THE FLORA OF SAN FELIX ISLAND

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With plate 165

THE ISLAND of San Felix, lat. 26° 16′ S., long. 80° 0′ W., lies over 800 kilometers off the north coast of Chile and about an equal distance north of the islands of Juan Fernandez. It is volcanic, apparently a portion of a disrupted crater, and is surrounded by depths of about 4000 m. The island is about 2.5 km. long. At the narrow west end there is an abruptly elevated hill of yellowish tuff called Cerro Amarillo, 183 meters high. The principal part of the island, however, is broad and flattish and is composed of a series of black lavas that form a platform which gently slopes towards the north and broadens towards the east end to a maximum width of nearly 1.5 km. It is bounded by sea-cliffs, 50–70 m. high on the south and 15–20 m. on the north side. This broad flattish part of the island is overlaid here and there with a thin covering of fine dry earth, and is strewn all over with fragments of lava of no great size. In appearance the island is extremely barren and desolate.

Most of the surface of San Felix is devoid of plants. Dr. Chapin informs me that on the flattish major part of the island the flora consists of three evident species, of which the scattered, depressed growths of the shrubby *Suaeda nesophila* are the most conspicuous. The other two species, members of *Eragrostis* and *Cristaria,* are ephemeral annual herbs of scattered occurrence. Two species can be attributed to Cerro Amarillo. On its lower slopes *Atriplex Chapinii* grows in the soft yellowish volcanic rock. The only erect shrub on the island, *Thamnoseris lobata,* grows in a few sheltered ravines on its upper slopes, where some adiabatic fogs supplement the extremely scanty rains of this desert island. The flora of San Felix is hence very poor in the number of its species, as well as in the number of individual plants. It is, however, high in endemism.

In the same small archipelago, about 18 km. east of San Felix, is the island of San Ambrosio. This is a slightly smaller island but is uniformly lofty, being surrounded by imposing cliffs and reaching an altitude of 450 m. Its high fog-bathed cliffs and crests are very much more favorable for plants than the low arid flats and slopes of San Felix. The very different environmental conditions have given it a flora almost completely different from that of its neighbor. Though San Ambrosio

evidently has a much richer and more interesting flora, the difficulties of landing on the island and of climbing its precipitous sides have hindered its proper exploration. What is known of its flora today rests almost exclusively upon a few fragmentary specimens collected on its green crests by Simpson in 1869. These fragments, carried off the island in his hat (!), are all that has been collected of a number of very distinct endemic genera and species. The flora of San Ambrosio is obviously a remarkable one, high in endemism and still a promising source for new genera and species. No island off the west coast of America is in greater need of exploration.

The present paper is concerned only with the relatively small flora of the more accessible San Felix and is an account of the two collections from the archipelago preserved in North American herbaria. Its prime purpose is to put on record certain new species and new names for use in research growing out of the recent visit to the island by the yacht, *Zaca*.

The first botanical collections from San Felix and San Ambrosio appear to have been made by Enrique Simpson in August, 1869. The eight species represented were enumerated by R. A. Philippi, Bot. Zeitung, **28**: 496–502, tab. 8a (1870). Simpson had only one species from San Felix, a *Parietaria,* which has not since been collected in the archipelago.

The second and best existing account of the flora of San Felix and San Ambrosio is by Frederico Philippi, Anal. Univ. Chile, **47**: 185–194, cum tab. (1875). This paper reviews the collections of Simpson and discusses those made by Ramon Vidal in September, 1874. Simpson reached the crest of San Ambrosio, whereas Vidal got only the few plants he could obtain from the sides of that island. Vidal, however, did collect more carefully on San Felix. In publishing, the younger Philippi, unfortunately, treated the archipelago as a whole and gave only rare indications as to the particular island upon which Vidal made his several collections. From some notes which I made in the Philippi Herbarium at Santiago in 1926, from internal evidence within Philippi's report, and from mention of collections in Reiche's Flora de Chile, it is possible to state that Vidal obtained on San Felix specimens of *Suaeda, Cristaria, Lycapsus* and *Thamnoseris*. It is just possible that a *Tetragonia* and a *Frankenia* were also obtained. In his official report of his "Esploracion de las islas San Félix i San Ambrosio," Anal. Univ. Chile, **45**: 735–756 (1874), Vidal antedated the report of the younger Philippi and gave an atrociously misspelled list of 9 angiospermous species stated to represent the flora of San Felix. The determinations were attributed to

Philippi. The list evidently contains the species obtained by Vidal on San Ambrosio as well as San Felix. Among the species attributed to San Felix by Vidal, the following, to judge by the Vidal specimens in the Philippi Herbarium at Santiago, were collected on San Ambrosio only, — *Sicyos, Atriplex foliolosum, Heliotropium* (*Nesocaryum*), and *Frankenia.*

Subsequent to the report of Frederico Philippi accounts of the flora of San Felix and San Ambrosio have been largely compilation. Hemsley, Report Voy. Challenger, Bot. **3**: 97–100 (1884), apparently unaware of the report by the younger Philippi, translated and abridged the earlier and less complete report of the elder Philippi and recorded collections of *Lycapsus* and *Thamnoseris* made by Coppinger from rocks just south of San Ambrosio. Reiche, in Engler & Drude, Veg. Erde, **8**: 269 (1907), compiled a few general notes on the flora of the islands and mentioned the visit to the island by Johow. There is only the most general information recorded concerning the work accomplished by this latter botanist. According to the brief reports, Deutscher Wiss. Ver. Santiago, Verhandl. **3**: 525 and 529 (1898), Johow visited the island in October 1896. His collections, so long unenumerated, have only recently been placed in the capable hands of Prof. Carl Skottsberg for critical study and report.

The only other botanical collections from the islands known to me are those specially treated in this paper. Prof. Bailey Willis visited San Felix in May 1923 for geological observations and there obtained five specimens now preserved in the herbarium of Stanford University. An account of his visit to the islands, with numerous photographs, is to be found in the Publications of the Carnegie Institution, vol. **382**: 120–124, tab. 64–68 and 74–75 (1929). Dr. James P. Chapin visited San Felix for ornithological work on Feb. 18, 1935. He was a member of the "Templeton Crocker Pacific Expedition" of which there is an account in the Scientific Monthly, **41**: 281–285 (1935). His botanical collections consisting of nine numbers represent four species. The first set of them is in the New York Botanical Garden and a set of duplicates is in the Gray Herbarium. The collections represent plants from various parts of the island and are uncommonly ample. They are the best that have been made on San Felix. Through the courtesy of Dr. Chapin I am able to reproduce two of the photographs he made on the island.

In my list of the flora of San Felix there are seven species accredited to the island. Of this number two, *Eragrostis* and *Parietaria,* are non-endemic, occurring also on the arid coastal region of northern Chile and southern Peru. Of the remaining five, *Lycapsus* is known from San Ambrosio as well as San Felix. This is the only species accredited to

both of the islands. The endemic species of San Felix belonging to non-endemic genera, *Atriplex, Suaeda* and *Cristaria,* are rather well marked but have their closest affinities with plants of the coastal hills of southern Peru and northern Chile. The archipelago has two genera of the Compositae, each of which has a species on San Felix. These genera are endemic and are so distinct that their natural position in their respective subfamilies is yet open to question. The genus *Thamnoseris* perhaps is nearest to *Dendroseris* of Juan Fernandez. The tribal position of *Lycapsus* is still undetermined. If we may judge from the relationship evident in all other members of the flora of San Felix and San Ambrosio, we may perhaps surmise that these two genera of Compositae had relationships, now lost or obscured, in western South America.

CATALOGUE OF THE SPECIES

Gramineae

Eragrostis peruviana (Jacq.) Trinius, Mem. Acad. St. Petersb. sér. 6, **1**: 396 (1831).

Collected in a mature condition by Chapin (1108). Not only a new species for the known flora of San Felix but also the first monocot to be reported from the archipelago. The species has heretofore been known only in the coastal hills from central Peru south to the Taltal region in northern Chile. A close comparison of Chapin's collections with abundant material from the continent has revealed no characters or even tendencies whereby it might be distinguished.

Urticaceae

Parietaria debilis Forster, Prodr. 73 (1786). — *Parietaria feliciana* Philippi, Bot. Zeit. **28**: 501 (1870); F. Philippi, Anal. Univ. Chile, **47**: 192 (1875).

This genus is known from San Felix only through a collection from Simpson. It was the only plant he obtained on that island. I have compared a fragment of his collection with the common and variable plant of western South America passing as *P. debilis* and can find no characters to separate them.

Chenopodiaceae

Atriplex Chapinii, sp. nov., perennis monoica fruticosa e caudice crasso lignoso erumpens depressa pallida 1–3 dm. alta, 3–12 dm. lata; caulibus prostratis vel decumbentibus ramosis, juventate summum ad apicem inconspicue evanescenter pubescentibus mox glabratis; foliis concoloribus glabris lanceolatis vel oblanceolatis numerosis confertis evidenter costatis sed inconspicue nervatis 8–15 mm. longis 2–7 mm.

latis apice subacutis basi in petiolum ca. 1 mm. longum gradatim attenuatis margine integerrimis; floribus staminatis in spicas terminales 2–3 cm. longas infra medium plus minusve interruptas et bracteatas flavescentas (maturitate plus minusve fuscas) aggregatis; floribus pistillatis in axillis foliorum superiorum dispositis; bracteis fructiferis ultra medium connatis in ambitu angulatis 6–7 mm. longis 5–6 mm. latis, corpore crassis induratis subobovoideis 2–3 mm. longis 2 mm. latis plus minusve verrucosis, margine prominente herbaceis planis sparse dentatis plus minusve trilobatis; seminibus erectis 1–1.5 mm. diametro, testa brunnescente, radicula verticali.

SAN FELIX: low bush about 2.5 dm. tall and 3–9 dm. broad, Feb. 18, 1935, *J. P. Chapin 1104* (Gray Herb., TYPE; NY); low bush, leaves grayish green, forming circular or oval clumps 3–12 dm. in diameter, 2.5–3 dm. high, *Chapin 1105* (NY); with male flowers, *Chapin 1106* (G, NY) and *1109* (G); a flat-growing plant keeping close to soil and rocks, May 2, 1933, *Bailey Willis 4* (Stanf.).

The material collected by Chapin and by Willis is quite similar and evidently conspecific. The island plant is most closely related to the poorly understood group of spreading monoecious perennials of the Chilean coastal region. Although collected by a busy geologist and by a busy ornithologist the species is curiously lacking in the collections of Vidal, who seems to have been the most energetic botanizer on the island, unless the report of *Tetragonia maritima,* by the younger Philippi, Anal. Univ. Chile, **47:** 88 (1875), may have been based upon a sterile specimen of it misidentified.

Atriplex Chapinii is evidently distinct from *A. foliolosum* Phil. which is known only from sterile specimens collected on the adjacent island of San Ambrosio. The latter endemic has crowded sessile ovate-triangular leaves only 2.5 mm. long and 2 mm. broad.

Suaeda nesophila, nom. nov. — *Suaeda divaricata* Moq. var. *microphylla* F. Philippi, Anal. Univ. Chile, **47:** 193 (1875); Reiche, Fl. Chile, **6:** 175 (1911), not *S. microphylla* Pallas.

This shrub was collected both by Willis (no. 2) and by Chapin (1107 and 1110). According to Dr. Willis it is the common bush growing on the flatter parts of the island in rounded masses up to 9 dm. in diameter and 5 dm. in height. Dr. Chapin notes that the leaves are at first a light grayish green which turns finally to a dull purplish red. The distal leaves are almost always reddish. He adds that the rounded clumps are 2.5–3.5 dm. tall and 9–12 dm. broad. This endemic species is evidently related to *S. foliosa* Moq. of the coastal hills of northern Chile and southern Peru, from which it is quickly distinguished by its very much more

slender and more branched habit and very much smaller clavate leaves. It is certainly not closely related to *S. divaricata* Moq., which is a large bush confined to Argentina.

MALVACEAE

Cristaria insularis F. Philippi, Anal. Univ. Chile, **47**: 186 (1875); Reiche, Anal. Univ. Chile, **91**: 405 (1895) and Fl. Chile, **1**: 257 (1896).

Collected on San Felix by Willis (no. 3 a–b) and by Chapin (nos. 388, 1111). Their collections are very mature with the leaves mostly dried and weathered. There are some flowers and much good fruit. The plant is endemic though related to a group of small-flowered annuals occurring in the coastal hills from central Chile to central Peru.

COMPOSITAE

Lycapsus tenuifolius Philippi, Bot. Zeit. **28**: 499, tab. 8a, fig. 1–5 (1870); Philippi, Anal. Univ. Chile, **43**: 484 (1873), locality incorrect; F. Philippi, Anal. Univ. Chile, **47**: 188 (1875). — *Alomia tenuifolia* (Phil.) Benth. & Hook. ex Reiche, Anal. Univ. Chile, **109**: 10 (1901) and Fl. Chile, **3**: 260 (1902); Robinson, Proc. Amer. Acad. **49**: 439 and 453 (1913).

There are photographs and fragments in the Gray Herbarium of the original collections at Santiago made by Simpson and by Vidal. Simpson's collection is labeled as from San Ambrosio. Vidal's collection is given as from San Felix. Dissections of this authentic material shows conclusively that this endemic genus is not a Eupatorioid as has been supposed. The plant has fertile pistillate marginal florets with a 3-toothed ligule about once and a half the length of the tube. The tubular inner florets appear to be hermaphroditic and sterile. The style-branches are linear, flattened and abruptly contracted into a short triangular apex. The receptacle bears conspicuous slender scales which seem to separate the marginal florets from the inner ones. Except for the bracteate receptacle the plant is very suggestive of some of the Helenioids or even certain Asterioids. The bracteate receptacle suggests the Helianthoids but none of the other structures suggest that group of the Compositae. The same may be also said for the Madineae. *Lycapsus* has relations even more vague than *Thamnoseris,* the other endemic genus of the Compositae.

Thamnoseris lobata, sp. nov. — *Thamnoseris laceratus* sensu F. Philippi, Anal. Univ. Chile, **47**: 190, cum tab. (1875); Reiche, Anal. Univ. Chile, **116**: 580 (1905) and Fl. Chile, **5**: 6 (1910), as to shrub of San Felix.

The specimens from Prof. Willis (no. 1) which consist of leaves, flow-

ering inflorescence and parts of stem, agree well with the collections from San Felix by Vidal which were described at length and illustrated by the younger Philippi. According to Willis' notes the plant grew in a sheltered ravine on Cerro Amarillo, 150 m. alt., and formed a low, abundantly lactiferous shrub with thick woody trunk and branches. The bark was light gray, smooth and "swollen looking."

Neither the collection by Vidal nor that by Willis matches the single leaf of the lactiferous shrub of San Ambrosio upon which the elder Philippi, Bot. Zeit. **28**: 499, tab. 8, fig. A6 (1873), based his *Rea ? lacerata*. This leaf from San Ambrosio is triangular in outline, broadest at the base, cut 9/10 of the way to the rachis and has the well spaced 3–4 pairs of lobes prominently and narrowly lobulate. In the San Felix plant, as given by the younger Philippi and later by Reiche, and as shown by the material collected by Bailey Willis, the leaves are lanceolate, broadest above the middle, gradually contracted towards the base, cut ½–⅔ to the rachis, and the crowded 3–5 pairs of lobes sparsely lobulate-toothed. The material from San Felix is consequently quite different in appearance from the scanty specimen originally described from San Ambrosio and so seems to merit a new name. The lengthy descriptions given by the younger Philippi and by Reiche are based upon the collection of Vidal illustrated by the former author. This collection and the mentioned descriptions and plate amply characterize *Thamnoseris lobata* of San Felix.

The imperfectly known plant that is correctly known as *Rea lacerata* Phil., *Thamnoseris laceratus* (Phil.) F. Phil. or *Dendroseris lacerata* (Phil.) Hemsley, is consequently known only from San Ambrosio where Simpson reported it as common on the crests and Hemsley, Report Challenger Voy. Bot. **3**: 99 (1884), reported it as occurring on a rock just south of that island. Until the flowers and inflorescence of this plant of San Ambrosio are described, its exact relationship with *T. lobata* of San Felix must remain a matter of surmise.

The lactiferous shrub of San Felix is evidently a member of the Cichorioideae. It has naturally been compared with *Dendroseris,* an endemic genus of Juan Fernandez having similar habit, for *Thamnoseris* and *Dendroseris* not only occur in adjacent archipelagos, but are unique among the Cichorioids in having a pronounced woody habit. Floral structures of these two genera, however, show many differences. I am inclined to the opinion that we must await the judgment of some future student who has mastered the complexities of the classification and interrelation of the Cichorioids, before we definitely select similarities of habit as indicative of direct relationship between the two insular endemic

WEST END OF SAN FELIX FROM THE LAVA CLIFFS ON THE SOUTHSIDE OF THE ISLAND; THE HIGH HILL OF TUFF IS CERRO AMARILLO.

SOUTHEAST PORTION OF SAN FELIX SHOWING THE TOPOGRAPHY OF THE PRINCIPAL PART OF THE ISLAND; THE ISLET OF GONZALES IS ON THE RIGHT AND TO THE LEFT, EASTWARD IN THE DISTANCE, IS THE ISLAND OF SAN AMBROSIO.

genera. The similarities of habit may be simply parallel evolution, the similar responses of two different stocks isolated under equitable insular climates. Many groups of angiosperms, prevailingly low and herbaceous on the continents, have produced woody forms on oceanic islands. The woody habits of *Dendroseris* and *Thamnoseris*, accordingly may be simply ecological and not indicative of immediate relationship. The exact relationship of the two insular genera with each other and with other Cichorioids is still uncertain. Their relationship does not seem to be Old Pacific, for the Cichorioids are very scantily represented in New Zealand and Australia and northward in the Pacific, and none of them in this region have structures suggestive of close affinity with our insular genera. In the past our genera have been associated with the genus *Fitchia*, a woody group of Polynesia, but as suggested by Drake del Castillo, Jour. de Bot. **12**: 176 (1898), that genus now proves to be a Mutisioid. Consequently the old hypothesis as to an Old Pacific relationship of our shrubs must seek new justification. Though I can find no evident relatives of them in South America, I suspect that, like other members of our insular florulas, the insular Cichorioids were probably derived from South American ancestors. The best development of the Cichorioid Compositae in the Southern Hemisphere is to be found in western South America. Our insular Cichorioid shrub may be merely aspects of the evolutionary activity centering on the adjacent continent.

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