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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

PRITCHARDIA AND COCOS IN THE HAWAIIAN ISLANDS
Otto & Isa Degener

When the Hawaiian Islands were rediscovered by Captain James Pace Cook in 1778, only two genera of palms grew in the archipelago. The one was Pritchardia, consisting of many taxa of fan-leaved or palmate palms; the other, Cocos, consisting of a single species of feather-leaved or plumose palm. Odoardo Beccari and Joseph F. Rock in 1921 published their beautifully illustrated work entitled *A Monographic Study of the Genus Pritchardia, 1-77. It is the last, authoritative work on the group. Though we know it conceals errors, we do not yet know enough to correct them. The species are native mostly to Micronesia and Polynesia, attaining their major development in the Hawaiian Archipelago. They grow from sea level to about 5,000 feet elevation; from desert to dense rainforest. According to Beccari & Rock's findings, there are about 25 species and five varieties extending from the Island of Hawaii westward to distant Nihoa. Since 1921 additional taxa have been described, some of questionable validity.

Beccari & Rock describe as new, single individual palm trees growing in hot, lowland gardens, and not known anywhere in the wild. Could not such individual palms be the offspring of seeds collected in the rainy mountains of our islands? Do they merely look new because they are growing under greatly changed conditions? We do not presently know.

One of our local botanists, Dr. Harold St. John, collected specimens from a single palm in the mountains near Punaluu, Oahu and, using the monograph, keyed it to a certain species. At a different season he visited the identical palm, collected additional material and, using the same key, came to an entirely different species! Obviously, something is wrong somewhere.

While botanizing for five months in 1928 on Molokai, the kane writer searched for Pritchardia, known to Hawaiians as loulu, and noted some growing cultivated near the coast in the garden of an elderly Hawaiian known to him as Levi. From his part-Hawaiian assistant, in whom Levi had confided, he learned that Rock had heard about loulu palms growing in some Molokai fastness. He offered Levi pay to fetch him specimens. As Rock refused the price Levi wanted, Levi resolved to have his cake and eat it too. So he agreed to Rock's more modest offer but, instead of climbing the mountain range to get specimens of the elusive palm, he merely substituted material from one of the trees in his yard. Levi thought it a great

*Mem. B.P. Bish. Mus. 8(1).

joke, and chuckled while telling the writer's assistant about the deception. Evidently some Molokai taxon is listed erroneously in the monograph as to habitat.

We see no way of greatly revising Beccari & Rock's work, excellent for the time and conditions under which it was produced, without concentrating on collecting herbarium specimens from all colonies still extant, a task easily facilitated by airplanes spotting of these conspicuous trees. Seeds from each colony, preferably from the same palm from which voucher material had been preserved, should then be planted under uniform conditions with similarly procured seeds from other colonies. Such cultivated plants must then be compared with one another when they finally flower and fruit, as well as against the vouchers collected from the parent plants many years before. The difficulty of such a project is the gathering of material so often growing in almost inaccessible jungles and on cliffs, the acreage needed for the tests, the length of time before a seedling finally matures to produce diagnostic characters of flower and fruit, and the pathetic fact that so many of such distinctive colonies already have succumbed to the bulldozing "progress" of so-called civilized man. The investigator still will not be sure if the old, historical specimens collected by Rock and others had not come from such colonies that are now extinct. Even though the task of getting order out of chaos seems hopeless, Foster Botanical Garden under Director Paul R. Weissich has made a good beginning.

If the above preamble is correct, it is obvious that many kinds of loulou are endemic to the Hawaiian Islands, even though no one yet knows how many species and varieties existed here in 1778. It is also plain that this genus must have been in the Hawaiian Islands for eons - certainly before the arrival of the Polynesians - to enable it to speciate to such an extent.

The fossil record certainly proves the antiquity of the loulou. Until recent bulldozing on Oahu destroyed them, erect molds of the trunks were observable on the north side of the road leading mauka to the U.S. Army Tripler General Hospital. Such palms were thriving until the lower parts of their smooth trunks were buried by the rain of ash that fell during the explosions that formed Salt Lake Crater.

On the Island of Hawaii at Kailiili, near Wahaula within Hawaii Volcanoes National Park, a few impressions of prostrate trunks can be seen on a prehistoric though not very old pahoe-hoe lava flow. Beyond the southwestern boundary of the National Park, between the main road and the ocean, at *Kawaa, lies an expanse of prehistoric, smooth pahoe-hoe.

*Incorrectly spelled "Kawa" on some Government maps.

Armed with camera, broom, whiskbroom and trowel, the writers and Mr. & Mrs. Theodore L. Picco fanned over the area. Here the pahoe-hoe had gently flowed through a palm grove, the wet trunks burning slowly through the base so that the trees fell helter skelter upon the cooling lava. Several score impressions were carefully examined, all showing the relatively smooth, unbranched outline of a side of the palm trunk (Fig. a). Many also showed rectangular checks formed as the lava oozed into the charring wood (Figures b, c). One impression even showed the base of a fan-like blade (Fig. d),



Figures a,b,c. Trough-like *Pritchardia* tree molds, c at left showing impressions of checked charcoal.





resembling that of a modern *Pritchardia* (Fig. e) now growing at nearby Punaluu. Not a single trunk impression exhibited leaf scars. No palm fruits nor seeds were observed.



Fossil (Fig. d) and modern (Fig. e) leaf blades.

"According to tradition, at least the large-fruited type of coconut known as *niupolapola* was brought to the Hawaiian Islands by the early Polynesian immigrants from Bolabola, an island not far from Tahiti. Before Captain Cook's coming the Hawaiians knew also a few other kinds, such as the *niuhiwa* with dark-colored fruit and the *niulele* with yellowish fruit."* The fruit was both food and drink for the Polynesian voyagers, and certainly the most necessary and efficient supply of a potable liquid in transportable form for a long ocean voyage. We surmise some coconuts escaped being consumed, and were planted in the newly discovered islands.

Between Kawa Bay and the boundary of the National Park is the coastal village of Punaluu. Just back of the black sand beach is a mixed grove of *loulu* (*Pritchardia affinis* Beccari) and *niu* or coconut (*Cocos nucifera* L.) palms. The

*Degener, O., Plants Haw. Nat. Park, 72. 1930.

former, a fan palm, bears erect, slender trunks hardly thickened at base and without prominent leaf scars. The latter, a feather palm, bears a curving trunk thickened at base and somewhat constricted at the prominent leaf scars. The contrast is well shown in figures f and g. with these differences in mind, the reader should compare the photographs of the living trees with those of the fossils.



Figures f and g showing two coconut palm trunks with prominent leaf scars and several *Pritchardia* trunks with obscure leaf scars.

In conclusion, the writers are convinced that the loulou reached the Hawaiian Islands some eons ago, and may have even more or less encircled many stretches of the Islands with extensive groves, particularly before the Polynesians brought the pig and, perhaps as stowaway, the seed-eating Polynesian rat. The fossil impressions at Kailiili and above all at Kawaa are irrefutable proof of this fact. These beautiful palms may well have extended along the shore of Hawaii Volcanoes National Park, and hence deserve replacement. Regarding the coconut, however, we consider it a newcomer to the Hawaiian Islands until irrefutable evidence to the contrary appears. Tradition bolsters this belief as well as the fact that no fossil imprints of a coconut palm have ever

been seen, not even at Kawa Bay where conditions were ideal for its growth and fossilization.

Many have been confounded by the loulu growing in such isolated localities. It is of course possible that those trees perched on cliffs reached there as fruits falling or washing down from the plateau forest above. Or a grove may have existed for ages on a plateau before this was slowly eroded into gulches and finally into cliff-flanked canyons. The grove of palms simply continued to grow in the same spot from generation to generation, first on gulch sides and finally on the resultant cliffs. All this is possible, but is it probable? On the Island of Hawaii lives the native crow alala (Corvus tropicus Gmelin). To be sure all crows are black; but this one, as the kane writer observed in 1927 in the Kona jungle, is unique in keeping its bill agape to exhibit to its mate the beautiful akala-berry-red surface within. Evidently the ancestors of such a species, now so distinctive, must have come to the Archipelago eons ago. Today the species is on the verge of extinction, perhaps less than a dozen individuals persisting on the Island of Hawaii. In 1891, however, when the ornithologist George C. Munro surveyed this island for birds "the alala was numerous. They were in flocks - --." Perhaps crows and/or other large, seed eating birds were numerous also on some of the remaining islands and aided in the early distribution of the loulu. If "civilized" man could just about exterminate the crow on the Island of Hawaii from flocks to perhaps less than a dozen individuals in eighty years, what could not the natives have accomplished during the past few thousand? We know "The Hawaiians snared the crow and used the black feathers for kahilis and for dressing idols."

There is hope for the preservation of the Pritchardia molds because these and the archaeological features of the general area can be of value to the lucrative tourist industry. Besides having these easily accessible and clear, prostrate tree molds, the Kawa Bay region is flanked to the northeast by the ruins of the massive Keeku heiau or temple. This must have catered to a large neighboring population attracted by the beach and the nearby freshwater springs. Unfortunately the many house sites have been washed flat by the tsunami of 1868; but ilili, or smooth water-worn pebbles from the beach and from the flooring of the huts, are scattered everywhere. One even finds evidence of ancient pleasures and industry. Here and there, pecked into flat, smooth lava are the depressions of the papamu, or checker-board (Fig. h), upon which the Hawaiians played konane with white coral pebbles against black lava ones; and along the rocky coast are cup-like depressions ("baitcups") in which the natives pounded their churning material used



Fig. h, a papamu.

for luring fish. A few stone "salt pans" in which seawater was evaporated to gain salt for barter with upland residents are also there. Such an area rich in Hawaiiana and fossils may well escape destruction.

We are grateful to Mr. & Mrs. Picco for helping us sweep and for taking the photographs.

SOPHORA IN HAWAII

Otto & Isa Degener

A letter from Dr. Ronald Melville of Kew, dated January 13, 1971, regarding the present status of the endemic Sophorae of the Hawaiian Archipelago, induced us to write the present article.

Hillebrand's Flora of the Hawaiian Islands, published posthumously in 1888, on page 108 describes a single endemic species of Sophora, namely S. chrysophylla (Salisb.) Seem., for the Hawaiian Archipelago. He locates the species on "Hawaii! Maui! Kauai!" The writers, and some other local botanists, know the genus from the Islands of Oahu, Molokai and Lanai as well. Mr. Alvin K. Chock, as a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Botany at the University of Hawaii, published the results of his two year study of Hawaii Sophorae in Pacific Science 10:136-158 in 1956. The Degener collection deposited at the Field Museum was mailed him in January 1954 to aid him in his studies.

Counting such names as Sophora chrysophylla (Salisb.) Seem., and Sophora chrysophylla ssp. glabrata var. ovata subvar. ovata f. maunakeensis Chock, the monographer recognizes as valid for the Archipelago 1 species, 4 subspecies, 11 varieties, 5 subvarieties and 12 forms. We are less conservative and judge the Islands to harbor more than one species, such as Sophora grisea Deg. & Sherff (in Sherff, Bot. Leaflet 5:24. 1951.) and S. unifoliata (Rock) Deg. & Sherff (ibid. p. 25), as well as one each from the Islands of Lanai and Molokai. We believe, also, the monographer should have considered character of legume of greater taxonomic importance. We consequently here are changing to different taxonomic ranks:

1. SOPHORA LANAIENSIS (Chock) Deg. & Deg.

Sophora chrysophylla sensu Rock, Indig. Trees Haw. Isl. 189. 1913. "A few small trees were found on Lanai just above the homestead of the former manager of the Lanai Ranch Co., in a small gulch all by themselves. Whether they were planted there by human hand or by birds cannot be ascertained, but the former may be more reasonable, as they were not found elsewhere on Lanai."

Not Sophora chrysophylla Seem. Fl. Vit. 66. 1865. "Insulis Sandwich, legit A. Menzies." (Brit. Mus.)

Sophora chrysophylla var. glabrata sensu Rock, Leg. Pl. Haw. 123. 1920. (Lanai.)

Not Edwardsia chrysophylla var. glabrata A. Gray in U.S. Expl. Exp. 429. 1854. (Hawaii.)

Sophora chrysophylla ssp. glabrata var. lanaiensis Chock in Pac. Sci. 10:147. 1956. (Lanai.)



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C-O

Sophora lanaiensis (Chock) Deg. & Deg.

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Symmetrically round lacy tree with many branches arising from short erect trunk and bearing numerous long slender twigs longitudinally sulcate and during first year antrorsely appressed-golden-strigose. Leaves commonly with 7 - 10 mm. long petiole and 50 - 80 mm. long rachis both deeply narrowly grooved above and golden-strigose; leaflets about 13, opposite to alternate, the smallest below and the largest above on leaf, 10 - 30 mm. long, 4 - 11 mm. wide, oblong-ob lanceolate, cuneate to minutely abruptly rounded to petiole 1 mm. long or less, broadly rounded to somewhat truncate and emarginate with usually faint mucro at apex, golden-strigose especially beneath. Flowers up to 7 or even 9 per 5 - 10 mm. long inflorescence, on 10 mm. long pedicels having 1 mm. long incurved boat-shaped subulate bract at base. Calyx 8 mm. long from base to shallowly 5-dentate limb, with single 3 mm. deep sinus, strigose-pubescent without, glabrous within. Corolla: standard 26 mm. long, 9 mm. wide, the ovate-elliptic limb at apex somewhat obtuse and barely re-tuse; wings with 4 mm. long claw and 18 mm. long 5 mm. wide limb having obliquely truncate base and somewhat rounded apex; keel petals with claw 4 mm. long but blade 24 mm. long and 6 mm. wide, connate for 10 mm. near middle of lower margin, with acuminate apex. Stamens about 20 mm. long, abruptly dilated at base, glabrous. Pistil 25 mm. long, terete, strigose-pubescent except for thinner anterior fifth. Legume dark brown, somewhat glossy, straight, indehiscent, commonly 60 - 100 mm. long, with slightly curved 5 - 15 mm. long caudate apex; sterile basal part 5 - 20 mm. long, golden-strigose; fertile part more or less moniliform with 5 - 9 one-seeded segments 7 - 10 mm. long, 6 - 8 mm. wide, about 4 mm. thick, glabrate to somewhat strigose-pubescent, with 2 rows of 2 - 3 mm. separated rough 1 mm. high wings bordering narrow sides of pod, wings less prominent between seed-bearing areas; in case no seed develops the area remains sublinear. Seeds yellowish brown, smooth, glossy, thick, elliptic-globose, 5 - 6 mm. long, 3 mm. thick, hardly compressed.

The type, deposited in the Marie C. Neal Herbarium of the Bernice P. Bishop Museum, was collected by Rock "On the plateau leeward side, near Koele, back of Gibson [Walter Murray Gibson, 1822-1888] Homestead, flowering and fruiting July 29, 1910. George Campbell Munro (May 10, 1866 - Dec. 4, 1963), who was manager of most of the Island of Lanai for many years and saved much of its endemic vegetation from herbivores, wrote voluminous notes concerning Lanai plants about 1927. From a transcription we took a few years before his death, we find: "Sophora chrysophylla glabra, Rock. Native name manane. Not common, found most commonly on the Kaluanui bench, one plant at Kanepuu from which a number are now growing." Chock cites a plant collected by Munro April 16, 1919, deposited in the Bishop Museum and in NY, from Kaluanui. In a letter to us of July 25, 1957, Mr. Munro wrote us expressly that S. chrysophylla and the var. glabrata grew on Lanai. In fact, regarding the latter, "Rock described this. I did not see it." Munro collected 950 Lanai specimens of ferns and flowering plants, which C.N. Forbes determined. A set

went to the Bishop Museum; another to the Hawaiian Sugar Planters Experiment Station; and the rarest (letter of Oct. 14, 1950) to the "British Museum, Sydney, Australia."

Thanks to the courtesy of the Dole (Pineapple) Company which rented us a cottage, we resided in 1963-64 for about six months on Lanai to botanize. During this lengthy stay, we discovered just mauka of the pineapple fields presumably the last stand of Sophora lanaiensis, beautifully rounded, bright green, lacy trees. About 75 herbarium specimens from this colony are being widely distributed under the following label: "Deg. & Deg. 31,383. Almost extinct! (4 thriving, spreading, 3 m. high trees with many branches arising from low trunk; prolific seeder but not a single seedling because of thick mat of Melinis grass; petals canary yellow; filaments whitish; anthers yellow; pistil greenish yellow.) Kaluanui Bench, Lanai. Decadent, dryish forest with deer browse line. Jan. 24, 1964." Today, with Lanai practically a hunting preserve stocked with feral goat, axis deer, mouflon and pronghorn, we surmise the four trees are no more. At least voucher specimens exist to show how beautiful a creation this species had been. The above description is based on No. 31,383, healthy trees with 5 - 9 seeds per legume; very rarely, perhaps due to faulty pollination, down to only one. Chock's description gives "the pod 1 - 5 seeded".

2. SOPHORA MOLOKAIENSIS sp. nov., nom. nud.

June 1, 1961, with Mr. Noah Pekelo, Jr., we drove to Maunahui, Molokai, and from there took a foresters' jeep road makai eastward to the lower edge of the rainforest. Here we discovered a rather gnarled, ugly mamane new to Science. We collected abundant material and, since Mr. Chock had published on the genus, turned over all our specimens to him. We intended to publish jointly, after a proper drawing had been executed. Before that could be accomplished, Mr. Chock and family removed to the Mainland and the package of specimens lies somewhere in the Museum where, no one knows. We believe this species extinct because, when we collected specimens from the plant in 1961 the area, thanks to the jeep road, was being bulldozed in strips for the planting of Pinus taeda to foster a lumber industry. Eventually, after the herbarium specimens have come to light, we shall properly publish an illustrated description.

The taxa with more or less unifoliolate leaves we prefer to alter in name as follows:

3. SOPHORA UNIFOLIATA (Rock) Degener & Sherff, s.s.

Sophora chrysophylla var. unifoliata Rock in Haw. Bd. Commrs. Agri. & For., Div. For., Bot. Bull. 5:44. 1919.

Edwardia unifoliata Degener, Fl. Haw. Fam. 169c. 1932.

Sophora unifoliata Deg. & Sherff in Sherff, Bot. Leaflet 5:24. 1951.

Sophora chrysophylla ssp. unifoliata Chock in Pac. Sci. 10:155. 1956.

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This taxon, now apparently extinct, grew in the Puuwaawaa region of Hawaii.

3a. SOPHORA UNIFOLIATA var. ELLIPTICA (Chock) Deg. & Deg.

Sophora chrysophylla ssp. unifoliata var. elliptica Chock in Pac. Sci. 10:156. 1956.

This taxon, known from Degener, Bertram & Clay 19,327, was collected in 1948 at Hokukano, East Maui.

3b. SOPHORA UNIFOLIATA var. KANAIOENSIS (Chock) Deg. & Deg.

Sophora chrysophylla ssp. unifoliata var. kanaioensis Chock in Pac. Sci. 10:156. 1956.

This taxon, collected by Forbes in 1920 and by Degener in 1952, is apparently endemic to the neighboring area at Kanaio, East Maui.

So few in the Hawaiian Islands realize the scientific value of our endemics, and ruthlessly destroy them to gain a few pounds of venison or board feet of lumber. Our protests fall on deaf ears. Perhaps some of our akamai legislators and citizens will heed Dr. Melville's statement in his letter to us: "It appears to me that Sophora chrysophylla is an extremely interesting example of diversification in a plant species comparable with that of the Darwin Finches in the Galapagos, and I think this comparison could be made use of in urging the conservation of this species."



The extinct (?) Molokai Sophora collected June 1, 1961.

REVIEW AND COMMENTS ABOUT A THING

Otto & Isa Degener

Between August 2 and 31, 1967, with the help of a \$5,000 grant from the National Park Service, The Nature Conservancy sponsored a scientific expedition into Kipahulu Valley, Island of Maui, Hawaiian Islands. Dr. Richard E. Warner, Foundation of Environmental Biology, Berkeley, California, was leader of about twenty scientists of various biological disciplines and a variable number of guides, *paniola and porters. The specialists in the main volunteered their services or their institutions lent these men for the expedition.

The Conservancy copyrighted the result of the study in 1968 under the title "Scientific Report of the KIPAHULU VALLEY EXPEDITION. Sponsored BY: THE NATURE CONSERVANCY. Edited By: Richard E. Warner, Ph. D. Expedition Leader." The 184 loose-leaf pages, measuring 8 1/2 by 11 inches, are bound in a Manilla cover. There is a panoramic photograph of the valley itself, eight of expedition members, about 49 showing beautifully the type of vegetation, three about the endemic "picture-winged" fruit flies, and four of close-ups of birds. In addition there are full-page maps of Kipahulu Valley showing expedition trails and locations of the three base camps; of soils; a topographic vegetation profile; and of vegetation respectively of the lower, the central, and the upper part of the valley.

Kipahulu Valley extends from sea level to 7,350 feet, more or less in a northwesterly direction, joining Haleakala National Park at its eastern end hundreds of feet above Paliku Cabin. The two mile wide valley funnels the trade winds. Its eight mile length is confined by two very steep ridges clothed largely with tapestry forests, here and there broken by shrubby ledges and some cliffs. The floor consists largely of two nearly parallel, sloping flats, the one about 700 feet higher than the other, especially toward the middle-makai end. This unusual geologic structure is explained by the formation eons ago of a deeply eroded valley on Haleakala Volcano's flank followed by a period of filling by lava flows. During quiescence of volcanic activity, one side of the partly filled valley was then badly eroded by the forerunner of Kaukau Stream. With a fresh period of activity, this new valley within Kipahulu was partly filled with veneers of lava. Thus the higher flat, contrary to expectation, is much older than the lower one.

The lower reaches of the valley from a biotic standpoint are not too interesting, being pasture overgrown with lemon guava and other

*As Spaniards were the first cowboys in the Hawaiian Islands, paniola became the vernacular name for a man of this profession.

exotics. Nevertheless, geologically the area is locally interesting and delightful with the stream forming a series of pools - seven were "sacred" to the Hawaiians - of considerable fame but too profane for discussion in a botanical review.

The rest of the valley to the inversion layer at about 7,000 feet is a dense rainforest. Below a transition band between 3,000 and 4,000 feet, koa (Acacia) is the predominant tree; above, ohia lehua (Metrosideros) predominates, giving way mauka as the terrain becomes increasingly dry to such sclerophyllous shrubs as Dodonaea, Bailliaridia, Styphelia and Vaccinium. The summit slope is crowned with windy flats of the endemic bunchgrass (Deschampsia hawaiiensis f. haleakalensis (Skotts.) St. John (incorrectly identified as D. nubigena) interspersed here and there with endemic bracken (Pteridium aquilinum var. decompositum (Caud.) Tryon, Pellaea ternifolia (Cav.) Link native to the Hawaiian Islands as well as to the Andes, and the endemic Neurophyllodes tridens (Hillebr.) Deg. & Greenw.

Though terrestrial shrubs and herbs as well as lianes and epiphytes abound between 3,000 and 6,000 feet, the warm rainfall of perhaps 200 inches annually, augmented by abundant fog drip, stimulates bacterial decay and dissolution. As a result, the water-drenched soil is practically devoid of litter and exceptionally poor in saprophytic fungi. Above 6,000 feet, with less rainfall and cooler weather, the layer of litter can be two inches thick overlying three inches of humus. Saprophytic fungi are abundant, having available sustenance.

The Report contributes 13 pages to Ecological Conditions; 31 to Vascular Plants and Botanical Potential; 25 to Phytogeography; 3 to Climatology; 1 to Some Observations of the Biotic Factor under headings of pigs, rats, owls and birds [why "owls" are not included in the same category with "birds" is strange indeed]; 5 to Genetics, Evolution and Drosophila Ecology; 7 to other branches of Entomology; 15 to Mosses; 1 to Lakes of Eastern Haleakala; 3 to Mammals; and 16 to Birds, including the rediscovery of one considered extinct.

According to the bibliography given on page 86, the writers (except Mr. William J. Ho) followed some of the archaic plant determinations made by Dr. F.R. Fosberg (incorrectly spelled "Forsberg") for Island of Hawaii plants in Doty, M.S., & Mueller-Dombois, D., Atlas Bioec. Stud. Haw. Volc. Nat. Park. 1966. As one of the reviewers had been Ranger-Naturalist for Hawaii National Park (including Haleakala) in 1929 and both reviewers have lived in and about Haleakala - the kane in 1927 at the grassy head of Kipahulu would have dropped into a crevice of consolidated ash had he not instinctively stuck out his arms akimbo - to study and publish about its flora, they herewith add their opinions regarding the taxonomy given in the Report. Obvious typographical errors, superficially noticed,

needing correction are: Freycinetia, Liparis, Sadleria, Pteridophyta, Asplenium contiguum, Labordia, Lysimachia hillebrandii, Metrosideros, Cheirodendron trigynum, Grimmia haleakalae, Molkenboer, Monachus schauinslandi, Lasiurus and Plagithmysus.

PAGE	REPORT'S VERSION	DEGENER'S VERSION
15	" <u>Dubautia</u> sp." " <u>Pelea clusiaefolia</u> " (Recommendation 73G (c) of the Code.)	Mainly <u>Railliardia</u> sp. <u>P. clusiifolia</u> A. Gray
16	" <u>Lycopodium cernuum</u> " " <u>Ancectochilus s.</u> " " <u>Trematolobelia macrostachys</u> " " <u>Dicranopteris linearis</u> "	<u>L. c.</u> var. <u>crassifolium</u> Spr. <u>Odontochilus sandwicensis</u> (Lindl.) Benth. & Hook. <u>T. sandwicensis</u> Deg <u>D. l.</u> var. <u>maxima</u> Deg. & Deg.
19	" <u>Erechtites valerianaefolia</u> " " <u>Nertera depressa</u> "	<u>E. valerianifolia</u> (Wolf) DC. <u>N. granadensis</u> var. <u>insularis</u> Skotts.
20	" <u>Vaccinium berberidifolium</u> " (As <u>V. penduliflorum</u> var. <u>berberifolium</u> A. Gray was raised by Skottsberg to a species, we see no reason to change the orthography to " <u>berberidifolium</u> .") " <u>Hypochaeris radicata</u> "	<u>V. berberifolium</u> (A. Gray) Skotts. <u>Hypochaeris r.</u> <u>P. c.</u> var. <u>oahuensis</u> (Mueller) Deg. & Deg.
25	" <u>Psilotum complanatum</u> " " <u>Psilotum nudum</u> "	<u>P. n.</u> forma <u>fosbergii</u> Deg. & Deg.
26	" <u>Ophioglossum pendulum</u> ssp. <u>falcatum</u> "	<u>Ophioderma falcatum</u> (Presl) Deg.
27	" <u>Callistopteris baldwinii</u> " " <u>Vandenboschia draytoniana</u> "	<u>Macroglena toppingii</u> Deg. & Deg. <u>Crepidopteris draytonianum</u> (Brack.) Deg. & Deg.
28	" <u>Sphenomeris chinensis</u> "	<u>S. chusana</u> (L.) Copel.
29	" <u>Cyclosorus goggilodus</u> " (That Schkuhr's orthography in text and index is " <u>goggilodus</u> " and on his plate " <u>goggylodus</u> " indicates carelessness by author or printer. Both spellings are meaningless, unintentional errors. Following the Code, we consider correction of the errors to " <u>gongylodes</u> ," an authentic Latin adjective meaning "roundish," proper.) " <u>Cyrtomium boydiae</u> " (Because of venation, this fern hardly belongs in the genus <u>C.</u>) " <u>Dryopteris keraudreniana</u> "	<u>C. gongylodes</u> (Schkuhr) Link <u>? boydiae</u> <u>Toppingia keraudreniana</u> (Gaud.) Deg., Deg. & A.R. Smith
30	" <u>Elaphoglossum alatum</u> var. <u>parvisquameum</u> "	<u>E. parvisquameum</u> Skotts.
36	" <u>Peperomia ligustrina</u> var. <u>copulana</u> "	<u>P. l.</u> var. <u>copulana</u> Yuncker

PAGE REPORT'S VERSION

DEGENER'S VERSION

- "Peperomia lilifolia var. nudilimba" E. lilifolia var. n.
(Recommendation 73G (c) of the Code.)
- 37 "Phytolacca sandwicensis Endl." P. brachystachys Moq.
(Endlicher's binomial is a nom. nud.)
- 38 "Fragaria chiloensis" F. c. var. sandwicensis
(Decaisne) Deg. & Deg.
- 39 "Geranium arboreum" Neurophyllodes arboreum
(A. Gray) Deg.
- "Geranium multiflorum var. ovatifolium" Neurophyllodes ovatifolium (A. Gray) Deg. & Greenw.
- "Pelea clusiifolia" P. clusiifolia A. Gray
- 41 "Eugenia sandwicensis" Syzygium sandwicense (A. Gray) Ndz.
- "Jussiaea suffruticosa var. lingustraeifolia" J. s. var. lingustrifolia (HBK) Griseb.
- 42 "Myrsine lessertiana" Rapanea lessertiana (A. DC.) Deg. & Hosaka
- "Myrsine sandwicensis var. mauiensis" Rapanea s. var. m. (Lév.) Deg. & Deg.
- "Alyxia olivaeformis" A. oliviformis Gaud.
- "Gouldia hillebrandii Forsberg [sic] var. hillebrandii"
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- 46 "Cyanea grimesiana var. ?" C. g. (probably) var. lydgatei Rock
- 47 "Lobelia grayana" Neowimmeria grayana (E. Wimm.) Deg. & Deg.
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- 48 "Dubautia montana var. robustior" Railliardia montana var. robustior Sherff
- "Dubautia thyrsiflora" Railliardia thyrsiflora Sherff
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O. & I. Degener, Review & comments

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PAGE

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One of the main objectives of the expedition was "to prepare a report of the findings for the Nature Conservancy and the U.S. Department of Interior, including recommendations for acquisition, use, and longterm conservation of the area." The part about birds and picture-winged Drosophila, we believe, will be arguments for politicians and intelligent laymen alike to conserve the area under the wing of the National Park Service. These are precisely the individuals who, with contacts and funds, can best implement a project to a successful conclusion. But the botanical part of the report is sorely disappointing and not of much help. No striking plant, like a striking bird, was noted as threatened with extinction even though many, many kinds belong in this category! It took Dr. St. John only until April 1970 to describe and illustrate over a dozen novelties from the area (See Pac. Sci. 25:39-79, 1971.) such as: Panicum lamiatile, Panicum lusitiale, Peperomia kipahuluensis, Pelea anapanapaensis, Pelea clusii-

folia var. minor, Pelea c. var. m. f. stenophylla, Pelea kipahuluensis, Lysimachia spathulata, Clermontia rosacea, Cyanea bicolor, Cyanea haleakalaensis, Argyroxiphium forbesii, Argyroxiphium virescens var. paludosa, Lagenophora viridis and Railliardia demissifolia var. dolichophylla. Further botanical exploration will undoubtedly uncover many more plants new to Science.

Had the importance of plants been stressed as much as of birds and insects, would not the report have been more effective? According to a local newspaper article dated April 3, 1971, " - - - the Nature Conservancy in three years raised \$1.2 million to buy 4,000 acres in Kipahulu Valley to add to Haleakala National Park on the promise the State would add 5,000 acres to it. So far, the land has not been signed over by Gov. John A. Burns. And the lack of action is holding up a further fund-raising effort which the Nature Conservancy hopes will add 400 more acres to the park." Nero played on his Stradivarius while Rome burned to destruction. Will History repeat itself, and Kipahulu be destroyed?

The present reviewers are confused as to what they have reviewed. The 184 illustrated and bound pages have been copyrighted (not patented nor registered), are available in some local libraries, and have been distributed to various interested individuals. Some, not all, copies bear an an insertion claiming that the Report is not a publication! Being neither fish, flesh, fowl nor good red herring, what is this thing?

REVIEW AND COMMENTS ABOUT A THING

Otto & Isa Degener

Between August 2 and 31, 1967, with the help of a \$5,000 grant from the National Park Service, The Nature Conservancy sponsored a scientific expedition into Kipahulu Valley, Island of Maui, Hawaiian Islands. Dr. Richard E. Warner, Foundation of Environmental Biology, Berkeley, California, was leader of about twenty scientists of various biological disciplines and a variable number of guides, *paniola and porters. The specialists in the main volunteered their services or their institutions lent these men for the expedition.

The Conservancy copyrighted the result of the study in 1968 under the title "Scientific Report of the KIPAHULU VALLEY EXPEDITION. Sponsored BY: THE NATURE CONSERVANCY. Edited By: Richard E. Warner, Ph. D. Expedition Leader." The 184 loose-leaf pages, measuring 8 1/2 by 11 inches, are bound in a Manila cover. There is a panoramic photograph of the valley itself, eight of expedition members, about 49 showing beautifully the type of vegetation, three about the endemic "picture-winged" fruit flies, and four of close-ups of birds. In addition there are full-page maps of Kipahulu Valley showing expedition trails and locations of the three base camps; of soils; a topographic vegetation profile; and of vegetation respectively of the lower, the central, and the upper part of the valley.

Kipahulu Valley extends from sea level to 7,350 feet, more or less in a northwesterly direction, joining Haleakala National Park at its eastern end hundreds of feet above Paliku Cabin. The two mile wide valley funnels the trade winds. Its eight mile length is confined by two very steep ridges clothed largely with tapestry forests, here and there broken by shrubby ledges and some cliffs. The floor consists largely of two nearly parallel, sloping flats, the one about 700 feet higher than the other, especially toward the middle-makai end. This unusual geologic structure is explained by the formation eons ago of a deeply eroded valley on Haleakala Volcano's flank followed by a period of filling by lava flows. During quiescence of volcanic activity, one side of the partly filled valley was then badly eroded by the forerunner of Kaukaual Stream. With a fresh period of activity, this new valley within Kipahulu was partly filled with veneers of lava. Thus the higher flat, contrary to expectation, is much older than the lower one.

The lower reaches of the valley from a biotic standpoint are not too interesting, being pasture overgrown with lemon guava and other exotics. Nevertheless, geologically the area is locally interesting and delightful with the stream forming a series of pools - seven

*As Spaniards were the first cowboys in the Hawaiian Islands, paniola became the vernacular name for a man of this profession.

were "sacred" to the Hawaiians - of considerable fame but too profane for discussion in a botanical review.

The rest of the valley to the inversion layer at about 7,000 feet is a dense rainforest. Below a transition band between 3,000 and 4,000 feet, Koa (Acacia) is the predominant tree; above, ohia lehua (Metrosideros) predominates, giving way auka as the terrain becomes increasingly dry to such sclerophyllous shrubs as Dodonaea, Raillardia, Styphelia and Vaccinium. The summit slope is crowned with windy flats of the endemic bunchgrass (Deschampsia hawaiiensis f. halakalensis (Skottsbo.) St. John (incorrectly identified as D. nubigena) interspersed here and there with endemic bracken (Pteridium aquilinum var. decompositum (Gaud.) Tryon, Pellaea ternifolia (Cav.) Link native to the Hawaiian Islands as well as to the Andes, and the endemic Neurophyllodes tridens (Hillebr.) Deg. & Greenw.

Though terrestrial shrubs and herbs as well as lianes and epiphytes abound between 3,000 and 6,000 feet, the warm rainfall of perhaps 200 inches annually, augmented by abundant fog drip, stimulates bacterial decay and dissolution. As a result, the water-drenched soil is practically devoid of litter and exceptionally poor in saprophytic fungi. Above 6,000 feet, with less rainfall and cooler weather, the layer of litter can be two inches thick overlying three inches of humus. Saprophytic fungi are abundant, having available sustenance.

The Report contributes 13 pages to Ecological Conditions; 31 to Vascular Plants and Botanical Potential; 25 to Phytogeography; 3 to Climatology; 1 to Some Observations of the Biotic Factor under headings of pigs, rats, owls and birds [why "owls" are not included in the same category with "birds" is strange indeed]; 5 to Genetics, Evolution and Drosophila Ecology; 7 to other branches of Entomology; 75 to Mosses; 1 to Lakes of Eastern Haleakala; 3 to Mammals; and 16 to Birds, including the rediscovery of one considered extinct.

According to the bibliography given on page 86, the writers (except Mr. William J. Ho) followed some of the archaic plant determinations made by Dr. F.R. Fosberg (incorrectly spelled "Forsberg") for Island of Hawaii plants in Doty, M.S., & Mueller-Dombois, D., Atlas Bioc. Stud. Haw. Volc. Nat. Park. 1966. As one of the reviewers had been Ranger-Naturalist for Hawaii National Park (including Haleakala) in 1929 and both reviewers have lived in and about Haleakala - the kane in 1927 at the grassy head of Kipahulu would have dropped into a crevice of consolidated ash had he not instinctively stuck out his arms akimbo - to study and publish about its flora, they herewith add their opinions regarding the taxonomy given in the Report. Obvious typographical errors, superficially noticed, needing correction are: Freyinetia, Liparis, Sadleria, Pteridophyta, Asplenium contiguum, Labordia, Lysimachia hillebrandii, Metrosideros, Cheirodendron trigynum, Grimmia haleakalae, Molkenboer, Monachus schauinslandi, Lasiurus and Plagithmysus.

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- 15 "Dubautia sp."
 "Pelea clusiaefolia"
 (Recommendation 73G (c) of the Code.)
- 16 "Lycorodium cernuum"
 "Anoctochilus s."
 "Trematolobelia macrostachys"
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 "Dicranopteris linearis"
- 19 "Erechtites valerianaeifolia"
 "Nertera demissa"
- 20 "Vaccinium berberidifolium"
 (As V. penduliflorum var. berberifolium A. Gray was raised by Skottsberg to a species, we see no reason to change the orthography to "berberidifolium.")
- 25 "Hypochoeris radicata"
 "Psilotum complanatum"
 "Psilotum nudum"
- 26 "Ophioglossum pendulum ssp.
falcatum"
- 27 "Callistopteris baldwini"
 "Vandenboschia draytoniana"
- 28 "Sphenomeris chinensis"
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P. clusiifolia A. Gray
L. c. var. crassifolium Spr.
Odontochilus sandwicensis
 (Lindl.) Benth. & Hook.
T. sandwicensis Deg.
D. l. var. maxima Deg. & Deg.
E. valerianifolia (Wolf) DG.
N. granadensis var. insularis Skottsbg.
V. berberifolium (A. Gray) Skottsbg.
Hypochoeris r.
P. c. var. oahuensis (Muel-ler) Deg. & Deg.
P. n. forma fosbergii Deg. & Deg.
Ophioderma falcatum (Presl) Deg.
Macroglena toppingii Deg. & Deg.
Crepidopteris draytonianum (Brack.) Deg. & Deg.
S. chusana (L.) Copel.
C. gongyloides (Schkuhr) Link
? Boydiae
Toppingia keraudreniana (Gaud.) Deg., Deg. & A.R. Smith
E. parvisquamum Skottsbg.
P. l. var. copulana Yuncker
P. lilifolia var. n.

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	<u>"Racomitrium"</u>	<u>Rhaconitrium</u>
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SOME ALEURITES TAXA IN HAWAII
AND
A NOTE REGARDING ARGEMONE

Otto & Isa Degener

Due to Dr. B.C. Stone's wanderlust and resulting peregrinations from the University of Hawaii to the Smithsonian, then to the College of Guam, and now to the University of Malaya at Kuala Lumpur, our plans, agreeable to us three by letter to jointly describe a "mango-leaved" taxon of Aleurites, went awry. In fact, even the small specimen we had mailed him on loan as type and cotypes is presumably stored in some forgotten herbarium cabinet in one of the above institutions and presently beyond reach.

Now we two find the new taxon named in Pacific Science as a nom. nud. As agreed by past correspondence (much pertaining to plants has been deposited in the Hunt Botanical Library in Pittsburgh), we three validly name this novelty as follows:

ALEURITES MOLUCCANA var. KATOI Degeners & Stone. A var. moluccana folia lanceolata differt.
KATO KUKUI, MANGO-LEAVED KUKUI

Aleurites moluccana var. katoi Degeners & Stone nom. nud., ex
Stone in Pac. Sci. 21:553. 1967.

The variety katoi differs mainly from the var. moluccana in bearing lanceolate leaves occasionally widened by two obscure lobes near base of blade.

As stated on page 553, the taxon "is named for Mr. Tadayuki Kato of Kauai High School, who has been very helpful to me and to other visiting botanists. The holotype specimen, taken from the tree on the grounds of Kauai High School in Lihue, is at the Bishop Museum (Stone 3427, collected on 15 April 1960)." That "A further specimen collected by Dr. Degener is also available" is not strictly correct. Otto & Isa Degener 23,956 was collected by Mr. Hans W. Hansen from a cultivated tree on Kauai on Sept. 24, 1955. Whether Degeners 23,956 of 1955 and Stone (collected with Kato according to herbarium sheet label) 3,427 of 1960 are from the same tree, we do not know. According to Mr. Hansen, his plant was a cultivated one and was said to be native to Samoa.

In Hawaiian and most other Polynesian dialects, typical Aleurites moluccana is known as "kukui" or some variant of this spelling. In English it is often called the "candlenut tree," referring to its former use as a source of light. The

Kato kukui, with its unusual "mango leaves," is conspicuous and attractive. So by this time it may be seen cultivated here and there about residences and in parks.

ALEURITES MOLUCCANA var. REMYI (Sherff) Stone, the Remy kukui, is a reduction made in the same publication by Stone of A. remyi Sherff in Field Mus. Bot. Ser. 17:558. 1939. We early followed Dr. Sherff, printing an illustrated description of this taxon in our Flora Hawaiiensis. After studying a large series of sheets of Aleurites recently, we noted that both the remyi and the katoi tendencies occur in various islands of the South Pacific. We now tend to the belief that Stone's interpretation may be the superior one.

The first paragraph of Stone's page 552 is obviously garbled: The "mango-leaved" kukui (var. katoi) with practically no lobes is obviously not the same as the "Kona" kukui (var. remyi) with very narrow lobes.

ALEURITES MOLUCCANA var. AULANII Deg. & Deg. var. nov. Arbor semenibus circa 23 mm. latis.
AULANI KUKUI, SMALL-SEEDED KUKUI

This hitherto undescribed variety has seeds about 23 mm. wide, 15 mm. thick and 20 mm. high; while the ubiquitous var. moluccana has them commonly 30 mm. wide, 23 mm. thick and 30 mm. high. The type is Deg. & Deg. 32,481. Collected in Kukuihaele, Hawaii, by Stanley and Aulani Loo, March 28, 1971, and deposited in NY.

The botanical recognition of this taxon was fortuitous. Forced by a broken tooth into Dr. Robert N. Ogawa's dental chair in Hilo, Hawaii, the kane patient learned that Mrs. Ogawa was an amateur botanist, the daughter a professional botanist with the University of Michigan, and Dr. Ogawa himself an ardent maker of seed lei or necklaces as a hobby. In the case of the kukui "nut," turned ebony black by burial in a taro patch, Dr. Ogawa explained his perfected method of preparing the seeds. The conversation then changed to the prevalent rumor of a small-seeded kukui growing in isolated Waipio Valley, District of Kohala. Apparently only one tree remains in this once heavily populated valley, badly mauled by careless collectors of its prized seeds. The dentist was a bit evasive.

Returning for further treatment days later, the patient was surprised and delighted to receive from Dr. & Mrs. Ogawa a truly regal lei for Mrs. Degener consisting of 25 matched, dwarf kukui seeds originally collected in Waipio Valley and neighboring Kukuihaele. "Kukuihaele," contrary to our hope, does not refer to this rare kukui variety. The complex word

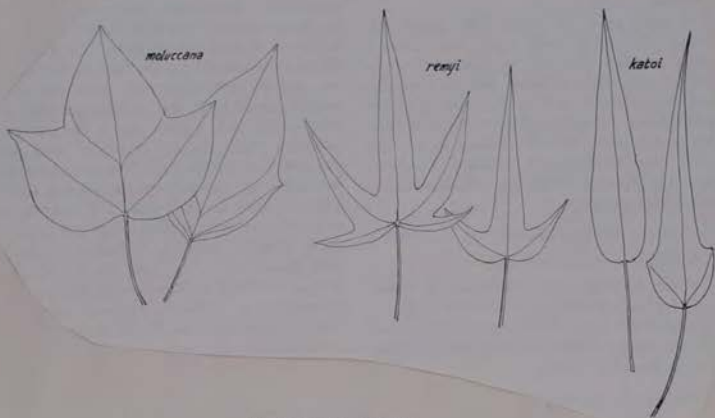
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Degener & Degener, Some Aleurites taxa

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means "moving kukui tree," probably in allusion to the action on the trees of the strong trade winds funneled between the heights of Mauna Kea and Kohala.

As one surprise deserves another, the writers named this new taxon provisionally var. ogawae, mailing a copy of the manuscript to Mrs. Ogawa with the plea she furnish good flowering and fruiting material from a chosen tree as type and co-type specimens.



After B.C. Stone

The third surprise was an answering 'phone call from Mrs. Ogawa: The couple had not collected the material at all. The collector had been Mr. Stanley *Kolomona Loo, a resident of Honokaa of Chinese-Hawaiian ancestry, and his son Aulani. The family knows of two trees growing on such precipitous terrain that the father must help his son Aulani to and from the trees with aid of a rope. As these trees are such a rarity and might be injured by vandals or careless visitors, we feel it wise not to divulge their location. Because of Mrs. Ogawa's insistence and Mr. Loo's knowledge and advice, we here name the plant in his son's honor Aleurites moluccana var. aulanii. The name "Aulani" is particularly appropriate for the kukui or candlenut as it means "Light of Heaven" in Hawaiian.

The unspoiled native Hawaiian forests (some have escaped lumbering, or bulldozing for other commercial interests) teem

*As the Hawaiian alphabet lacks the letter "S", "K" is substituted for it.

with endemic birds and endemic insects, all nicely adjusted to one another over eons of time. On the contrary, as we have mentioned elsewhere, our kukui forests are conspicuously silent except for the occasional thud of a heavy kukui fruit striking the ground; nor are they teeming with insects. Furthermore, thus far no one has unearthed kukui pollen among other fossil pollens in old, undisturbed layers of earth. These observations and the fact that the kukui is so valuable to the Polynesians for light, food, medicine, native jewelry, tapa dye, gum and for tanning fishnets moves us to the belief that the tree is of aboriginal introduction from the South. Birds and insects, during the couple thousand years of its possible introduction, simply have not yet had time to become adjusted to the plant or to evolve with the plant as they have done to the unquestionable endemic ones in the Hawaiian flora.

Whether the rumor is true regarding the arrival at least of one tree of variety katoi coming from Tahiti or Samoa presumably since the landing of Captain Cook in 1778, we are almost certain that varieties remyi and ualanii were here before that date. Did such taxa develop de novo in the Hawaiian Islands, or are they relics of taxa the Polynesians had brought with them from the South? If the latter is true, a careful comparison in museums of taxa in the Hawaiian Archipelago with those in the South Seas should add evidence as to the migrations and island stop-overs made before these vikings of the sunrise settled in Hawaii Nei to intermarry, multiply and become amalgamated into a distinct race recognizable by their distinctive features as the true kamaaina.

Should the pricklepoppy once so common on Oahu be Argemone glauca L., A. glauca Pope, A. glauca (Prain) Degener or A. glauca (Prain) Deg. & Deg.? Regarding Dr. Stone's assumptions about the Argemone binomial, appearing in the same article on page 550, the kane writer had the simple explanation had he been asked for it. He enrolled at the University of Hawaii for the 1922-23 school year, frequently taking the Honolulu trolley to the end of the Kaimuki line. There he botanized in the red 'dobe soil and dust, collecting such xerophytes as Waltheria, Sida, Lipochaeta, Jacquemontia and Argemone, plants now replaced by houses and watered lawns with bordering cultigens. A New Yorker, he returned to his home, enrolling for an advanced degree at Columbia University, though spending most of his time critically identifying his Hawaiian collections at the affiliate, the New York Botanical Garden. There he identified the Argemone, judging its correct name to be Argemone glauca (Prain) Degener and thus noting it in his manuscript for a "Flora Hawaiiensis" he hoped eventually to publish. In fact, he printed the name "Argemone glauca" in 1930 in his "Plants Hawaii National Park."

While he was at his home on Vancouver Highway, later re-named University Avenue, Honolulu, Dr. Willis Pope, first President of the College of Hawaii in fact but not in name and later prominent horticulturist of the government experiment station in Makiki Valley, came to visit him with the bulky manuscript of his "Manual Wayside Plants Hawaii." He left it with the writer, who spent the better part of a week sometimes with Dr. Pope but mostly alone, revising it. One of the first deletions he recommended which, however, was not followed, were marine algae! Among one of the many corrections he made was changing Pope's name of Argemone mexicana to A. glauca (Prain) Degener. Whether Dr. Pope or more likely some later reviser of the same manuscript altered the authority to "Argemone glauca L.", wissen nur die Götter. As the Degeners have been in frequent correspondence for decades with Dr. Stone mainly concerning the genus Pelea, a simple inquiry about Argemone would have saved the making of unnecessary assumptions.

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