NOTES ON THE FLORA AND FAUNA OF LEHUA AND KAULA ISLANDS

By

EDWARD L. CAUM

INTRODUCTION

Through the courtesy of Mr. F. A. Edgecomb, Superintendent of the Fourteenth Lighthouse District of the United States Department of Commerce, I was given transportation on the lighthouse tender *Kukui* when lights were established on the tiny rocky islets of Lehua and Kaula, in the spring of 1931 and the late summer of 1932. Lehua, 291 acres in extent and 702 feet high, lies just off the north point of Niihau, and Kaula, 136 acres in extent and 540 feet high, is about 23 miles west-southwest of Niihau.

In company with Dr. Harold S. Palmer of the University of Hawaii, geological, botanical, and ornithological surveys of these two islets were made, so far as I know for the first time. The results of the botanical and ornithological investigations are embodied in the accompanying notes. Unfortunately no entomological collections were made on Lehua, but the few insects collected on Kaula were reported on by Mr. E. H. Bryan Jr.[1]

The plant cover of Lehua and Kaula is rather extensive, both in quantity and in number of species, considering the adverse climatic, geologic, and faunal conditions. Only those species can survive that can endure aridity and strong, continuous winds. Consequently with very few exceptions the plants are low-growing shrubs or herbs which belong to a semi-arid or a strand flora. The boobies and frigate-birds, both of which use great quantities of nesting material, are no small factor in keeping down a vegetative cover that is scanty at best, and on Lehua, overrun as the island is by rabbits, the plants have these enemies in addition with which to contend.

The collections on which these notes are based were made during dry seasons. At other times it is not unlikely that the cover would

[1] Haw. Ent. Soc., Proc. for 1932, vol. 8, no. 2, p. 245, 1933.

appear much more extensive in quantity although probably not in variety. On Kaula great areas are entirely barren, but a search among the rocks in apparently similar areas on Lehua usually revealed the presence of grass and sedge stubble, showing that the vegetation there would be far more conspicuous following the rains.

A comparison of the floras of these two islets is interesting. Of the 26 plant species collected on Lehua, only Jacquemontia and Waltheria are of general distribution, the others being more or less localized. On Kaula, on the contrary, localization of species is the exception rather than the rule, 11 of the 15 species found being of general distribution over the islet. Even the 2 plants of Solanum were separated by about 300 feet, and 2 of the 3 plants of Capparis were separated by almost the full length of the islet, with the third about half-way between them. Opuntia appears to be spreading on Lehua, particularly on the outer slope. There are comparatively few plants on the inner side of the crescent. The plants are tall and strong, and in a healthy and flourishing condition. On Kaula this cactus is represented by a clump covering about 300 square feet, at the northwest part of the island. In sharp contrast to the stand on Lehua, the plants are extremely poor, not over two feet tall, with the pads small and thin.

Of the 35 species of plants collected on the two islands, only 6, *Panicum lanaiense, Portulaca oleracea, Opuntia megacantha, Boerhaavia diffusa, Sida fallax*, and *Heliotropium curassavicum* are common to both. It is interesting to note that of these only Panicum makes a comparable growth in both places. Portulaca, Boerhaavia, and Sida are much more common on Kaula than on Lehua, and are more healthy and flourishing. Opuntia and Heliotropium grow better on Lehua. The difference in the number of species collected on these two islets lies mainly in the Monocotyledons, this group being represented on Lehua by four grasses, three sedges, and one fern (included here for the sake of the statistics), and on Kaula by a single grass. Lehua has 18 species of Dicotyledons compared with 14 on Kaula, but most of the species are represented by a greater number of individuals on Kaula than on Lehua. Kaula's one grass will compare in quantity favorably with the same species or with Heteropogon on Lehua.

PLANTS COLLECTED

PTERIDOPHYTA

POLYPODIACEAE

Doryopteris decipiens (Hooker) J. Smith.

Lehua: rare, a few clumps found on the inner slope near the peak, just below the crest of the ridge. Fruiting April 18, 1931, (no. 15)[2].

MONOCOTYLEDONAE

GRAMINEAE

Chaetochloa verticillata Beauvois.

Lehua: very rare, only one clump was found on a tiny ledge near the landing place. In company with Sonchus, it was growing in a soil pocket formed by a small mat of *Heliotropium curassavicum*. This species is probably a recent immigrant from Niihau. Fruiting April 19, 1931 (no. 20).

Heteropogon contortus Roemer and Schlechtendal.

Lehua: common on the outer side of East Horn, and scattering over the eastern half of the southern slope. It grows very sparingly if at all west of the median line. Fruiting April 18, 1931 (no. 8).

Panicum lanaiense Hitchcock.

Lehua: rather common along the crest of the southwest ridge and at the tip of West Horn. Most of the plants found were dead. Flowering and fruiting April 18-19, 1931 (nos. 9, 23). Kaula: of general distribution, the stand heaviest toward the north end, on the western slope. All the plants found were dead. Old fruit August 17, 1932 (no. 9).

Syntherisma debilis (Desfontaines) Skeels.

Lehua: a number of dead plants were found in a small patch near the middle of West Horn, and a single dead plant was on the crest of the southwest ridge. Old fruit April 18-19, 1931 (nos. 10, 24).

[2] Numbers in parentheses refer to field labels. Plants described are in the herbarium of Bernice P. Bishop Museum.

CYPERACEAE

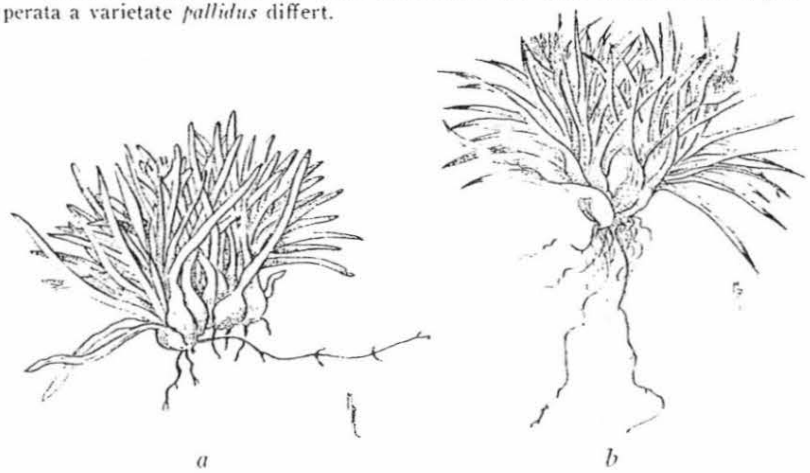
(Determined by Dr. Georg Kükenthal)

Cyperus stuppeus Forster.
(*Cyperus pennatus* Hillebrand.)

Lehua: not uncommon on the outer face of the islet, growing just below the crest near the base of East Horn, in the radial valleys of the southern slope near the cliffs, and just behind the bench to the west of the gas tank houses. In bud and old fruit April 18, 1931 (no. 5).

Cyperus polystachys Rottboell variety **pallidus** Hillebrand form **pornanus**, new form (fig. 1, *a*).

Culmo nonnisi 1 cm alto folia abscondito nec non inflorescentia depauperata a varietate *pallidus* differt.



a *b*

FIGURE 1.—Lehua: *a*, *Cyperus polystachyus pallidus* form *pornanus* Kükenthal (no. 17); *b*, *Fimbristylis cymosa pycnocephala* (Hillebrand) Kükenthal (no. 29). Natural size.

Lehua: a tiny form (the normal variety is 20 to 30 cm tall) found only near the base of East Horn, on the outer side just below the crest. Flowering April 18, 1931 (no. 17).

Fimbristylis cymosa R. Brown variety **pycnocephala** (Hillebrand) Kükenthal.

Lehua: rare, growing sparingly along the crest of the southwest ridge, where it forms mats in the tiny rock pockets. A single very small although fully mature clump was found on the crest of West Horn, well out toward the tip. (See fig. 1, *b*.) In flower and old fruit April 19, 1931 (nos. 7, 29).

Concerning this plant Dr. Kükenthal writes: "Diese Varietät ist durch Übergangsformen deren var. umbellato-capitata (Mann) Hillebr. eng verbunden. Nur der dichtköpfige Blütenstand trennt."

DICOTYLEDONEAE

CHENOPODIACEAE

Chenopodium sandwicheum Moquin.

Kaula: very common and widely distributed. Flowering and fruiting August 17, 1932 (no. 8).

AMARANTACEAE

Amarantus viridus Linnaeus.

Kaula: not uncommon, growing in large clumps 10 to 12 inches in diameter, scattered over the island. Flowering and fruiting August 17, 1932 (no. 2).

NYCTAGINACEAE

Boerhaavia diffusa Linnaeus.

Lehua: very rare, only three tiny seedlings found in the immediate neighborhood of the tank houses. One of these plants bore a single flower. Flowering April 22, 1931, (no. 28). Kaula: not common, growing mainly on the ledges near the derrick. A few very poor plants were found on the inner side of the crescent near the crest. Flowering August 17, 1932 (no. 13).

AIZOACEAE

Sesuvium portulacastrum Linnaeus.

Lehua: a number of large flourishing patches grow along the southern side, in the spray of the surf, and on the crest of West Horn near the tip. Flowering April 18, 1931 (no. 4).

PORTULACACEAE

Portulaca caumii F. Brown.

Kaula: on the ridge, most commonly on the northern half, where mats 12 to 14 inches in diameter were found. This is the first

record of the species elsewhere than on Nihoa, the type locality. Flowering August 17, 1932 (no. 5).

Portulaca lutea Solander.

Kaula: very common and well distributed over the island. On the southwestern slope in particular the species grows in great masses in pure stand. Flowering and fruiting August 17, 1932 (nos. 4, 6).

Two plants of a somewhat different form were found, which on cursory examination seemed to represent a natural hybrid between *P. lutea* and *P. oleracea*. The material available was not sufficient for a detailed examination, and plants grown in Honolulu from cuttings of the supposed hybrid and of the typical *P. lutea* have thus far failed to flower. Vegetatively the plants are very similar, although not identical.

Portulaca oleracea Linnaeus.

Lehua: not common, although scattered the length of the crest from about the middle of the southwest ridge to near the tip of East Horn. In the main, the plants were very small and in poor condition. Flowering and fruiting April 18, 1931 (no. 11). Kaula: common on the western side of the crest, especially at the northern end, where large flourishing mats were found. Flowering and fruiting August 17, 1932 (no. 3).

Portulaca villosa Chamisso.

Lehua: rare, found only in one small stand on the crest of West Horn, near the tip. The plants were all small and in poor condition. Fruiting April 19, 1931 (no. 12).

A root, brought to Honolulu and planted, furnished a basis for the determination of the species. In addition to these plants, three small broken pieces of a Portulaca, well dried, were found lying on the ground about half way out East Horn. Old fruit April 18, 1931 (no. 1). The material collected was entirely inadequate for accurate identification, and seeds planted in Honolulu failed to germinate, but it is probable that the fragments must be referred to this species.

Papaveraceae

Argemone mexicana Linnaeus.

Lehua: rare, two plants were found in a pocket just behind the cliffs on the south side, and two more were seen in a deep gully on the northern side of the southwest ridge. Flowering April 19, 1931 (no. 6).

This is the species which Degener[3] considers endemic, distinct from the *A. mexicana* of Linnaeus, and which he names, without description, *Argemone glauca*.

Capparidaceae

Capparis sandwichiana De Candolle.

Kaula: rare, only three plants were found, one near each end of the island and one about midway between. They were all small, the stems not more than a foot long, although one had a trunk about 1¾ inches in diameter. Flowering August 17, 1932 (no. 1).

Zygophyllaceae

Tribulus cistoides Linnaeus.

Kaula: rather common on the ledges near the derrick, and scattered elsewhere. In flower and green fruit August 18, 1932 (no. 14).

Euphorbiaceae

Euphorbia celastroides Boissier.

Kaula: well distributed over the island. The plants were all very low and sprawling, with heavy stems. Flowering August 17, 1932 (no. 10).

Euphorbia hirta Linnaeus.

Lehua: not uncommon, scattered along the crest of the island, and very sparingly elsewhere. The plants were all small and distinctly prostrate. Flowering and fruiting April 18, 1931 (no. 13).

Malvaceae

Sida fallax Walpers.

Lehua: rare, two plants were found near the tip of East Horn, on the inner side, and one dead plant and several small seedlings near the tip of West Horn, on the crest. In flower and fruit April 18, 1931 (no. 18). Kaula: not common, and apparently restricted to the northern end. Several plants were found which bore flowers

[3] Degener, Otto, Ferns and flowering plants of Hawaii National Park, Honolulu, p. 164, 1930.

with petals rather narrower at the base and more widely spread apart than is usual. Flowering August 17, 1932 (nos. 11, 11a).

STERCULIACEAE

Waltheria americana Linnaeus.

Lehua: very common in all parts of the islet with the exception of the farther part of West Horn, where it occurs very sparingly. With the exception of Jacquemontia it is the commonest plant species on the island. Flowering April 18, 1931 (no. 3).

CACTACEAE

Opuntia megacantha Salm-Dyck.

Lehua: common on the southern and eastern faces of the islet, and a few scattered clumps on the inner side of the crescent near the base of West Horn. Flowering April 18, 1931 (not collected). Kaula: a single rather small, scrubby patch near the northern end of the island. Flowering August 17, 1932 (not collected).

ASCLEPIADACEAE

Asclepias curassavica Linnaeus.

Lehua: rare, a few plants only having been found in a clump of Opuntia well down on the southern slope, east of the landing. In flower and old fruit April 20, 1931 (no. 25).

CONVOLVULACEAE

Ipomoea indica (Burmann) Merrill.

Kaula: not common, a few rather long-stemmed plants on the ledges near the derrick, and a few very small plants elsewhere. Sterile August 17, 1932 (no. 12).

Ipomoea pes-caprae Roth.

Lehua: rare, only one small patch having been found on the inner side of the base of West Horn, about 200 feet below the summit. Flowering April 22, 1931 (no. 27).

Jacquemontia sandwicensis Gray.

Lehua: the prevailing plant, common in all parts of the island except the tip of West Horn. Flowering and fruiting April 19, 1931 (no. 2).

BORAGINACEAE

Heliotropium anomalum Hooker and Arnott.

Lehua: restricted to the inner side of the crescent. From the base of East Horn westward to about the median line, on the rocks of the pre-summit series, it forms an almost pure stand. From there nearly to the base of West Horn, and above the heavy stand, it grows sparingly. Flowering and fruiting April 18, 1931 (no. 16).

Heliotropium curassavicum Linnaeus.

Lehua: uncommon, growing in a few places on the southern cliffs, in the neighborhood of the landing, just above the water. Flowering and fruiting April 19, 1931 (no. 19). Kaula: very rare, only two plants having been found, well out on East Horn. Flowering August 17, 1932 (no. 7).

VERBENACEAE

Lantana camara Linnaeus.

Lehua: very rare. Only one plant was seen, in a soil pocket on the edge of the southern cliffs, west of the tank houses. This plant was destroyed after specimens had been taken. Sterile April 20, 1931 (no. 26).

Mr. Aubrey Robinson, the owner of the island of Niihau, has for a number of years conducted a systematic campaign of extermination against lantana on Lehua, to prevent the spread of the plant to Niihau.

SOLANACEAE

Solanum nigrum Linnaeus.

Kaula: very rare, only two plants having been found, one on the ledge near the derrick, the other about three fourths of the way up the western face. Flowering and fruiting August 18, 1932 (no. 15).

CUCURBITACEAE

Sicyos sp.

Lehua: rare, found in only one place, in an Opuntia thicket at the foot of a radial valley just to the west of the tank houses. The vines were all dead, cut off at the base apparently by rabbits. They were sterile, and definite determination was not possible. April 19, 1931 (no. 22).

COMPOSITAE

Ageratum conyzoides Linnaeus.

Lehua: uncommon, scattered sparingly along the crest of the islet, and a few larger and more vigorous plants in the deep gulches on the inner side of West Horn. Flowering and fruiting April 18, 1931 (no. 14).

Sonchus oleraceus Linnaeus.

Lehua: very rare, only two plants having been found on a tiny ledge near the landing. Like the Chaetochloa with which it was associated, this plant is probably a recent immigrant from Niihau. Fruiting April 19, 1931 (no. 21).

LIST OF BIRDS

Anous stolidus (Linnaeus) *Laridae*. Noddy Tern.

Lehua: fairly common, nesting in deep caves near the landing, and a few under overhanging rocks in the valleys to the west of the tank houses. Kaula: the most numerous species on the island, distributed everywhere, but centering on the face of the islet toward the southern end.

Gygis alba kittlitzi Hartert *Laridae*. White Tern; Love-bird.

Kaula: not common, a few in the cliffs toward the center of the inner slope of the crescent.

Micranous hawaiiensis Rothschild *Laridae*. Noio; Hawaiian Tern.

Lehua: rather rare, nesting with the noddys in the deep caves near the landing.

Procelsterna saxatilis Fisher *Laridae*. Necker Island Tern.

Kaula: a small colony living in the steep cliffs at the North Horn.

Sterna fuliginosa Gmelin *Laridae*. Sooty Tern.

Kaula: rather common, mainly on the face of the islet, in the central part and toward the south.

Sterna lunata Peale *Laridae*. Gray-backed Tern.

Kaula: not common, mainly on the crest north of the center.

Diomedea nigripes Audubon *Diomedeidae*. Brown Gooney; Black-footed Albatross.

Lehua: only a few birds seen, and none known to be nesting on the islet. Kaula: none seen, but one old egg was found, indicating that the islet is visited.

Pterodroma leucoptera hypoleuca (Salvin) *Procellariidae*. Bonin Island Petrel.

Kaula: one chick, which I believe to be of this species, was found in a shallow cave on the inner slope of the crescent. No adult birds were noted.

Bulweria bulweri (Jardin and Selby) *Procellariidae*. Bulwer's Petrel.

Kaula: several individuals were seen in flight, and one chick which appeared to be of this species was found on a ledge on the outer face of the islet.

Puffinus pacificus cuneatus (Salvin) *Procellariidae*. Uau kane; Wedge-tailed Shearwater.

Lehua: very common, nesting in fault-cracks along the crest of the islet and in the soil in the radial valleys of the southern slope. Kaula: only two individuals were seen, but there were many unoccupied burrows, showing that during the breeding season they visit the island in appreciable numbers.

Phaethon rubricauda (Boddaert) *Phaëthontidae*. Koae; Bos'n; Red-tailed Tropic Bird.

Lehua: probably the commonest species on the islet, nesting in caves and under overhanging rocks everywhere. Kaula: rather common along the inner side of the crescent.

Sula cyanops (Sundevall) *Sulidae*. Blue-faced Booby.

Lehua: only a few individuals seen. Two or three pairs were nesting with the iwa and common boobies at the southeast corner of the islet. Kaula: rather common, mainly along the crest near the East Horn, and at the edge of the high cliff toward the northern end.

Sula piscator (Linnaeus) *Sulidae*. Red-footed Booby.

Kaula: not uncommon, on the inner slope of the islet near the East Horn.

Sula sula (Linnaeus) *Sulidae*. Common or Hooded Booby.

Lehua: not uncommon, a few pairs nesting at the southeast

corner of the islet. Kaula: very common, mainly near the north end and at the extreme tips of the two horns of the crescent.

Fregata minor palmerstoni Gmelin *Fregatidae*. Iwa; Frigate-bird; Man-o'-War Hawk.

Lehua: rare, only a few individuals seen. Two or three pairs were nesting in a patch of Sesuvium on the edge of the cliff at the southeast corner of the islet. Kaula: very common along the inner side of the crescent from the center toward the East Horn.

Pluvialis dominicus fulvus (Gmelin) *Charadriidae*. Kolea; Pacific Golden Plover.

Kaula: several individuals seen on the shelf along the inner curve of the crescent, just above the surf.

Arenaria interpres (Linnaeus) *Charadriidae*. Akekeke; Turnstone.

Lehua: several individuals seen, apparently visitors from Niihau.

Alauda arvensis Linnaeus *Alaudidae*. Skylark.

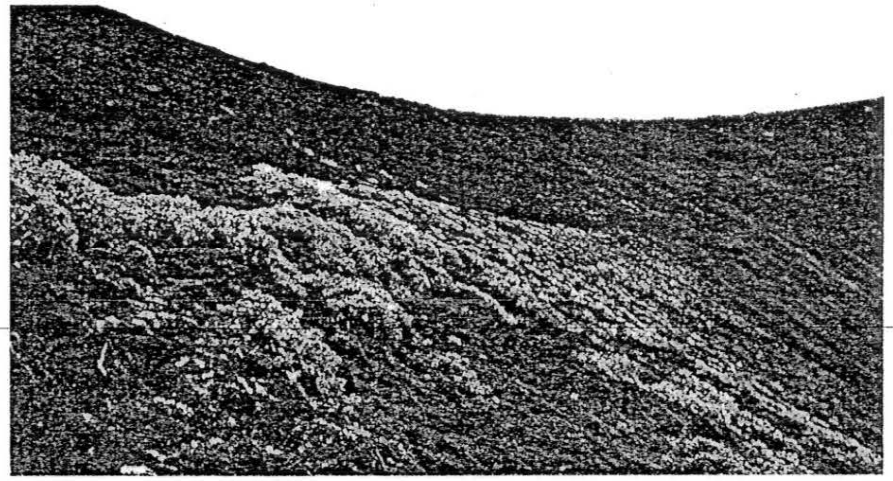
Lehua: rather common. Many are certainly visitors from Niihau, as they were seen to cross the channel between the islands, but a few pairs were nesting in the cactus clumps on the southern slope.

It might be noted that both families of lizards known in Hawaii, the Gekkonidae and Scincidae, are represented on Lehua, but apparently only the geckos have reached Kaula, as no skinks were seen. None were collected, so that no specific determinations were made. The geckos were scarce, only two individuals having been seen on Lehua and one on Kaula, but on Lehua the skinks were common, flashing about among the rocks in all parts of the islet. I saw no mammals of any sort on Kaula, although the lighthouse personnel more recently have reported the presence of a small rat which, from their description, is probably the native Hawaiian rat. Lehua was overrun with rabbits, and I have heard that rats are present there, but I saw no traces of them.

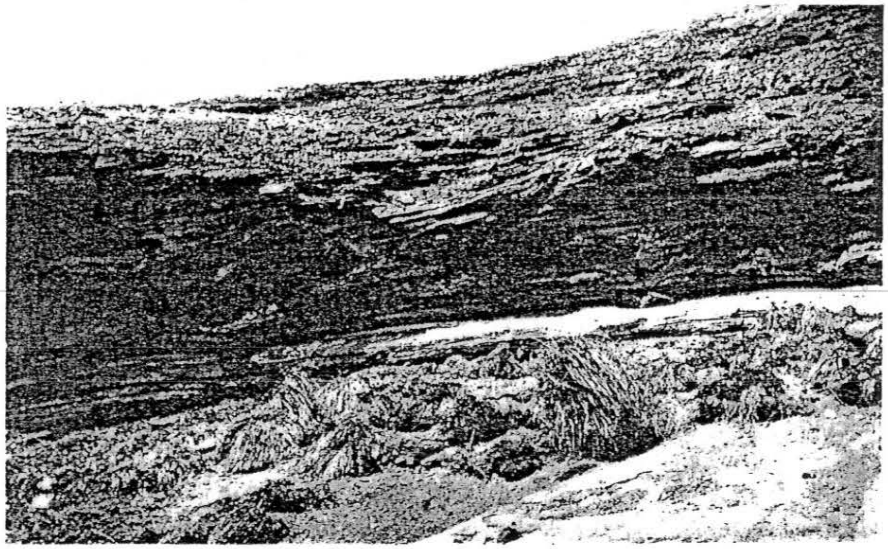
A

B

PLATE 1.—*Opuntia megacantha*: *A*, Lehua, at the foot of a radial valley on the southern slope; *B*, Kaula, stand of *Opuntia megacantha* with a mat of *Portulaca oleracea* in the left foreground and *P. lutea* in the center and to the right.



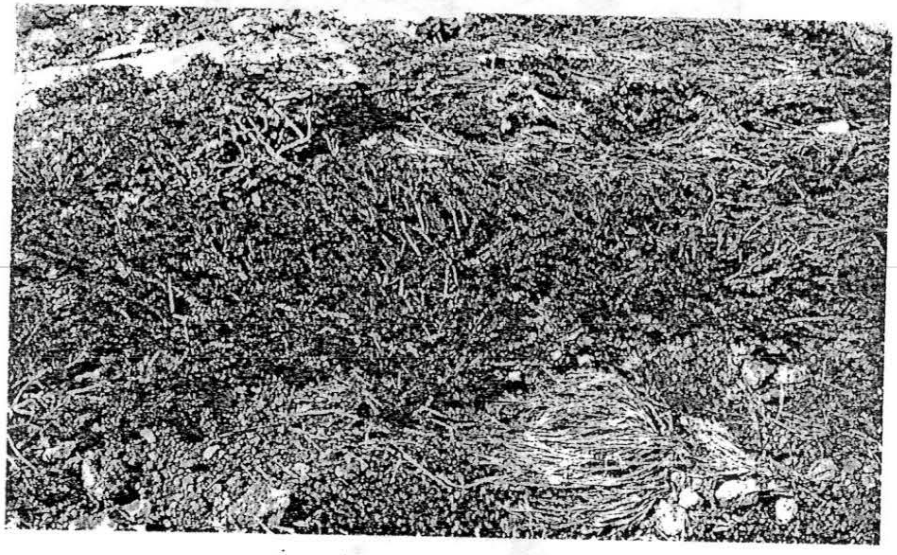
A



B

PLATE 2.—Lehua: *A*, *Heliotropium anomalum* on the eastern half of the inner slope of the islet; *B*, *Cyperus stuppeus* and *Jacquemontia sandwicensis* in a small cove on the southern shore.

A



B

PLATE 3.—Kaula: *A*, a heavy stand of *Portulaca lutea*; *B*, *Portulaca oleracea* in the middle foreground, with *Panicum lanaiense* to the right, *Portulaca caumii* in the center, small plants of *Sida fallax* behind.