VASCULAR PLANTS OF THE LEEWARD ISLANDS, HAWAII

BY

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and

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INTRODUCTION

This paper is a systematic treatment of the vascular plants of the Leeward Islands of the Hawaiian Archipelago, with notes on their vegetation. The Leeward Islands compose a chain of uninhabited islands and reefs that extends northwest from Kauai, the northernmost inhabited island. From east to west the islands or islet groups are as follows: Nihoa Island, Necker Island, French Frigates Shoal, Two Brothers Reef, Brooks Shoal, Gardner Island, Dowsett Reef, Maro Reef, Laysan Island, Lisiansky Island, Pearl and Hermes Reef, Gambia Shoal, Midway Islands, and Kure (Ocean) Island. Possibly there are one or two submerged reefs still further west. (See map, fig. 1.)

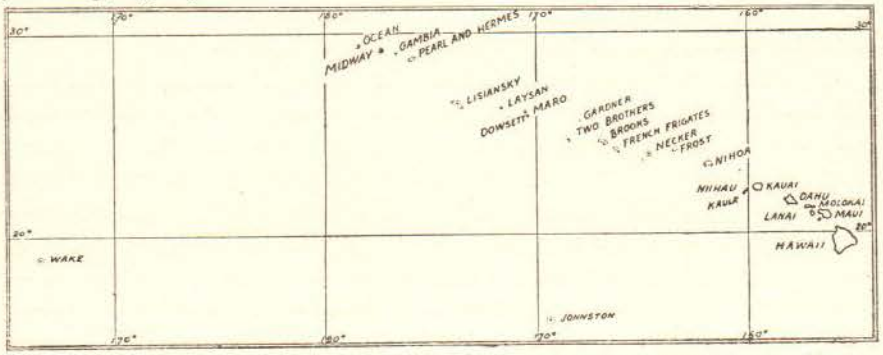

FIGURE 1.—Map showing the position of islands and reefs surveyed by the Tanager Expedition.

Brooks Shoal, Two Brothers Reef, Dowsett Reef, Gambia Shoal, and Maro Reef are submerged coral reefs without higher plant life. Nihoa, Necker, and Gardner islands are remnants of volcanic cones. French Frigates Shoal includes both coral islets and volcanic remnants. All the other islands to the west, with the exception of the submerged reefs, are of coral sand not exceeding a height of 25-30 feet.

After the period of discovery (1786 to 1859), the Leeward Islands were from time to time voluntarily visited by surveying parties and many a time

involuntarily by other parties. Since 1890, when profitable phosphate deposits were discovered on some of them, they have been visited, more or less regularly, by guano schooners and of more recent years by fishing vessels. Since the establishment of a cable relay station in 1903 and a lighthouse in 1905 Midway Islands are, of course, regularly visited. Naturalists have at intervals taken advantage of these connections, and notes on the plant and animal life, as well as collections, have been made available.

With the exception of the species of palm on Nihoa Island, which according to Hillebrand (21, p. 451) was brought to Honolulu by Dr. Rooke in 1858, the first collection of plants, to our knowledge, was made by Dr. Schauinsland (34) on Laysan Island in 1896. In Bernice P. Bishop Museum is a set of duplicates (all but one species) of this excellently preserved collection, which has been studied and incorporated in the present paper.

Plants from the Leeward Islands in the Bishop Museum herbarium include those collected by Mr. W. A. Bryan (5) on Midway Islands (August, 1902), on Laysan Island (April, 1903 and in 1911); by Mr. D. T. Fullaway on Laysan Island in 1912; and by Captain Brown, on Nihoa Island, in 1914. The main collections from the Leeward Islands were made by the botanists of the Tanager Expedition of 1923 and 1924 (16, 17): Gerrit P. Wilder, Edward L. Caum, and Erling Christophersen. Plants were also collected by C. S. Judd, E. H. Bryan, Jr., and other members of the expedition. The *Tanager* visited all of the Leeward islands, and the exhaustive collections made form the main body of material for this paper.

At the time when we started work on the "Tanager" collections Dr. F. B. H. Brown had already described some of the new species and varieties which they contained, and his descriptions are here included. He has also passed his opinion on some of the other plants for which we express our indebtedness. We are also indebted to Rev. Dr. G. Kükenthal for putting his description of *Cyperus pennatiformis* and the var. *bryanii* at our disposal; to Dr. A. S. Hitchcock for his determination of some of the grasses; to Mr. J. Ramsbottom for photographs of types in the British Museum; to Dr. P. C. Standley for his opinion on some of the *Boerhaavia* specimens; to Mr. F. J. Rae for a comparison of *Amarantus brownii* with certain material in the National Herbarium of Victoria; to Dr. E. D. Merrill for his opinion on our specimens of *Ipomoea indica* (Burmann) Merrill, and to Dr. E. Quisumbing for a comparison of these specimens with material at the Bureau of Science, Manila; to Dr. F. V. Coville, Curator of the United States National Herbarium for the loan of plants collected by Mr. J. O. Snyder on Laysan and Necker islands during the visit of the *Albatross* in 1902 (13); to Dr. E. B. Copeland for the loan of certain specimens for comparison.

Unless otherwise stated all the specimens cited are in the Bernice P. Bishop Museum herbarium.

NOTES ON THE VEGETATION

NIHOA ISLAND

Nihoa Island (fig. 2), the largest and highest volcanic remnant in the Leeward Islands, comprises an area of 156 acres and attains an elevation of 895 feet. Its surface, which slopes gently toward the south, is cut by six rather broad valleys, abruptly terminated by relatively low cliffs. On all other sides the cliffs are high and precipitous. The soil is decomposed and disintegrated basalt, to some extent mixed with bird guano. At the head of the southwestern bay is a small beach (Derbys Landing), made of calcareous and basaltic sand (29, p. 10).

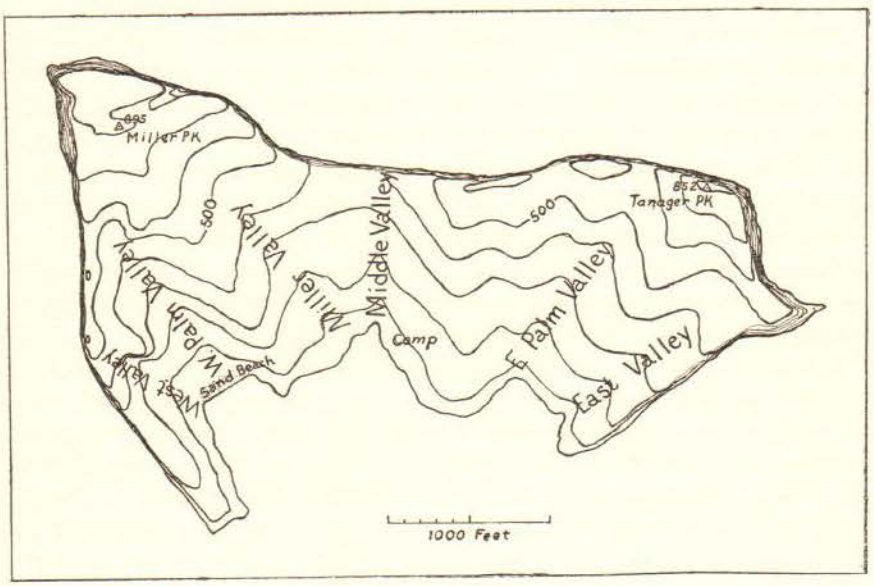

FIGURE 2.—Map of Nihoa Island showing principal geographic features based on a topographic map by C. S. Judd.

Most conspicuous in the vegetation of the island are the palms (*Pritchardia remota*) growing in two rather extensive groves. Otherwise there are no trees, and the grass and bushes give a brownish or grayish green color to the plant cover. The grass usually is predominant on the ridges, while the valley bottoms are covered with a dense scrub, knee-high or more. (See Pl. I.) The following 20 species of vascular plants are found on the island:

Eragrostis variabilis. Common, especially on ridges and at valley heads; in places forms almost pure stands, elsewhere, mixed with *Chenopodium sandwicheum* and *Solanum nelsoni* varieties.

Panicum torridum. Widely distributed, most plentifully in the central part; much less common than *Eragrostis variabilis.*

Pritchardia remota. In West Palm Valley, between Derbys Landing and the western cliff, C. S. Judd, in 1923, counted 347 palms—omitting the small seedlings—and 168 in East Palm Valley leading up to Tanager Peak, a total of 515 palms for the island. Most of the trees on Nihoa are 7 to 10 feet high, but a few trees 25 feet high were seen (Pl. II, *A*).

Rumex giganteus. Found only at the foot of Millers Peak at the upper end of Devils Slide.

Chenopodium sandwicheum. Probably the commonest plant; grows everywhere except on the small plateau below and north of Millers Peak; in places almost pure stands, but commonly associated with *Sida fallax* and *Eragrostis variabilis.* It grows to a height of 3 feet with stems 2 inches in diameter.

Amarantus brownii. Most common on the ridge leading to Millers Peak, but abundant also on the ridges to the east.

Boerhaavia diffusa. Found only on the sand beach.

Tetragonia tetragonioides. Rare, found only just above the sand beach and on steep rock faces west of it.

Portulaca lutea. Observed only in the lowermost part of Middle Valley.

Portulaca caumii. Same as for *Portulaca lutea.*

Schiedea verticillata. Seen only on the cliff west of the sand beach, and north of Millers Peak, just below the summit.

Sesbania tomentosa. Distributed all over the island, but nowhere in dense stands.

Tribulus cistoides. Observed only at the foot of the ridge leading up to Millers Peak, just above the cliff.

Euphorbia celastroides. Common on the edge of the cliffs. Immediately below Millers and Tanager peaks, and at the foot of the Tanager Peak ridge, it forms dense mats (Pl. II, *B*).

Sida fallax. Found all over the island, mainly at the lower elevations; most common in the eastern part, usually mixed with *Chenopodium sandwicheum* to form a dense knee-high scrub.

Ipomoea indica. Rare; observed in the gorge just below Millers Peak, at the base of the pinnacle on the west cliff, and above the sand beach.

Heliotropium curassavicum. Apparently limited to the sand beach and the area immediately above it.

Solanum nelsoni vars. caumii and acuminatum. Common all over the island, growing in the *Chenopodium-Sida* scrub, and with *Eragrostis variabilis;* not found in pure stands; most common at the lower elevations.

Solanum nigrum var. nihoense. Two plants only were observed; one on the

edge of the southern cliff, about the middle of the island, and the other in the pocket of a stream bed just above the sand beach.

Sicyos sp. Observed only below Tanager Peak

NECKER ISLAND

Necker Island, like Nihoa Island, is the remnant of a volcanic cone. It is much smaller, covering an area of about 41 acres only, and with a maximum elevation of 276 feet (29, p. 20). The backbone of the island forms a gently rounded plateau from which the cliffs descend steeply, especially toward the south and west. The soil is shallow, coarse, and most of it mixed with a great amount of loose rock. It is basaltic with some admixture of bird guano.

The vegetation on Necker Island is very inconspicuous (Pl. III, *A*). In no place do the higher plants form a closed cover, and great parts of the island are destitute of any plant life whatsoever. Only five species of vascular plants are found:

Panicum torridum. In 1923, moderately common on the north side of the main part of the island, but most of the plants were dead. In 1924 only two clumps were observed: one on the slopes of Annexation Hill; another on the east side of Bowl Hill.

Chenopodium sandwicheum. The commonest plant on the island; abundant on the sloping sides, but rare on the flat top; plants low and straggling; few exceed a height of 2 feet.

Sesuvium portulacastrum. Found only on the southern slopes of Annexation Hill where it grows in great abundance in the talus within reach of the spray.

Portulaca lutea. Common on the flat tops, as well as on the small ledges of the precipitous cliffs; most of the plants are rather small and poor.

Sesbania tomentosa. A few plants, low and widespreading, along the flat top of the main part of the island; most of these less than 2 feet high, but spreading as much as 6 to 10 feet in diameter; much favored as nesting site by boobies and frigate birds. (See Pl. III, *B*.)

On the shores of Shark Bay seeds of *Aleurites moluccana* were found. In June, 1923, C. S. Judd sowed seeds of the following species in the saddle between Flagpole Hill and Summit Hill: *Haematoxylum campechianum* Linnaeus, *Thespesia populnea* Solander, *Casuarina equisetifolia* Linnaeus, *Pritchardia pacifica* Seemann et Wendland, *Pritchardia* sp., *Livistonia australis* Martius, and *Lycopersicum esculentum* Miller. In July, 1924, no seed plants of these species were found.

FRENCH FRIGATES SHOAL

French Frigates Shoal is a crescent-shaped atoll consisting of 16 sand and 2 rock islets, the last remnants of a volcanic cone. The total area of the sand

islets is about 46 acres, none of them exceeding 12 feet in height. The larger of the two rock islets, La Perouse Rock, is about 120 feet high and 500 feet long, the smaller one is only about 10 feet high and 100 feet long (Pl. IV, *A*).

The vegetation is sparse, only nine of the sand islets supporting growth of higher plants. The other sand islets and La Perouse Rock are entirely devoid of higher plant life. (See Pls. IV, V.) The following 6 species of plants were collected:

Lepturus repens. Common along the beach crest; also scattered inland.

Chenopodium sandwicheum. Most abundant on Whale Island, the central part of which supports an open scattered stand.

Boerhaavia diffusa. Very common; found on eight islets; on most of them scattered throughout.

Portulaca lutea. Well distributed over the surface.

Tribulus cistoides. Abundant only on East Island, the central part of which supports a pure stand.

Ipomoea pes-caprae. Confined to East Island, where three small patches grow along the windward beach.

The following table gives the size of the various sand islets, and the extent of their vegetation cover, as mapped by Palmer (29, p. 30). The distribution of vascular plants has been added.

	Shark	Tern	Trig	Skate	Whale	Round	East	Gin	Little Gin
Islet area in acres	1.1	11.	5.3	3.	5.3	1.6	9.6	5.(?)	2.5(?)
Vegetation in acres	small	3.	3.7	1.5	2.5		6.0		small
Lepturus repens		x	x	x	x	x	x		x
Chenopodium sandwicheum		x		x	x		x		
Boerhaavia diffusa	x	x	x	x	x	x	x		x
Portulaca lutea		x	x	x	x	x	x	x	x
Tribulus cistoides		x	x	x	x	x	x		
Ipomoea pes-caprae							x		

GARDNER ISLAND

Gardner Island, the westernmost volcanic rock island of the Hawaiian chain, as described by Palmer (29, p. 31), consists of two islets, the larger of which is 170 feet high and 200 yards in diameter. (See Pl. IV, *B*.)

The only species of vascular plant recorded from this island, is *Portulaca (lutea?)*, collected by Gerrit P. Wilder in 1923. The specimens have disappeared from the general collection of the Tanager Expedition; the duplicate field label is the only record.

LAYSAN ISLAND

Laysan Island is a coral island, no volcanic rock being exposed. Its surface, covered by sand and phosphate rock, rises to a maximum height of 30 feet above mean sea level. According to Dill (11) its area is about 2 square

miles. The central part is occupied by a closed lagoon bordered by a marsh. This lagoon is of high salinity, stated by Schauinsland (34, p. 20) to be of from 12 to 15 per cent salt, and by Elschner (12, p. 33), 9.10 per cent chlorides of sodium and potassium. South of the lagoon was formerly a small pond of brackish water, in 1923, found to be filled by drifting sand.

A few notes on the vegetation of the island in 1828, have been left by Von Kittlitz (23). Von Kittlitz did not see the island himself; the notes were taken down from the verbal communication of the ship's physician, C. Isenbeck, who landed on the island (23, p. 120): " . . . sie ist fast durchgängig bewachsen mit einer starken buschigten Grasart und zum Theil mit kurzem Gesträuche, zwischen welchem einige zwerghafte Exemplare einer Art Fächerpalme aufgekommen waren."

At the time of Schauinsland's visit to Laysan (June to September 1896), 26 species of vascular plants were to be observed, and the vegetation was on the whole luxuriant. Schauinsland writes (34, p. 39): "Von Eigenthümlichkeiten der Flora sei noch erwähnt, dass die einzelnen Pflanzen hier auf dem Korallensand eine grosse Ueppigkeit aufweisen, eine grössere als sie sie auf dem fruchtbaren Lavaboden der hawaiischen Inseln zeigen." It also appears that the island has been well covered with vegetation throughout, the most characteristic types being the rather open *Eragrostis variabilis* grassland and *Chenopodium sandwicheum* scrub, the former species growing to a height of 6 feet, the latter 2 to 6 feet. Schauinsland observed a difference between the development of the vegetation in the western and eastern parts of the island, the western part being the more luxuriant, both individually and in the number of species.

Laysan Island was visited by the *Albatross* in 1902. From the report of the expedition it appears that the vegetation had undergone no important change since 1896. Fisher writes (13, p. 773): "The inner slope [of the beach crest] is covered with tall bushy grass that grows in separate tussocks, and several species of shrubs, one of which (*Chenopodium sandwicheum*) covers considerable areas. This grassy portion comprises the greater part of the island."

The island was visited by W. A. Bryan in 1903 and again in 1911. In his report (11, p. 28) he makes comparisons on the conditions in the two different years, as follows:

> Rabbits now literally swarm over the island by thousands. The amount of damage done by them can better be imagined than told. They are exterminating first one species of plant then another. Several species that were common everywhere eight years ago have entirely gone, others are already doomed. Unless some drastic measures are resorted to within a very short time, not a bush or spear of grass will be alive.

No such measures were taken, and, in 1923, the Tanager Expedition found that the island had been transformed into a desert of sand. Only four species

of vascular plants were observed of the 26 species found on the island by Schauinsland in 1896. The following species of vascular plants have been recorded from Laysan Island:

Cenchrus agrimonioides var. laysanensis. Collected in 1896 (scattered among the *Eragrostis* in drier places), also collected in 1902, 1903, and 1911. Now exterminated.

Cynodon dactylon. Collected by W. A. Bryan in 1903 only; probably introduced by the guano workers.

Eragrostis variabilis. In 1896 the most common plant on the island, growing in bunches over the greater part of the interior. It was collected also in 1902, 1903, and 1911, but was not observed in 1923.

Lepturus repens. A common plant on the north shore of the island; collected in 1896 and 1903, but not subsequently.

Sporobolus virginicus. Found in 1896 in the same places as *Lepturus repens;* collected again in 1902 and 1903, but has since apparently disappeared.

Cyperus pennatiformis var. bryanii. In 1896 a common plant in the less dry parts of the island; collected again in 1902, 1903, and 1911, but since exterminated.

Cyperus laevigatus. In 1896, growing luxuriantly in the vicinity of the lagoon and also present in a few low places in the northern part of the island; collected as late as in 1911, but was not observed in 1923.

Pritchardia ?sp. Observed in 1828, 1859, and 1891, but no specimens are known to us. The palms are now extinct.

Santalum cuneatum var. laysanicum. The endemic Laysan sandalwood, in 1896 growing along the shore, most luxuriantly on the northwestern side of the island; the largest shrub found on the island, growing to a height of 8 feet and more, with a stem 4 inches in diameter; again collected in 1902, 1903, and 1912; in 1923, a patch of this plant was found along the southwestern side of the island, appearing as a lot of dry stumps sticking up out of the sand (Pl. VII, *A*). On close examination many of the stumps were seen to be alive and trying to sprout, in spite of their being kept trimmed clean by the rabbits.

Chenopodium sandwicheum. In 1896, next to *Eragrostis variabilis,* the commonest plant on the island, forming a dense scrub as much as 6 feet in height; last collected in 1903; no sign of the plant was seen in 1923.

Amarantus viridis. In 1896 represented by only a few specimens; in 1903, common along the track and in the guano beds. Since then it has not been collected.

Achyranthes splendens var. reflexa. In 1896, present as a small but luxuriant patch in the northwestern part of the island. In 1903 it seemed to hold the same position; not present in subsequent collections.

Boerhaavia diffusa. Up to 1903, common over the island; in 1923 only dead plants were seen.

Sesuvium portulacastrum. Represented in all the collections examined by us; in 1896, growing very luxuriantly in the flats near the lagoon. In 1923, three moderate-sized patches were observed, on the southern, eastern, and northern shores of the lagoon (Pl. VI, *A*), only the first of which seemed at all healthy; observed to spread along the western edge of the lagoon as well as inland to the south.

Portulaca lutea. In 1896, scattered over the drier parts of the island; present in all collections examined by us, in 1923 it was observed to grow only in a small patch in the heart of the *Sesuvium* patch east of the lagoon.

Lepidium owaihiense. Reported only by Schauinsland in 1896, who observed only one specimen in the eastern part of the island.

Capparis sandwichiana. In 1896, present especially in the western part of the island; collected again in 1902; in 1903 reported to grow in patches all over the high parts of the island. Not collected in 1911, nor in 1923.

Tribulus cistoides. In 1896, present over almost all the island; collected in 1902, 1903, and 1911. In 1923 only tiny seedlings and numerous seeds were found in a few places.

Ipomoea indica. In 1896, growing scattered all over the island with the exception of the vicinity of the lagoon; reported in 1903 as quite common; not since collected.

Ipomoea pes-caprae. Reported to grow everywhere on the beach crest in 1896; in 1903, reported not abundant anywhere, but present on the eastern, southern, and western sides, close to high water mark; not reported since, except for 2 seeds found among the rocks at the south end in 1923.

Nama sandwicensis var. laysanicum. Growing on the beach crest all around the island in 1896; collected in 1903 and 1911, but not observed by the Tanager Expedition in 1923.

Heliotropium curassavicum. In 1896, growing only in the salt marsh about the lagoon, where it was abundant as late as 1903; since that time it has not been collected.

Phyllostegia variabilis. In 1896, growing scattered near the beach in the western and eastern parts of the island; in 1903, observed to grow in small patches, mostly on the windward side, but not seen by the Tanager Expedition in 1923. Fortunately that expedition found the plant growing on Midway Islands, so that it is not completely exterminated from the surface of the earth.

Solanum laysanense. In 1896, growing only on the sand dunes near the beach in the northern part of the island, at which place two or three

patches were observed in 1903. It has since been exterminated here, but is found on Pearl and Hermes Reef and Midway Islands.

Sicyos hispidus. In 1896, confined to the vicinity of the small brackish lake in the southern part of the island. Collected in 1903 and 1911, but found to be extinct in 1923.

Sicyos microcarpus. Reported only by Schauinsland in 1896, as growing scattered on the higher northern shores of the lagoon.

Sicyos sp. Collected in 1903 and 1911; in 1903 reported as not abundant, growing in sand and guano.

Scaevola frutescens. In 1896, confined to the beach zone, more luxuriant on the western than on the eastern side of the island. Collected in 1902 and 1911, but in 1923 only three exceedingly poor patches were found: one southeast of the lagoon, about midway between the shore and the lagoon, on the inner side of the sand hills; another on the north side of the island, on the outer side of the sand hills; the third in the northeastern corner of the island.

Lipochaeta integrifolia. In 1896, growing in the transition zone between the beach and the inland; in 1903, reported to grow in the fine guano about the edge of the lagoon; not since collected.

In 1828, Isenbeck (23) observed some dwarfed specimens of a fan palm on Laysan Island (p. 9). The existence of this palm, of which no specimen, living or dead, is now to be found, has been reported also at later times. Capt. John Paty (30) who visited the island in 1857, states that " . . . 5 or 6 small palm trees were also seen." On an accompanying map he marked off the palms on the northeastern shore of the lagoon. Two years later, Lieut. J. M. Brooke of the *Fenimore Cooper* visited several islands of the Leeward chain. On his map of Laysan Island, now in the Survey Department, Territory of Hawaii, two palm trees are marked off on the eastern shore of the lagoon. Later in the same year (1859), Capt. N. C. Brooks in the *Gambia,* visited the Leeward Islands. He records (4) that "Laysan Island . . . is covered with a luxuriant growth of shrubs . . . There are five palm trees on the island, and I collected 25 varieties of plants, some of them splendid flowering shrubs, . . . " In 1891 Munro (28, p. 688) spent 10 days on Laysan Island, and he saw there "the remnant of a grove of palms, two low trees and several dry stumps." Captain Schlemmer, for a long time resident on Laysan Island, told one of the writers that he remembered a small group of palms in the southeastern (?) part of the island at the time he took possession (in the early '90s), two or three of which he moved to the vicinity of the buildings, but which failed to survive transplanting.

When Schauinsland (34) visited the island in 1896, he did not find any living specimens of this palm, but numerous stumps and roots, some of them

with a diameter of 50 cm. He found them both in the northern and southeastern part of the island, and concludes that the original number of trees must have been several hundred. From the verbal description that he obtained, he ventured the opinion that they belonged to *Pritchardia gaudichaudii* H. Wendland. Rock (31, p. 104) states under *Pritchardia remota:*

"This palm is not known to the writer, but on Laysan Island Prof. [W. A.] Bryan saw a single palm with a short trunk which is probably Beccari's *Pr. remota.*" This statement apparently refers to Bryan's first visit to the island in 1903, and probably rests on some misunderstanding, as Schauinsland, who stayed 3 months on the island in 1896, definitely states that he saw stumps but no living trees, and in the list of plants published by Fisher (13, p. 807), no mention is made of any palms.

Rothschild (33, pt. 1, pl. I, facing p. VI) reproduces a photograph of palms labeled, "Group of palm trees. Laysan Island," and another photograph (33, pt. 1, pl. XX, facing p. 27) labeled, "Palm tree mentioned by Kittlitz, with gannet's nest. Laysan Island." In the list of plates (33, pt. 3, p.XVII) "Laysan Island" is changed to "Lehua." Both photographs were undoubtedly taken on Nihoa Island. Authentic photographs of the palms on Laysan Island, probably taken between 1891 and 1896, exist, however, and they leave little doubt but that the palms belong to *Pritchardia.* (See Pl. VI, *B.*) From the numerous localized species found in this genus, it may safely be concluded that the Laysan Island palms belonged to an endemic species.

In addition to these plants there were, in 1923, a few others, reminders of the occupancy of Laysan by the guano diggers—if the glaring waste of sand where once was luxuriant vegetation be not reminder enough. Two trees of *Cocos nucifera* Linnaeus were growing by the buildings, where were also observed a poor specimen of *Casuarina equisetifolia* Linnaeus and three specimens of *Hibiscus tiliaceus* Linnaeus. Specimens of *Nicotiana tabacum* Linnaeus were collected by W. A. Bryan in 1911, and in 1923, a rather large patch of this plant was found near the southern end of the lagoon and was observed to spread through the southern and southwestern parts of the island. One seed of *Entada scandens* (Roxburg) Bentham, was found on the south side of the island, about midway between the lagoon and the shore. On the beach at the north side were found one seed of *Mucuna gigantea* (Roxburg) De Candolle, two seeds of *Dioclea altissima* (Velloso) Rock and one seed of *Caesalpinia crista* Linnaeus (?). *Mucuna gigantea* was also found well inland from the west coast. Several seeds of *Aleurites moluccana* Willdenow were found along the beaches.

In 1923, about 2 pounds of seed of *Thespesia populnea* Solander and 1.5 pounds of *Casuarina equisetifolia* Linnaeus were sowed in various parts of the island. Other species were also sowed, and roots of *Eragrostis variabilis*

(from Kure Island and Pearl and Hermes Reef) and *Lepturus repens* (from Pearl and Hermes Reef) were planted in the same year.

LISIANSKY ISLAND

Lisiansky Island is a low coral island covered with sand. It is about one mile long and one-half mile wide.

The vegetation seen by the Tanager Expedition in 1923 was exceedingly poor, one patch of grass at the north end and a few other plants sparsely distributed being all that was to be found. (See Pl. VII, *C*.) The island has, however, at an earlier time had a much more generous plant cover. Lisiansky (25), who discovered the island in October, 1805, writes of the vegetation: " . . . almost at every step, we sunk up to our knees in holes, that were concealed by overgrown creeping plants, . . . Its soil consists of coral sand, that is overgrown with creeping plants and grass, . . . "

In 1891 Captain Walker (37, p. 44) wrote of the island: "Right around the island is a beautiful sandy beach about one hundred feet wide; above that the low scrub brush commences." And Palmer, who was there at the same time, collecting birds for the Honorable W. Rothschild, records in his diary (33, pt. 1, p. XII):

> The small Gannets (*Sula piscator*) are sitting on their nests, which are built on some small scrub that is growing round what I believe at one time must have been a lake, on the south side of the island. This scrub, although it does not grow so high, is, I think, the same as that found on Laysan, and which, with the exception of two or three small spots only, grows round this dried-up lake.

What this "scrub" could have been cannot be definitely determined. But it is highly improbable that it is referable to any of the plants found on the island in 1923. At any rate no such growth as described was found at that time.

Contrast these earlier descriptions with that of Elschner (12, p. 56) who visited Lisiansky in 1914:

> Surrounding the houses are small patches of tobacco, which grow wild, having been brought by Captain Schlemmer. This is in fact the only vegetation on the island, and there hardly is a blade or stalk of any other plant to be seen with the exception of perhaps two poorly looking specimens of *Ipomoea* which I saw. Save for the presence of many thousands of sea birds, the island presents a dreary and desolate appearance as has never confronted me, even on my travels over the deserts of North Africa and Syria.

Elschner further states that he saw a few living rabbits on the island, but many dead ones. That the destruction of the vegetation is a result of the introduction of these rabbits can hardly be doubted. (See Pl. VII, *B*.)

At the time of the visit of the *Tanager* in 1923, no living rabbits were seen; only their dead remains. And the vegetation was apparently slowly starting to come back, so far as it can be judged by the short descriptions at

hand. Neither of us has visited the island. Four species of vascular plants have been collected from Lisiansky Island:

Eragrostis variabilis. Growing in a patch about 700 feet long at the north end of the island.

Sesuvium portulacastrum. Rare.

Portulaca (lutea?). Not in the collections; the duplicate field label is the only record.

Nama sandwicensis var. laysanicum. Rare.

Elschner (12) reports that he saw patches of tobacco on Lisiansky Island in 1914, and two poor specimens of *Ipomoea*. According to Ball (1) one seed of *Ipomoea* sp. was picked up inland. Seeds of *Barringtonia asiatica* (Linnaeus) Kurz were sowed on the island in 1923 by Gerrit P. Wilder.

PEARL AND HERMES REEF

Pearl and Hermes Reef is a coral atoll consisting of several sand covered islets. Four of these were visited by the Tanager Expedition: Southeastern, Middle, and Seal islands in the southern part of the group, and North Island in the northeastern part.

The three southern islands are very small, hardly more than 10 feet high, and consist of sand banks with a raised coral reef at one end. This reef, which is undoubtedly under water during storms, is simply a platform of rough coral rock covered with a coarse shingle of broken coral and shells. On Southeastern and Seal islands this reef has a luxuriant growth of *Sesuvium portulacastrum,* but no other plants are found on it. The sandy portions of the islands are dominated by the grasses *Eragrostis variabilis* and *Lepturus repens,* on Southeastern and Seal islands distributed indiscriminately, on Middle Island *Eragrostis variabilis* restricted to the central part of the island (Pl. VIII, *B*) leaving the peripheral part for *Lepturus repens.* Eleven species of vascular plants have been reported from this group:

Eragrostis variabilis. Common on the three southern islets visited, covering the main interior parts, in pure stand or mixed with *Lepturus repens.*

Lepturus repens. Present on the three southern islets visited, confined to the beach crest except in Southeastern Island where it is distributed throughout.

Achyranthes splendens var. deflexa. Common on Seal Island; only two plants seen on Middle Island; entirely absent from Southeastern Island; found on North Island. (See Pl. VIII, A.)

Boerhaavia diffusa. Present on all of the three southern islets visited; nowhere in abundance.

Sesuvium portulacastrum. On Southeastern and Seal islands only, growing on raised reef and low muddy flats.

Lepidium owaihiense. On Middle and Seal islands only; rare.

Capparis sandwichiana. Only on Seal and North islands; on Seal Island, scattered throughout except on the raised reef.

Tribulus cistoides. On all four islets visited, but common only on Middle and Seal islands, one seedling only noted on Southeastern Island.

Solanum laysanense. On Middle and Seal islands; nowhere in abundance.

Sicyos hispidus. On Southeastern Island a few plants; a large flourishing plant in the eastern half of the higher part of Seal Island.

Scaevola frutescens. On Middle and Seal islands, only a few small plants were observed.

On the beach of Southeastern Island were found one seed each of *Mucuna gigantea* (Willdenow) DeCandolle and *Mucuna urens* (Linnaeus) Medikus.

MIDWAY ISLANDS

Midway Islands consist of two larger sand-covered coral islets, Sand Island and Eastern Island, and one or two small and variable, barren banks. (See fig. 3.) Sand Island is now the only inhabited island of the entire Lee-

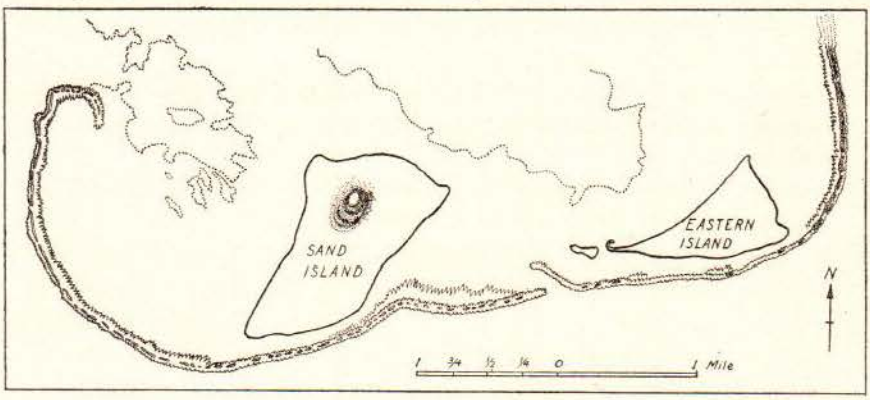

FIGURE 3.—Map of Midway Islands showing land areas and part of the encircling reef.

ward chain, being a relay station of the Commercial Pacific Cable Company. Naturally a great many introduced plants are to be found, both ornamentals and accidentally introduced weeds. Of natural vegetation but little is present. Eastern Island has a wide belt of moderately dense *Scaevola frutescens* scrub encircling an open, flat, central plain, in which is found a low growth consisting of several species, but characterized by the absence of grasses (Pl. IX, *A*). At one end there is a small clump of planted *Casaurina equisetifolia* Linnaeus.

The map of the United States Hydrographic office (*Lackawanna* Survey in 1867), indicates a sharp contrast in the natural vegetation of these two

islands; Eastern Island is marked as having a dense continuous cover of vegetation, but Sand Island appears to have only a few scattered patches. This same condition prevailed in 1891, when Midway Islands were visited by Palmer (33, pt. 1, Pl. XIII), and again in 1902, shortly before the establishment of the cable station, when the island was visited by Bryan (5, p. 39), who writes: "On the top of most of these dunes [on Sand Island], a few hardy shrubs and grasses manage to subsist, and form the only relief for the eye in what is little else than a waste of shifting sand. . . . Compared with the island just described, it [Eastern Island] presents an interesting contrast for it is clothed in green down to the beach . . ."

A total of 19 species of vascular plants have been recorded for Midway, excluding the ornamental trees and weeds about the cable station:

Psilotum nudum. Sparingly in the sand near the center of Sand Island.

Cenchrus agrimonioides var. laysanensis. Not collected or observed by the Tanager Expedition, in 1923; collected by Bryan in 1902, who states that he saw only two or three bunches inland on Eastern Island.

Cenchrus hillebrandianus. Observed in 1923 to grow in one small stand in the central plain of Eastern Island, also on Sand Island; perhaps to be classified among the station weeds.

Eragrostis falcata. In 1902, noted as not abundant on Eastern Island but common on the lowland at the west end of Sand Island; not seen by the Tanager Expedition.

Eragrostis variabilis. Recorded for Sand Island only, where it is fairly common, particularly in the central part of the island.

Lepturus repens. Collected on both islands in 1902; noted as common, in bunches on Sand Island. It was not seen by the Tanager Expedition.

Achyranthes splendens var. reflexa. In 1902, noted as fairly common on Eastern Island and growing on the sand mounds of Sand Island. Not observed by the Tanager Expedition.

Boerhaavia diffusa. Recorded from both islets; in 1923 growing abundantly in the central plain of Eastern Island.

Portulaca lutea. Found only on Eastern Island, where a few plants grow in the central plain.

Lepidium owaihiense. Collected only on Eastern Island where it is common in the central plain (Pl. IX, *A*), but also observed as not uncommon on Sand Island.

Capparis sandwichiana. Recorded for Eastern Island only, where it was fairly common in 1902, but uncommon in 1923.

Tribulus cistoides. Recorded for Eastern Island only; in 1902 observed to be fairly common on the sandy shore, and in 1923 common in the central plain.

Sida fallax. In 1923 only one small plant observed on Eastern Island.

Ipomoea indica. Recorded for both islets, not collected on Eastern Island since 1902, when it was plentiful in the center of the island. In 1923 found on Sand Island only on the beach near the landing.

Ipomoea pes-caprae. Recorded for Sand Island only; in 1923, a few plants found growing inland.

Phyllostegia variabilis. Recorded for Eastern Island only, where one moderate-sized clump was found in the central plain in 1923. After its eradication from Laysan Island, the type locality, this is the only known occurrence of the species.

Solanum laysanense. Recorded for both islets in W. A. Bryan's collection in 1902.

Solanum nelsoni var. intermedium. Recorded for Eastern Island, where it was observed to be abundant in the central plain in 1923.

Scaevola frutescens (Pl. IX, *B*). Recorded for both islets; the principal plant on Eastern Island, completely encircling the island in a broad belt.

Several species of ornamental plants have been introduced for the grounds of the cable station, and with the imported soil also several weeds. The so called "San Francisco Grass," determined in the field as *Ammophila arenaria* (Linnaeus) Link, has been introduced from the sand dunes of San Francisco Bay as a sandbinder, and is now growing all along the dunes and in places inland, forming a conspicuous element in the vegetation of the island (Pl. IX, *B*).

KURE (OCEAN) ISLAND

Kure Island, unofficially called "Ocean Island," is a coral atoll consisting of three low, sand islets, the largest of which is about three-fourths of a mile long and up to about one-half mile wide, with a maximum elevation of 25 feet. It is the westernmost Hawaiian island, except for a few submerged reefs, and is located about 1100 miles from Nihoa Island, the easternmost unit in the Leeward Islands chain.

The largest islet of Kure is completely encircled by dunes, rising rather steeply from the beach. Most of it, including the tops and inner sides of the dunes, is covered with a dense, almost impenetrable growth of *Scaevola frutescens* (Pl. X, *B*), which averages 5 to 6 feet in height, except in small areas, generally on the tops of the sand hills, where it is only about waist high and fairly open. In these openings and along the outer rim of the thicket are a few other plants, principally the tall bunch-grass, *Eragrostis variabilis,* and the creeping *Boerhaavia diffusa.* Toward the east central part of the islet is a large, open plain, probably 20 to 25 acres in extent, entirely surrounded by the tall *Scaevola frutescens.* (See Pl. X, *A.*) Here were found many plants seen in no other place on the islet. With the exception of a few "islands" of *Scaevola frutescens,* scarcely any vegetation in this

central plain was over 2 feet high, and most of it was considerably under that height. The two other islets are only small spits devoid of higher plant life.

Thirteen species of vascular plants were collected by the Tanager Expedition in 1923:

Cenchrus agrimonioides var. laysanensis. Observed in two clumps only, one in the *Scaevola* scrub and one on the edge of the central plain; growing to a height of 6 feet.

Eragrostis falcata. Grows sparingly on the outer side of the dunes at the northwest corner of the islet; most of the tufts seen were dead.

Eragrostis variabilis. Grows in the central plain and in isolated clumps in openings of the *Scaevola* scrub.

Lepturus repens. Observed in one place only, a fairly open space of the *Scaevola* scrub.

Achyranthes splendens var. reflexa. Only three or four plants were seen, in the central plain.

Boerhaavia diffusa. Growing in the central plain also in fairly open places of the *Scaevola* scrub, and at its outer edge.

Lepidium owaihiense. Growing in open places of the *Scaevola* scrub and in the central plain.

Tribulus cistoides. Growing in the central plain only.

Ipomoea indica. Common, climbing over the *Scaevola* bushes.

Solanum nelsoni var. intermedium. In the central plain and in openings of the *Scaevola* scrub nearby; elsewhere rare.

Sicyos hispidus. Growing on the "Scaevola islands" in the central plain and on the inner edge of the scrub.

Scaevola frutescens. The dominant plant, forming a dense scrub over the island, leaving a fairly open plain towards the eastern end, in which it was only found scattered in isolated "islands."

Lipochaeta integrifolia. Found growing in the central plain only.

As beach drift were found *Cocos nucifera* Linnaeus (two dead nuts), *Aleurites moluccana* Willdenow (many dead nuts), *Mucuna urens* (Linnaeus) Medikus (two seeds), and *Entada scandens* (Roxburg) Bentham (one seed).

LIST OF VASCULAR PLANTS

In the citation of specimens it is stated whether flowers or fruits are present. The abbreviations used are: *b*, bud; *fl*, flower; *fr*, fruit; *y*, young.

PTERIDOPHYTA

PSILOTACEAE

PSILOTUM Swartz

Psilotum nudum (Linnaeus) Grisebach: Abh. Kön. Gesell. Wiss. Göttingen, vol. 7, p. 278, 1857.

Midway: Sand Island, sandy plain near lighthouse, fertile, April 24, 1923, E. L. Caum No. 35.

Tropics and subtropics.

MONOCOTYLEDONEAE

GRAMINEAE

CENCHRUS Linnaeus

Cenchrus agrimonioides Trinius var. **laysanensis** F. Brown, varietas nova (Pl. XI, *A*).

Perennial, stems branched, prostrate and creeping at the base, ascending, subscandent, 50-200 cm. in length, leaf-bearing throughout, scabrous below the inflorescence, glabrous or nearly so elsewhere. Leaf blades linear-lanceolate, 30 ± cm. long, 2 ± cm. broad, scabrous; sheaths longer than the internode, compressed, keeled, loosely clasping; ligule ciliate, 2 mm. in length. Spikes 8-14 + cm. long, the axis, pedicels, and base of involucres densely puberulent; involucres closely arranged on pedicels 1-2 mm. in length, turbinate, 1 ± cm. in length; outer bristles numerous, spreading, slender, 2± mm. in length, retrorsely scabrous; middle series of bristles somewhat longer and stouter than the outer, suberect, retrorsely scabrous near the apex, villose below; inner series stout, retrorsely scabrous near the apex, thickened and villose below, connate only at the base or irregularly fused up to two-thirds the length of the bur; spikelets single in each involucre; glumes all broadly triangular and acute or cuspidate, the basal one 2-4 mm. long, 1-5-veined; second glume 5-7 + mm. in length, 5-9-veined; third glume 6-7 + mm. in length, 7-12-veined with a thin 2-7-veined staminate palea in the axil; fourth glume 6-7 + mm. in length, 7-11-veined, enclosing a 3-7-veined bisporangiate palea.

Laysan: *fl*, H. H. Schauinsland in 1896; *fl, fr*, May 1902, J. O. Snyder (U. S. Nat. Herb. no. 594966); *fl*, April 1903, W. A. Bryan no. 8728; *fl*, April 25, 1911, W. A. Bryan no. 8729. Type, B. P. Bishop Mus. Midway: Easter Island, August 22, 1902, W. A. Bryan. Kure: at edge of and near central, *fl*, April 18, 1923, E. L. Caum no. 18.

Endemic.

A distinct variety characterized by the numerously veined glumes and palea, and by the robust habit of growth, large leaves and large spikes.

Cenchrus hillebrandianus[1] Hitchcock: B. P. Bishop Mus. Mem., vol. 8, No. 3, p. 211, 1922.

Midway: Eastern Island, central plain, *fl*, April 23, 1923, Caum no. 26.

Area of distribution includes Hawaiian islands (Hawaii, Lanai, Molokai, Oahu), Easter Island, Tahiti.

This species comes very close to *Cenchrus echinatus* Linnaeus from which it differs chiefly in the pilose condition. Intermediate, only slightly pilose forms are to be found.

CYNODON L. C. M. Richard

Cynodon dactylon (Linnaeus) Persoon: Syn. pl., vol. 1, p. 85, 1805.

Laysan: at north guano bed, April 1903, W. A. Bryan.

Distribution: world wide.

A weed, once established on Laysan Island in a small patch only, now apparently wiped out.

As to the generic name *Cynodon* L.C.M. Richard, for which the older name, *Capriola* Adanson has lately come into rather extensive use, it might be mentioned that it is listed among the *nomina conservanda* of the "international rules."

ERAGROSTIS Beauvois

Eragrostis falcata (Gaudichaud) Gaudichaud: Steudel, Nom. bot., ed. 2, vol. 1, p. 563, 1840.

Midway: Sand Island, *fl*, August 21, 1902, W. A. Bryan; Eastern Island, *fl*, August 22, 1902, W. A. Bryan. Kure: along exposed side of dune, north side of island, *fl*, April 17, 1923, E. L. Caum no. 7 (determined by A. S. Hitchcock).

Hawaiian islands (Oahu), Pacific Equatorial islands, Australia.

Eragrostis variabilis (Gaudichaud) Steudel: Nom. bot., ed. 2, vol. 1, p. 564, 1840.—Hitchcock: B. P. Bishop Mus. Mem., vol. 8, No. 3, p. 135, 1922.

Nihoa: June 16, 1923, E. L. Caum No. 61. Laysan: *fl*, H. H. Schauinsland in 1896 (as *E. hawaiiensis* Hillebrand); *fr*. May 1902, J. O. Snyder (U. S. Nat. Herbarium, No. 594969); *fl*, April 1903, W. A. Bryan; D. T. Fullaway in 1911 (Hitchcock, 22, p. 137) [specimen not seen by us]; *fl*, April 1911, W. A. Bryan No. 8731 [2] [No. 8730, Hitchcock, 22, p. 137 (not seen by us)]. Lisiansky: *fl*, May 20, 1923, G. P. Wilder No. 7. Pearl and Hermes: Middle Island, *fl*, April 27, 1923, E. L. Caum No. 45; South-

[1] At the request of the authors, attention is called to the fact that, in the capitalization of generic and specific names, Bishop Museum follows the procedure of the United States Government Printing Office.

[2] W. A. Bryan did not number his specimens. Subsequently some of his collections were numbered, and No. 8731 was duplicated, having been assigned as well to a specimen of *Cyperus laevigatus*.

eastern Island, *fl,* April 26, 1923, E. L. Caum No. 38. Midway: Sand Island, August 21, 1902, W. A. Bryan [as *E. cynosuroides* (Retz.)]; Sand Island, sandy plain near lighthouse, *fl,* April 24, 1923, E. L. Caum No. 36. Kure: central plain, *fl,* April 18, 1923, E. L. Caum No. 10.

LEPTURUS R. Brown

Lepturus repens (Forster) R. Brown: Prodr. Fl. Nov. Holl., p. 207, 1810. Hitchcock: B. P. Bishop Mus., Mem., vol. 8, No. 3, p. 141, 1922.

French Frigates: *fl,* June 22, 1923, E. L. Caum No. 88. Laysan: *fl,* July 28, 1896, H. H. Schauinsland; April, 1903, W. A. Bryan. Pearl and Hermes: Southeastern Island, *fl,* April 26, 1923, E. L. Caum No. 39; Middle Island, *fl,* April 27, 1923, Caum No. 46. Midway: Sand Island, *fl,* August 21, 1902, W. A. Bryan; Eastern Island, *fl,* August 22, 1902, W. A. Bryan; Bartsch No. 92 [Hitchcock, 22, p. 141 (not seen by us)]. Kure: open space in *Scaevola* scrub, *fl,* April 18, 1923, E. L. Caum No. 19.

Central and South Pacific to Australia and Ceylon. Not on the main islands of Hawaii, according to Hitchcock (22).

The specimens examined agree very closely in their vegetative characters, with the exception of Caum No. 19, which seems to be a depauperate form with short thin spikes and small leaves. In the spikelets, however, some differences are to be observed, particularly in the length and shape of the second glume, being 7-9 mm. long, acute—shortly acuminate in Caum No. 88, and reaching a maximum length of 18-19 mm., tapering into a long seta in Schauinsland's specimens from Laysan and Bryan's from Sand Island, Midway. The palea and lemma vary only slightly through the specimens, being 4.5-5 (5.5) mm. long.

PANICUM Linnaeus

Panicum torridum Gaudichaud: Freyc. voy. Uran., Bot., p. 411, 1829.

Nihoa: *fl,* June 16, 1923, E. L. Caum No. 60 (determined by A. S. Hitchcock); cliff above beach, *fl,* July 9, 1924, Christophersen No. 5. Necker: exposed slopes among rocks, *fl,* June 12, 1923, E. L. Caum No. 56 (determined by A. S. Hitchcock); east slope of Bowl Hill, rocky, *fl, fr,* July 14, 1924, Christophersen No. 10.

Hawaiian islands (Hawaii, Maui, Lanai, Molokai, Oahu).

SPOROBOLUS R. Brown

Sporobulus virginicus (Linnaeus) Kunth: Rev. gram., vol. 1, p. 67, 1829.

Laysan: *fl,* H. H. Schauinsland in 1896; sterile, May 1902, J. O. Snyder (U. S. Nat. Herb. Nos. 594976, 594977); sterile, April 1903, W. A. Bryan.

Cosmopolitan in the tropics.

CYPERACEAE

CYPERUS Linnaeus

Cyperus laevigatus Linnaeus: Mant. pl., vol. 2, p. 179, 1771.

Laysan: *fl,* H. H. Schauinsland in 1896; in the salt marsh about lagoon, *fl,* April 1903, W. A. Bryan; *fl,* April 25, 1911, W. A. Bryan, Nos. 8731 and 8734 (determined by Kükenthal).

Cosmopolitan in the tropics and subtropics.

Cyperus pennatiformis Kükenthal, species nova (Pl. XI, *B*).

Rhizoma breve lignosum. Culmus 50-100 cm. altus validus compresso—triquetra laevis parte inferiore foliatus basi incrassatus. Folia culmum subaequantia 10-15 mm. lata plana subtus nodulosa marginibus scabris longe attenuata laete viridia coriacea, vaginae brunneo—fuscae. Bracteae 9 patentes vel reflexae longissimae. Anthela ampla satis compacta semicomposita pluriradiata, radii oblique patentes firmi breves indivisi vel rarius pauciramosi, radioli breves patentes rigidi. Spicae late cylindricae densae 3-4 cm. longae 3 cm. latae. Spiculae numerosae divergentes vel imae deflexae subdistichae anguste oblongae 15-20 mm. longae 3 mm. latae 16-24-florae acutiusculae turgidulae bracteola brevi setacea suffultae. Rhacheola rigida anguste alata. Squamae dense imbricatae coriaceae concavae vix carinatae ovatae obtusae superiores breviter mucronatae clare brunneae 9 nervosae dorso virides marginibus scariosae. Stamina 3, antherae longae lineares fusco-apiculatae. Nux 1/2-3/5 squamae aequans oblonga trigona apiculata nigrescens dense punctulata. Stylus longus satis crassus profunde trifidus.

Hawaiian islands: Maui, Hana (Faurie No. 1262).

Cyperus pennatiformis var. *β* **bryanii** Kükenthal, varietas nova (Pl. XII, *A*).

Radii anthelae ad 8 cm. longi. Spiculae breviores latiores oblongo—lanceolatae 8-12 mm. longae 3-4 mm. latae 6-8-florae. Squamae paullo laxius dispositae.

Laysan: W. A. Bryan Nos. 8732, 8733; H. H. Schauinsland; *fl, fr,* Snyder in 1902 (U. S. Nat. Herb. No. 594968, determined by Christophersen and Caum).

Endemic (the variety now probably extinct).

This stately species of the subgenus *Mariscus* is closely related to *Cyperus laeteflorens* (C. B. Clarke) Kükenthal (=*Mariscus laeteflorens* C. B. Clarke) from which it differs in its broader leaves, more numerous bracts, twice as long, many-flowered spikelets, and the light-brown color of the scales.

PALMAE

PRITCHARDIA Seemann et Wendland

Pritchardia remota Beccari: Malesia, vol. 3, p. 294, 1889; Webbia, vol. 2, p. 203, 1907; idem, vol. 4, p. 222, 1913.—Rock: Ind. Trees Hawaiian Islands, p. 104, 1913.—Beccari and Rock: B. P. Bishop Mus. Mem., vol. 8, No. 1, p. 36, 1921.

Pritchardia gaudichaudii Hillebrand, Fl. Haw. Isl., p. 450, 1888 (pro parte).

Washingtonia remota O. Kuntze, Rev. gen. pl., vol. 2, p. 737, 1891.

Eupritchardia remota O. Kuntze, Rev. gen. pl., vol. 3, pt. 2, p. 323, 1898.

Nihoa: Dr. Rooke in 1858 (Hillebrand, 21, p. 451); [not seen by us]; *b, fr,* Captain Brown in 1914 (1911?), no. 10347; June 19, 1923, E. L. Caum No. 72; *b, fr,* July 9-12, 1924, Christophersen No. 9*a*.

Endemic.

This palm was first described by Beccari in 1889 from a flowering spadix in Kew Herbarium, collected by Hillebrand, probably from the cultivated specimen in the palace yard, Honolulu, mentioned by him (21, p. 451). Then again by the same author in 1907 where the fruits are briefly described. But the first detailed description appears in Beccari and Rock's monograph of 1921 from material collected by Captain Brown of the U. S. Revenue Cutter *Thetis* in 1914 (possibly some in 1911).

From the data and specimens secured by the Tanager Expeditions, in 1923 and 1924 (Caum No. 72, Christophersen No. 9*a*) the following notes may be added.

Trees 8-10 m. high, 15-20 cm. in diameter, breast-high. The mature leaf blade reaches a length of 1.40 m. measured from the ligula to the apex, the central undivided portion being ca. 60 cm. long measured along the midrib; the central segments are 4 cm. broad at their disjunction places. Petioles 3-3.5 cm. broad in the upper part, partly covered with wool or becoming glabrescent. The peduncle is partly covered with wool or glabrous, in the dry state less than 1 cm. in diameter below the first branch of the inflorescence. Branches of the inflorescence about 25. Bracteoles filiform from a broader base, up to 5 mm. long. Fruits slightly flattened laterally, not longer than the broadest part, 19x19x17 mm.—20x20x18 mm.

A *Pritchardia* possibly different from *P. remota* formerly grew on Laysan Island. (See pp. 12-13.)

DICOTYLEDONEAE

SANTALACEAE

SANTALUM Linnaeus

Santalum cuneatum (Hillebrand) Rock var. **laysanicum** Rock: Haw. Board of Agri. For., Bot. Bull. 3, p. 39, pl. 12, 1916.—Skottsberg: B. P. Bishop Mus., Bull. 43, p. 59, 1927.

Laysan: *fl,* H. H. Schauinsland in 1896. Type, B. P. Bishop Mus.; J. O. Snyder in 1902 [not seen by us]; *fl,* April, 1903, W. A. Bryan; *fl, fr,* December, 1912, D. T. Fullaway.

Endemic.

POLYGONACEAE

RUMEX Linnaeus

Rumex giganteus Aiton: Hort. Kew, ed. 2, vol. 2, p. 323, 1811.

Nihoa: Shelves and holes in cliff near Millers Peak, *fl, fr,* June 18, 1923, E. L. Caum No. 71; cliff below Millers Peak, July 10, 1924, Christophersen No. 8.

Area of distribution includes Hawaii, Maui, Molokai.

The plants have cordate leaves, even some of the leaves near the inflorescence show this character although they tend to have a truncate or acute base. The leaves, however, are glabrous, and the nuts, which according to Skottsberg (35) afford the most important distinguishing characters show the broad wings in cross section characteristic of *Rumex giganteus* Aiton. The presence of this species on Nihoa means a disjunction in its hitherto known distribution, being known from the three easternmost islands only, while *Rumex albescens* Hillebrand is accredited to Oahu and Kauai.

CHENOPODIACEAE

CHENOPODIUM Linnaeus

Chenopodium sandwicheum Moquin, f. **microspermum** Aellen: Fedde Rep., vol. 26, p. 125, 1929.

Nihoa: dry slope just above the sea cliff, *fl,* June 20, 1923, Judd No. 1; *fl, fr,* June 17, 1923, E. L. Caum No. 67; cliff at base of Millers Peak, 250-300 m.s.m., *fl, fr,* July 10, 1924, Christophersen No. 7. Necker: J. O. Snyder in 1902 (not seen by us); *fl, fr,* June 13, 1923, E. L. Caum No. 58; on Flagpole Hill, *fl, fr,* July 15, 1924, Christophersen No. 14. French Frigates: *fl, fr,* June 22, 1923, E. L. Caum No. 89. Laysan: *fl, fr,* H. H. Schauinsland in 1896; *fl, fr,* May 1902, J. O. Snyder (U. S. Nat. Herb. No. 594967); *fl,* April 1903, W. A. Bryan.

Area of distribution includes Lanai, Kauai, perhaps also other Hawaiian islands.

AMARANTACEAE

AMARANTUS Linnaeus

Amarantus brownii species nova (Pl. XII, *B*).

Herba annua, ad 1 m. alta. Caulis ramosus, ramis sulcatis glabrescentibus. Folia magna vel parva lanceolata-linearia, supra glabra, subtus glabra vel glabrescentia, apice obtuso mucronato, basi sensim in petiolum contracta, margine leviter et irregulariter undulato glanduloso, laminae petiolis adiectis ad 7 cm. longae 6 mm. latae, mediocriae 4 cm. longae 3 mm. latae. Glomeruli florum in axillis foliorum superiorum contracti,

saepe spicastrum densum multiflorum formantes. Prophylla triangulari-ovata aristata, ad 1 mm. longa 0.7 mm. lata. Sepala florum masculorum 3 inaequalia lanceolata mucronata, ad 1.3 mm. longa 0.8 mm. lata. Antherae 3 inclusae. Sepala florum femineorum 3 inaequalia spathulata, 0.8—1 mm. longa 0.2-0.5 mm. lata, apice mucronata. Utriculus ovatus lenticulari-compressus muricato-rugosus in apiculum brevem bidentatum contractus, 0.8-1 mm. longus 0.6-0.8 mm. latus, operculo non dehiscenti. Semen rubronigrum nitidum lenticulare.

Nihoa: *fl, fr,* June 17, 1923, E. L. Caum No. 73. Type, B. P. Bishop Mus.; *fl, fr,* June 20, 1923, C. S. Judd No. 2.

Not known elsewhere.

This species, named in honor of Dr. F. B. H. Brown is distinguished prominently by its narrow linear leaves. It approaches *Amarantus* (*Euxolus*) *lineatus* R. Brown as defined by Moquin (27) based partly on Gaudichaud's specimen from the Hawaiian islands, and included in partial translation by Hillebrand (21, p. 375). We have not seen Gaudichaud's or Hillebrand's specimens, but we have compared our specimens with a photograph of the type of *Amarantus lineatus* R. Brown in the British Museum, which shows that they differ widely in leaf characters. Bentham (2) reduces 3 of Robert Brown's species to *A. interruptus* R. Brown, among them *A. lineatus* as based on the Australian plant but excluding Gaudichaud's Hawaiian specimen. He states that *A. interruptus* in this sense is readily distinguished by the number of the segments of the female perianth, of which there are, almost constantly, 5. The specimens collected by the Tanager Expedition on Nihoa Island have only 3 segments.

Amarantus viridis Linnaeus: Sp. pl., ed. 2, p. 1405, 1763.

Laysan: *fl, fr,* July 4, 1896, H. H. Schauinsland; *fl, fr,* May, 1902, J. O. Snyder (U. S. Nat. Herb., No. 594963); along the track and in the guano beds, *fl, fr,* April, 1903, W. A. Bryan.

Cosmopolitan in the tropics to temperate regions.

ACHYRANTHES Linnaeus

Achyranthes splendens Martius var. **reflexa** Hillebrand; Fl. Haw. Isl., p. 371, 1888.

Laysan: *fl,* July 6, 1896, H. H. Schauinsland; on the north side of the island, close to high water, *fl,* April, 1903, W. A. Bryan. Pearl and Hermes: North Island, *fl, fr,* May 18, 1923, G. P. Wilder no. 3; Middle Island, *fl, fr,* April 27, 1923, E. L. Caum no. 50. Midway: Eastern Island, *fl,* August 22, 1902, W. A. Bryan; Sand Island, on the sand mounds, *fl,* August 21, 1902, W. A. Bryan. Kure: the central plain, *fl, fr,* April 18, 1923, E. L. Caum no. 17.

The specimens conform very closely with Hillebrand's var. *reflexa,* of which we have examined a part of the type material deposited in Bernice P.

Bishop Museum. Hillebrand (21, p. 371) states that the median nerve of the bracts is not prolonged into an awn. This does not, however, fit his specimen, which has awned bracts just as our specimens have.

NYCTAGINACEAE

BOERHAAVIA Linneaus

Boerhaavia diffusa Linnaeus: Sp. pl., p. 3, 1753.

Nihoa: on sand beach, *fl, fr,* June 14, 1923, E. H. Bryan no. 3*a*; among rocks on beach above tidal zone, *fl, fr,* June 17, 1923, E. L. Caum no. 79. French Frigates: *fl, fr,* June 22, 1923, E. L. Caum nos. 86 and 87. Laysan: *fl, fr,* H. H. Schauinsland in 1896; *fl, fr,* May, 1902, J. O. Snyder (U. S. Nat. Herb., no. 594964); *fl, fr,* April, 1903, W. A. Bryan. Pearl and Hermes: Southeastern Island, *fl, fr,* April 26, 1923, E. L. Caum nos. 40 and 41; Middle Island, *fl, fr,* April 27, 1923, E. L. Caum nos. 47 and 48. Midway: Sand Island, *fl, fr,* August 21, 1902, W. A. Bryan; Eastern Island, *fl,* August 22, 1902, W. A. Bryan; Eastern Island, central plain, *fl, fr,* April 23, 1923, E. L. Caum nos. 27 and 28. Kure: *fl, fr,* April 17, 1923, E. L. Caum no. 6; *fl, fr,* April 18, 1923, E. L. Caum no. 11.

Tropics of the old (and new?) world.

The specimens here aggregated, with the possible exception of those from Nihoa Island which have narrow acute leaves, evidently belong in a closely related group. They vary considerably in the degree of pubescence, from sparsely pubescent on stems and petioles with few glandular hairs (Schauinsland in 1896) to densely pubescent and viscose (Caum no. 47), but Dr. P. C. Standley who has kindly examined the specimen collected by Caum refers it to *Boerhaavia diffusa* and Kuntze (24) observes regarding *B. diffusa* that "Die verschiedene Behaarung dieser Art (f. glabriuscula, hirsuta, viscosa) ist unabhängig von der anderen Variabilität."

The group is widely distributed in Polynesia, especially on the coral islands, and is generally referred to *Boerhaavia tetrandra* Forster. Until the various Polynesian forms are better understood, it seems, however, best to refer the specimens examined to *B. diffusa* Linnaeus sens. lat. as outlined by Heimerl (20). (For a more detailed discussion see Christophersen, 8.)

AIZOACEAE

SESUVIUM Linnaeus

Sesuvium portulacastrum Linneaus: Syst. nat., ed. 10, p. 1058, 1759.

Necker: southwestern side of main island, *fl,* June 29, 1923, E. L. Caum no. 93; rocky slopes of south side of Annexation Hill, *fl,* July 15, 1924, E. Christophersen no. 12. Laysan: H. H. Schauinsland in 1896; May, 1902,

J. O. Snyder (U. S. Nat. Herb., no. 594975); *fl,* April, 1903, W. A. Bryan; April, 1911, W. A. Bryan; shores of central lake, *fl,* April 8, 1923, E. L. Caum no. 2. Lisiansky: *fr,* May 20, 1923, G. P. Wilder no. 6. Pearl and Hermes: Seal Island, raised coral reef at East end, *fl,* April 27, 1923, E. L. Caum no. 55; Southeastern Island, low lands near isthmus, *fl,* April 26, 1923, E. L. Caum no. 43.

Both hemispheres, tropics to warm temperate regions.

TETRAGONIA Linnaeus

Tetragonia tetragonioides (Pallas) O. Kuntze: Rev. gen. pl., vol. 1, p. 264, 1891.

Tetragonia expansa Murray: Comm. Goetting., vol. 6, p. 13, 1783.

Nihoa: on shelves along cliff at south side of beach, *fr,* June 17, 1923, E. L. Caum no. 80; cliff south of beach, *fr,* July 9, 1924, E. Christophersen no. 2.

Hawaiian islands (Oahu), Austral Islands, Norfolk, Lord Howe, New Zealand, Kermadec, Stewart, Australia, Tasmania, Japan, Easter Island, and extra tropical South America. It is found also in other places, sometimes cultivated.

PORTULACACEAE

PORTULACA Linnaeus

Portulaca lutea Solander: in Forster, De pl. esc., p. 72, 1786.

Nihoa: *fl, fr,* June 17, 1923, E. L. Caum no. 65. Necker: *fr,* May 31, 1902, Dr. Gilbert (U. S. Nat. Herb., No. 594972); *fl, fr,* June 14, 1923, E. L. Caum no. 59; dry rocky soil near Flagpole Hill, *fl, fr,* July 15, 1924, E. Christophersen no. 13. French Frigates: *fl, fr,* June 22, 1923, E. L. Caum no. 90. Gardner: in rock pocket, May 23, 1923, G. P. Wilder no. 10? (not seen by us). Laysan: *fl,* H. H. Schauinsland in 1896; J. O. Snyder in 1902 (not seen by us); *fr,* April, 1903, W. A. Bryan; *fr,* April, 1911, W. A. Bryan; shore of central lake, April 13, 1923, E. L. Caum no. 4. Lisiansky: sandy depression, May 15, 1923, G. P. Wilder no. 9? (not seen by us). Midway: Eastern Island, central plain, *fl, fr,* April 23, 1923, E. L. Caum no. 24.

Hawaiian islands (Hawaii, Molokini, Lanai, Oahu), Wake, Line Islands, Baker, Howland, Samoa, Society Islands, Austral, Tuamotus. Probably of general occurrence in the Pacific.

This species is readily distinguished in the field by its large flowers and suffrutescent habit. In the herbarium, however, it is easily confused with *Portulaca oleracea* Linnaeus, from which it may not be separated in sterile

condition. The stellately rugulose but not prominently warty seeds (as in *P. oleracea*) is a good distinguishing character, and the larger size of its flowering parts and more numerous stamens are also characteristic. Christophersen (8) gives a fuller discussion.

The specimens collected by Schauinsland on Laysan Island have been referred to *P. oleracea* Linnaeus by Bitter (3, p. 431), but on the basis of the large petals and the numerous stamens (about 20) it belongs in *P. lutea* Solander. The plants collected by Caum from the same island are sterile (on one sheet a flowering twig is mounted, which obviously does not belong here as according to the field notes no flowers were seen). The specimens collected by Wilder on Gardner and Lisiansky islands have not been seen by us. On the duplicate label they are referred to *Portulaca oleracea* Linnaeus, but as this species is not recorded with certainty from any of the other islands, they are referred here. A specimen collected by W. A. Bryan on Laysan Island, April, 1903, which is in fruit only, is not typical; its seeds show more pronounced warts, in character intermediate between this species and *P. oleracea* Linnaeus.

Portulaca caumii F. Brown, new species (Pl. XIII, *A*).

Prostrate herb. Stem branched, 5-10 + mm. in diameter. Leaves spirally arranged, linear lanceolate, 1-2.5 cm. long; axils pilose. Flowers several in a terminal cluster, sessile, partly concealed in long white hairs; calyx 5 mm. long the two lobes broadly ovate, obtuse, membranous at the margin; petals 10 mm. long, membranous, obovate, white, finely reticulate veined; stamens numerous (30 ±), unequal, 2-4 mm. in length; filaments compressed, slender; anthers broadly elliptical, 1 ± mm. in length, versatile, bright-yellow in color; style 5-parted; capsule campanulate with a broadly turbinate base, 3-4 mm. in length, 2.5 ± mm. broad, dehiscent, of firm texture but not sclerous; seeds globular reniform, 0.6 ± mm. in length, black, the surface rugose with fine linear zig-zag or stellate grooves visible under a lens.

Nihoa: *fl, fr,* June 18, 1923, E. L. Caum No. 66. Type, B. P. Bishop Museum.

Not known elsewhere.

Allied to *P. villosa* Chamisso from which it differs in the color of the flower, the commonly flat leaves, and the smaller minutely rugose seeds.

CARYOPHYLLACEAE

SCHIEDEA Chamisso et Schlechtendal

Schiedea verticillata F. Brown, new species (Pl. XIII, *B*).

Stems herbaceous, 50 ± cm. in length, erect, prostrate, or pendant, sparingly branched, longitudinally sulcate, pubescent in the upper portions, glabrate below. Leaves opposite or 3-verticillate, broadly elliptical or ovate-elliptical, acute, contracted and commonly more or less connate at the sessile base, up to 17 cm. long and 12 cm. broad, 9-15-veined, succulent in the living condition, thin when dry, glabrous when mature. Inflorescence cymose paniculate, terminal extending well above the leaves; bracts tri-

angular lanceolate, obtuse or acute, 3-25 mm. in length; pedicels 5-20 + mm.; perianth composed of 4-5 greenish, imbricate, oblong-lanceolate tepals 7-8 mm. in length; staminodia functioning as glands, of the same number as the tepals and opposite to them, linear from a broad base, 6 mm. in length, emarginate at the apex. Stamens 8-10 in number, slightly exserted, arranged in 2 cycles, the inner stamens opposite to but free from the staminodia; filaments slightly longer than the tepals; anthers linear, 2.5 mm. in length, attached slightly above the base, versatile or subversatile; styles 7-9 in number, 5 mm. in length, free, stigmatose throughout the distal half. Capsule ovoid, 9 mm. in length, slightly longer than the perianth, longitudinally dehiscent. Seeds orbicular reniform, compressed, 1 mm. in length, minutely rugose tuberculate.

Nihoa: pockets in cliff wall, south side of Derbys Landing, *fl, fr,* June 17, 1923, E. L. Caum no. 70. Type Bishop Museum; June 13, 1923, E. H. Bryan no. 2; cliff south of Derbys Landing, *fl, fr,* July 9, 1924, E. Christophersen no. 3.

Not known elsewhere.

A distinct species characterized especially by the verticillate arrangement of the leaves—a character not hitherto reported for any other species of the genus. It is one of the most primitive members of the genus, and resembles *Alsinidendron* in habit.

CRUCIFERAE

LEPIDIUM Linnaeus

Lepidium owaihiense Chamisso et Schlechtendal: Linnaea, vol. 1, p. 32, 1826.

Laysan: *fr,* H. H. Schauinsland in 1896. Pearl and Hermes: Middle Island, *fl, fr,* April 27, 1923, E. L. Caum no. 51. Midway: Eastern Island, *fr,* August 22, 1902, W. A. Bryan; Eastern Island, central plain, *fl, fr,* April 23, 1923, E. L. Caum no. 30. Kure: *fl, fr,* April 17, 1923, E. L. Caum no. 5.

Area of distribution includes Hawaiian islands (Hawaii, Maui, Lanai, Molokai, Oahu, Kauai?) and Wake Island.

This species is characterized by its relatively broad emarginate silicules and its short fruiting style, the stigma not protruding beyond the margin of the silicule.

Specimens collected on the Pacific Equatorial Islands have been referred to this species by Rock (32) and with much doubt by Christophersen (7). They differ in the longer and relatively narrower silicules.

CAPPARIDACEAE

CAPPARIS Linnaeus

Capparis sandwichiana De Candolle: Prodr., vol. 1, p. 245, 1824.

Laysan: *fl,* July 12, 1896, H. H. Schauinsland; *fl,* May, 1902, J. O. Snyder (U. S. Nat. Herb., no. 594965); April, 1903, W. A. Bryan. Pearl and

Hermes: Seal Island, April 27, 1923, E. L. Caum no. 54; Seal Island, May 18, 1923, G. P. Wilder no. 2. Midway: Eastern Island, *fl, fr,* August 22, 1902, W. A. Bryan; Eastern Island, in central plain, April 23, 1923, E. L. Caum no. 23.

Hawaii, Fiji?, Society Islands, Tuamotus, (del Castillo, 6, p. 5), and Austral Islands?

LEGUMINOSAE

SESBANIA Scopoli

Sesbania tomentosa Hooker et Arnott: Bot. Beech. Voy., p. 286, 1842 (?).

Nihoa: *fl,* June 14, 1923, E. H. Bryan no. 5; *fl,* June 17, 1923, E. L. Caum no. 63; in the gulch, *fl,* June 20, 1923, C. S. Judd no. 3; slopes above beach, *fl, fr,* July 9, 1924, E. Christophersen no. 4. Necker: *fr,* Dr. Gilbert, May 31, 1902 (U. S. Nat. Herb., No. 594974); exposed place among rocks, *fl, fr,* June 13, 1923, E. L. Caum no. 57; on Flagpole Hill, *fl, fr,* July 14, 1924, E. Christophersen no. 11.

Hawaiian islands (Hawaii, Lanai, Molokai, Oahu, Kauai, Niihau?), not Mexico.

ZYGOPHYLLACEAE

TRIBULUS Linnaeus

Tribulus cistoides Linnaeus: Sp. pl., p. 387, 1753.—Hillebrand: Fl. Haw. Isl., p. 59, 1888.

Nihoa: southeastern part of island, *fl, fr,* June 17, 1923, E. L. Caum no. 78; *fl, fr,* June 13-14, 1923, E. H. Bryan no. 2 *a.* French Frigates: *fl,* June 22, 1923, E. L. Caum no. 85. Laysan: *fl, fr,* H. H. Schauinsland in 1896; *fl, fr,* May, 1902, J. O. Snyder (U. S. Nat. Herb., no. 594978); *fl,* April, 1903, W. A. Bryan; *fl, fr,* April, 1911, W. A. Bryan; north end of island, near small lake, April 10, 1923, D. T. Fullaway no. 3. Pearl and Hermes: Middle Island, *fl, fr,* April 27, 1923, E. L. Caum no. 44; Seal Island, *fl, fr,* May 18, 1923, G. P. Wilder no. 1. Midway: Eastern Island, *fl, fr,* August 22, 1902, W. A. Bryan; Eastern Island, central plain, *b,* April 23, 1923, Caum no. 22. Kure: central plain, *fl,* April 18, 1923, E. L. Caum no. 15.

Tropics of old and new world.

EUPHORBIACEAE

EUPHORBIA Linnaeus

Euphorbia celastroides Boissier: D. C. Prodr., vol. 15, pt. 2, p. 11, 1862. (Pl. II, *B*).

Nihoa: on the summit, *fl, fr,* June 14, 1923, E. H. Bryan no. 6; among rocks on edge of wind-swept cliffs, *fl,* June 17, 1923, E. L. Caum no. 64; steep rocky hillside, *fl,* June 20, 1923, C. S. Judd no. 5.

Hawaiian islands (Oahu, Kauai, Niihau).

The specimens have been compared with fragments of Remy's specimen in Musée National d'Histoire Naturelle, deposited in Bishop Museum, and they conform very closely, except that some of the leaves in the plants from Nihoa are broader and more spatulate, in this respect resembling *E. stokesii* C. N. Forbes, a species that comes close to *E. celastroides.* The leaves in our specimens are 26-50 mm. long and 12-27 mm. broad, while those from Remy's specimen are 21-40 mm. long and only 9-13 mm. broad. Our specimens show the characteristic long peduncle, 2-11 mm. long

MALVACEAE

SIDA Linnaeus

Sida fallax Walpers: Nov. act. acad. Caes. Leop.-Carol. Nat. Cur., vol. 19, suppl. 1, p. 306, 1843.

Nihoa: in the gulch, *fl, fr,* June 20, 1923, C. S. Judd no. 4; *fl, fr,* June 17, 1923, E. L. Caum no. 69; *fl,* E. H. Bryan no. 1*a*. Midway: Eastern Island, central plain, *fl,* April 23, 1923, E. L. Caum no. 31.

Area of distribution includes Hawaii, Pacific Equatorial, Malden, and Wake islands.

A variable species not clearly separable from *Sida cordifolia* Linnaeus. The leaves in the Midway specimens are rather small, rounded and subcordate, while the Nihoa specimens have acute leaves up to 65 mm. long.

CONVOLVULACEAE

IPOMOEA Linnaeus

Ipomoea indica (Burmann) Merrill: Interpr. Herb. Amb., p. 445, 1917.

Ipomoea insularis (Choisy) Steudel; Nomencl. bot., p. 817, 1841.

Nihoa: side of gorge, just below Millers Peak, June 19, 1923, E. L. Caum no. 83; above beach, west side of island, *fl,* July 9, 1924, E. Christophersen no. 1. Laysan: *fl,* July 4, 1896, H. H. Schauinsland; *fl,* May, 1902, J. O. Snyder (U. S. Nat. Herb., no. 594971); *fl,* April, 1903, W. A. Bryan. Midway: Eastern Island, *fl,* August 22, 1902, W. A. Bryan; Sand Island, outer side of dunes on north side of island, *fl,* April 24, 1923, E. L. Caum no. 34. Kure: *fl,* April 18, 1923, E. L. Caum no. 9.

Area of distribution includes Hawaii, Marianas Islands, Fiji, Norfolk Island, New Caledonia, Australia, East Indies, Mexico, West Indies.

This rather distinct species with its long, narrow bracts and sepals, the latter falcately curved at the apex, and its purplish-blue flowers (turning red when dried), was described as *Pharbitis insularis* by Choisy (9, 10), and transferred to *Ipomoea* by Steudel (36). Hallier (18) referred it to *I. congesta* R. Brown (Prodr. Fl. Nov. Holl., p. 485, 1810) and in a later publication Hallier (19) also included the West Indian—Central American *I. acuminata* (Vahl) Roemer et Schultes.

Merrill (26) identifies *Convolvulus indicus* Burmann (Index Univ. Herb. Amb., 7, 1755), with *I. congesta* R. Brown, creating the new combination *I. indica* (Burmann) Merrill. We have not seen authentic specimens of the Amboina or Australian plants, but Dr. Quisumbing has kindly compared one of our specimens (Caum no. 34) with the material at the Bureau of Science in Manila, and he states that with the exception of its more copious pubescence, it matches well with *I. indica*. Dr. E. D. Merrill has kindly examined a specimen of the same number at the New York Botanical Garden, and he states as his opinion that it is allied to *I. indica* (Burmann) Merrill but distinct in its pubescence. However, a great deal of variation in the degree of pubescence is exhibited by plants from the Hawaiian islands which can not be separated in other respects. The specimens mentioned above (Caum no. 34) happen to come from densely pubescent plants with silky pubescent stems, mature leaves and calyx, more densely so than in the plants from Kure Island (Caum no. 9), Laysan Island (Schauinsland) and Nihoa Island (Christophersen no. 1). Bryan's specimens from Laysan Island (collected in 1903) are much less pubescent, becoming glabrate in parts, and from the main islands of the Hawaiian group we have seen almost glabrous and slightly pubescent specimens (Forbes nos. 637 H., Hawaii; 2368 O., Oahu; 552 K., Kauai).

These less pubescent plants are apparently identical to *I. indica* approaching very closely a specimen of this species from the Solomon Islands (Herre no. 141) deposited in Bishop Museum, and they are not specifically distinct from the more pubescent plants. Hallier (19) states as his reason for including also the West Indian *I. acuminata* in this species that "in der Südsee diese weit verbreitete Pflanze bisweilen völlig glatt ist," showing that he does not consider the degree of pubescence as of specific value. The densely pubescent plants may, however, be referred to a separate form.

Ipomoea pes-caprae (Linnaeus) Roth: Nov. pl.. sp., p. 109, 1821.

French Frigates: near beach, *fl*, June 22, 1923, E. L. Caum no. 91. Laysan: *fl*, July 14, 1896, H. H. Schauinsland; April, 1903, W. A. Bryan. Midway: Sand Island, sandy plain between dunes inland, April 24, 1923, E. L. Caum no. 33.

Cosmopolitan in the tropics and subtropics.

HYDROPHYLLACEAE

NAMA Linnaeus

Nama sandwicensis A. Gray var. **laysanicum** A. Brand: Engl. Pflr., IV, 251, p. 152, 1913.

Laysan: *fl, fr,* H. H. Schauinsland in 1896; at high water mark on east side of island, *fl, fr,* April, 1903, W. A. Bryan; *fl, fr,* April, 1911, W. A. Bryan. Lisiansky: May 20, 1923, G. P. Wilder no. 8.

Probably endemic.

This variety, founded entirely on the character of the pubescence, is rather vague, and seems to come close to forms of the main islands (Kauai, Oahu) in the density of the pubescence, but is distinct in the more hirsute character of the same. The Lisiansky Island specimen has larger leaves, reaching a maximum size of 23 by 6 mm.

BORAGINACEAE

HELIOTROPIUM Linnaeus

Heliotropium curassavicum Linnaeus: Sp. pl., p. 130, 1753.

Nihoa: among rocks on beach, *fl, fr,* June 17, 1923, E. L. Caum no. 77; small patch at west end of sand beach, *fl, fr,* June 13, 1923, E. H. Bryan no. 4; above the beach, *fl, fr,* July 9, 1924, E. Christophersen no. 6. Laysan: *fl,* July 3, 1896, H. H. Schauinsland; *fl,* May, 1902, J. O. Snyder (U. S. Nat. Herb. no. 594970); in the salt marsh about the lagoon, *fl,* April, 1903, W. A. Bryan.

Cosmopolitan in the Tropics to temperate regions.

The plants from Nihoa differ from those of Laysan in their smaller flowers, the calyx attaining an average length of 1.5 mm., while it is 2 to 3 mm. long in the Laysan plants. The Nihoa plants also have smaller leaves, and less glaucous than commonly seen in this species.

LABIATAE

PHYLLOSTEGIA Bentham

Phyllostegia variabilis Bitter: Abh. Nat. Ver. Brem., vol. 16, p. 435, 1900.

Laysan: *fl, fr,* H. H. Schauinsland in 1896; *fl, fr,* April, 1903, W. A. Bryan. Midway: Eastern Island, central plain, *fl, fr,* April 23, 1923, E. L. Caum no. 25.

Endemic.

In addition to the description of Bitter (3, p. 435) it may be stated that the color of the petals is white.

SOLANACEAE

By F. B. H. Brown

SOLANUM Linnaeus

Solanum laysanense Bitter: Abh. Nat. Ver. Brem., vol. 16, p. 433, 1900 (Pl. XIV, *A*).

Laysan: dunes on the north side of the island, *fl, fr,* July 14, 1896, H. H. Schauinsland; north side of island, *fl,* April, 1903, W. A. Bryan.

Pearl and Hermes: Middle Island, *fl,* April 27, 1923, E. L. Caum no. 49; Southeastern Island, *fl, fr,* May 18, 1923, G. P. Wilder no. 5.

Midway: Sand Island, August 21, 1902, W. A. Bryan; Eastern Island, *fl, fr,* August 22, 1902, W. A. Bryan.

Solanum nelsoni Dunal: D. C. Prodr., vol. 13, pt. 1, p. 123, 1852.

Suffrutescent, stellately pubescent. Stems more or less woody, prostrate or ascending. Leaves alternate: petioles 10-25 + mm.; blades orbicular-ovate, 3-6 + cm. in length, 2-5 + cm. broad, commonly cordate at the base, obtuse or acute at the apex, the margin entire or somewhat sinuate, both surfaces more or less densely pubescent with 7-8-armed stellate hairs, the hairs on the under surface larger and more closely crowded than those on the upper; the second leaf, when present, small. Cymes subopposite to the leaves and subequal to them in length; peduncles 1 ± cm., pedicels 5-10 mm., calyx broadly turbinate, 6 ± mm. in length, the 5 lobes triangular acute, 4 ± mm. in length, densely pubescent on both surfaces except the interior of the cup; corolla 10-12 mm. in length, 5-lobed, densely pubescent on the outer surface nearly glabrous within, white or yellowish in color with purple reticulate veins; filaments compressed, 1.5 ± mm. in length, connate at the base, glabrous; anthers 2.5-3 mm. in length, straight or curved; ovulary narrowly ovoid, 3 ± mm. in length, densely pubescent. Berry spherical, 12 ± mm. in diameter, red to reddish black in color. Seed broadly reniform, 2-4 + mm. in length, compressed, conspicuously pitted under a lens.

Solanum nelsoni var. **typicum** F. Brown, new variety (Pl. XIV, *B*).

Leaf blades cordate with subentire margin; pubescence thick, felt-like, the hairs on the lower surface of the blades with arms 317-494 + μ in length, the hairs on the upper surface smaller with arms 176-300 + μ in length.

Molokai: Moomomi shore, March, 1910, J. F. Rock, sheet A; Moomomi, March 24, 1915, C. N. Forbes no. 613 Mo. The leaves are typical in shape and pubescence; the fruits, however, seem rather small.

Solanum nelsoni var. **intermedium** F. Brown, new variety (Pl. XV, *A*.)

Leaf blades ranging from ovate-cordate, ovate, to suborbicular in outline and from subacute, rounded, truncate to slightly cordate at the base, symmetrical or inequilateral, 4-8 cm. long, 3-6 cm. wide; margin entire slightly sinuate; stellate hairs nearly as large as in var. *typicum*, those on the under surface with arms up to 440μ in length, those on the upper surface with arms up to 240μ in length; calyx lobes broadly triangular; corolla 10 ± mm. in length. Berry 8 ± mm. in diameter, reddish black when dry; seed orbicular reniform, 3 mm. in length, conspicuously pitted under a lens.

Midway: Eastern Island, central part, *fl, fr,* April 23, 1923, E. L. Caum no. 29. Ocean [Kure]: central plain, *fl,* April 18, 1923, E. L. Caum no. 12. Type, B. P. Bishop Museum.

Endemic.

This variety approaches *S. laysanense* Bitter of Laysan Island.

Solanum nelsoni var. **caumii** F. Brown, new variety (Pl. XV, *B*).

Suffrutescent. Stems 1 ± meter in length, prostrate, or suberect if supported. Petioles 1-3 cm.; blades broadly ovate-cordate, 3-7 + cm. long and nearly as broad, obtuse to acute at the apex, the margin varying from subentire to coarsely sinuate; hairs of the under surface densely crowded, with arms 200-360μ long, those on the upper surface less crowded, smaller, with arms 80-200μ in length. Calyx lobes narrow, 4 ± mm. in length; corolla 12 mm. in length, anthers 3 mm. in length, attenuate toward the two-pored apex, inwardly curved. Berry spherical, 10-15 mm. in diameter, red to reddish black in color; seeds 3.8 ± mm. in length, conspicuously pitted.

Nihoa: at 75 meters altitude, *fl, fr,* June 19, 1923, E. L. Caum no. 84. Type, B. P. Bishop Museum. Fruit nearly black when collected.—*Fl,* June 13, 1923, E. H. Bryan no. 3. Fruit red when collected.—Shallow soil in rocky gulch, 100 meters altitude, *fl, fr,* June 20, 1923, C. S. Judd nos. 6, 7, and 8.

Endemic.

This variety approaches *S. sandwicense* Hooker et Arnott, of Kauai and Oahu, but the pubescence and fruit characters are nearer to those of typical *S. nelsoni.*

Solanum nelsoni var. **acuminatum** F. Brown, new variety (Pl. XVI, *A*).

Similar to var. *caumii* except that the leaves are commonly ovate and more or less acuminate, somewhat undulate 3-5 cm. long, 2-4 cm. wide; calyx lobes rather shorter; apex of anthers dark-colored; ovulary shorter than the stamens; fruit 10-15 mm. in diameter, red when collected, reddish black when dry. Seeds as in var. *caumii.*

Nihoa: at 75 meters altitude, *fl, fr,* June 19, 1923, E. L. Caum no. 68. Type, B. P. Bishop Museum.

Endemic.

Solanum nigrum Linnaeus var. **nihoense** F. Brown, new variety (Pl. XVI, *B*).

Herbaceous, 25-50 cm. in height, pubescent throughout, the hairs simple, short, rarely over 0.3 mm. in length, multicellular. Stem much branched with smooth or tuberculate longitudinal ridges, densely pubescent when young, thinly pubescent when mature. Leaves geminate in part, the lamina ovate, acute or obtuse, 2-4 + cm. long, 1-3 + cm. wide, pubescent on the under surface, puberulent or glabrate above, margin entire or slightly sinuate, petiole 5-15 mm. in length. Cymes lateral from the upper portion of the internodes, 2-4-flowered, pubescent; peduncle 5-15 mm.; pedicel 2-4 mm.; calyx pubescent 2-2.5 mm. long, 3 mm. in diameter, the lobes short, semi-circular, obtuse, 0.6 mm. in length; corolla white with purple streak, 3.5 mm. in length, the obtuse lobes puberulent on the outer surface; stamens not exceeding the corolla lobes, the filaments

shorter than the anther, pubescent; anthers broadly ellipsoidal, 1 mm. long, emarginate at the apex; ovulary subspherical, glabrous; style slightly longer than the stamens. Berry spherical, 6-8 mm. in diameter, dull red to nearly black in color.

Nihoa: At 50 meters altitude, *fl, fr,* June 17, 1923, Caum no. 62. Type, B. P. Bishop Museum.

Endemic.

KEY

1. Pubescence of simple hairs.....**S. nigrum** var. **nihoense**
1. Pubescence composed of stellate hairs (2)
2. Leaves circular or elliptical.....**S. laysanense**
2. Leaves truncate or cordate at the base(3)
3. Margin more or less sinuate (4)
3. Margin subentire (5)
4. Leaves truncate, acuminate.....**S. nelsoni** var. **acuminatum**
4. Leaves cordate.....**S. nelsoni** var. **caumii**
5. Leaves cordate.....**S. nelsoni** var. **typicum**
5. Leaves cordate to sub-acute at the base.....**S. nelsoni** var. **intermedium**

CUCURBITACEAE

SICYOS Linnaeus

Sicyos hispidus Hillebrand: Fl. Haw. isl., p. 136, 1888.

Laysan: male *fl, y. fr,* July 4, 1896, H. H. Schauinsland; male *fl,* April, 1903 B, W. A. Bryan; male and female *fl,* May, 1911 B, W. A. Bryan. Pearl and Hermes: Southeastern Island, East side, male *fl,* April 26, 1923, E. L. Caum no. 42; Seal Island, male and female *fl, fr,* April 27, 1923, E. L. Caum no. 53; Southeastern Island, male and female *fl,* May 18, 1923, G. P. Wilder No. 4. Kure: In central plain, male *fl, y. fr,* April 18, 1923, E. L. Caum no. 13.

Hawaiian Islands (Maui, Lanai).

Our plants have been compared with a specimen of *Sicyos hispidus* Hillebrand from the Hillebrand and Lydgate collection in Bernice P. Bishop Museum, collected in Kula, Maui, probably representing a part of the material upon which the species was founded. From this specimen our plants differ in the sparser pubescence of the stems and denser pubescence of the upper leaf surfaces and in the more rounded, relatively slightly broader leaves. In the more essential floral characters, however, they seem to come very close, agreeing also in the characteristic woolly fruits with articulate flattened hairs.

Caum no. 42 from Pearl and Hermes Reef, in staminate flowers only, differs somewhat in the shape of the leaves and the type of pubescence from the other specimens cited.

Sicyos microcarpus Mann: Proc. Am. Acad. Sci., vol. 7, p. 167, 1866.

Accredited to Laysan Island by Bitter (3, p. 431). The specimens collected by Schauinsland have not been seen by us.

Sicyos sp.

From Laysan Island we have specimens (W. A. Bryan, April, 1903 A and May, 1911 A) which differ from Schauinsland's specimens and W. A. Bryan 1903 B and 1911 B in the less densely hairy leaves, the hairs being stiffer and thicker at the base, in the glabrate peduncles, the pistillate flower heads not being densely woolly, and in the white staminate flowers ("pea green" in Bryan 1911 B), and the longer staminal column, being ca. 1.5 mm. long while it is less than 1 mm. in the other specimens, and finally in the glabrous young fruits (Bryan 1903 A). They come very close to A. Gray's interpretation (14) of *S. pachycarpus* Hooker et Arnott differing from it mainly in the longer staminal column.

On Nihoa Island plants were found (E. Christophersen and T. Dranga no. 9) which are identical to specimens seen from Oahu (C. N. Forbes no. 2323 O. A). It remains to be proved if they are identical also to Collie's specimens from "Diamond Hill" on Oahu, on which *S. pachycarpus* Hooker et Arnott is founded.

GOODENIACEAE

SCAEVOLA Linnaeus

Scaevola frutescens (Miller) Krause: Engl. Pflanzenreich, IV, 277, p. 125, 1912.

Laysan: *fl,* July 12, 1896, H. H. Schauinsland; May, 1902, J. O. Snyder, (U. S. Nat. Herb., no. 594973); April, 1911, W. A. Bryan; sides of sand hills, April 8, 1923, E. L. Caum no. 1. Pearl and Hermes: Middle Island, edge of beach, April 27, 1923, E. L. Caum no. 52. Midway: Sand Island, on the sand mounds, *fl,* August 21, 1902, W. A. Bryan; Eastern Island, *fl, fr,* August 22, 1902, W. A. Bryan; Eastern Island, interior part, April 23, 1923, E. L. Caum no. 20; Eastern Island, above beach, April 23, 1923, E. L. Caum no. 21.

Kure: Interior part, April 18, 1923, E. L. Caum nos. 8 and 16.

Polynesia to Madagascar.

COMPOSITAE

LIPOCHAETA De Candolle

Lipochaeta integrifolia (Nuttall) Gray: Proc. Am. Acad. Sci., vol. 5, p. 130, 1861.

Laysan: H. H. Schauinsland in 1896; *fl,* April, 1903, W. A. Bryan. Kure: central plain, *fl,* April 18, 1923, E. L. Caum no. 14.

Hawaiian islands (Maui ?, Lanai, Molokai, Oahu, and Kauai ?).

Our specimens are not typical as compared with a fragment of the Gray Herbarium type deposited in Bishop Museum. The deviation is most strikingly exhibited in the leaves, which in the type are short and spatulate, while those of our specimens are longer and lanceolate to linear lanceolate. They agree, however, in the prominent venation on the lower surface, although Gray in his description states that the veins are not prominent in the type.

Plants with typical leaves seem to be rare, only two having been seen in 16 herbarium numbers, in both of which specimens non-typical leaves were mounted on the same sheet with the same number. Both specimens were from stunted plants as if they had grown in a dry open place. A leaf form similar to that of the specimens from the Leeward Islands is to be found in specimens from the main islands (Rock no. 10304 Oahu). This and other specimens show some variation in the shape and size of the leaves, with an approximation to the type. The specimens, from the Leeward Islands, therefore, should probably not be referred to a distinct variety.

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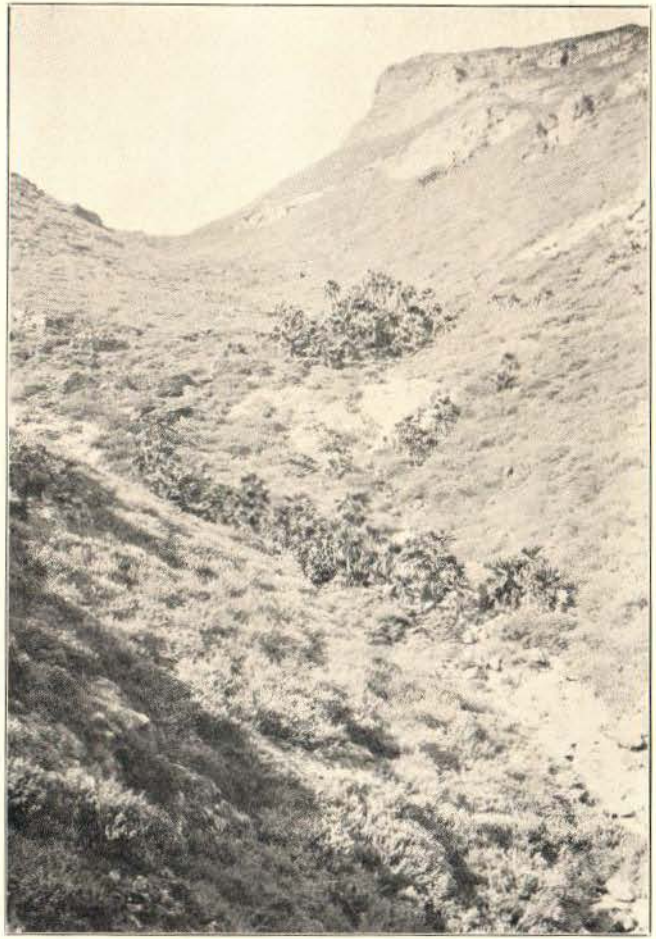

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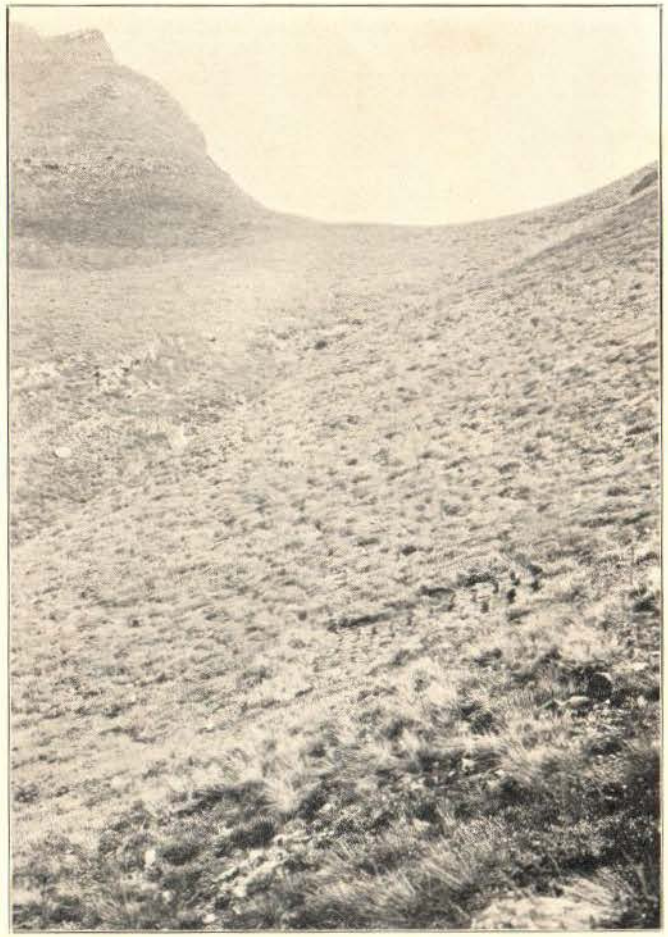
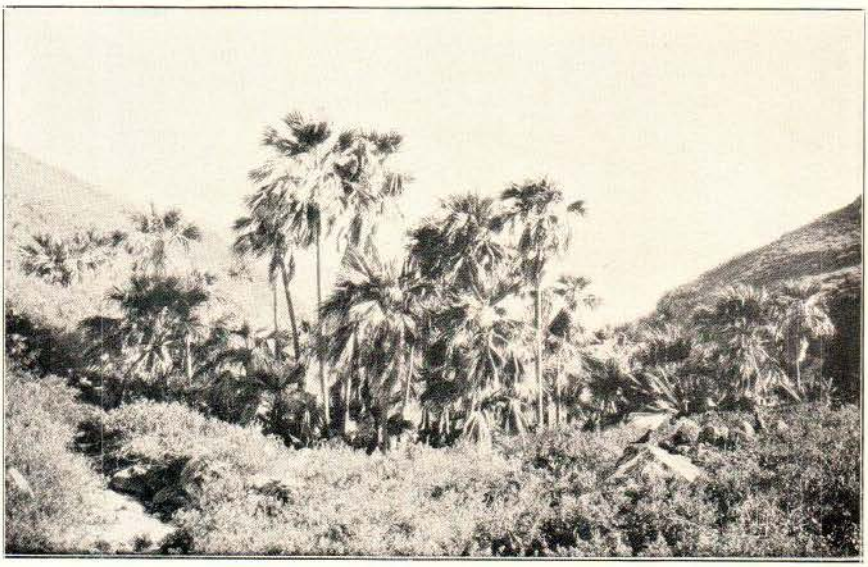


B

VIEWS OF NIHOA ISLAND VEGETATION: *A*, GROVE OF PALMS (PRITCHARDIA REMOTA) IN EAST PALM VALLEY, JUNE, 1923; *B*, VIEW OF THE VEGETATION IN MIDDLE VALLEY, ERAGROSTIS VARIABILIS AND CHENOPODIUM SANDWICHEUM IN THE FOREGROUND, JUNE, 1923. (PHOTOGRAPH BY K. P. EMORY.)



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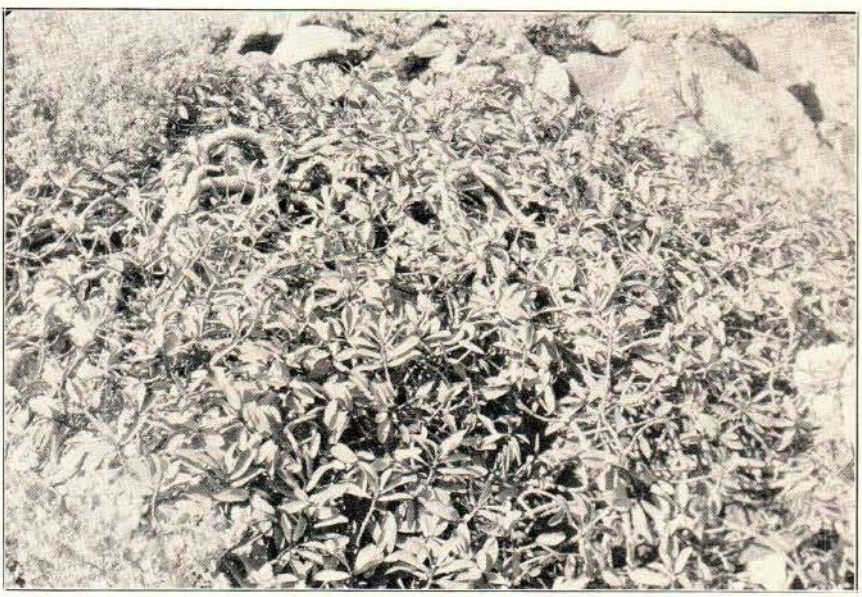


B

NIHOA ISLAND VEGETATION: *A*, PALMS (PRITCHARDIA REMOTA) IN EAST PALM VALLEY, JUNE, 1923; *B*, MAT OF EUPHORBIA CELASTROIDES BELOW MILLERS PEAK, JUNE, 1923.

A

B

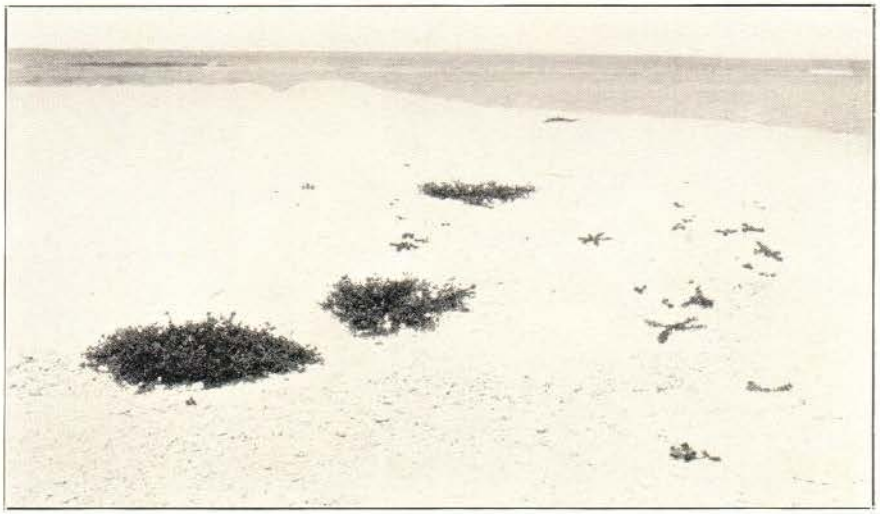
VIEWS OF NECKER ISLAND: *A*, SPARSE VEGETATION ON FLAGPOLE HILL (FOREGROUND) AND ANNEXATION PEAK, JUNE, 1923; *B*, FRIGATE BIRD'S NEST IN A BUSH OF SESBANIA TOMENTOSA, JUNE, 1923.

A

B

C

FRENCH FRIGATES SHOAL AND GARDNER ISLAND: *A*, LA PEROUSE ROCK (FRENCH FRIGATES SHOAL), JUNE, 1923 (PHOTOGRAPH BY H. S. PALMER); *B*, SMALLER ISLET (GARDNER ISLAND) FROM THE NORTH, MAY, 1923 (PHOTOGRAPH BY C. GRANT); *C*, VEGETATION ON TERN ISLAND (FRENCH FRIGATES SHOAL), CHIEFLY LEPTURUS REPENS, C. S. JUDD PLANTING HAU (HIBISCUS TILIACEUS), JUNE, 1923 (PHOTOGRAPH BY E. H. BRYAN).



A

B

FRENCH FRIGATES SHOAL: *A*, TOTAL VEGETATION (PORTULACA LUTEA) ON GIN ISLAND, JUNE, 1923; *B*, VEGETATION ON EAST ISLAND, LEPTURUS REPENS AND BOERHAAVIA DIFFUSA IN FOREGROUND, JUNE, 1923.

A

B

LAYSAN ISLAND: *A*, PATCH OF SESUVIUM PORTULACASTRUM ON THE SHORE OF THE LAGOON, APRIL, 1923; *B*, REMNANT OF GROVE OF PALMS (PROBABLY PRITCHARDIA), DENSE COVER OF VEGETATION, MOST OF IT CHENOPODIUM SANDWICHEUM. (1891-1896, photographer unknown.)

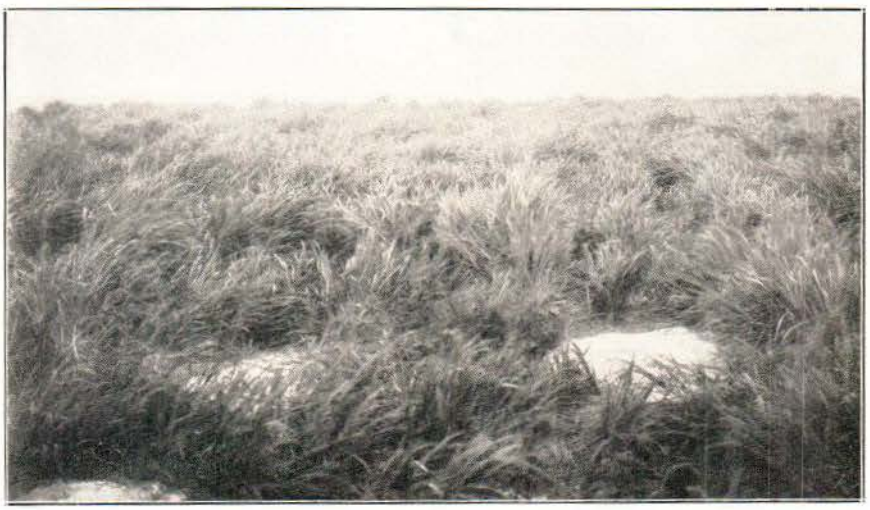
A

B

C

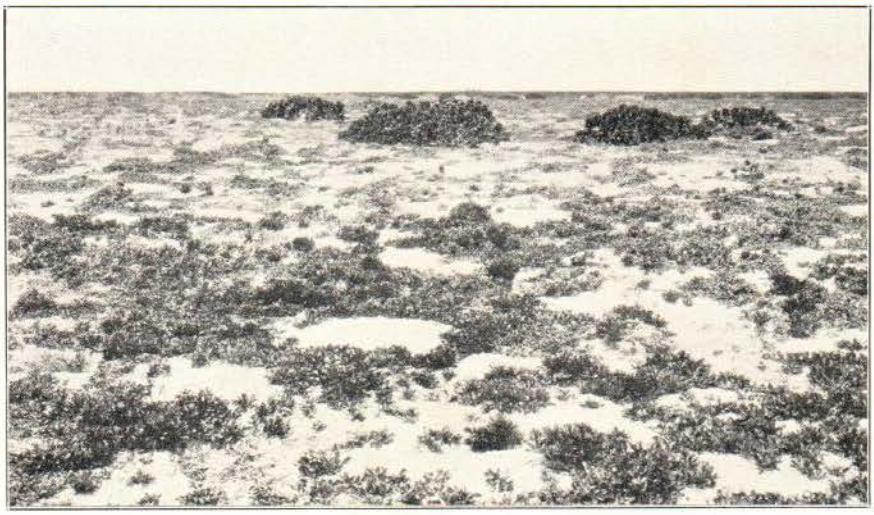
LAYSAN AND LISIANSKY ISLANDS: *A*, REMAINS OF THE SANDALWOOD GROVE, LAYSAN ISLAND, APRIL, 1923; *B*, VEGETATION STRIPPED OFF BY RABBITS, LISIANSKY ISLAND, MAY, 1923 (PHOTOGRAPH BY C. GRANT); *C*, PATCH OF ERAGROSTIS VARIABILIS AT THE NORTH END, LISIANSKY ISLAND, MAY, 1923. (PHOTOGRAPH BY FRANK LAWRENCE.)

A



B

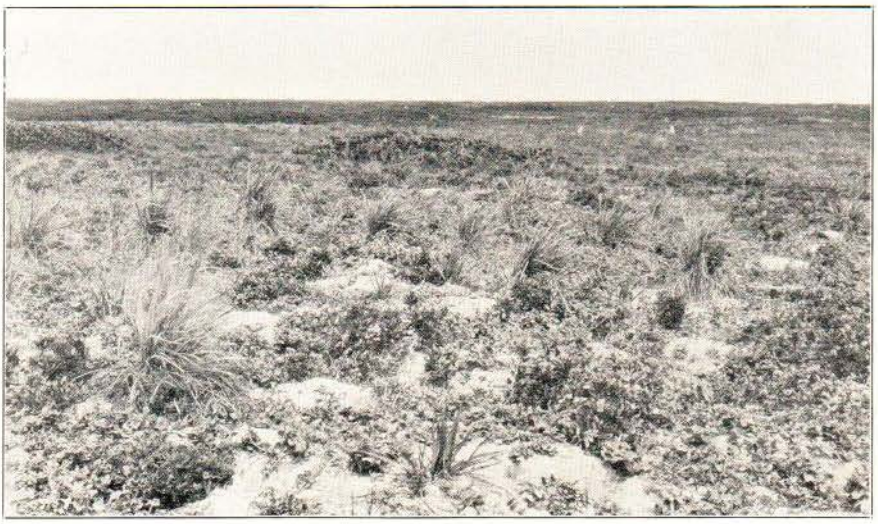
PEARL AND HERMES REEF: *A*, PATCH OF ACHYRANTHES SPLENDENS VAR. REFLEXA ON SEAL ISLAND, APRIL, 1923; *B*, LUXURIANT GROWTH OF ERAGROSTIS VARIABILIS ON MIDDLE ISLAND, APRIL, 1923.



A

B

MIDWAY ISLANDS: *A*, VEGETATION IN THE CENTRAL PLAIN, EASTERN ISLAND, LEPIDIUM OWAIHIENSE COMMON IN THE FOREGROUND, APRIL, 1923; *B*, VEGETATION ON SAND ISLAND, SCAEVOLA FRUTESCENS TO THE RIGHT, "SAN FRANCISCO GRASS" TO THE LEFT, APRIL, 1923.



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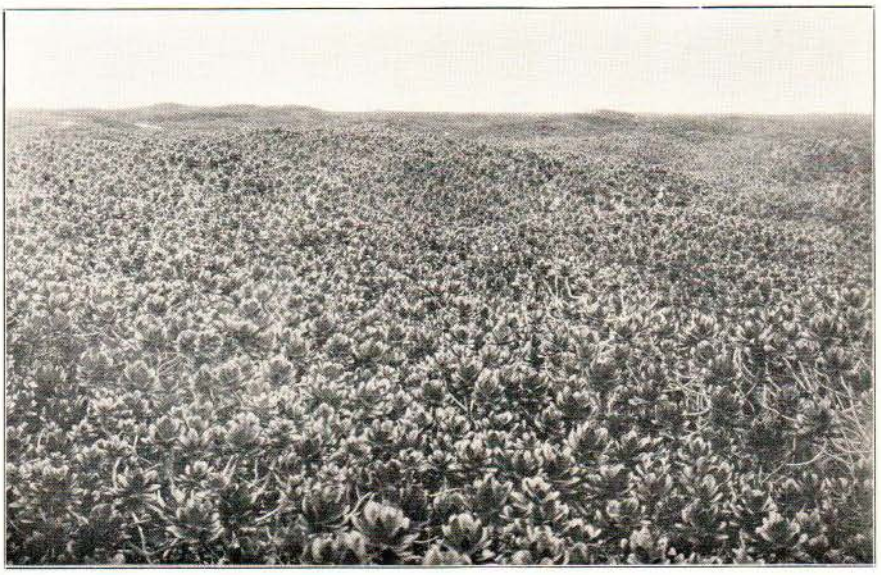
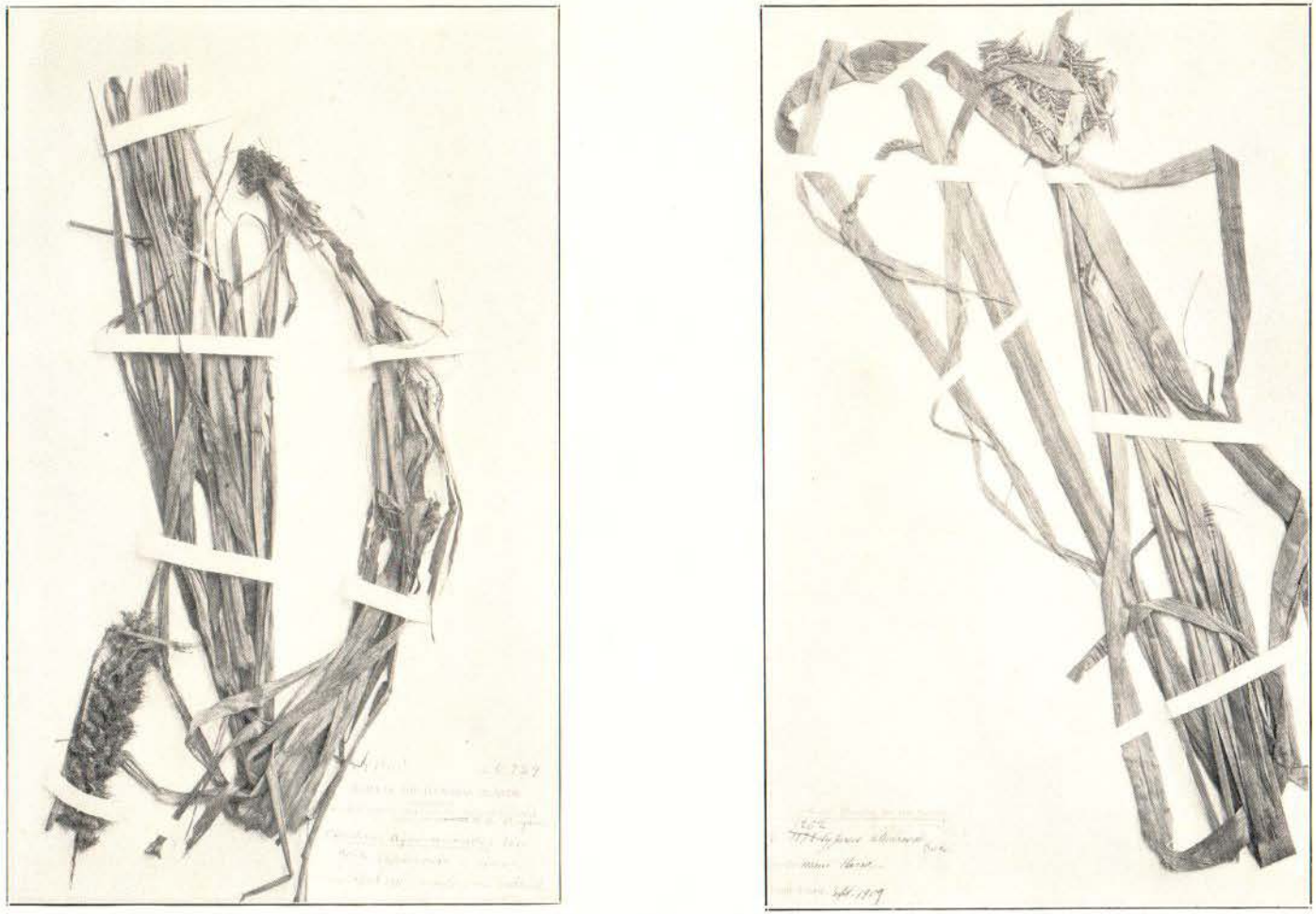


B

KURE ISLAND: *A*, VEGETATION IN THE CENTRAL PLAIN, ERAGROSTIS VARIABILIS, SOLANUM NELSONI VAR. INTERMEDIUM, AND LEPIDIUM OWAIHIENSE IN THE FOREGROUND, APRIL, 1923; *B*, DENSE GROWTH OF SCAEVOLA FRUTESCENS LOOKING SOUTHEAST FROM THE NORTH DUNE, APRIL, 1923.



A 0 10 20 cm B

A, CENCHRUS AGRIMONIOIDES TRINIUS VAR. LAYSANENSIS F. BROWN, TYPE; B, CYPERUS PENNATIFORMIS KUEKENTHAL, COTYPE IN B. P. BISHOP MUSEUM.

A, CYPERUS PENNATIFORMIS KUEKENTHAL, VAR. *β* BRYANII KUEKENTHAL, CITED SPECIMEN IN B. P. BISHOP MUSEUM; *B*, AMARANTUS BROWNII CHRISTOPHERSEN ET CAUM, TYPE.

A, PORTULACA CAUMII F. BROWN, TYPE; *B*, SCHIEDEA VERTICILLATA F. BROWN, TYPE.

A, SOLANUM LAYSANENSE BITTER, COTYPE IN B. P. BISHOP MUSEUM; *B*, SOLANUM NELSONI DUNAL VAR. TYPICUM F. BROWN, TYPE.

A 0 10 20 cm B

A, SOLANUM NELSONI DUNAL, VAR. INTERMEDIUM F. BROWN, TYPE; *B*, SOLANUM NELSONI DUNAL, VAR. CAUMII F. BROWN, TYPE.

A, SOLANUM NELSONI DUNAL VAR. ACUMINATUM F. BROWN, TYPE;
B, SOLANUM NIGRUM LINNAEUS VAR. NIHOENSE F. BROWN, TYPE.