. *Scaevola plumierii* (L.) Vahl

*Scaevola plumierii* Vahl, Symb. Bot. 2: 36 (1791); Brandg. Zoe 5: 28 (1900); Standley, Contr. U. S. Nat. Herb. 23: 1400 (1926).

Although Brandege, loc. cit., reported this species from Socorro, the collections by Anthony (no. 387) which he distributed are clearly indicated on a printed label as being from Clarion. As the plant has a number which falls in a block of numbers which are all from Clarion I am accepting that island as the source of the *Scaevola*. This strand-plant is widely distributed in the West Indies but has a very disrupted and erratic distribution on the adjacent continents. It is not known from the west coast of the American mainland. The only Pacific stations are the Galapagos, the Revillagigedos and the tip of the peninsula of Lower California.

#### COMPOSITÆ

##### 112. *Vernonia littoralis* Brandg.

*Vernonia littoralis* Brandg. Erythea 7: 3 (1898) and Zoe 5: 27 (1900); Blake in Standley, Contr. U. S. Nat. Herb. 23: 1414 (1926). *Eremosis littoralis* Gleason, No. Am. Fl. 33: 100 (1922).

Known only from Socorro where the type was collected by Anthony (sine no.). Mason (no. 1656) found it in the dense forest near the summit of the island where it clambered to a height of 15 m. and produced its conspicuous pendent flowering branches from the tree-tops. The corollas are said to be white or pink. The leaves vary from oblong-ovate through elliptical to ovate-orbicular, from entire to distinctly sinuate and from acute to rounded with an abrupt obtusish acumination. The leaf-blade becomes as much as 10 cm. broad and 12 cm. long. The affinities of the species are with *V. shannoni* Coult. and *V. heydeana* Coult. of Guatemala and southern Mexico.



113. *Eupatorium pacificum* Robinson, n. sp.

Fruticose, shortly pilose; stems erect or more often curved-ascending, branched above, subterete, brown; pith white; internodes 3-10 cm. long; hairs short, spreading, slender and attenuate, nodulose; leaves opposite, slender-petioled, deltoid-ovate, acuminate, spreadingly dentate but entire towards the broadly cordate or subcordate base, green on both sides and at first sight apparently glabrous, but in fact slightly puberulent on the nerves and veins, beneath somewhat paler, delicately reticulate (the veinlets immersed), membranaceous, 2.5-9 cm. long, 2-7 cm. wide; teeth of the limb 1.5-3 mm. high, 2-6 mm. broad at base, subacute to obtuse or rounded; petiole spreadingly hirtellous, 1-5 cm. long; corymbs composite, opposite-branched, leafy-bracted; heads about 40-flowered; phyllaries subequal, lanceolate-linear, acute, 2-3-seriate, loosely imbricate, at maturity about 5 mm. long, the outer ones densely but very shortly hairy; corollas white, smoothish; the proper tube slender, 2 mm. long; throat narrowly campanulate, 1-1.3 mm. high; achenes black, sharply angled, slightly lucid, 1.5-2 mm. long, slightly pointed at both ends, often hispidulous on the angles; pappus-bristles about 20, white, delicate, scarcely roughened, almost equalling the corolla.

*Type:* No. 186613, Herb. Calif. Acad. Sci., collected May 8, 1925, by H. L. Mason (no. 1666) near the summit of Socorro Island.

Mason's collections are overly mature, having shed nearly all their florets, but are obviously conspecific with immature material collected by Barkelew (sine no.) also on Socorro. The species appears to be endemic. In many respects it is similar to *E. pazcuarensis* HBK. and *E. conspicuum* Kunth & Bouché, both of southern Mexico. From the former it differs in its much greater lignescence and in its more deltoid-ovate distinctly cordate leaves, which are 3-nerved from the very base. From the latter it may be readily distinguished by its somewhat coarser and more spreading pubescence and shorter petioles as well as by its leaf-blades, which are nerved from the very base, much less toothed towards the base, and not disposed to be decurrent on the petiole.



114. **Brickellia peninsularis** Brandg., var. **amphithalassa**  
Robinson, n. var.

Leaves subdeltoid-ovate or almost orbicular, scarcely longer than wide, more firmly membranaceous than in the typical variety, or even subcoriaceous, very finely and densely puberulent-hirtellous on both sides, peduncles for most part 8-24 mm. long; corollas yellowish, scarcely nigrescent in drying.

*Type*: No. 186615, Herb. Calif. Acad. Sci., collected April 26, 1925, by H. L. Mason (no. 1555) on **Clarion Island**.

Collections of this plant made by Anthony on Socorro and Clarion were reported by Brandegees, *Zoe* 5: 27 (1900), as *Brickellia* sp. It has also been collected on Socorro by Barkeley (no. 198) and Mason (no. 1598). On Clarion, Mason (no. 1555) reports that it is the dominant cover and gives a grayish aspect to the hillsides. It is a shrub 6-15 dm. tall, branched from the base, and very brittle. The variety is endemic to the archipelago, differing from the typical form of southern Lower California in its proportionately broader leaves, finer and denser pubescence of the foliage, somewhat longer peduncles, and paler florets. In Prof. Robinson's monograph of the genus, *Mem. Gray Herb.* 1: 108 (1917), it is mentioned as a peculiar form of *B. peninsularis*. Blake, *Contr. U. S. Nat. Herb.* 23: 1483 (1926), reports it from Socorro under the name, *Coleosanthus peninsularis* (Brandg.) Blake.

115. **Erigeron socorrensis** Brandg.

*Erigeron socorrensis* Brandg. *Erythea* 7: 4 (1898) and *Zoe* 5: 27 (1900); Blake in Standley, *Contr. U. S. Nat. Herb.* 23: 1499 (1926), in pt. *Erigeron* sp. Vasey & Rose, *Proc. U. S. Nat. Mus.* 13: 148 (1890).

This slender shrub is known only from Socorro, where the type was collected by Anthony (no. 376) and other collections have been obtained by Townsend, Barkeley (nos. 189, 214) and Mason (no. 1618). Mason's collection is from the dry slopes above Grayson Cove. The relations of this species are clearly with the endemic of San Benedicto, *E. crenatus*, but beyond that they are extremely vague. The shrubby species of *Erigeron* on the Revillagigedos, like the shrubs on Juan Fernandez, Galapagos and Bermuda islands, belong to the section *Caenotus*, a section containing many ill-defined and rather



weedy species that are widespread in temperate and tropical America. The species of the section *Caenotus* are notorious for the difficulties they present to classification. This, due to their variability and lack of distinctive characters, will probably always remain a problem. In any case, the group is now in such hopeless confusion that any attempt to discuss their phylogeny must be wasted time. It does seem significant, however, that the common weedy species of the section *Caenotus*, even when clearly annual, do show a distinct tendency to produce hard and more or less woody stems. It is likely, therefore, that their shrubby insular relatives have continued and accentuated this tendency under an equitable frostless insular climate and consequently unbroken growing season. I do not believe that the shrubs on the various archipelagos are directly related, but rather, that in each case they have developed on the island from probable annual stock derived from the nearby mainland. As there is no species of the section native to Lower California, I believe we may eliminate the peninsula as a possible source of the species on the Revillagigedos. It seems most probable that their ancestors came from southern Mexico, where a number of possible relatives now exist.

116. *Erigeron crenatus* Eastwood, n. sp.

A small low shrub 1-4 dm. tall, usually producing several coarse branches from near the base, younger parts finely villose or strigose but at length becoming glabrate in age; stems distinctly woody, becoming as much as 3 dm. long and 2-5 mm. thick, erect or usually ascending, very densely clothed for several centimeters below the apex with the ascending functional leaves and below these with the deflexed tardily deciduous old ones, the older parts roughened by the indurate persistent bases of fallen leaves; leaves dark green when fresh but drying grayish, oblanceolate or spatulate and frequently quite broadly so, somewhat coriaceous, costate but only obscurely veined, 5-15 mm. broad, 4-6.5 cm. long, broadest just below the obtuse or rounded apex and then gradually contracted into the slender petiole which forms 1-2 cm. of their total length, margins entire to crenate or lobulate-crenate, narrowly revolute and perhaps somewhat thickened; inflorescence a corymbose panicle, usually projecting only a few centimeters



from the rosulate cluster of crowded leaves, usually compound, being formed of a group of simple panicles springing from adjacent leaf-axils or reduced lateral shoots; heads 3-4 mm. high, 4-5 mm. thick, on sparsely bracteolate peduncles 3-15 mm. long, frequently inclined; tegules (except for the few short outer ones) narrowly lanceolate, the back somewhat glandular in texture, the margins hyaline; achenes flattened, thick-margined, sparsely strigose; pappus barbellate ca. 1.7 mm. long; ray-florets glabrous, white, very numerous, 2-3-seriate, pistillate, scarcely if at all surpassing the hermaphroditic disk-florets; style 1.2 mm. long, glabrous; style-branches 0.5 mm. long, ca. 0.1 mm. broad, appendages very short; disk-florets numerous, 2.5 mm. long, sparsely pubescent or glabrous, tube ca. 0.7 mm. long, lobes triangular and ca. 0.5 mm. long.

*Type:* No. 186604, Herb. Calif. Acad. Sci., collected May 11, 1925, by H. L. Mason (no. 1683) in loose ashy soil on **San Benedicto Island**.

This species is known only from San Benedicto where it has been collected by Barkelew (no. 176) and Mason (no. 1683). It is obviously related to *E. socorrensis*, the endemic species of Socorro, but differs not only in its low habit of growth but in being coarser and larger in all its parts. The plant of Socorro is a slender loosely branched shrub becoming 12 dm. tall and has much smaller very conspicuously less crowded paler leaves and a more slender more open inflorescence of smaller heads. Although these differences are largely matters of degree, they serve to distinguish the plants found on the two islands. The plants from Socorro and San Benedicto each have a very characteristic aspect. The two species may be recognized instantly at a glance. Blake, Contr. U. S. Nat. Herb. 23: 1499 (1926), refers to the San Benedicto plant under *Erigeron socorrensis*.

### 117. *Gnaphalium attenuatum* DC.

*Gnaphalium attenuatum* DC. Prodr. 6: 228 (1837).

A single plant of this species was collected by Mason (no. 1665) near the hot springs close to the summit of Socorro. The species is known otherwise from central Mexico south into Central America.



118. *Coreopsis insularis* (Brandg.) Blake

*Coreopsis insularis* Blake, Proc. Am. Acad. Sci. 49: 340 (1913). *Leptosyne insularis* Brandg. Erythea 7: 5 (1898) and Zoe 5: 28 (1900).

Endemic to Socorro where the type was obtained by Anthony (no. 394) and subsequent collections have been made by Barkelew (no. 223) and Mason (no. 1624). A loosely branched perennial with elongate shrubby stems which grows "in patches from sea-level up". The linear leaf-lobes in the fresh condition are succulent, terete and pungent. The rays are yellow. Although very distinct, the species is probably most closely related to *C. pinnatisecta* Blake of Oaxaca and Puebla in southern Mexico.

119. *Viguiera deltoidea* Gray, var. *townsendii* Vasey & Rose

*Viguiera deltoidea*, var. *townsendii* Vasey & Rose, Proc. U. S. Nat. Mus. 13: 148 (1890); Brandg. Zoe 5: 28 (1900); Blake, Contr. Gray Herb. 54: 90 (1918); Blake in Standley, Contr. U. S. Nat. Herb. 23: 1544 (1926).

This very ill-defined variety was originally based upon material collected on Socorro by Townsend. It has subsequently been collected there by Anthony (no. 389) Barkelew (no. 181) and Mason (nos. 1601, 1606). According to Mason, who collected it at Benner Cove, it is an erect or scandent shrub which is occasional on the drier slopes of the island. The island plant is most obviously related to *V. deltoidea* var. *chenopodina* Blake of Lower California. I am by no means certain that var. *townsendii* and var. *chenopodina* are really separable or are practicable taxonomic units or that they are much more than mere extreme xerophytic phases of the species, the type of which came from Cape San Lucas.

120. *Perityle socorrosensis* Rose

*Perityle socorrosensis* Rose, Bot. Gaz. 15: 118, t. 13, f. 9 (1890); Vasey & Rose, Proc. U. S. Nat. Mus. 13: 148 (1890); Brandg. Zoe 5: 27, 28 (1900); Rydb. No. Am. Fl. 34: 16 (1914).

The type and original collection of this species was made on Socorro by Townsend. Anthony (no. 383), Barkelew (no. 192) and Mason (nos. 1605, 1605a) have subsequently recol-



lected it there. Mason's material came from Benner Cove. Material from San Benedicto has been obtained by Anthony (no. 372), Barkeley (no. 175) and Mason (no. 1684). On Clarion, where Mason notes that it is a shrubby perennial, it grows on sandy beaches almost to the water's edge as well as on the steep sea-cliffs. Collections from Clarion have been made by Anthony (no. 415) and Mason (nos. 1578, 1579). The plant varies somewhat in the size of its succulent leaves, apparently in response to its environment. There is also interesting variation in the development of pappus. The material from Clarion tends to be awnless or to have only a single awn, that from San Benedicto and Socorro generally having 1-2 awns developed. As in most species of *Perityle* of this relationship the marginal flowers, from plant to plant, vary conspicuously in the degree of development of ligule. The relationship of the species is clearly with *P. crassifolia* Brandg. of southern Lower California.





Johnston, I. M. 1931. "The flora of the Revillagigedo Islands." *Proceedings of the California Academy of Sciences, 4th series* 20, 9–104.

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