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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.

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I emigrated to the then Territory of Hawaii directly upon graduation from the University of Massachusetts in 1922. Arriving at actually a frontier community, I lacked adequate herbarium and library facilities in Honolulu to be able to write a local Flora in a logical way: monograph after monograph. The only method, under the circumstances, to produce my Flora Hawaiiensis was to print it loose-leaf, each sheet representing some one species I could work up with the source books at hand. These were Engler-Prantl publications; Gray's Manual; Britton & Brown; Britton's "Flora of Bermuda;" Hillebrand's excellent but antiquated "Flora of the Hawaiian Islands," published posthumously in 1888 (Hillebrand had left the Islands in 1871); and a small collection of pertinent pamphlets.

Surrounded everywhere by living, undescribed endemics beyond my facilities to work up, I invited by a brief note in Torreya 33 : 123. 1933 ("An Opportunity to Cooperate in the Study of Hawaiian Plants") monographers of the World to help get order out of chaos. I logically concentrated on field work, ever siphoning my finds to leading specialists. Thus almost every monograph dealing with Hawaiian plants published after about 1928 at least cites my collections, often quotes me and not infrequently contains descriptions of novelties published jointly with me. Articles by me alone are in the minority. Nevertheless, the following uncritical list of titles represents papers in which Otto Degener somewhere "had his finger in the pie;" The books written alone, listed in more detail below, are "Plants of Hawaii National Park," "Naturalist's South Pacific Expedition: Fiji," and "Flora Hawaiiensis or New Illustrated Flora of the Hawaiian Islands," Books 1 - 6.

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As the above references show, I am primarily a collector in regions where collecting is extremely important due to the rapidity with which the native flora is being exterminated; secondarily, a botanical writer. These pages, incidentally, give pertinent references for writers desiring to continue the Flora Hawaiiensis.

Book Review
Otto & Isa Degener

(—) "DRUGS AND FOODS FROM LITTLE-KNOWN PLANTS: Notes in Harvard University Herbaria," by Siri von Reis Altschul, xii xll & 366 pp., Harvard University Press, Cambridge, Mass. 02139. 1973. $LO.00.

This is an attractively bound book adequately reviewed by Alma L. Moldenke in the March 1975 issue of "Phytologia." For Hawaiian residents we wish to add that the author performed worthwhile drudgery in culling from the two and a half million sheets deposited in the herbaria of Harvard University over 5,000 quotations regarding the alleged medicinal and other native uses noted on plant labels by collectors. Among these last may be mentioned Degener & Ordonez, van Royen, Rock, and A.C. Smith. It is a pity that the need for space induced the author to omit the authorities for the scientific plant names, thus perhaps inducing some confusion. As expected in such work where the collectors' handwritings may be difficult to read, errors appear. For example regarding Alphitonia moluccana, van Royen & Sleumer, not "Schleumer," collected specimen 5848 in New Guinea in 1961; and regarding Gardenia storckii, O. Degener collected specimen No. 15064 in Fiji in 1941. Degener never used the spelling "cocoanut" as there attributed to him. It is unfortunate that this labor of love, completed in the '60s, is not being kept up to date. It furnishes research workers, usually empirically noticed, for the discovery especially of new medicines and organic chemicals. clues

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Aug. 3, 1974.

Dear Dr. Stafleu:

To save time, we should like your reaction to the enclosed manuscript. We plan to submit it in toto to our Hawaiian Botanical Society Newsletter. As the readers are just a handful of professional botanists and a large number of gardeners and amateurs, we believe a simple paragraph like the last one on page 1 ("Because the tax") is desirable. It must be omitted, however, for more erudite botanical readers such as those of Taxon or Phytologia.

The first paragraph on page 3 ("One of the reviewers") should stand IF we are correct about Conocarpus. I have written to my colleagues at the New York Bot. Garden for advice, and Mrs. Degener & I can settle whether we wish this paragraph deleted or not when we get our answer.

With the above information, can Taxon publish our review? Do please let us know soon, so that if it is unsuitable we can submit it to Phytologia or elsewhere. It is certainly high time for this review to appear of a book published in August 1973. We never knew, in our isolation, that it ever existed until recently!

We believe European and North American taxonomists should stop getting excited about some trivial new taxon in their local floras, and instead hop a 'plane for the Hawaiian Islands to record our botanical wealth before all is lost forever.

I am beginning to act my age in my writings - getting a bit garulous. If you cannot use the enclosed ms., please return it. It would save me the trouble of typing another from my smeary carbon copy.

Aloha,

Dr. Otto Degener

BOOK REVIEW AND APPRAISAL OF HAWAIIAN TAXONOMY

Otto & Isa Degener

"List of Flowering Plants in Hawaii," authored by Harold St. John August 30, 1975, is Memoir Number 1 of the Pacific Tropical Garden of the Island of Kauai. The book, in board covers, comprises 380 pages. It sells for $22.50, with a special price of $15.00 for students. This work is a vade mecum for the professional botanist and advanced student interested in the taxonomy of the Hawaiian Islands. It is indispensible for every institution housing a collection of Polynesian plants. The body of the book devotes pages 9 to 13 to Gymnospermae; 14 to 132 to Monocotyledones; 133 to 159 to to Dicotyledones; 369 to 374 to "New Names or Combinations"; 375 to 378 to an addendum; and finally an index ending with page 519.

"The aim of this publication is to present a list of the flowering, or higher, plants known to be in the Hawaiian flora. For each is given the scientific and common names of the plant, genus, species, and infraspecific taxon. The name of the author of the scientific name is given in full or in abbreviation, and the date of publication is added. If the plant is restricted to one or more of the Hawaiian Islands, hence a native to that region, its scientific name is printed in bold face, - - - and the islands where it occurs are listed. If it is native to the islands, but also to other regions, it is printed in bold face and is marked indig. - - -. If it is an introduced weed, it is printed in Roman type - - -. If the plant is described or mentioned in any of the four basic books on Hawaiian botany, those by Hillebrand, Rock, [*] Degener, and Neal, a page reference to it is given. Since the date of publication of each scientific name is given, it would have been helpful also to have given the full reference to its place of publication. Although these references were verified, this detail is deemed beyond the scope of the present summary."

*Taxon 18[5]:571. 1965.

To be sure, full citation of species would have added to the cost and bulk of the volume quite unnecessary as such information, except for dates, is readily available in the Index Kewensis. For the reviewers, however, full citation of trinomials ignored by the Index would have enhanced still more the value of the "List" by saving the reader the drudgery of scouring a library for such obscure references.

Because the taxonomic characters of a population of plants are so variable and various taxonomists judge the importance of characters differently, no two workers can be expected to agree fully on the precise composition of a flora. To the lay person this sincere search for truth by each variable

Taxonomist and his temerity to express it in print may appear as mere quibbling. The present "List" is the mature botanical judgement of the author, a judgement of value due to his keen training, insight, diligent field work and herbarium study for many years. With this in mind, the reviewers here do not express their criticisms, but rather their opinions of a field familiar to them.

In almost 8,000 scientific plant names the reader can expect typographical and other errors made by the author andor type setter, and never noted by the proofreader. Among such annoyances, we wish the author had used in keeping with Article 73, note 6 rather than note 5 of the International Code the specific names kauaiensis and mauiensis rather than kavaiensis (p. 188 & elsewhere) and maviensis (p. 207 & elsewhere). According to a local gazetteer, the islands Kauai and Maui were never called "Kavai" and "Mavi." On the other hand, he erroneously ascribes the binomial Xanthium pennsylvanicum to O. Degener (p. 369) without comment when the latter expressly stated why he used "pensylvanicum." Incidentally, the correct archaic spelling "pensylvanicum" is used in Recommendation 73D of the Code.

Regarding an epithet taken from the name of a man, the author cites over eighty binomials, such as Calamagrostis Hillebrandi (p. 22) in which the specific word fails to end in "ii." He similarly cites about ten binomials such as Carex Nealae (p. 44), honoring Marie C. Neal, without using our preferred orthography "nealiae." At times incorrect species names, such as "Eragrostis Hosaka"(p. 28) are corrected emphatically to "Hosakae," yet a bit inconsistently such errors as"Pritchardia Munroii"(p. 58), "Cyrtandra Wawrai" (p. 314) and "Plantago Krajinai" (p. 319) fail of correction and comment. In about fifty cases where species names are of compound origin, the connecting vowel or vowels are wrong. Thus "Drymophloeus olivaeformis" is corrected to D. "oliviformis" (p. 54), yet the name "Alyxia olivaeformis" (p. 279), that of a common Hawaiian liana, remains a stumbling block for the gullable student reader. There, no correction is made. Too many connecting vowels are "iae" instead of the correct "ii." The present comment is registered with the hope that the author will make desirable changes in a future edition, and that botanists of the World will vote to alter Recommendation 73C (and many others) in the Code into retroactive mandates. It would ease such burdens to memory whether the species of a certain Hawaiian plant is correctly spelt the archaic way "hillebrandi" and "nealae" or spelled in the more modern way "hillebrandii" and "nealiae."

The spelling of the generic names Exocarpos (see p. 148) and Sigesbeckia (see p. 366) have been conserved over all other names in spite of prior date of publication. "Eichornia" (p. 79) is an error. "Eichhornia," though

strange to a reader not versed in German, is correct. A squirrel in German is called Eichhörnchen because, we presume, it favors living in Eichen or oak trees, and has ears each with a horn-shaped tuft of fur. The botanist Eichhorn, for whom the water hyacinth genus was named by Kunth in 1842, we suspect, had some forebear somehow associated with the squirrel. Be that as it may, the double "hh" in Eichhornia is the proper orthography.

One of the reviewers, who introduced the lovely, silky, street tree to Hawaii from New Providence Island (Nassau), used the binomial Conocarpus erecta L., in his Flora in 1937 for the glabrous variety. He was under the impression that Linnaeus had in mind that Conocarpus was a tree or arbor, a word feminine in Latin. Linnaeus therefore purposely had given the species the feminine ending. If the name is to be changed to the more logical erectus as the author has done (p. 248), should not logically the specific names of many oaks, such as Quercus alba and Q. nigra be changed to Q. albus and Q. niger respectively? The word Quercus has the masculine ending. To consider a genus ending in "carpus" masculine is the wise Recommendation 75A of the Code. It is unfortunately not retroactive as the author explains on page 206.

Botanists are human, and the author is no exception. He favors most of the opinions held by a former protegé regarding local Rubiaceae even though three or four colleagues disagree. Chromosome counts, not available years ago, appear to discredit some older beliefs regarding relationships.

The "List of Flowering Plants in Hawaii" is so valuable for its many facts regarding our state of knowledge up to 1973 of the local flora that any adverse remarks expressed about the book are trivial. Its "Summary of the Flowering and Seed Plants in the Hawaiian Flora," page 4, prompts the following digression:

The reviewers believe the Hawaiian Archipelago may well have boasted an endemic flora of 50,000 endemic species and infraspecific taxa before the advent of man. At that time close to 99% of the native organisms occurring in the Islands from sea coast to mountain top were endemic. The Hawaiian Islands before man's coming were truly a Paradise of the Pacific.

Man first discovered the Hawaiian Islands just a few thousand years ago. He belongs to the Polynesian race, and brought with him during frequent early voyages animals and plants. Among the former were dogs, pigs, chickens and, probably as stowaways, rats. Among the latter introductions were many plants useful as clothing, food, and medicine, mostly cultigens of Marquesan, Samoan and Tahitian origins.

As the Polynesians bred and multiplied on the choicest islands to devel-

op into a superb new strain aptly called Hawaiian, the lowlands particularly in the drier, lee sides and the coastal valleys on the wetter, windward side became heavily populated. "Overpopulation" was tempered not by infectious diseases but rather by famine, war, infanticide, and sacrifice of men on the altar. Set fires and the pursuit of agriculture wiped out much of the original, extensive, dry forests; *Pritchardia palm groves

footnote *Phytologia 21:320-326. 1971.)

and shrubby plains where so many endemic taxa are usually restricted to limited areas. Man and especially feral pigs, certainly decimated the vegetation in many areas where agriculture was not practiced. We shall not mention the slaughter for food andor feathers of flightless and other birds, and the hunting of the monk seal. Thus a few thousand years of pseudoneolithic man exerted a profound influence on the biota.

The second ~~major~~ discovery of the Hawaiian Islands occurred during the Sixteenth Century when a Spanish galleon was shipwrecked on the Island of Hawaii - galleons have been sailing yearly between Acapulco, Mexico and Manila, Philippines for centuries. The "unwritten literature" or epics of the Hawaiians handed down from father to son refer to such an occurrence, some natives now living along the Kona Coast of Hawaii maintain their relationship to some of these Spaniards, natives were in possession of metal of European origin before Captain Cook's coming, and they may have had the pineapple or hala-kahiki since Spanish times. Any baneful influence on the endemic biota, however, by the Spaniards was probably nil.

The third discovery of the Hawaiian Islands began with Captain Cook's landfall in 1778. This opened the Islands up to the present to two hundred years of viciously efficient extermination of endemics by the introduction of Occidental and Oriental crop plants, ornamentals, trees for timber, and aggressive Mainland weeds and plant diseases; to livestock and herbivorous game animals preferring an endemic diet, to aggressive insect pests; and to the bulldozing of vast areas for human habitation, roads, golf courses, etc. Some of such destruction of endemics is unfortunate but justifiable; yet much is inexcusable, wanton vandalism. Due to population pressure, this destruction during the last few "bulldozer decades" has been geometric rather than arithmetric in extent.

Yet despite wholesale destruction, goodly proportions of most islands are still relatively undefiled, particularly in our two National Parks, in the fogbelt too wet for crop plants and farm animals, and on the precipitous slopes. Botanists of the World should realize that the Hawaiian Islands are still the Mecca for taxonomic research - such work has hardly begun! Too often when a novelty has been discovered that does not fit any description

in Hillebrand's "Flora of the Hawaiian Islands," an excellent book for the time it was published posthumously in 1888, the finder would discard it with the casual remark that endemics are hopelessly polymorphic or that his specimen represents an individual belonging to a swarm of hybrids. To us the author's statement that endemic species and infraspecific taxa number 2,668 is patently absurd; nor are we at all in agreement that "The endemic, indigenous, and adventive plants in the flora have been well collected and are now quite well known."

It has long been the reviwers' conviction that the flora of the Hawaiian Islands in Captain Cook's time did not consist of a mere 2,668 taxa, but of 20,000 or more likely 30,000! Diligent monographic work on historical specimens collected since David Nelson's botanizing during Cook's voyage and diligent collecting and studying of the presently surviving flora, should enable us to know about half the elements that were living two hundred years ago. An inkling of the reviwers' assertion of the number of taxa is shown, for example, by the author's treatment of the genus Cyrtandra (Gesneriaceae), beginning on page 308. Note the reviewers' following tabulation for the major islands of the Hawaiian Archipelago:

ISLAND	NUMBER OF TAXA	SQUARE MILES	SUMMIT IN FEET
Oahu	128	604	4,045
Maui	29	728	10,025
Hawaii	23	4,030	13,792
Kauai	22	555	5,170
Molokai	13	260	4,970
Lanai	4	141	3,370

Cyrtandra taxa are partial to wet jungles, and these peter out above the inversion layer where the terrain becomes increasingly dry. This is at about 7,000 feet elevation. Hawaii and Maui, with high mountains, nevertheless have vast rainforests. Can it be true that they harbor but 23 and 29 Cyrtandrae respectively? Though Kauai has about fifty square miles less area than Oahu, it has a somewhat greater elevation. This greater range in resulting temperature might well increase speciation. Kauai, according to the author, has 22 taxa to Oahu's 128! In fact, Oahu with its ~~XXX~~ 604 square miles has 128; while the other five islands with a combined total of 5,814 square miles have only 911 The explanation for the discrepancies is not botanical, but HUMAN.

Oahu has been the center of human activity for nigh two hundred years. It is the seat of the capital, Honolulu, where the Bishop Museum and the University are located. Most visiting botanists resided there, and collected within easy walking, riding or driving distance of the city. Teachers,

not excluding the author of the "List," scoured Oahu with their students week-ends and holidays for its botanical riches. The outside islands, in contrast always have been neglected. What wealth of plants must still be growing there unknown to man! What applies to Cyrtandra, relatively unknown in the Archipelago excepting on Oahu, applies more or less to the remaining native genera.

With this in mind, the reviewers appeal to the biological workers of the World to come to this Mecca to collect its neglected riches before "progress" destroys them. With the torch of knowledge feebly flickering during the last decade of questionable political ethics in Washington, Federal funds for Hawaiian taxonomy have high dried up. Even the fabulous Marie C. Neal Herbarium is lying fallow in Honolulu for want of funds. As botanists cannot prevent the continuous slaughter of one endemic taxon after another, they should at least attempt to collect, preserve and record as much of the Hawaiian flora that is still extant so that future generations shall have a better understanding of what a splendid Paradise their forebears lost.

Book Review and appraisal of Hawaiian Taxonomy
Otto & Isa Degener

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Book Review

rather than kavaiensis (p. 188 & elsewhere) and maviensis (p. 207 & elsewhere). According to a local gazetteer, the islands Kauai and Maui were never called "Kavai" and "Mavi." On the other hand, he erroneously ascribes the binomial Xanthium pennsylvanicum to O. Degener (p. 369) without comment when the latter expressly stated why he used "pensylvanicum." Incidentally, the archaic spelling "pensylvanicum" as used in Recommendation 73D of the Code.

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Botanists are human, and the author is no exception. He favors most of the opinions

held by a former protegé regarding local Rubiaceae even though three or four colleagues disagree. Chromosome counts, not available years ago, appear to discredit some older beliefs regarding relationships.

The "List of Flowering Plants in Hawaii" is so valuable for its many facts regarding our state of knowledge up to 1973 of the local flora that any adverse remarks expressed about the book are trivial. Its "Summary of the Flowering and Seed Plants in the Hawaiian Flora," page 4, prompts the following digression:

According to many modern geologists a plate of the earth's crust under the Pacific Ocean is moving about one to two decimeters per year westward, its edge sliding under Japan to cause volcanism and earthquakes. This action has been transpiring from time immemorial. In conjuction with this movement, a more or less permanent "hot spot" exists precisely where the Island of Hawaii now stands. In fact, this island is the result of veneer upon veneer of lava spilling up from this area for perhaps the last 50,000,000 to 25,000,000 years. It may have taken half the time for the accumulation of lava actually to grow up from the bottom of the ocean to break its surface to begin to produce the island. What is transpiring now with Hawaii has been happening in the past. Thus a lovely fleet of islands has been launched, traveling ever toward the setting sun. Maui and Molokai have advanced a mere and miles respectively from the "hot spot:" Kauai, miles; while Midway has had such an enormously early head start that it is not only miles away but has given the elements plenty of time to erode it down toward sea level.

The Hawaiian Archipelago, considering its beginning from the ocean depths, may be one or more hundred million years old. It has been a haven, since its terrestrial birth, for archaic plants (and animals) that have developed in unique directions prompted by isolation on different islands, on different mountain tops and in different gulches, and in kipukas formed by veneering and branching lava flows. Amalgamation of island from time to time and frequent hybridization have stimulated speciation. After the initial successful immigration from the Continents had waned, immigration was keen between elements of the Archpelago itself. The Hawaiian Archipelago may well have boasted an endemic flora of ferns and flowering plants of 50,000 endemic species and infraspecific taxa before the advent of man.

Man first discovered the Hawaiian Islands just a few thousand years ago. He belongs to the Polynesian race, and brought with him during frequent early voyages animals and plants. Among the former were dogs, pigs, chickens and, probably as stowaways, rats. Among the latter introductions were many plants useful as clothing, food, and medicine - mostly cultigens of Marquesan, Samoan and Tahitian origins. At that time close to 99% of the organisms occurring in the Islands from sea coast to mountain top were endemic. The Hawaiian Islands before man's coming were truly a Paradise of the Pacific.

As the Polynesians bred and multiplied on the choicest islands to develop into a superb new strain aptly called Hawaiian, the lowlands particularly in the drier, lee sides and the coastal valleys on the wetter, windward sides were heavily populated. "Overpopulation" was tempered not by infectious diseases but rather by famine, war, infanti-

cide, and sacrifice of men on the altar. Set fires and the pursuit of agriculture wiped out much of the original, extensive, dry forests; Pritchardia palm groves (Phytologia 21:320-326. 1971.) and shrubby plains where so many endemic taxa are usually restricted to limited areas. Man and especially feral pigs, certainly decimated the vegetaion in many areas where agriculture was not practiced. We shall not mention the slaughter for food andor feathers of flightless and other birds, and the hunting of the monk seal. Thus a few thousand years of pseudoneolithic man exerted a profound influence on the biota.

The second ~~major~~ discovery of the Hawaiian Islands occurred during the Sixteenth Century when a Spanish galleon was shipwrecked on the Island of Hawaii - galleons have been sailing yearly between Acapulco, Mexico and Manila, Philippines for two centuries. The "unwritten literature" or epics of the Hawaiians handed down from father to son refer to such an occurrence, some Hawaiians living near Kealakekua Bay, South Kona Coast of Hawaii maintained their relationship to some of these Spaniards, ~~the~~ natives were in possession of metal of European origin before Captain Cook's coming, and they may have had the pineapple or hala-kahiki since Spanish times. Any baneful influence on the endemic biota, however, by the Spaniards was probably nil.

The third ~~major~~ discovery of the Hawaiian Islands was Captain Cook's landfall in 1778. This opened the Islands up to the present to two hundred years of viciously efficient extermination of endemics by the introduction of Occidental and Oriental crop plants, ornamentals, trees for timber, and aggressive Mainland weeds and plant diseases; to livestock and herbivorous game animals preferring an endemic diet, to aggressive insect pests; and to the bulldozing of vast areas for human habitation, roads, golf courses, etc. Much of such destruction of endemics is unfortunate but justifiable; yet much but is inexcusable, wanton vandalism. Due to population pressure , this destruction during the last few "bulldozer decades" has been geometric rather than arithemtric in extent.

Yet despite wholesale destruction, goodly proportions of most islands are still relatively undefiled, particularly in our two National Parks, in the fogbelt too wet for crop plants and farm animals, and on the precipitous slopes. Botanists of the World should realize that the Hawaiian Islands are still the Mecca for taxonomic research - such work has hardly begun! Too often when a novelty has been discovered that does not fit any description in Hillebrand's "Flora of the Hawaiian Islands," an excellent book for the time ~~when~~ it was published posthumously in 1888, the finder would discard it with the casual remark that endemics are hopelessly polymorphic or that his specimen represents an individual belonging to a swarm of hybrids. To us the author's statement that endemic species and infraspecific taxa number 2,668 is patently absurd; nor are we at all in agreement that "The endemic, indigenous, and adventive plants in the flora have been well collected and are now quite well known."

It has long been the reviwers' conviction that the flora of the Hawaiian Islands in Captain Cook's time did not consist of a mere 2,668 taxa, but ~~XXXXXX~~ of ~~XXXX~~ 20,000 or more likely 30,000! Diligent monographic work on historical specimens collected since David Nelson's botanizing during Cook's voyage and diligent collecting and studying of the presently surviving flora, should enable us to know about ~~XXX~~ half the elements that were living two hundred years ago. An inkling of the reviewers' assertion of the large number of taxa is shown, for example, by the author's treatment of the genus Cyrtandra

(Gesneriaceae), beginning on page 308. Tabulating it, Note the following for the major islands of the Hawaiian Archipelago:

ISLAND	NUMBER OF TAXA	SQUARE MILES	SUMMIT IN FEET
Oahu	128	604	4,045
Maui	29	728	10,025
Hawaii	23	4,030	13,792
Kauai	22	555	5,170
Molokai	13	260	4,970
Lanai	4	141	3,370

Cyrtandra taxa are partial to wet jungles, and these peter out above the inversion layer where the terrain becomes increasingly dry. This is at about 7,000 feet elevation. Hawaii and Maui, with high mountains, nevertheless have vast rainforests. Can it be true that they harbor but 23 and 29 Cyrtandrae respectively? Though Kauai has about fifty square miles less area than Oahu, it has a somewhat greater elevation. This greater range in temperature might well increase speciation. Kauai, according to the author, has 22 taxa to Oahu's 128! In fact, Oahu with its 604 square miles has 128; while the other five islands with a combined total of 5,814 square miles have only 91! The explanation for the discrepancies is not botanical but human.

Oahu has been the center of human activity. It is the seat of the capital, Honolulu, where the Bishop Museum and the University are located. Most visiting botanists resided there, and collected within easy walking or driving distance of the city. Teachers, not excluding the author of the "List," scoured Oahu with their students week-ends and holidays for its botanical riches. The outside islands, in contrast always have been neglected. What wealth of plants must still be growing there unknown to man! What applies to Cyrtandra, relatively unknown in the Archipelago excepting on Oahu, applies more or less to the remaining native genera.

With this in mind, the reviewers appeal to the biological workers of the world to come to this Mecca to collect its neglected riches before "progress" destroys them. With the torch of knowledge feebly flickering during the last decade of questionable political ethics in Washington, Federal funds for Hawaiian taxonomy have nigh dried up. Even the fabulous Marie C. Neal Herbarium is lying fallow in Honolulu for want of funds. As botanists cannot prevent the continuous slaughter of one endemic taxon after another, they should at least attempt to collect, preserve and record as much of the Hawaiian flora that is still extant so that future generations shall have a better understanding of what a splendid Paradise their forebears lost.

May 23, 1955

Dear Dr. Degener,

Thank you for the use of your interesting article. I have quoted from it and hope you see it in our Garden Section in a week or so.

Hope to meet you in person some time soon.

Peggy Hickok

P. Hickok

BOTANIZING IN FIJI

by

Otto Degener

M. S., University of Hawaii, '23

Collaborator in Hawaiian Botany, New York Botanical Garden

Ordonez, my Filipino assistant, entered in his diary for February 24, 1941, "Go hiking - Mr. Degener, Timoce and I. Reach the top of a neighboring mountain. Timoce is receiving inspiration in the botanical line. I guess he hasn't much to think or worry about. That 's why he is absorbed in what he does manually. Mr. Degener is indeed happy, contented, and patient in his botanical accomplish,ents! Romance is evidently permeating my mind! Occasional day-dreaming is common! A great hinderance to success!"

February 24, that memorable day, we followed faithful Timoce into what he called the Nauwanga forest. That memorable day we found a tree with rather ugly flowers and, being as usual greedy for specimens to scatter far and wide among worthy institutions to stimulate study, I collected ample material. There were numerous flowers but considerable search disclosed only a single fruit. This collection, to which I gave the number 14,537, was pressed and dried like all other collections and in due time mailed from Nandarivatu to Dr. Smith. Later, when I returned to my Mokuleia Beach home on Oahu, Smith wrote me some astoundingly gratifying letters. I was flabbergasted! February 24 is truly far more important to me than the anniversary of my birthday or the date of my death. February 24 is my very private, personal, memorable "Memorial Day."

The story was told officially by I. W. Bailey and A. C. Smith (~~1942:~~ 1942. Arnold 23: 356-365). I quote in part:

> In 1934 the junior author collected specimens of a fruiting tree on the Fijian island of Vanua Levu, but efforts to place the plant in a family failed. Neither fruit nor foliage suggested any plant previously known from the Pacific. Although wood from the trunk was available, no definite suggestion of a family could be made by those who examined the specimen. Recently, a re-examination of the wood and a study of the internal structure of the twigs and leaves indicated that the plant is related to the Magnoliaceae, and it has subsequently been ascertained that

the plant is conspecific with a tree collected in flowering condition in the interior of Viti Levu by Mr. Otto Degener in 1941. This Fijian plant, which is now represented by ample foliage, flowers, fruits, and wood, is definitely a member of the ranalian complex. It exhibits close similarities to the Magnoliaceae, particularly in the internal structure of its vegetative organs, in its pollen, and in the vascularization of its stamens. However, we cannot place it in the Magnoliaceae, for reasons to be discussed on succeeding pages - - - -. These three families, Magnoliaceae - - - -, Himantandraceae, and the proposed Degeneriaceae, form a group with salient morphological similarities. - - - - The remarkable stamens and carpels of Degeneria deserve special consideration, since they are likely to prove of some significance in future discussions of the floral morphology of the angiosperms.

To have one's name associated with an entirely new plant family is an honor almost unheard of. Nevertheless, I am not the family's original discoverer! Two other workers found trees belonging to the Degeneriaceae before I did. Dr. Smith, as mentioned in the quotation, discovered one on May 7, 1934, on Vanua Levu, in the "Lower Wainunu River valley, alt. 0 - 200 m." As he was the one who studied and published descriptions of the new species, genus and family with Dr. Bailey, he could not well name them for himself. This would violate good taste and a long-established custom. The second discoverer of Degeneria is my friend Mr. B. E. V. Parham, Government Botanist in Suva. After my find came to Dr. Smith's attention, I visited Mr. Parham at his Nanduruloulou home where he showed me his herbarium. Much of it had not yet been studied because of the pressure and confusion of war work. I then suggested that he ship his collection to Smith for determination. When Smith finally got the Parham plants on loan for study, he found a Degeneria among the lot. This had been collected at Nanduna, Viti Levu, in 1939, four years after Smith's find and two years before mine.

According to Dr. S. F. Blake at least one other family bears the name of a living botanist. This is Chingithamnaceae Hand.-Mazz., the type specimen for the family having been collected in Kwangsi by R. C. Ching, Botanist of the Metropolitan Museum of Natural History (Nanking) and Research Fellow of the China Foundation for Promotion of Education and Culture. This family is ignored, in error, in the Index Kewensis. But this

work does record the fact that Handel-Mazzetti, who originally proposed the new family, soon regretted his action. By merging his genus Chingithamnus with Microtropis, he equated his Chingithamnaceae out of existence into the Celastraceae. The family Degeneriaceae, however, is still in good standing.

June, 1925, Herbert L. Mason collected a peculiar brown seaweed off Clarion, the most westerly of the Revillagigedo Islands, southwest of Lower California. It was named Masonophycus paradoxa after its discoverer and its unusual characters. It is so different from any other seaweed known that it constitutes a family all its own, namely the Masonophyceae. Thus, Degeneriaceae and Masonophyceae, each based on a single kind of plant, are the only valid plant families commemorating living botanists peculiar to the Pacific region at this time.

The Coconut Palm, a Street tree in Honolulu, observations, unanswered questions, and an unsolved problem.

by T. P. Haas

When in the Garden Journal July-August 1963 my article "the Date and the Coconut" was published, I did not know that, after retirement, I would move to Honolulu-Waikiki where the coconut palm is a street tree. I am now living here for 13½ years! Before the Laniolu, my home, grows a very good specimen and I can observe flowering and fruiting and photograph this with my 400 mm tele-lens.

In the November 1976 issue of the "Scientific American" is an article "Urban Trees" by Thomas S. Elias and Howard S. Irwin. The trees mentioned are oak, maple, linden (Basswood), American elm (threatened by the Dutch elm disease), plane tree and others. We find these trees in many cities in the U.S. and also in Europe, yet all in the temperate zone. They would not survive in Honolulu, because they all need a winter cold which we do not have in tropical Honolulu.

The coconut palm (Cocos nucifera L.) is a monocotyleous, unbranched tuft tree with a swollen base. The crown is formed by a tuft of giant pinnate leaves. Hidden deep in the trunk is the growing point, producing leaves and inflorescences the latter enclosed in a woody spathe. These inflorescences with staminate, "male," and pistilate, "female" flowers are initiated lateral on the growing point. The following illustrations show this. That kind of initiation is decisive for the growth of the palm. If the inflorescence-initiation is terminal flowering and fruiting used up the growing point and the plant or the particular shoot die off. So it is with the bananas, many orchids and others, and also with the palms. It was in 1950 that I saw this at the former Harvard Botanical Garden in Soledad-Cuba. A ca. 20 years old umbrella palm (Corypha umbraculifera) was in bloom. The stem of the palm proceeded directly into the axis of the giant inflorescence a top: a magnificent picture! The plant died. It was "haparanthic" (once flowering) a term which is generally used for annuals. The umbrella palm, palm and a few others, like the sago palm, can grow for many years but when they change from the vegetative stage to the generative stage, they die afterwards.

the top of the coconut palm shows dry brown stipules, the giant leaves and the lateral located inflorescences with their spathe. The old leaves drop off

letting back a scar on the trunk ,but no piassave (silicated vessel/ fibers, used for stiff brooms).Having no cambium between xylem and phloem there is no secondary growth in thickness.This is the cause of the slenderness of even 100 years old coconut palms.In contrast to the date palm (Phoenix dactilifera L.) where staminate and pistilate flowers are on different plants the coconut palm is monoecious and it blooms throughout the whole year.The branched inflorescences carry many staminate and much less numerous ball shaped pistilate mainly on the lower part and increasing in size.The life time of the former,the male flowers is short and they drop off very soon .The pistilate,the female flowers,are completely enclosed by bracts and perianth.When the male flowers have disappeared,their anthesis begins.The uppermost part of the ovary becomes visible with a white styleless stigma. This opens with 3 lobes,originating from the 3 carpels.Both flowers are trimerous.The male flowers have 6 stamens and a very reduced,not functioning apocarpous gynaeceum.The female flowers have a big,fused, a syncarpous ovary.Both flowers have nectar producing glands,attracting insects as pollinators..After pollination the stigma turns dark and and dries..From the ovary develops the the fruit,the coconut,a drupe,like the cherry,not a nut.The wall of the ovary soon becomes devided into 3 different and different functioning layers:the exocarp,the outside skin,making the coconut waterproof,the fibrous mesocarp,the husk,corresponding with the juicy flesh of the cherry and contributing to the boyancy of the coconut and the endocarp. the future "stone".The endocarp contains the ovule and after fertilization and hardening the embryo.At the time of the anthesis the endocarp has the size of a cherry stone.It is white and soft and shows that it is composed of 3 fused carpels,letting open in the centera small canal which is extended through the mesocarp and through which the pollen tube may reach the ovule and fertilize. The growth of the mesocarp is accelerated very much and this makes it so difficult to make cuts!The endocarp is located on the base of the coconut.Very early it becomes hollow and filled with a nutritive watery li uid,increasing in quantity with the increasing size of the fruit;it is the coconut water!During the further growth the "stone" moves away from the base into the center of the

fruit ,at the beginning pointed and becoming roundish.Only one carpel has an embryo,the other 2 ~~are~~ steril fused with it,are steril.The mature "stone" shows 3 "eyes" ,from one appears the seedling,which grows in the basal area of the husk.It looks like if the stone would move into the center of the fruit if it should make space for the developping seedling! Here I have 3 unanswered uestion:Do we have with the 2 steril carpels a partial parthenocarpy? When the "stone" moves away from the base and the fibrous husk fills up this area,how is it with the food supply of the "stone"?And finally from where originates the water in the fruit,the coconut water?

When the ripe coconut drops off from the palm the embryo is very little differentiated..When the germination begins ,from the cotyledon a structure grows into the interior of the hollow,partly li uid filled interior of the ftuit.It is the houstorium,absorbing the food there.The food containing coconut water becomes the solid endosperm,the white flesh or meat which is dried the copra.The seedling now develops roots and shoot all in the area of the original base of the husk.The ~~young~~ early folinge of the seedling ~~differs from the pinnate leaves of the adult plants.~~ young plants is pinnate. As autogeny occasionally plagiotrogeny, it indicates not only that the ancestors of the coconuts and all other feather palms were actually fan palms.

The coconut palm

The coconut palm is the most important plant of the tropics. The dried flesh or meat inside the ripe coconut is the copra one of the most important trade-articles. From the copra originates fat or oil, used for maragarine, in cosmetic and for man many other utilities. The main producing countries are the Philippines, India, Indonesia and copra is the main-crop of the oceanic islands. In the Philippines, in India and other copra producing countries also breeding work with the coconut palm is done. (artificial pollination of selected palms) They want to increase either the number of the coconuts on the palms or the fat content of the copra. Shredded coconut meat of of the ripe coconuts, used in bakery, is to mention among the products. From unripe fruits, not fitted for copra, the fibers of the husk with the name "coir" are used for floor covers, runners tet. they can ve died.. the hard shell of the "stone" can be polished and be used for bowls, cups ect. Also charcoal is made from it. Stems and leaves are used for the building of homes for the natives. Everything of the coconut palm is used!

In Honolulu the cocnut palm is only a display plant and a very expensive display plant too! It is a street tree! In Waikiki the palms are mostly 50 years old but there are also older ones. The coconut palm supposed native to South-Asia* was brought to the Hawaiian islands already by the seafaring Polynesians, also in in different varieties as it happens with all cultivated plants, all cultivars. The falling old leaves and coconuts are hazardous for residents and tourists Therefore twice a year men have to climb up the trunks and to remove leaves, inflorescences and more or less ripe fruits. I was told if only the development of the latter could be prevented the city of Honolulu which owns the street trees, could save a lot of money! As mentioned the coconut palm is monoecious therefore it produces coconuts and until now to prevent this, no means are known and there are also no unisexual male coconut palms which coludbe planted, an unsolved problem.

Though in Honolulu no products of the coconut plam are used, for the botanist it is a very interesting plant!

* It is supposed that the coconut palm is native to South-Asia, because there exists a big crab, the cocos-robber Birgus latro, whoih is adapted to the coconut; with some of his legs he can obtain the flesh of the ripe coconut. inside.

Collecting Experiences in Hawaii

At the meeting of the Torrey Botanical Club on October , 1934, Mr. Otto Degener told about his work on the Hawaiian flora. He briefly sketched how his chance meeting with Prof. H. H. Whetzel in Bermuda in the summer of 1920 induced him to enter the University of Hawaii as a Graduate Student two years later, how he began the collecting and study of Hawaiian plants, and how he resolved to write a "Flora Hawaiiensis" or "New Illustrated Flora of the Hawaiian Islands" when he discovered no comprehensive, up-to-date work of the kind extant for this important region.

For the school year of 1924-25 Mr. Degener enrolled at Columbia University as candidate for a Ph. D., studying at the New York Botanical Garden the small collection of Hawaiian plants he had been able to amass. After completing his residence requirements and courses at Columbia, he returned to the Islands to complete his thesis and to teach Botany at the University of Hawaii. Then he botanized during the summer of 1926, dividing his time equally between the islands of Kauai and Hawaii. In this work he was ably assisted by one of his students in whose veins coursed the blood of the Hawaiian, the Caucasian and the Oriental. After the second year of teaching, he spent the summer of 1927 collecting on the Island of Maui, assisted by three students. One of these was a Hawaiian-Samoan while another, who illustrated the more interesting plants discovered, was of Japanese extraction.

Severing connections with the University of Hawaii in 1927 and relieved of all teaching duties, he henceforth devoted his entire time to his project, using Honolulu as his base of operations. In May 1928 he sailed for Molokai on a five months' collecting trip, spending most of his time in the rain-forest near Maunahui. The valleys and ridges about Kamalo were also searched for plants and a futile attempt was made to climb Olokui from Wailau Valley in the hope of finding a mythical silversword or Argyroxiphium. The following winter botanizing and illustrating were continued on the Island of Oahu.

In the summer of 1929 he moved to the Island of Hawaii with five or six assistants, one or two to act as collectors and the others as artists. During that time he became Naturalist of Hawaii National Park. Realizing that his official duties at the Park would interfere with his botanical studies, he resigned to continue his collecting and to write his 328-page book on the "Plants of Hawaii National Park, with Descriptions of Ancient Hawaiian Customs and an Introduction to the Geologic History of the Islands". This appeared on the market during the Christmas Season of 1930.

When about two-thirds of the manuscript of the Hawaii National Park book had been written, Mr. Degener decided to question some of the few remaining kahunas, or sorcerers, and old natives regarding the ancient uses of certain plants. He engaged one of his former Hawaiian students as interpreter and camped in one fishing village after another along the coast of Hawaii. At Milolii he found native life the most primitive. He camped in the sand-covered yard of the public school - a modern building closed for the year because insufficient Hawaiian scholars had enrolled, according to the Department of Public Instruction of that time, to warrant the appointment of a single teacher - and made friends with the inhabitants. One young Hawaiian, highly respected in the hamlet, was especially helpful in describing native customs. The simple way these folk lived in Milolii and their naif philosophy may be exemplified by some of the answers received from my new friends. Though "owning" almost

Collecting

the entire hamlet, my host was practically penniless. When asked why he charged no rent for his property, he replied he did not care to do so. If he were to try to collect it, his friends would move away and he would be lonely. When one of the little urchins, deprived of schooling, was asked if he had had a good teacher the year before, he answered: "Yes, he good teacher - he no whip much." Few visitors to Honolulu will ever guess that primitive Hawaii may still be found [illegible] hidden away here and there along the coast.

The years of 1930 - 32 were spent on Oahu in continued collecting and describing of plants. Then shortly after the publication of Book 1 of his "Flora Hawaiiensis" in June 1933, Mr. Degener sailed for California, with two of his assistants. As a party of three, motoring across the Continent by the southern route, they arrived at the New York Botanical Garden in August. Here the Hawaiian herbarium, weighing about two and a half tons, had preceeded them. Work was resumed and in November 1934 Book 2 of the "Flora Hawaiiensis" was completed.

After a stay of almost a decade in the Hawaiian Islands Mr. Degener has been able to amass an unexcelled collection of Hawaiian plants estimated to contain upward of 40,000 specimens. He has written three profusely illustrated books on the Hawaiian flora, one of which is of a popular nature. He has amassed hundreds of illustrations of local plants drawn by students under his personal direction. More than half of these plates yet remain to be published in succeeding books of the Flora. He has collaborated by the loan of specimens to the B. P. Bishop Museum and the Field Museum in monographic studies of the Mosses, Asteliae, Peperomiae, Labiatae and Compositae. He has distributed by gift, sale or exchange duplicate specimens of Hawaiian plants to leading botanical institutions in America and Europe. These [illegible] shipments comprise chiefly endemic plants, though pan-tropic ones are not lacking.

As opportunities for students have greatly improved in the Islands since the administration of Governor Poindexter, Mr. Degener now plans to return to continue the describing and illustrating of Hawaiian ferns and flowering plants from living specimens. This work, no doubt, will be followed by a third visit to the New York Botanical Garden where facilities for the critical determination of Hawaiian plants is almost ideal.

The meeting was illustrated with lantern slides.

Flora of the North Caucasus
Otto & Isa Degener
New York Botanical Garden

We were impressed by the display of modern Floras, many beautifully illustrated in color, at the XII International Botanical Congress in Leningrad in 1975. We felt frustrated that these were figuratively as well as actually closed books to us by being printed in Russian in the Cyrillic alphabet. While on a week's tour of the Caucasus under leadership of Prof A.I. Galushko, we emphatically expressed our conviction that the Science of Botany was hampered by so many botanists in different parts of the World publishing in a Babel of tongues. We broached the suggestion that Russian works should be accompanied by an English summary; and English, by a Russian one. Workers then would not only profit by foreign research, but would avoid wasting time by duplicating it.

Our opinion expressed to him in 1975 was evidently convincing. It certainly fits in with Russia's wish for bi-national scientific *collaboration. An example is the 280-

*Irwin, H.S. Détente and the Green World. Garden Journ. 176-179. 1976.

page book about the "Flora of the North Caucasus and Questions of its History," edited and in part authored by Dr. Galushko in 1976. Though no English summary appears, subtitles are in English and the 1,000 - 1,200 Latin plant names, such as Achillea millefolium, Equisetum arvense, Quercus rubor and Xanthium californicum, are in Roman type.

Dr Galushko, mindful of bi-national cooperation, under date of January 20, 1977, wrote us "that the interests of your and our scientists go beyond the limits of their own Countries." His accompanying, rather full summary in his English of the volume, unfortunately greatly abbreviated and somewhat edited by us, reads as follows:

"Flora of the North Caucasus and Questions of its History," A.I. Galushko, Editor & Coauthor. 200 pages. 1976. 1 Pushkin Street, Stavropol, U.S.S. Russia. Price 1 ruble, 20 copeck.

Chapter 1. Galushko, A.I. "An Analysis of the Flora of the Western Part of the Central Caucasus." 125 pages, 17 tables, 11 maps. The flora of the highest parts of the Main Caucasus, namely Pritelbrusye, Balkaria and Western Ossetia is analysed systematically, ecologically and arealogically. It shows that every zone in the Central Caucasus is a refuge. Nine types of areals and 31 complexes have been noted: the boreal areal predominates with 834 species or 36%, the Caucasian areal with 511 or 22%, the Mediterranean with 312 or 14%, the fore-Asiatic areal with 275 or 12%, and five less important zones. One hundred twenty four endemic taxa are attributed to the North Caucasus. A map shows the above centres of species formation, of which the biggest, Elbrusski, has 27 endemics and the "Jurassic cuesta" has 21. Another map shows location of the nine principal refuges. The role of epeirogenesis, glacial epochs and the epochs of arid climate in floragenesis is stressed. Contrary to many botanists, the author maintains that the Central Caucasus shows no ~~vertical substitution, or~~ vertical vicarism; but many examples of horizontal vicarism. This shows the antiquity of the oreophytes in the Caucasus and that the local oreophytes are not connected with the present flora of the plains and elevated areas. In short, the ~~first~~ second are not derived from the ~~second~~ first.

Regarding the glacial period, contrary to the belief of many others, the author contends that "syncretic" or mixed floras prove the reality of glacial epochs and that the amount of syncretion of the periglacial flora is proportional to how far south glaciation extended. His evidence is based on analysis of recent periglacial floras of glaciers Ullukhiran and Karachul (extending down to 3,200 m.), Azau (2,400 m.), and Besengi (3130 m.). He maintains it is impossible to explain the floral compositions of every zone without postulating ancient and more recent broad glacial and interglacial migrations. Regarding arid periods, he stresses their exclusive importance in floragenesis, and notes that in the Holocene the North Caucasus (presently part of the Boreal plant association) was a portion of the Mediterranean plant association, and that the flora of the Central Caucasus during the last 20,000 years fluctuated between boreal-mesophytic and xerophytic-Mediterranean as well as xerophytic and steppe-like types. An example of a semiarid zone, or a zone of oreoxerophytes, shows the survival of the period when the Central Caucasus was part of the Mediterranean flora. Two maps illustrate his new floragenetic conclusions on the position of the zones in the glacial (Würm) and in the arid Holocene time. Maps show areas of numerous Caucasian species, the migration of mesophyllic and xerophyllic floras in the Caucasus during the Holocene; and tables listing the species. A chronological survey of the main stages of flora genesis and a table of local changes in the Pliocene-Pleistocene follow.

Chapter 2. Prima, V.M. "Some Questions of the Floragenesis of the Upper Alpine

Flora of the Eastern Caucasus." 27 pages, 1 map. This article, verifying Galushko's conclusions, divides the Eastern Caucasus into three districts: Tersko-Argunski, Koisunski and Transsamurski. It compares the alpine and subnival floras of 269 species of the Eastern Caucasus, Verkhnaya Svanetia, Polshaya Liakhva, Western part of the Central Caucasus, Central Transcaucasus and Maly Caucasus (Armenian plateau).

Chapter 3. Nemirova, E.S.. "Geographical Distribution of Species Jurinea Cass., Sect. Neobellae Nemirova and some Questions of the Floragenesis." 14 pages, 1 map. The floragenesis of the Cruciferae genus Jurinea, an endemic Caucasian Section of Neobellae, is given based on the geographic spreading of its taxa throughout the Caucasus. Two centres of origin and the present occurrence of taxa of Section Neobellae are postulated. The Western Caucasus is the primary center where Pumilae and Leviorarae of the Subsection Coronopifoliae and the Subsection Mamullosae thrive. In fact, Mammulosa is endemic to the western Caucasus. The Central Caucasian centre is a derivative even though an ancient one, within the limits of which the majority of species of Subsection Coronopifolia occur. They developed at the end of the Pliocene. In summary, the wealth of taxa in the Central Caucasus is due to two invasions: one during the Pliocene and one during the Riss-Würm. A map shows the direction of migrations.

Chapter 4. Prima, V.M. "On Some of the Particularities of the Upper Alpine Flora of the Baba-Dag Mountains." 14 pages. A check list of taxa, many new, on the mountain Baba-Dag shows its relationship in the Caucasian flora.

Chapter 5. "Floragenetical Regions of the Peredovoj Ridges (Terski-Ridge and Sunjenski-Ridge) of Chechena-Ingushetia." 19 pages, 1 map. Five floristic regions and several subregions occur such as the Malgobekski, Bragunski, Eastern part of the Sunjenski Range, and Alkhanchurto-Sunjenski. The Bragunski region is the most original. The most characteristic species are listed.

Chapter 6. Prima, L.C., & Galushko, A.I. "On Aquatic Flora of Kissyk Lake." This article deals with the "Types of Woods and Forestry in the Chechena-Ingushetia."

The reviewers are mortified that after preaching that articles in English should have a brief summary in Russian printed in the Cyrillic alphabet that they can find no Russian scholar in the ~~KAMAKAXX~~ Island of Hawaii to write it for them, and no printer in Ann Arbor with a Cyrillic font ~~to print it for them~~!

Flora of the North Caucasus
Otto & Isa Degener
New York Botanical Garden

We were impressed by the display of modern Floras, many beautifully illustrated in color, at the XII International Botanical Congress in Leningrad in 1975. We felt frustrated that these were figuratively as well as actually closed books to us by being printed in Russian in the Cyrillic alphabet. While on a week's tour of the Caucasus under leadership of Prof. A.I. Galushko, we emphatically expressed our conviction that the Science of Botany was hampered by so many botanists in different parts of the World publishing in a Babel of tongues. We broached the suggestion that Russian works should be accompanied by an English summary; and English, by a Russian one. Workers then would not only profit by foreign research, but would avoid wasting time by duplicating it.

Our opinion expressed to Dr. Galushko in 1975 was evidently convincing. It certainly fits in with Russia's wish for bi-national scientific *collaboration. An example is the 200-page book about the "Flora of the North Caucasus and Questions of its History," edited and in part authored by Dr. Galushko in 1976. Though no English summary appears, subtitles are in English and the 1,000 - 1,200 Latin plant names, such as Achillea millefolium, Equisetum arvense, Quercus rubor and Xanthium californicum, are in Roman type.

*Irwin, H.S. Détente and the Green World. Garden Journ. 176-179. 1976.

Dr Galushko, mindful of bi-national cooperation, under date of January 20, 1977, wrote us "that the interests of your and our scientists go beyond the limits of their own Countries." His accompanying, rather full summary in his English of the volume, unfortunately greatly abbreviated and somewhat edited by us, reads as follows:

Without his kind help, we could never have prepared the following review:

"Flora of the North Caucasus and Questions of its History," A.I. Galushko, Editor & Coauthor. 200 pages. 1976. 1 Pushkin Street, Stavropol, U.S.S. Russia. Price 1 ruble, 20 copeck.

Chapter 1. Galushko, A.I. "An Analysis of the Flora of the Western Part of the Central Caucasus." 125 pages, 17 tables, 11 maps. The flora of the highest parts of the Main Caucasus, Prielbrusye, Balkaria and Western Ossetia is analysed systematically, ecologically and arealogically. It shows that every zone in the Central Caucasus is a refuge. Nine types of areals and 31 complexes have been noted: the boreal areal predominates with 834 species or 36%, the Caucasian with 511 or 22%, the Mediterranean with 312 or 14%, the fore-Asiatic areal with 273 or 12%, and five less important ones. One hundred twenty four endemic taxa are attributed to the North Caucasus. A map shows the above centres of species formation, of which the biggest, Elbrusski, has 27 endemics and the "Jurassic cuesta" has 21. Another map shows location of the nine principal refuges. The role of epeirogenesis, glacial epochs and the epochs of arid climate in floragenesis is stressed. Contrary to many botanists, the author maintains that the Central Caucasus shows no vertical substitution, but vertical vicarism; but many examples of horizontal vicarism. This shows the antiquity of the oreophytes in the Caucasus and that the local oreophytes are not connected with the present flora of the plains and elevated areas, In short, the first are not derived from the second.

Regarding the glacial period, contrary to the belief of many others, the author contends that "syncretic" or mixed floras prove the reality of glacial epochs and that the amount of syncretion of the periglacial flora is proportional to how far south glaciation extended. His evidence is based on analysis of recent periglacial floras of glaciers Ulluchiran and Karachul (extending down to 3,200 m.), Azau (2,400 m.), and Besengi (2130 m.). He maintains it is impossible to explain the floral compositions of every zone without postulating ancient and more recent broad glacial and interglacial migrations. Regarding arid periods, he stresses their exclusive importance in floragenesis, and notes that in the Holocene the North Caucasus (presently part of the Boreal plant association) was a portion of the Mediterranean plant association, and that the flora of the Central Caucasus during the last 20,000 years fluctuated between boreal-mesophytic and xerophytic-Mediterranean as well as xerophytic and steppe-like types. An example of a semiarid zone, or a zone of oreoxerophytes, shows the survival of the period when the Central Caucasus was part of the Mediterranean flora. Two maps illustrate his new floragenetic conclusions on the position of the zones in the glacial (Würm) and in the arid Holocene time. Maps show areas of numerous Caucasian species, the migration of mesophyllic and xerophyllic floras in the Caucasus during the Holocene; and tables listing the species. A chronological survey of the main stages of floragenesis and a table of local changes in the Pliocene-Pleistocene follow.

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8/26/46

Foreword to Second Edition

The following few pages explain how the writer's editions of the "Flora Hawaiiensis" and "Plants of Hawaii National Park" were depleted. They do not describe, however, the coup de grace of April 1, 1946. On that day the tidal wave sweeping south from the Aleutians mixed most of the remaining books in a three-foot deep maelstrom of salt water containing limu, or seaweed, and astonished fishes and crabs.

The present inexpensive edition of Books 1, 2, 3 and 4 of the "New Illustrated Flora of the Hawaiian Islands" is practically a facsimile copy of the first edition originally selling for $ 14.00. This second edition of the first four volumes, bound in a single cover, omits preliminary indices no longer necessary, sheets later supplied corrected, and sheets which more recent researches show require revision. These last, brought up to date, will appear in Book 5 or in later volumes.

Our present knowledge of the complicated native Hawaiian flora is woefully incomplete and in such a state of flux that any bound book about Hawaiian plants is out of date within a very few years. The published monographic work of not one single worker - and the writer modestly includes himself - will stand the scrutiny of time. Further botanizing will very likely unearth additional plants not dealt with in their studies and will necessitate a modification - at times most drastic - of their results. Our ohia lehua trees, for example, have been studied in great detail and the different ones observed have been described and named as good species, varieties and forms. I suspect more than half of these scientifically named units simply represent individual hybrids or swarms of hybrids deserving no such names at all. Our loulu palms likewise have been described in great detail and beautifully so, some species being known from single trees growing in some plant lovers' gardens. They are not known in the wild. I suspect such trees merely simulate distinct species because they had been brought down from their rainy mountain fastnesses as seeds and forced to grow in a dry lowland environment. Changed conditions changed

their appearance only superficially. A recent publication - evidently a potboiler - describing new kinds of mokihana relatives is so briefly and sketchily written in Latin that I am not a keen enough botanist to be able to recognize the plants therein described. I doubt if any one except the author who sired them can do so. The writing appears to emulate in haste the editorial work perpetrated upon the scientific names appearing in "Hawaii's Crop Parade," a book that otherwise could have been of great usefulness to the Territory. A naupaka hastily named for Skottsberg, a keen student of the flora of the Hawaiian Islands, was described in print as having its closest relative growing in Australia (!) when its closest relatives were growing not more than a mile or so from the botanist's own back yard in Honolulu and at Kilauea. Even Skottsberg, who ranks with Sherff in doing most careful work with the highest type of scholarship, monographed the Hawaiian sandalwoods in such a way that the writer found it later necessary to correct him in the "Flora Hawaiiensis." Skottsberg likewise monographed naupaka, placing our beautiful yellow-flowered plant in the genus Scaevola before he was willing to follow the writer in placing it in Camphusia. Sherff, in dealing with our native euphorbias and aalii at the outset admitted his findings as provisional until more field work and research unearth additional data to work upon. And even Degener, who came to the Islands in 1922 and spent more continuous time in collecting and studying the flora, in spite of some elements of sabotage, has made many, many blunders. But, unlike the writers of hide-bound books whose errors stand so long as their books hold together, Degener corrects his many blunders by issuing up to date sheets to bind in his Flora in place of the out-dated ones.

The lives of botanists connected with the Hawaiian flora have been hectic. Nelson, who botanized in the Hawaiian Islands during Captain Cook's explorations, later joined notorious Captain Bligh - "breadfruit bligh" - and stuck with him during the mutiny. He died as a result of the

hardships encountered after ~~he was~~ being set adrift by the mutineers. Douglas, who collected silverswords, was gored to death by a wild bull on Hawaii. Mann died a mere youth. Forbes was hounded to a tragic early grave. Rock and later botanists left the Islands because of frustration or disgust. Degener was deprived of his teaching position after he began working on his Hawaiian Flora, presumably in a graceful attempt to induce him to sail away from Hawaiian shores. Tenaciously he remained, while the conspirators themselves, with mild persuasion, at length found it convenient to depart. Heretofore the layman may have thought that the scientist - especially one who deals with the pretty flowers growing in our Paradise of the Pacific - as above plagiarism, ppetty bickering, accusations of theft, and jealousy. He is wrong. Modern botanists in Hawaii - temperamental artists rather than scientists that they are - simply vent their spleen in a more flowery way, as the reader himself may have noticed.

With the passing - the saints be praisdd - of some rugged administrators from the Hawaiian scene and their replacement by men with modern ethical concepts, I can predict a renaissance in our study of Hawaiian plants. The only need is that these new administrators watch over their quarrelsome hirelings to guard them from erring ways or to send them packing on field trips to Micronesia or some other isolated regions where their effervescent spirits can do no harm.

The preceeding philippic and the following account of a botanist's departure from Hawaii are extraneous to the "Flora Hawaiiensis" and must be discarded.

Independence Day, 1946.

Foreword

The above copyrighted drawing is so excellent that it was reproduced without permission in a booklet under editorship - so states the introduction - of Dr. Harold St. John. This editing, conspicuous by its careless haste, fails to cite in the bibliography the author and work plagiarized.

The above copyrighted drawing seems to have been reproduced, partly turned upside down, to be sure, without permission in a booklet under editorship - so states the introduction - of Dr. Harold St. John. Such ~~careless~~ faulty editing, so reminiscent of that found in "Hawaii's Crop Parade", is hardly of an ethical standard to be recommended for university students to emulate.

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The present ~~inexpensive~~ edition of Books 1, 2, 3, and 4 of the "New Illustrated Flora of the Hawaiian Islands" is practically a facsimile copy of the first one originally selling at a considerably higher price. ~~This~~ It, second edition of the first four volumes, bound in a single cover, is a stream-lined edition omitting indices no longer necessary and sheets revised according to most recent findings. Book 5, to be completed shortly, will contain additional plants of interest.

Our present knowledge of the complicated native Hawaiian flora is woefully incomplete and in such a state of flux that any bound book about Hawaiian plants is out of date within a very few years. Only a loose-leaf work like the "Flora Hawaiiensis" can remain at the fore-front of botanical research because there old pages are discarded for new ones embodying the latest results of research and discovery.

Otto Degener
N.Y. New York Botanical Garden
New York

BERNICE P. BISHOP MUSEUM
HONOLULU, HAWAII

August 26, 1946

Mr. Otto Degener
24 East 82nd Street
New York, N. Y.

Dear Mr. Degener:

I must apologize for my delay in answering your letter of July 7th and acknowledging the copy of your proposed introduction to your Flora Hawaiiensis. I have read both with interest from the light they throw on past history and with a certain amount of regret that the course of science should have been disturbed by the attitude of individuals. Fortunately for me, I was not involved in the events which occurred and I am glad that you distinguish between individuals and institutions. If the Bishop Museum has suffered in the past, we can let the dead past bury its dead and look forward to a better understanding in the future.

The Sherff incident I regret as much or more than you. Whoever or whatever was responsible for the confusion, the Bishop Museum lost some plants which should not have happened had the terms of the loans been carried out. However, both Sherff and the Chicago Natural History Museum have done what they could to rectify matters and this incident is also closed.

I am not given to anger and it is futile for me to be angry at what the Museum lost from you and the late Mr. Topping. Here again, let us bury our dead and look forward to your next 25 years of collecting, even though I may be in office barely long enough to receive your first contributions.

The Bishop Museum as I know it will not be hurt in the slightest at your printing a Flora. We have no desire to monopolize publications on Hawaiian botany, but on the contrary are pleased that others save us the expense.

With aloha.

Yours sincerely,

Peter H. Buck

Peter H. Buck
Director

PHB:MS

Gunnera and Dianella, with an Illustration of a New Variety
by
Otto Degener

The apeape plants, giant herbs growing wild on our fog-swept mountains, are described by Dr. Harold St. John, Professor of Botany, University of Hawaii, in the Proceedings of the California Academy of Sciences, for November 1946. Whereas heretofore botanists have recognized only one or two kinds from the Hawaiian Islands, ~~St. John recognizes only one or two kinds from the Hawaiian Islands,~~ St. John recognizes seven and probably rightly so.

All Hawaiian apeape belong to the genus Gunnera, and all are described technically in full by St. John. Though such necessary descriptions never make interesting reading, not even to the professional botanist, his account of his collecting these giant herbs is quite entertaining. G. kauaiensis, as the name indicates, inhabits Kauai. It is the only apeape with umbrella-shaped leaves, all the others having their leaf-stalks attached to the edge of the blade. G. makahaensis inhabits the leeward slope of Mt. Kaala, Oahu. A second Oahu plant is G. kaalaensis. This grows more on the windward slope of Kaala as well as elsewhere on the Waianae and Koolau Ranges ~~of Oahu.~~ G. molokaiensis is, of course, peculiar to Molokai. Similar to Oahu, the island of Maui harbors two kinds: G. petaloidea native to West Maui; G. mauiensis, to the wet, ravine-cut slopes of Haleakala, East Maui. Though the island of Hawaii has a huge area, only one apeape is known from there. It is G. Eastwoodae, thus far collected only from the ancient, eroded land mass of Kohala. It was named in honor of Miss Alice Eastwood of the California Academy of Sciences.

It is gratifying that St. John has this time untangled our confusion regarding the naming of our seven kinds of Gunnera. But similar to Crawford's "Hawaii Crop Parade," which failed to receive expert treatment in the identification of its plants at the hands of his department, St. John threatens to set us back in his article in our knowledge of Dianel-

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la, an interesting group of native lilies. In his remark on page 379 that "The recently described Dianella lavarum Degener and D. multipedicellata Degener are considered exact synonyms" of D. sandwicensis, he perhaps senses an error but instead of correcting it he blunders into making a greater one. I therefore take the opportunity, as I did in the case of a Scaevola or naupaka he named in error for Dr. Skottsberg, in correcting him.

There are at least four kinds of Dianella known to the Hawaiian Islands. They are all characterized by having dryish leathery leaves, not soft, almost flaccid ones as I noted in a Dianella I collected in Fiji. The two best known local species, species that any neophyte can recognize in the field, are Dianella sandwicensis Hook. & Arn., and D. lavarum Degener, both described and pictured by me in detail elsewhere. The former plant has inky blue, often elongate berries; the latter, sky blue, usually broadly spherical berries. D. sandwicensis grows in the forests and clearings, often on the mossy trunks of trees, of Kauai, Oahu and Maui. Typical specimens of D. lavarum inhabit, as I have tried to indicate by the name, lava wastes, particularly about Kilauea, Hawaii, and to a lesser degree on Haleakala, Maui. Somewhat aberrant forms grow west of Mt. Kaala, Oahu, perhaps constituting a relic flora of the one that flourished there when the slopes of this eroded volcano resembled in its lava covering that of the Kilauea region of Hawaii. Another aberrant form grows mauka, or inland, from Lahaina, Maui. These two unusual kinds of D. lavarum show evidence of forming natural hybrids with D. sandwicensis growing in the neighborhood. The third kind of Dianella, described and pictured by me as D. multipedicella, is perhaps not a distinct species as St. John and, before him, Skottsberg suggested. Instead, it constitutes a ~~well-marked~~ new variety of D. sandwicensis which I herewith officially rename Dianella sandwicensis var. multipedicellata Degener comb. nov. (Syn. D. multipedicellata Degener, Fl. Haw. 68 : Dian.: Mult. 193 .).

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The fourth Dianella known from the Hawaiian Islands is peculiar to Molokai. Though I discovered it growing about Halawa Valley in 1928, I never described and named it, feeling we should know more about it before doing so. May I suggest that some resident of Molokai study this plant thoroughly in the field and, using my descriptions of Dianella sandwicensis or lavarum as model, write one for it? He need not be a professional botanist to qualify for this task. There will be little more to do than to rewrite my description, adjusting measurements and shapes to fit the Molokai plants. Then if he can execute a suitable drawing of a plant, and press it and other specimens for distribution to leading botanical institutions of the World, he is at liberty to publish this species with a new name, either in my Flora Hawaiiensis or in any publication he may wish to choose for himself. He should name the Molokai plant either for some outstanding characteristic that distinguishes it from other kinds of Dianella, or name it for the geographical region it inhabits. To work out this little problem would be not only fun but also scientifically valuable. Who on Molokai, I wonder, will take up this challenge and become a Dianella specialist?

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The Hawaiian Archipelago, Nature's Botanic Garden

Dr. Otto Degener
Author, "Flora Hawaiiensis", etc.

The Hawaiian Archipelago - this includes the entire chain of islands extending from Ocean and Midway to Hawaii - developed from the slow extrusion of lava from a crack or series of cracks on the ocean floor. This volcanic activity may have begun 100 million years ago, the mountain peaks, however, not piercing the surface of the ocean to form these lovely islands until 25 or even a scant 10 million years ago. Many of these peaks along the older, western end of the crack on the ocean bottom are so ancient, by the way, that they have been worn down by rain, wind and wave practically to sea level and are now known to us as obscure Ocean and Midway Islands, the home of seabirds and perhaps aviators.

To these isolated islands of bare lava came about 250 kinds of flowering plants to leave offspring to within historical times. Some blew here during storms; some floated here on ocean currents; some came here stuck to the feathers or feet of migratory birds, or hidden away in their intestinal tracts. About three-fourths of these plants came from Malaya and Australia, and the rest from America and elsewhere.

Finding a land devoid of competition, these 250 pioneer immigrants bred and multiplied at a prodigious rate, spreading everywhere. They found areas of pure or salt-impregnated coral beach sand and rough _aa_ and smooth _pahoehoe_ lavas to sour bogs and treefern jungles; of near tropic heat, as in the Kona District on the southwest side of the Island of Hawaii, to ice and snow, as on 13,784 foot high Mauna Kea; of desert conditions, as in Kau, to over 600 inches annual rainfall, as at Waialeale; of cloud filtered light, as in the coffee region of _mauka_ Kona, to intense rays of the sun, as within Haleakala Crater; and all possible combinations of such conditions. No wonder the offspring of these 250 immigrants, by a process of natural selection, were induced to speciate or bring forth variable offspring. These varied all the way from salt tolerant, fleshy leaved _naupakas_

The Hawaiian Archipelago, Nature's Botanic Garden

Dr. Otto Degener
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or half-flowers and lava flow inhabiting ohia lehuas to sunlight repelling, silver haired silverswords. Furthermore, such variations were at the same time intensified by isolation more extreme in the Hawaiian Archpelago than probably in any other region on the globe. The plants were not only separated from their relatives by growing on distinct islands but often in distinct kipukas, or lava oases, which, unlike formerly, now occur only on East Maui and Hawaii. Shade loving plants in one deep gulch, for instance, were separated by high, dry, sun baked ridges from their relatives in neighboring gulches. Conversely, sun loving plants of one ridge were separated by deep, dark gulches from their sun loving relatives on neighboring ridges. There were no mammals to disseminate seeds from one area to another as in most other regions of the world. There were relatively few insects to carry pollen from one insect pollinated plant in one gulch to another insect pollinated plant in another gulch. Nor did the winds carry pollen to all points of the compass to mix up the different strains of wind pollinated plants so long as almost continuous trades prevailed. No, the Hawaiian Archipelago was no melting pot for plant races as it is for races of the human species.

As the result of variation and isolation of the offspring of the original 250 plants over a period of 25 million years or less, the Hawaiian Archipelago at the time of Christ could boast a flora of about 20,000 different kinds of flowering plants, and 98% of these grew no other place on earth! The endemism is so extraordinary that some grew only on a single mountain like Diamond Head or on a single sunny ridge or shady gulch. Truly, the archipelago was a Paradise - a superb Botanic Garden planted by the Creator.

At length magnificent Polynesians - ancestors of the present Hawaiians - sailed up from the South in huge double canoes to these uninhabited islands. They brought with them as a future source of food the pig, the dog, the chicken and, perhaps as a stowaway or for the chiefly sport of shooting with bow and arrow, the Polynesian rat. They likewise brought with them as

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With the coming of the Polynesians, the destruction of the Botanic Garden that is Hawaii began. It is regrettable but it was mostly justifiable. The pigs, a necessary source of animal food, ran loose and rooted about in the fern forest and elsewhere, eating and damaging native vegetation. The rats were perhaps a mixed blessing, for, while eating seeds, they probably dropped a goodly share and thus may have helped in their sowing. The crop plants, needing land cleared by manual labor or burning, may have crowded out a few native lowland species. All in all, however, the Hawaiian Islands, before the coming of Cook, were still a lovely Paradise in the Pacific with the native vegetation largely unspoiled and intact.

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tal and the Oriental Races of Man - the destruction of the native flora has progressed with leaps and bounds. Much of it is justifiable as we must have space for the growing and raising of food, and for housing. For example, vast areas once covered with native plants growing no other place on earth have been cleared for the growing of sugarcane, pineapple, rice, macadamia nuts and other crops. The cane and pineapple areas are familiar to us all. Even those of us who have not visited Lanai or West Molokai have seen photographs of their monotonous but profitable veneer-like covering of pineapple plants that has taken the place of the interesting native dry forest consisting of species endemic to those areas and now as extinct as the dodo and the passenger pigeon. We are apt, too, to forget that rice crowded out native marsh plants on most islands until the rice borer, excepting on the Island of Kauai, gained a foothold and made further planting hopeless. Nor do many readers realize that large areas of unique native jungle in the Panaewa region of Hawaii are being vulldozed free of all native vegetation for macadamia nut culture.

Many native plants have been exterminated or decimated during the drainage or dredging of marshes, and the clearing of land, for houses and gardens. A striking example in recent years of the latter activity is the bulldozing of vast sand dune areas to build the Dream City of the Island of Maui. Many interesting Hawaiian plants have been wiped out completely by having grown if areas given over to grazing. Even the few plants there not palatable to stock succumb, due to trampling, the disturbance of their shallow rooting system,and the inability of their seeds on the now eroded, humus poor soil to germinate and replace their parents as these die of age.

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plow and bulldozer. The earth of the Island of Kahoolawe has blown into the sea after the haole or white man introduced browsing animals to this once interesting spot. Deer are now eating up the last vestage of native forest on the Island of Lanai. Due to feral sheep and to a lesser degree goats, Mauna Kea is now little more than a bare desert of lava with unpalatable weeds like the stinkweed marigold taking the place of the now exterminated silversword which in this particular strain was so abundant in the time of the horticultural explorer David Douglas that he used its dead stems for his campfire. Due to goats, the drier slopes of Haleakala are little better. And while such herbivors were allowed daily to fatten on native plants, we tax payers employ armies of men and boys to plant foreign weed trees and shrubs where these native plants had thrived. We long ago should have caught the bull by the horns and shot off the feral herbivors with the aid of our hunters and allowed the native plants to heal the damage to forest and water reserve in their own efficient way, and without expense. They have had millions of years experience in this work, even covering fresh lava flows most expertly with verdure.

Another factor, largely unjustified, that continues to decimate our native flora is the introduction, by design and by accident or carelessness, of exotics. As a result, our Islands, once a Paradise for interesting Hawaiian plants, are no longer that but, instead, a Paradise for weeds introduced from all corners of the earth:ghorse, lantana, pricklypear, pamakani, cocklebur, stinkweed marigold, golden crownbeard, guava, spiny amaranth, Spanish needle, euphorbias of many kinds, American blackberry, castorbean, parrotfeather, cassias, melastomes, apple-of-Sodom and troublesome grasses like bur, Hilo and fountain grass.

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years to evolve, AND THIS DEVASTATION CONTINUES WITH EVER INCREASING DEADLY EFFICIENCY. "What hath God wrought" in our Islands is a question future generations have a right to ask, yet we thoughtless vandals by our acts of eradication and extermination will soon obliterate all possible means of answering it. The flora is being wiped out faster than botanists can collect, study and preserve (even as dried specimens) sample for future generations to admire.

Individuals interested in strange and beautiful plants, such as shrubby violets two to four feet tall, all sorts of lobelias, the giant-leaved apé-apé or Gunnera, the colorful cousin of the begonia called Hillebrandia, the glistening silversword, sandalwood, tiny filmy ferns and majestic tree ferns, fan palms or Pritchardias, and thickets of groundpine have still the opportunity to see them in what is left of Nature's superb Botanic Garden. Whether their children and grandchildren will have the same glorious opportunity, however, is quite doubtful.

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How Many Mute Inglorious Miltons?

The fact that the Asian plant Rauvolfia serpentina has dramatically aided more than a hundred victims of severe insanity at the Modesto hospital in California and that its close relative, the plumeria (according to today's Advertiser "may become an important source of antibiotics," gives us in Hawaii Nei cause to ponder. Nine kinds of Rauvolfia - known as hao to the Hawaiians - are peculiar to our Islands. They grow, for example, in the hills mauka of Honolulu and about Kolekole Pass, Oahu; near Ulupalakua, Maui; in kipukas near South Point, Hawaii; etc. Were these hao properly studied by Modesto or Queens physicians, how many would be found to emulate or even surpass the Asiatic plant in therapeutic value? In fact, how many mute, inglorious Miltons in the plant world are about us? If we are not prepared to study such plants, is it not our duty to preserve them from extinction so that future generations may study them and profit thereby?

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With the coming of the Polynesians, the destruction of the Botanic Garden that was Hawaii Nei began. It is regrettable but it was mostly justifiable. The pigs, a necessary source of animal food, ran loose and rooted about in the fern forests and elsewhere, eating and damaging native vegetation. The rats were perhaps a mixed blessing, for, while eating seeds, they probably dropped a goodly share and thus may have helped in their sowing. The crop plants, needing land cleared by manual labor or burning, may have crowded out a few native lowland species. All in all, however, Hawaii Nei, before the coming of Cook, was still a lovely Paradise in the Pacific with the native vegetation largely unspoiled and intact.

Since the coming of Captain Cook and the haoles in general - and I use this term in the original sense so that it means both Occidental and Oriental - the destruction of the native flora has progressed with leaps and bounds. Much of it is justifiable as we must have space for the growing and raising of food, and for housing. For example, vast areas once covered with native plants growing no other place on earth have been cleared for the growing of cane, pineapple, rice, macadamia and other crops. The cane and pineapple areas are familiar to us all. Even those of us who have not visited Lanai or West Molokai have seen photographs of their monotonous but profitable veneer-like covering of pineapple plants that has taken the place of the interesting native dry forest consisting of species endemic to those areas and now as extinct as the dodo and the passenger pigeon. We are apt, too, to forget that rice crowded out native marsh plants on most islands until the rice borer, excepting on Kauai, gained a foothold and made further planting hopeless. Not do many readers outside Hilo realize that large areas of unique native jungle in the Panaewa region of Hawaii are being bulldozed for macadamia culture.

Many native plants have been exterminated or decimated during the drainage or dredging of marshes, and the clearing of land, for houses and gardens. A striking example in recent years of the latter activity is the bulldozing of vast sand dune areas to build the Dream City of the Island of Maui.

Many Hawaiian plants have been wiped out completely by having grown in areas given over to grazing. Even the few plants there not palatable to stock succumb, due to trampling, the disturbance of their shallow rooting system, and the inability of their seeds on the now eroded, humus poor soil to germinate and replace their parents as these die of age. The picturesque but uninteresting rolling green hills between Kamuela and Hawi on Hawaii exemplify such necessary but tragic destruction of a once flourishing native forest.

Much of the extermination of our native flora, sorry to say, is not justified at all. It is due largely to past and present "lack[1] of wisdom" and to negligence. For example, the escape from domestication of goats, cattle, deer, sheep and the lowly African snail has subjected the native vegetation to destruction in regions not touched by plow and bulldozer. The earth of the Island of Kahoolawe has blown into the sea after the haole introduced browsing animals to this once interesting spot. Deer are now eating up the last vestige of native forest on the Island of Lanai. Due to feral sheep and to a lesser degree goats, Mauna Kea is now little more than a bare desert of lava with unpalatable weeds like the stinkweed marigold taking the place of the now exterminated silversword which in this particular strain was so abundant in the time of David Douglas that he used its dead stems for his campfire. Due to goats, the drier slopes of Haleakala are little better. And while such herbivors were allowed daily to fatten on native plants, we tax payers paid for armies of the government employees of men and boys to plant foreign weed trees and shrubs where these native plants had thrived. We should have caught the bull by the horns and shot off the feral herbivors with the aid of our hunters and allowed the native plants to

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In conclusion, Man in less than 200 years has wrecked a good fourth of the native Hawaiian vegetation that has taken the Creator 25 million years to evolve, AND THIS DEVASTATION CONTINUES WITH EVER INCREASING DEADLY EFFICIENCY. "What Hath God Wrought" in our Islands is a question future generations have a right to ask, yet we thoughtless vandals by our acts of eradication and extermination will soon obliterate all possible means of answering it.

Cannot we good people of Hawaii Nei save what wreckage there still remains of our native Hawaiian flora? Cannot our Legislators increase the help for the experts in their work to exterminate harmful weeds and harmful plant-devouring animals? Can they not turn over one of the many uninhabited valleys on Oahu that extends from sea level to a height of 3,000 feet to our Garden Club for a Botanical Garden where plants of promise or on the verge of extinction can be cultivated and saved for later generations? Can they not do likewise with barren Diamond Head, ideal for plants native to our lava flows and arid leeward regions? Such a valley and such a crater, later supplied with laboratories, might well become the Mecca for study by scientists from all over the World, and tourist attractions as well.How many of such rescued plants will later prove to

have been mute, inglorious Miltons like our Rauvolfias or hao that may emulate or even surpass in therapeutic value the asiatic species now used as medicine in Modesto, California.

Dr. Otto Degener
Collaborator in Hawaiian Botany
New York Botanical Garden

Wo ist Campylopus exasperatus?
Rhodobryum gradifolium?
Entodon subcuspidatus

Key to Hawaiian mosses

1. Leaves in two opposite rows and equitant.....2
   Leaves in 3 or more rows and not equitant.....9

2. Leaves costate, with dorsal blade; leaf cells hexagonal to rounded .....Fissidens.....3
   Bastram p. 174 Leaves ecostate, without dorsal blade; leaf cells linear, 5-6 µ wide .....Orthorrhynchium cylindricum

3. Leaves bordered with pale elongated cells.....4
   Leaves not bordered.....6

4. Leaves bordered on duplicate blade only.....F. baldwinii
   Bh. 17 Leaves bordered ~~allround~~ completely.....5

5. Having the male and fertile organs separate in the same plant; cells papillose .....P. hawaiicus
   Having the male and fertile organs mixed in the same plant; cells smooth.....F. insularis

6. Leaves obtuse; costa ending well below apex.....F. delicatulus
   Leaves with short, sharp point; costa percurrent or nearly so.....7

7. Leaf margin coarsely serrate in upper half..... F. pacificus
   Leaf margin minutely serrate.....8

8. Leaves with indistinct marginal band.....F. mauiensis
   (not in Bastram) Leaf marginal band ~~missing~~ none.....F. lancifolius

9. Stems erect; setae terminal on stem or secundary branches.....10
   Stems creeping; setae lateral on main stem or secundary branches.....140

10. Leaf cells dimorphous: Cells containing chlorophyl grains (= chlorocysts) and large hyalin cells (= leucocysts).....11
    All cells of blade similar; sometimes basal cells empty and hyalin or colored (= alar cells).....16

11. Branches near the tips of the stem in fascicles; leaf cells in one layer.....Sphagnum.....12
    Branches not in fascicles; leaf cells in 3 or more layers of cells.....13

B11 B12

12. Cortical cells of stem with fine fibres (= fibrilose).....S.palustre
Cortical cells of stem not fibrilose.....S.wheeleri

13. Capsule curved; chlorocysts in cross-section quadrangular .....Leucobryum.....14
Capsule erect; chlorocysts in cross-section triangular. .....Octoblepharum albidum

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p.59 14. Leaves 4-6 mm long; plants up to 1 cm. high.....Leucobryum S.gracile
Leaves 7-12 mm long, plants 5-9 cm. high.....15

p.62 p.61 15. Hyaline leaf border continous to apex .....L.pachyphyllum
Hyaline leaf border ending about 2/3 up.....L.hawaiiense
(Considering Reichardt's (1877) spelling Havrensis" a spharism.)

p 13 16. Capsule splitting vertically into 4 valves.....Andreaea rupestris
Capsule not splitting into valves.....17

17. Inner basal cells large, hyalin and sharply deffined, passing abruptly to the small cells of the blade (= cancellinae).....18

? Inner basal cells none cancellinae.....23

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Leaves without a hyaline border...Calymperes.....19

p 69 19. Small plants; leaf margin indistinct.....C.tenerum
p 70 Robust plants; leaves with a thickened, serrate border...C.hawaiiense

20. Stem erect; hyaline leaf border narrow...Syrrhopodon.....21
Stems creeping with erect branches; hyaline leaf border broad and irregularly inflexed.....Thyridium constrictum

p 64 21. Margin of the leaf base ciliate.....S.oahuense
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Syrrhopodon is (Following Rule p.75A)

p 65 22. Leaves crispate when dry; costa denticulate on the back above .....S.hawaiicus
p.66 Leaves erect-spreading when dry; costa papillose on the back. .....S.kilaueae

23. Leaves with longitudinal lamellae on the inner surface of the costa..24
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24. Capsule not angled; stomata ~~wanting~~ none ..... Pogonatum baldwinii
Capsule 4-angled, stomata present ..... Polytrichum 25

25. Robust plants; stem up to 10 cm. high ..... P. juniperinum
Hoary tufts; stem about 3 cm. high ..... P. piliferum

26. Calyptra large, like a bell (=campanulate) 27
Calyptra small, like a hood (= cucullate) 39

27. Stem creeping; branches erect ..... Macromitrium 28
Stem erect 33

28. Seta short; capsule ^ by perichaetial leaves ~~half or total covered~~ covered half or totally ... 29
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29. Capsule ^ by perichaetial leaves ~~total covered~~ totally covered; perichaetial leaves with a fine bristle-shaped point ..... M. brevisetum
Capsule ^ by perichaetial leaves ~~half covered~~ half covered; perichaetial leaves gradually tapering to a narrow point ..... M. emersulum

30. Leaves ending in a long hair-point ..... M. piliferum
Leaves ~~without hair-point~~ not caudate 31

31. Leaves rigid, appressed when dry, not curved and twisted, ... M. intricatum
Leaves very curled and twisted when dry 32

32. Seta 15 - 20 mm. long; upper leaf cells distinct and thick-walled .. .. M. owahiense
Seta 5 - 7 mm. long; ^ upper leaf cells obscure, not thick-walled ... M. cumingii

33. Calyptra plicate; leaves serrate above ..... Ptychomitrium hauiense
Calyptra not plicate; leaves not serrate 34

34. Calyptra not pilose, covering the entire capsule ... Encalypta 35
Calyptra more or less pilose, not covering the capsule. Orthotrichum. 36

35. Peristome none, leaves obtuse, capsule plicate when dry, calyptra not fringed ..... Encalypta ..... E. sandwicensis
Peristome present; leaves ending in a short abrupt point; capsule smooth, calyptra fringed at base ..... E. scabrata
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36. Capsule cylindric, ~~not~~ covered ..... O. hawaiicum
Capsule ^ by perichaetial leaves covered 37

37./ Leaf cells minutely papillose.....O.hillebrandii
Leaf coarsely papillose.....38

38./ Stomata superficial .....O.verrucostum
Stomata immersed.....O.berggrenii

39./ Leaf margin ~~rolled inwards~~ involute 40
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40./ Leaves narrow; peristome present.....Weisia.....41
Leaves broad; peristome wanting.....Hyophila dozi-molkenboeri

41./ Peristome teeth up to 200 mu high .....W.viridula
Peristome teeth rudimentary, 10-12 mu high .....W.ovalis

42./ Peristome wanting.....43
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43./ Fruit lateral on ~~the~~ stem 44
Fruit terminal on ~~the~~ stem 46

44./ Costa wide, about 100 mu, smooth, occupying nearly 1/2 of ~~the~~ leaf base .....Molendoa crassinervis
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45./ Leaves obtuse, ~~having a stout, abrupt point~~ mucronate; areolation opaque.....A.euchloron
Leaves with short, sharp point; areolation pellucid .....A.haleakalae

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47./ Capsule contracted and longitudinally furrowed when dry, ~~with small mouth~~ Zygodon.....48
~~Mouth of~~ Capsule ~~wide, not puckered~~ otherwise.....49

48./ Peristome single; leaves toothed above..... .....Z.reinwardtii
Peristome none; leaves entire.....Z.tetragonostomus

49./ Leaves broad, spatulate; leaf cells large and lax..Funaria.....50
Leaves narrow; leaf cells small and firm.....51

50./ Capsule erect; peristome none.....F.subintegra
Capsule curved; peristome double.....F.hygrometrica

Wie kommt es im Schlüssel?

51. Leaf cells papillose; costa denticulate on back..Philonotis.....52
Leaf cells and costa smooth.....Hymenostylium firmum

52. Capsule erect; peristome none.....P.hawaiica
Capsule nodding; peristome double.....53

Antheria flower cap moss nur für Phanerogamen Aufl.?

53. Male flowers bud-like (= gemmiform); leaves blunt.....P. [illegible]issima
Male flowers like a plate (= discoid); leaves gradually tapering to a narrow point.....54

54. Leaf margin plane; costa short excurrent.....P.falcata
Leaf margin revolute; costa long excurrent.....P.turneriana

55. Peristome teeth spirally twisted.....56
Peristome with straight teeth or unknown... these 60

56. Leaves bordered with elongated cells .....Streptopogon erythrodontus
Leaves not bordered.....57

57. Leaves broad obtuse; peristome teeth from a high basal tube .....Tortula.....58
Leaves narrow acute; peristome teeth from a low basal membrane.....59

58. Hair-point denticulate.....T.princeps
Hair-point smooth.....T.alpina

59. Basal cells hyalin, extending obliquely up the margins.....
.....Tortella caespitosa
Basal cells not hyalin and not extending up margins.....Barbula vinealis

60. Peristome single 61
Peristome double or only inner peristome present.....105

61. Capsule with a neck about twice as long as the urn.....
.....Trematodon latinervis
Capsule with a short or scarcely evident neck... 62

62. Costa very broad, occupying 1/3 - 2/3 the width of the leaf base....63
Costa ~~not so broad~~ narrower.....74

63. Upper leaf cells narrowly linear.....Dicranodontium falcatum
Upper leaf cells rhomboidal to oval...Campylopus.....64

64. Upper leaves with distinct hyaline tips.....65
Upper leaves without hyaline tips.....69

65. Costa smooth or only faintly ribbed on the back.....66
Costa with serrate lamellae on the back.....68

66. Costa in cross-section with stereid cells on both sides of median guide row.....C.wheeleri
Costa in cross-section with stereid cells on dorsal side only; ventral cells large.....67

67. Plants up to 12 cm; leaves appressed when dry.....C.skottsbergeri
Plants up to 7 cm; leaves spreading when dry.....C.tubulosus

68. Costa in cross-section with both dorsal and ventral stereid bands; capsule rough.....C.umbellatus
Costa in cross-section with dorsal stereid band only; capsule not rough at base.....C.introflexus

69. Leaf base distinctly bordered with a narrow band of hyaline, elongated cells.....70
Leaf base not bordered.....72

70. Leaves about 4 mm long, not pointed like a bristle; costa percurrent.....C.densifolius
Leaves 5-7 mm long, pointed like a bristle; costa excurrent.....71

71. Leaves crowded, widely spreading.....C.hawaiico-flexuosus
Leaves not crowded, except in the comose tufts.C.purpureo-flavescens

72. Leaves obtuse, often ~~having a small notch at the end~~ emarginate, and erose at the tips.....C.exasperatus
Leaves gradually to fine point ~~...?~~ tapering.....73

73. Costa in cross-section with stereid band on dorsal side only.....C.fumarioli
Costa in cross-section with both dorsal and ventral bands.C.boswelli

74. Alar cells strongly differentiated, hyaline to brownish.....75
Alar cells not or scarcely differentiated.....80

75. Leaves with a hyaline border...Leucoloma.....76
Leaves without a hyaline border.....77

76. Stems up to 5 cm. long; leaf border broad.....I.molle
Stems about 2 cm. long; leaf border small.....I.scaberulum

77. Slender plants, not covered with a felt of radicles.....
.....Dicranoloma gracile
Robust plants, covered with a felt of radicles (= tomentose).....78

78. Peristome teeth papillose; perichaetial leaves with long points..
.....Holomitrium.....79
Peristome teeth striate; perichaetial leaves with short points...
.....Dicranum speirophyllum

79. Leaves spreading when moist, with margin entire or with fine rounded teeth at apex; stem 10 - 15 cm. high.....Holomitrium seticalycinum
Leaves squarrose-curved when moist, with margin toothed at apex; stem 30 - 40 cm. high.....H.squarrifolium
Leaves erect to squarrose when moist, with margin entire at apex; stem 3 - 10 cm. high.....H.ferrici

Wer ist es?

80. Seta stout, curved downward like a swan's neck, (= cygneous).....
.....Campylopodium euphorocladum
Seta erect and terminal on main stem or secundary branches.....81
~~Seta lateral on the prostrate stem, erect, curved.....~~

War dieses Dicranella hawaiica?

81. Marginal leaf cells in cross-section bistratose.....82
Marginal leaf cells in one layer.....87

82. Cell-walls of the leaf base wavy from side to side (= sinuous)..
.....Grimmia.....83
sinuous
Basal cells with straight walls .....Dicranoweisia cirrata

83. Leaves without hair-points; capsule overtopped by the perichaetial leaves.....Jamaica G.scabrifolia
Leaves with hair-point; capsule uncovered.....84

84. Seta erect or scarcely curved 85
Seta curved like a swan's neck; upper leaf cells in one layer...
.....G.trichophylla
cygneous

85. Upper leaf cells in two layers.....G.haleakal
bistratose
ensis?
Upper leaf cells in one layer only (except "margin").....86

86. Hyaline hair-point short, and smooth.....G.torquata
Hyaline hair-point long, and rough.....G.laevigata

87. Leaf cell-walls ~~waved from side to side (= sinuose)~~ sinuous .Rhacomitrium...88
Leaf cell not sinuose.....90

88. Leaves without hyaline points.....R.fasciculare
Leaves with hyaline points.....89

89. Hyaline point papillose and irregularly notched .....R.lanuginosum
Hyaline leaf-point not papillose, finely toothed at ~~the~~ leaf margins..
.....R.crispulum

90. Leaves strongly crisped when dry.....91
Leaves erect and flexuose when dry, not crisped.....92

91. Leaves serrate above; stems densely covered with felt of radicles (= tomentose)..... Zygodon ..(See also no.45!).
Leaves entire or sinuate; stems not tomentose..Dicranoweisia..See No.81

92. Peristome teeth broad at base or in pairs.....93
Peristome teeth filiform..(in pairs or not?).....99

93. Peristome teeth bifid ? Richtig? 94
Peristome teeth in pairs... .....Rhabdoweisia denticulata

94. ~~Cells of leaves~~ leaf cells linear.....Dicranella.....95
Leaf cells rhomboidal, large, lax.....Tayloria sandwicensis

95. Peristome teeth coarsely papillose, not striate..... Dicranella D.integrifolia
Peristome teeth vertically papillose-striate.....96

96. Leaves erect and rigid.....D.rigidula
Leaves with flexuose-spreading or falcate to one side twisted points.97

97. Peristome teeth less than 200 mu high.. .....D.hillebrandii
Peristome teeth 250 mu or more high.. 98

98. Stems 3-4 cm. high; leaves 4-5 mm long, widely spreading .....D.hawaiica
Stems about 1 cm high; leaves to 2,5 mm long, falcate to one side...
.....D.hochreutineri

99. Leaf cells smooth.... 100
Leaf cells papillose.....101

100. Leaves with bluish green bloom on the back; capsule erect ..... Saelania glaucescens
Leaves without bloom; capsule inclined ..... Ceratodon purpureus

101. Leaf margin coarsely toothed above ..... Leptodontium brevicaule
Leaf margin not toothed 102

102. Leaf margin recurved ..... Didymodon recurvirostre
Leaf margin plane 103

103. Leaves obtuse, having a short abrupt point ... Trichostomum 104
Leaves 12 mm long, slenderly tapering to a narrow point .....
..... Pseudosymblepharis mauiensis

104. Leaves linear-lanceolate, fragile .. Trichostomum ..... T. mauiense
Leaves oblong-lanceolate, not fragile ..... T. oblongifolium

? median ?

105. Outer peristome wanting; segments of the inner peristome split along the medidial line ..... Mielichhoferia 106
Peristome double or unknown 107

106. Segments of inner peristome smooth, without appendages ..... M. nealiae
Segments of inner peristome with irregular appendages .... M. pulvinata

leaf

107. Costa toothed at back; marginal teeth of leaves in pairs .....
..... Rhizogonium 108
Leaf costa not toothed 109

108. Leaf costa very long excurrent ..... R. pungens
Leaf costa short excurrent ..... R. spiniforme

109. Leaf cells papillose; capsule elongate, about 4 x 1,5 mm .....
..... Timmia bavarica
Leaf cells papillose; capsule subglobose 110
Leaf cells smooth; capsule elongate (except "Plagiopus") 117

110. Alar cells differentiated; leaves plicate at base .. Breutelia 111
Alar cells not differentiated; leaves not plicate .. ? 112

111. Plants robust; marginal cells of the leaf base large .. B. arundinifolia
Plants small; marginal cells of the leaf base small ..... B. kilaueae

Kann man nicht sagen da Moose keine Phanerogamen sind!

112. Plants with whorled subfloral branches; leaves short..Philonotis...113
Plant Without whorled branches; leaves long..... ..Bartramia....116

113. Capsule erect; peristome none .....Philonotis...P.hawaiica
Capsule nodding; peristome double.....114

antheridia ?

114. Male flowers bud-like (= gemmiform).....P.laxissima
Male flowers like a plate (= discoid).....115

115. Leaf margin plane; costa short excurrent ...l.....P.falcata
Leaf margin revolute; costa long excurrent.....P.turneriana

116. Leaf base hyaline, sheathing; upper cells linear.....B.baldwinii
Leaf base scarcely differentiated; upper cells rectangular.....
.....B.halleriana

117. Capsule subglobose.....Plagiopus longisetus
Capsule elongate.....118

118. Very robust plants, subaquatic; leaves ~~pit~~ with thickened borders...
.....Limbella tricostata
Smaller plants; leaf borders not conspicuously thickened.....119

119. Leaves large, their cells 200 mu or more wide. 120
Leaves smaller, their cells much narrower. 122

120. Upper leaf cells isodiametric; border cells of leaves thickened...Mnium.....121
Upper leaf cells 4 - 5 times as long as wide; border cells of leaves not thickened.....Rhodobryum giganteum

121. Leaf margin with single teeth; lid long-rostrate.....Mnium M. rostratum
Leaf margin with teeth in pairs; lid short-~~beaked~~ rostrate.....M. serratum

122. Leaves closely appressed; stems smoothly cylindrical (= julaceous) ?
....Anomobryum angustirete
Leaves more or less spreading.....123

123. Capsule erect; inner peristome rudimentary.....Brachymenium exile
Capsule inclined or pendulous; inner peristome well developed.....124

124. Leaves linear, tapering to a long, slender point..Leptobryum pyriforme
Leaves broader.....125

125. Capsule deeply furrowed (= sulcate); mouth oblique...Funaria.....126
Capsule smooth; mouth not oblique.,..... 127

126. Capsule erect; peristome none.....F.subintegra
Capsule curved; peristome double.....F.hygrometrica

127. Cilia with knots in intervals (= nodose).....Pohlia.....128
Cilia with short, transverse bars at intervals (= appendiculate)...
.....Bryum.....132

128. Sterile stems without propagulae; leaf cells 4-5 mu wide, incrassate.129
Sterile stems with axillary propagulae; leaf cells 7-12 mu, not incrassate...130

? antheridia and archegonia ?

129. Having the male and fertile organs in the same inflorescence, but not mixed (= [illegible]).....131
Having the male and fertile organs on separate plants .(= dioecious)
.....P.mauiensis

? antheridia and archegonia ?

130. Propagulae filiform and pale.....P.gracilescens
Propagulae obovoid and brown.....P.leucostomoides

131. Leaf costa percurrent.....P.baldwinii
Leaf costa ending before the apex.....P.cruda

132. Leaves spirally twisted when dry .....B.vino-viride
Leaves not spirally twisted when dry.....133

133. Robust plants; leaves 3 mm. or more long.....134
Slender plants; leaves 2,5 mm. or less long.....135

134. Leaves spreading, the uppermost in comose, rosulate tufts..B.decaisnei
Leaves erect, not comose .....B.baldwinii

? Leaf costa ?

135. Leaves ending about 2/3 up; upper cells colorless.....B.argenteum
Leaf costa excurrent.....136

136. Leaf costa long excurrent.....B.caespititium
Leaf costa short excurrent.....137

137. Leaves about 2,5 mm long; capsule constricted under the mouth when dry..... .....B.megalostegium
Leaves about 1,5 mm long.....138

138. Leaves flaccid; seta 1,5 cm. long ..... B. mauiense
Leaves firm; seta 2,5 cm or more long..... 139

139. Leaves bordered with 2-3 rows of narrow cells..... B. crassicostatum
Leaves not bordered..... B. erythrocarpum

140. Stems with dimorphous leaves: "normal" leaves in two lateral rows and ventral leaves (= amphigastria)..... 141
Amphigastria wanting; "abnormal" leaves in 1 ventral row 142

141. Leaves bordered with linear cells..... Hypopterygium sandwicense
Leaves not bordered..... Rhacopilum cuspidigerum

142. Leaf costa about 2/3 length of leaf; branches divergent..... Hookeriopsis pupurea
Leaf costa single or short and double or none..... 143

143. Leaf costa single..... 144
Costa short and double or none..... 183

144. Leaves bordered with linear cells..... 145
Leaves not bordered..... 150

145. Peristome teeth papillose, with a zigzag median line. Daltonia... 146
Peristome teeth cross-striate, furrowed along the median line... Distichophyllum..... 149

146. Leaf cells lax, thin-walled; costa extending nearly to apex..... Daltonia baldwinii
Leaf cells firm, incrassate; costa shorter..... 147

147. Leaf border indistinct, especially below..... D. pseudostenophylla
Leaf border distinct..... 148

148. Leaf border 12 - 16 rows wide at base ..... D. contorta
Leaf border about 5 rows wide at base..... D. rufescens

Distichophyllum

149. Upper leaf cells uniform..... D. paradoxum
Upper leaf cells large and lax toward the costa..... D. freycinetii

150. Costa of branch leaves long excurrent, toothed on the back..... Cyrtopus setosus
Costa of branch leaves short excurrent or ending below apex, not toothed on back.. 151

151. Leaf cells papillose.....152
Leaf cells smooth.....164

152. Stems tripinnate or bipinnate, prostrate; stem- and branch-leaves dimorphous.....Thuidium.....153
Stems pinnate or irregularly branched.....156

153. Slender plants; leaves not plicate.....154
Robust plants; leaves plicate.....155

154. Seta smooth; perichaetial leaves not ciliate.....T. crenulatum
Seta rough above; perichaetial leaves ciliate.....T. nanophyllum

155. Costa of stem-leaves ending below the apex.....T. plicatum
Costa of stem-leaves ending in a long filiform point....T. hawaiiense

156. Very small plants with minute leaves.....157
Larger plants, leaves 2 mm. or more long.....159

157. Leaf costa faint, ending below mid-leaf; leaves very fragile, appressed when dry.....Haplohymenium triste
Leaf costa distinct, percurrent or nearly so; leaves not fragile but spreading and curled and twisted when dry..Claopodium....158

158. Leaf cells uniform, marginal row not different.....C. amblystegioides
Marginal row of cells elongated, smooth.....C. hawaiiense

159. Stems rigid; leaves not complanate.....Trachypus.....160
Stems long and flexuose; leaves complanate.....161

160. Rather large plants; leaves plicate.....T. bicolor
Slender plants; leaves not plicate.....T. mauiensis

161. Leaf costa extending into narrow point, upper margins undulate; cells unipapillate.....Aerobryopsis.....162
Leaf costa faint, ending about mid-leaf; cells with seriate papillae.....Floribundaria.....163

162. Leaves oblong-lanceolate, very long, narrowed to a point.....aeroberyopsis longissima
Leaves broadly ovate, short, narrowed to a point.....A. scariosa

163. Alar cells not or scarcely differentiated.....F. floribunda
Alar cells of branches-leaves in well defined group.....F. baldwinii

164. Leaves transversely undulate.....Neckeriopsis.....165
Leaves not transversely undulate.....166

165. Leaf costa very short and double,.....N.lepineana
Leaf costa extending beyond mid-leaf.....N.obtusata

166. Leaves strongly plicate.....167
Leaves not or scarcely plicate.....168

167. Leaves with large, incurved lobe (= auricle) on the basal angle..
.....Trachypodopsis ornans
Leaves not conspicuously auricled .....Pleuropus wilkesianus

168. Branch-leaves coarsely toothed above..... ..169
Branch-leaves not coarsely toothed 170

169. Branches very flat; leaf costa short.. ....Homaliodendron flabellatum
Branches slightly flattened; leaf costa ending near apex .....
.....Thamnium speciosum

170. Plants large and dendroid.....171
Plants smaller, not dendroid.. 172

Von welcher Lokalität stammt dieses Wort?

171. Leaves transversely undulate; stem and branches very flat.....
.....Baldwinella kealeensis
Leaves not undulate; branches slightly flattened..... sis
.....Trachyloma tahitense

♀

172. Plants very small and delicate with minute leaves, less than 1 mm. long.....Fabronia degeneri
Plants larger, leaves 1,5 mm, or more long 173

?, 173. Differentiated alar cells numerous.....Sterophyllum oahuense
Differentiated alar cells few or none.....174

174. Lid of capsule short, conic.....Brachythecium.....175
Lid of capsule with long needle-like beak 179

175. Leaves plicate..... 176
Leaves not plicate..... 177

long acuminate

176. Seta smooth; leaves long-tapering to point.....B.lamprocarpum
Seta scabrous; leaves shortly tapering to point.....B.rutabulum

short acuminate

177. Leaf margin sharply toothed.....B.hawaiiense
Leaf margin not serrate or minutely toothed.....178

178. Leaves minutely toothed .....B.oxyrrhynchium
~~Leaf margin~~ Leaves entire.....B.plumosum

179. Leaves narrow; capsule erect.....Rhynchostegiella hawaiica
Leaves broad; capsule horizontal.....Eurhynchium.....180

180. Stems slender; stem-leaves long, tapered to a narrow point; stem- and branch-leaves dimorphous.....E.vagans
Stems robust; stem- and branch-leaves scarcely different.....181

181. Leaves obtuse.....E.milleri
Leaves acute or gradually narrowed to a point 182

? antheridia and archegonia ?

182. Having male and fertile organs on separate plants; leaf costa ending in a prickle on the back.....E.selaginellifolium
Having male and fertile organs on the same plant, leaf costa not ending in a prickle.....E.celebicum

183. Leaves regularly transversely undulate.....184
Leaves not or indistinctly undulate.....186

184. Leaves obtuse or broadly rounded.....Neckeropsis.....185
Leaves acute.....Neckera hawaiico-pennata

Neckeropsis

185. Leaf costa very short and double.....N.lepineana
Costa extending beyond mid-leaf.....N.obtusata

186. Leaf cells very large and lax, 40 - 50 mu wide.....Hookeria acutifolia
Leaf cells smaller, less than 25 mu wide.....187

187. Leaves plicate.....188
Leaves not plicate.....189

188. Capsule overtopped by perichaetial leaves (= immersed).....
.....Garovaglia haleakala
Capsule ~~broadly~~ exserted; seta long.....Ptychomnion aciculare

189. Alar cells distinct: large and inflated or small and numerous.....190
Alar cells indistinct or none.....212

190. Alar cells few, inflated, hyaline or colored..... 191
Alar cells not inflated..... 196

191. Plants small; leaves less than 1,5 mm. long.....192
Plants larger; leaves 2 mm. or more long.....194

192. Leaves sharply toothed in upper half.....Hageniella pacifica
Leaves entire or minutely toothed.....193

193. Lid of capsule conic and short-beaked; leaf cells 2-3 mu wide, often seriate papillose.....Taxithelium mundulum
Leaf cell 4-5 mu wide, smooth; lid of capsule with long, needle-like beak; .....Semathophyllum hawaiiense

194. Seta 3-4 cm. long, smooth; cell of the outer wall of the capsule not collenchymatous.....Brotherella apaecodon
Seta less than 1,5 cm long, scabrous above.....195

195. Capsule cylindric; seta strongly scabrous; leaf cells often seriate papillose ....Trichosteleum hamatum
Capsule ovoid, very slightly scabrous above, leaf cells smooth..... ....Acroporium fusco-flavum

196. Small, slender plants, often with terminal clusters of microphyllous branches.....Aptchella robusta
Robust plants, without microphyllous branches.....197

197. Stems penculous, long, and flexuose.....198
Stems not penculous..... ... .199

198. Leaves deeply concave, ending with short abrupt point (= apiculate); leaf cells smooth.....Pilotrichella mauiensis
Leaves gradually narrowed to a long hair-like point; leaf cells often papillose..... ....Barbella trichophora

199. Leaves complanate or erect-spreading; alar cells numerous, not incrassate.....Entodon.....200
Leaves more or less curved to one side; alar cells fewer and incrassate or decurrent.....201

200. Stems flattened; leaves complanate with short sharp point. E. solanderi
Stems smooth and cylindrical; leaves obtuse.....E. subcuspidata

201. Robust, rigid; leaves short pointed, subentire. Camptochaete pulvinata
More slender, not rigid; leaf margin toothed..... 202

202. Leaves coarsely serrate.....203
Leaves finely narrowed to point.....204

? Stem ?

203. With pseudoparaphyllia (= minute leaf-like organs) at the branch-insertions..... .....Hypnum plumaeforme
Without pseudoparaphyllia.....Heterophyllum subauriculatum

204. Leaves with fragile, decurrent small lobes at the basal angles.... ..... Ctenidium..(See No.220).....205
Leaves without lobes at the basal angles..Glossadelphus.....206

Ctenidium

205. Robust plants; branches not flagelliform.....C.decurrens
Slender plants; ultimate branches filiform with microphyllous leaves ~~at~~ 1 mm. ~~length~~ long ....C.elegantulum

206. Leaves entire or nearly so.....207
Leaves serrate or finely toothed at the margins..... 208

207. Leaves obtuse; branches with moderately long, acute points..... .....Glossadelphus.....Cirroratus
Leaves rounded; branches blunt at tips.....G.mauiensis

208. Leaves obtuse..... 209
Leaves acute..... 210

209. Leaves narrowed at apex; cells smooth.....G.limnobioides
Leaves rounded, retuse; cells papillose.....G.baldwinii

210. Alar cells none or very few ...,.....G.zolingeri
Alar cells numerous, quadrate 211

211. Costa 1/2 of leaf-length.....G.chrysobasilaris
Costa none.....G.acutifolius

212. Leaf cells lax, up to 15-18 mu wide.....Vesicularia graminicolor
Leaf cells firm, long, narrow.....213

Plant?

213. Robust; stem bipinnate; branches ascending. Macrothamnium macrocarpum
Plant? More slender, branching subpinnate or irregularly, nearly prostrate...214

214. Leaves entire or minutely toothed at apex, narrowed gradually to point..... 215
Leaves finely toothed or rounded at apex.....219

215. Leaves decurrent or deeply concave..... ..Plagiothecium.....216
Leaves neither decurrent nor deeply concave....Isopterygium.....218

216. Rather robust plants; leaves deeply concave, more or less undulate
.. ..Plagiothecium..... P.draytoni
More slender plants; leaves slightly concave, not undulate.....217

217. Leaves up to 2 - 2,5 mm long; margin plane; cells 12 - 15 mu wide...
.....P.mauiense
Leaves up to 1,4 mm long; margin revolute below; cells 8-10 mu wide.
.....P.denticulatum

Isopterygium

218. Leaves up to 1,8 mm. long, ovate, short-pointed.....I.vineale
Leaves less than 1 mm long, slenderly narrowed to point..I.albescens

219. Leaves rounded or with short point....Glossadelphus..(See No." 204")
Leaves finely narrowed to long point..... 220

Plant

220. In dense plumose mats; capsule oblong; leave with fragile, decurrent lobes at basal angles...Ctenidium(See No. 204)
Plants in flat mats; capsule short and turgid ; leaves without lobes at basal angles...Ectropothecium.....221

marginally throughout

221. Leaves less than 1 mm long, finely toothed, around....E.viridifolium
but
Leaves about 1 mm long, finely toothed above, entire below.....222

222. Stems elongate, regularly branched, pinnate..... .....E.arcuatum
Stems short, irregularly branched.... .....E.sandwichense

Wir wissen nicht ob diese ein sphalm sein soll nach dem Regeln.

Degener's "Rosetta Stone". Please keep for me. O.D.

The following lists localities in which I collected plants. My herbarium number up to Jan. 6, 1942 is 15613. The next is to be 15614. because of some additional Fiji specimens numbered, I am beginning at 16,000 Oct. 6, 1942

7/19/41 Belo, near Vatukarasa, Viti Levu, Fiji. Aloisio Tambualewa alone.
7/9/41 Uluvatu, near Belo, Viti Levu, Fiji. Aloisio Tambualewa alone
7/8/41 Near Saru, Viti Levu, Fiji. Aloisio Tambualewa alone
6/22/41 (Arrive Belo, Viti Levu, Fiji
6/18/41 Buyobuyo, near Nambutini, Viti Levu, Fiji. Forest.
6/17/41 " " " "
6/14/41 Waimbale, near Nambutini, Viti Levu, Fiji. Dense forest.
6/13/41 Vatukathevatheva, near Vaileka, Viti Levu, Fiji.
6/10/41 Saulagitua Rewasa, Viti Levu, Fiji. Forest at top.
6/7/41 Forest southwest of Rewasa, Viti Levu, Fiji.
6/6/41 Vatumdamusewa, Rewasa, Viti Levu, Fiji.
6/5/41 Waidawa, Rewasa, Viti Levu, Fiji.
6/3/41 Mataimeravula, Rewasa, Viti Levu, Fiji. Dryish forehill forest & summit forest.
6/2/41 Vatumdamu, Rewasa, near Vaileka, Viti Levu, Fiji. Dry forested forehills.
5/30/41 Tuvavatu, between Rewasa & Nokonoko, Viti Levu, Fiji. Forehills & summit forest.
5/28/41 Mataimeravula, Rewasa, Viti Levu, Fiji. (dialect is Ra)
5/27/41 Korovou, Viti Levu, Fiji.
5/18/41 Naruku, near Belo, Viti Levu, Fiji. 800 ft elev.
5/15/41 Yawe, near Belo, Viti Levu, Fiji. 1000 ft. elev.
5/12/41 Uluvatu, near Belo, Viti Levu, Fiji. 1000 ft. elev.
5/10/41 Lumuka, Belo, Viti Levu, Fiji.
5/7/41 Belo, Viti Levu, Fiji.
5/5/41 Vatutavathe, near Gnaloa, Viti Levu, Fiji. 300-500 ft.
5/2/41 Vatuvilakia, near Gnaloa, Viti Levu, Fiji. 300 ft. elev.
4/29/41 Gnaloa along beach to Thulanuku Village, Viti Levu, Fiji.
4/25/41 Mt. Gamo, Gnaloa, Viti Levu, Fiji. Up to 500 ft.
4/20/41 Bulu, near Sovi Bay, Viti Levu, Fiji. (Aloisio Tambualewa's dialect is Nerua)
4/8/41 Natumbakula, near Singatoka, Viti Levu, Fiji.
4/7/41 " "
4/4/41 North of Natalau, near Lautoka, Viti Levu, Fiji. Dry forested gulch.
4/2/41 Fatia, west of Tavua, Viti Levu, Fiji. Dry forested gulch.
4/1/41 Korovou, east of Tavua, Viti Levu, Fiji. Isolated dryish forested gulch, "water reserve" at 200 - 500 ft.
3/26/41 Nadrau, Viti Levu, Fiji. 2000 ft. (Benny Collector)
3/23/41 Nadarivatu, Viti Levu, Fiji.
3/21/41 Vuninatabua, Navai, Viti Levu. Fiji (4th palm)
3/16/41 Nandala, west of Fish Hatchery, Viti Levu, Fiji.
3/14/41 Between Nadarivatu & Nandala, Viti Levu, Fiji.
3/13/41 Nauwanga, about 3 miles south of Nadarivatu, Viti Levu, Fiji. (Emilio Ordonez left on Mariposa; Michael came - his dialect is Lomaivuna, Viti Levu)
3/10/41 Avu, Nandala, Viti Levu, Fiji (Timoce Bembe collector)
3/9/41 Vuninatabua, Navai, Viti Levu, Fiji (Daniel for palms)
3/8/41 Nandala, near Nadarivatu, Viti Levu, Fiji.
3/6/41 Nauwanga (along mt. top toward lumber mill), near Nandala, Viti Levu, Fiji.
3/4/41 Sovutawabu, 5 miles from Nadarivatu, Viti Levu, Fiji.
3/2/41 Mt. Matomba, Nandala, Viti Levu, Fiji.
2/29/41 Nauwanga, near Nadarivatu, Viti Levu, Fiji.
2/28/41 Mt. Matomba, Nandala, Viti Levu, Fiji (Timoce Bembe Coll.)
2/27/41 Sovutawabu, near Nadarivatu, Viti Levu, Fiji. Open forest.
2/24/41 Nauwanga, near Nadarivatu, Viti Levu, Fiji.
2/18/41 Mt. Matomba, Nandala, near Nandarivatu, Viti Levu, Fiji. Timoce Bembe's dialeft is Sabatu.

2/15/41 Mt. Matomba, "andala, near Nadarivatu, Viti Levu, Fiji. Forest
2/13/41 Nauwanga, near Fish Hatchery, near Nadarivatu, Viti Levu, Fiji.
2/9/41 Fish Hatchery, near Nadarivatu, Viti Levu, Fiji
2/6/41 Fish Hatchery, Near Nadarivatu, Viti Levu, Fiji.
2/4/41 Fish Hatchery, near Nadarivatu, Viti Levu, Fiji. 2500 ft.
1/23/41 Mataqaledanu, near Salt Lake, Vanua Levu, Fiji.
1/22/41 Sana, Maravu, Vanua Levu, Fiji.
1/21/41 Along shore, Maravu, Vanua Levu, Fiji.
1/17/41 Maravu, back of "aina, Vanua Levu, Fiji.
1/16/41 Maravu, vanua Levu, Fiji.
1/12/41 East of Naunduna, Yanawai, Vanua Levu, Fiji.
1/10/41 Between Balanga & Valethi, Savu Savu Bay, Vanua Levu, Fiji.
1/6/41 Vatunivuamode Mt., Savu Savu Bay, Vanua Levu, Fiji.
1/2/41 Uluinabathi Mt., Savu Savu Bay, Vanua Levu, Fiji. 940 ft.
12/30/40 Hill east of Balanga, Savu Savu, Vanua Levu, Fiji.
12/29/40 Along shore from Balanga to Urata, Vanua Levu, Fiji.
12/26/40 Savuthuru Mt., northeast of Valethi, Vanua Levu, Fiji.
12/25/40 Savu Savu Bay between Urata & Valethi, Vanua Levu, Fiji (Deft "Cheng-Ho")
12/22/40 Makondronga, Fiji.
12/21/40 Levuka, Ovalau, Fiji.
12/15/40 Suva pumping sta ion. Viti Levu. Fiji
12/13/40 Rakiraki, Viti Levu, Fiji. Scrub at 100 ft.
12/5/40 Northwest gulch of small jagged range north of Lomolomo, Lautoka, Viti Levu, Fiji.
12/4/40 Lautoka, Viti Levu, Fiji. (Collected from wharf to village)
11/29/40 Gnaloa, Viti Levu, Fiji. (Emilio Ordonez called alone).
11/24/40 Left Nadarivatu, Fiji.
11/20/40 Loma Langi Trail, Nadarivatu, Fiji.
11/15/40 Near botanic garden, Suva, Fiji (Ended with 13,031 in Hawaii; started with 13,500 in Fiji)
# #
9/29/40 Puu Lio, West Maui, T.H.(Emilio Ordonez alone)
9/15/40 Kawaihapai Beach, Oahu, T.H.
9/15/40 Waihee, Maui. 3000 elev. Emilio Ordonez alone.
9/8/40 North slope of Papale Gulch, Hauula, Oahu.
9/1/40 Near Kapuhi, Kawaihapai, Oahu.
8/3/40 Kealia-Makua Trail, Oahu.
7/28/40 Lanaihale, Lanai (Emilio Ordonez Coll.)
7/21/40 Puu Alii, Lanai,(Emilio Ordonez Coll.)
7/14/40 Puu Alii, Lanai (" " "
7/7/40 Waialala Gulch, Lanai " " "
7/4/40 Hauula Valley, Oahu
6/23/40 Summit ridge between Puu Kanehoa & Puu Kaua, Oahu.
6/16/40 Oio, Paumalu Trail, Oahu.
6/11/40 Waipilopilo, Hauula, Oahu.
5/19/40 West branch Kaaawa Gulch (north of Kaala) having ditch tunnel.)
5/1/40 Middle ridge east of Puu Kanehoa, Oahu, T.H.
4/28/40 Peahinaia Trail, Oahu.
4/14/40 Northeast ridge of Puu Kanehoa, Oahu.
4/11/40 Kaumokunui, Oahu.
3/31/40 Northeast ridge of Puu Kanehoa, Oahu.
3/20/40 Honouliuli Contour Trail below Puu Kanehoa, Oahu.
1/8/40 3/4 mile southwest of Hokunui, Nawiliwili, Kauai.
1/5/40 Half mile southwest of Hokunui, Nawiliwili, Kauai.
1/3/40 Milolii Trail, Kokee, Kauai.
1/2/40 Kaawaloa Valley, Mana, Kauai.
12/31/39 Kalualea, Koloa, Kauai, T.H. (Up to 1800 ft.)
12/29/39 Hanapepe & Waimea outlook.
12/28/39 Nukumoi, Koloa, Kauai, T.H.
12/26/39 Kawaiumakua, Anahola, Kauai, T.H.
12/25/39 Waiokihi, Hanalei, Kauai.
12/24/39 Napali Trail between Makana and Waiahuakua, Kauai.

12/23/39 North slope of Pohakukane, Haena, Kauai.
12/22/39 Omoe, Kipu, Kauai, T.H.
8/30/39 Hana (by way of Makawao along main road), Maui, T.H.
8/28/39 Olowalu Valley, Maui.
8/26/39 Polipoli Springs, Maui.
8/25/39 Ukumehame Gulch, Maui.
8/20/39 Northwest side of Koolau Gap, Haleakala, Maui. Below cliffs at 5750 ft.
8/19/39 From Paliku to Holua Cave, Haleakala, Maui.
8/15/39 Cliffs south of Kuiki along east side of Kaupo Gap, Haleakala, Maui.
8/11/39 Mt. Haleakala southeast along Kaupo Gap cliffs & across Gap to Paliku, Maui.
8/9/39 Foggy region north of Kuiki just outside Haleakala Section of Park boundary, Maui.
8/7/39 Trail from Paliku to northeast rim of Haleakala Crater, Maui.
8/5/39 Paliku, Haleakala, Maui.
8/2/39 Maliko Bay, Maui.
7/30/39 McGregor, Maui
7/28/39 Southeast ridge of Iao Valley, Maui.
7/26/39 Haleakala rim chiefly from Rest House to Koolau Gap, Maui.
7/25/39 Haleakala, Maui.
6/20/39 Up ridge just southeast of Schofield Barracks boundary, Puu Hapapa, Oahu. Down short spur just east of Puu Hapapa summit.
6/4/39 First ridge just southeast of Schofield Barracks boundary, Puu Hapapa, Oahu.
5/28/39 East of Kanehoa, Oahu.
5/21/39 Honouliuli Trail on east slope of Puu Hapapa, Oahu.
5/7/39 Northeast ridge of Puu Hapapa to summit, Oahu.
4/30/39 Mauka of Kawaiiki ditch intake, Oahu.
4/9/39 Large valley on northeast slope of Puu Hapapa, Oahu.
3/25/39 Between Puu Pane & Maili, Oahu.
3/23/39 Anahulu Trail, Oahu.
3/18/39 Sacred Falls, north rim Kaluanui Valley, Oahu.
2/11/39 Makaleha Valley, Oahu.
9/25/39 Summit of Kaala, Oahu.
9/3/38 East slope of Puu Hapapa, Oahu
9/2/38 Pupukea, Oahu.
8/2/38 Kaaawa Gulch (north of Kaala), Oahu.
7/24/38 Waimea Valley, Oahu.
7/17/38 Kauiki, Oahu.
7/3/38 Kawailoa C.C.C. trail to summit divide, Oahu.
5/1/38 Summit of Kaala, Oahu
4/24/38 Pupukea-Kahuku region, Oahu.
4/3/38 Pupukea-Kahuku, Oahu.
3/21/38 Piko Trail, Makua Valley, Oahu.
3/12 (13?)/38 Kaumokunui Gulch, Oahu.
2/27/38 Ridge northwest of Kaluanui Valley, Hauula, Oahu.
1/16/38 Overlooking Kahanahaiki Valley and north of its rim, Oahu (With Hosaka)
1/1/38 Northeast of Kahanahaiki Valley, Oahu.
12/19/37 Southeast slope of Kaala, Oahu, T.H.
12/6/37 Aiea trail to summit, Oahu
10/24/37 Dillingham Ranch CCC Trail to Piko Trail at head of Makua Valley, Oahu.
8/10/37 Waianu (Waiahole), Oahu.
7/25/37 From Makua around Kaena Point to Kawaihapai, Oahu.
4/26/37 North of Kaala, Oahu.
4/17/37 Ridge directly north of Puu Kamaohanui, Oahu.
4/11/37 East side of Kaawa Gulch (north slope of Kaala), Oahu.

10/8/39 Kaneohe Oahu for Stenography Kaneohans Drs

3/29/37 Pig-God Trail, Punaluu, Oahu.
3/26/37 Ridge directly north of Kaala, Oahu.
3/17/37 Kaumuku Gulch, Puuiki, Oahu.
3/12/37 Southwest of Dillingham Ranch, Kawaihapai, Oahu.
3/6/37 Waimea Valley, Oahu.
3/3/37 Waiahole, Oahu.
2/25/37 Puulupe Trail, Kawailoa, Oahu.
2/2/37 CCC Trail, Kawaihapai, Oahu.
11/22/36 Southeast slope of Puu Kumakalii, Oahu.
10/23/36 "est central branch of Makaleha Valley, Oahu.
10/22/36 Puu Kaupakuhale, Oahu.
5/12/36 Middle Palawai Ridge, "aianae Range, Oahu.
4/21 (22 ?)/36 South Ekahanui (for most plants);Northeast for Pelea. Ekahanui ridge along Waianae Contour trail for Bidens)
4/19/36 Ekahanui, Oahu,
4/13/36 Kaumokunui Gulch, Mokuleia, Oahu.
4/10/36 Talus southwest of Waimanalo Landing, Oahu.
4/1/36 Northeast slope of Puu Kumakalii, Oahu.
3/31/36 Lahilahi, Oahu.
3/29/36 East ridge of Manoa Valley, Oahu.
3/15/36 CCC Trail, Aiea, Oahu.
3/1/36 East side of Palikea along new CCC firebreak trail to Pohakea Pass, Oahu.
2/22 (23?/36 Lahilahi, Oahu.
2/16/36 Aiea CCC Trail, Oahu.
2/9/36 Kawaiiki, Koolau Range, Oahu.
2/2/36 Half way up Kaala from Firebreak trail, Oahu.
1/19/36 East slope Puu Kaua, Oahu.
1/5/36 Palikea, Oahu.
12/16/35 From Palehua along ridge to Palikea, Oahu.
12/1/35 Nanakuli Valley below Mauna Kapu, Oahu.
11/23/35 Palehua, Waianae Range, Oahu.
11/20/35 Tantalus Cliff Trail, Oahu.
11/12/35 Around Tantalus rim, Oahu.
11/9/35
11/3/35 Waimalu, Koolau Range, Oahu
10/21 ~~(20?)~~/35 Sacred Falls, Oahu.
10/6/35 Waimano Trail toward summit, Koolau Range, Oahu
8/25/35 West of poamoho Trail, Laie, Oahu, T.H.
8/18/35 Poamoho Trail, Laie, Oahu.
7/29/35 Malaekahana Trail, Laie, Oahu.
7/26/35 Kaipapau, Oahu. pasture.
7/22/35 Nanakuli, Oahu.
7/21/35 "est side of Makaleha on trail meeting Piko Trail, Oahu.
7/20/35 Kaena Point, Oahu.
7/15/35 Kawaihapai, Oahu. Pasture & dunes.
7/14/35 Kawaihapai, Oahu (Hilea?? CCCtrail).
7/7/35 Kaipapau, east ridge, Oahu.
7/4/35 Pig God Trail to very summit of Koolau Range (distance of 6 miles along trail), Oahu.
7/3/35 Waimanalo, Oahu.
6/23/35 Kuliouou Valley, Oahu, T.H.
Blow Hole, Oahu.
6/16/35 Anahulu Trail, Koolau ~~Trail~~ Range, Oahu.
6/12/35 Mokuleia, Oahu.
6/9/35 Waimano, Oahu.
6/2/35 Kipapa Trail to summit ridge, Oahu.
5/26/35 Middle Halawa Ridge, Oahu.
8/15/33 Tropic, Florida also Daytona Beach, Fla.
8/14/33 Light House, Coastal dune also Deerfield, Fla.
8/13/33 Naples, sand dunes also Everglades, Fla.

Rosetta Stone

8/12/33 Venice. Coastal dune also Bonita Springs. Marsh. Fla.
8/11/33 High Springs. Field also Hernando also Tampa. Salt marsh. Fla
8/10/33 Lake City. Marsh. also Talahasse. Dry forest also Cypress also Marianna. "et meadow. also Houston. Marsh. All Florida.
8/9/33 Mobile. Alabama also Mossyhead. "et Meadow. Florida.
8/8/33 Logtown. Pine barrens. Louisians also Moss Point, Louisiana
8/7/33 Lake Pontchartrain, La.
8/6/33 Mermentau also New Iberia, La.
8/4/33 Smiley, Texas also Arcadia, Texas
8/2/33 Between Ft. Stockton & Pecos also Near Ft. Stockton also 7 miles east of Sheffield. also New Sheffield, ~~XXXXXXXXXX~~ all Texas
8/1/33 Carlsbad Caverns, New Mexico.
7/31/33 Roswell also South of Artesia, New Mexico
7/30/33 Santa Rosa also Vaughn also Romina all New Mexico
7/29/33 Rio Puerco, Arizona also Santa Fe, New Mexico also 4 miles east of Santa Fe, New Mexico.
7/28/33 Bluewater. Lava flow. also 5 miles west of open sandy dry juniper forest near Gallup. also Grant. Alkali meadow. also Old Laguna also Thoreau all New Mexico
7/27/33 3 miles east of Holbrook, Arizona. also Near Painted Desert Arizona
7/26/33 Cottonwood Wash near Winslow. On dry delta. also Walnut Canyon also 5 miles east of Walnut Canyon also 3 miles west of Holbrook,Ariz.
7/23/33 Hopi Point, Grand Canyon. On dry limestone cliff al so Grand Canyon, Arizona
7/25/33 Between Williams & Grand Canyon also Between Williams & Flagstaff also South of Montezuma Pt., Grand Canyon, all Arizona
722/33 South of Watsonville also 2 miles south of Grand Canyon, Ariz.
7/21/33 Between Ash Fork & Williams also Ash Fork also Between Williams & Grand Canyon, Ariz.
7/20/33 Oatman also 5 miles west of Peach Springs also Between Oatman & Kingman also Peach Springs all Arizona also Walapai,(Ariz.?)
7/19/33 East of San Bernadino also Hills west of Corona also Between Victorville & San Bernadino, Calif. also East of Victorville also at Victorville also Valentine also at hot springs near lava
7/14/33 Near Oxnard, Calif.
7/12/33 King City, Calif. also Salinas also Gonzales also Between Watsonville & Castroville, Calif.
7/11/33 Aptos also Santa Cruz also Between Alma & Santa Crus also San Jose also King City also Los Gatos also Alma also Solidad also Milpitam all Calif.
7/10/33 Reach San Francisco, Calif. 7/5/33 left Honolele SS Pres. Coolidg
5/7/33 Pupukea-Kahuku Trail, Oahu.
4/30/33 Pupukea-Kahuku region, Oahu.
4/12/33 Kamokuiki Valley (between Puuiki & Puu Kamaohanui), Oahu.
4/6/33 L.W.Bryan sent from Hawaii Sideroxylon & Rauwolfia
4/2/33 Directly mauka of Kawela Bay, Oahu.
3/20/33 " " " " "
3/27/33 Pupukea-Kahuku region on Kahuku side, Oahu.
3/14/33 Mokuleia, Oahu. pasture.
12/11/32 Gully having prominent dyke (this is just east of Abortopetalum Valley), Oahu.
12/4/32 Up same ridge from pipeline toward Kaala in Lualualei Valley,Oahu.
11/13/32 Up ridge leading to summit ridge half way between Kaala and Kalena on "aianae Valley side, Oahu.
11/6/32 Northern slope of Kahana Valley just opposite small Hawaiian church, Oahu.
10/30/32 Small valley southeast of Puu Hapapa, Oahu.
10/26/32 Around Tantalus rim, Oahu.
10/23/32 Below Palikea, Oahu (Third small valley south of one collected on 9/18/32
10/9/32 Red Hill & Piko Trail, Oahu.
10/2/32 (perhaps 10/4 on sheets) Manana Gulch, Oahu.

9/27/32 Southeast corner of Makua Valley (for Neowawrea with Charlie Judd)
9/18/32 Third small valley northeast of Palikea om Honolulu side (this contains pipe line arising from tunnel.), Oahu.
9/11/32 Waiawa Valley, Oahu.
9/4/32 Aiea ridge & gully, Oahu.
9/2/32 Pig God Trail, Punaluu, Oahu.
8/28/32 Hauula Vicinity, Oahu.
8/21/32 Niu Valley up streambed & down west ridge, Oahu.
8/14/32 Large branch of Lualualei Valley southwest of Pohakea Pass, Oahu.
8/7/32 Small valley northeast of Puu Hapapa, Oahu.
8/2/32 Heeia, Oahu.
7/31 (30?)/32 West side of Pohakea Pass, Oahu.
7/28/32 Puuloa, Oahu (for Cressa)
7/17 (18?)/32 From Piko Trail around rim to middle of Kahanahaiki Valley.
7/10/32 On summit from top of Piko trail to end of spur dividing Makua Valley from Kahanahaiki Valley, Oahu.
7/3/32 From Kahana church up ridge to sumpit of mountain southeast of Kahana Bay, Oahu.
6/26/32 Up ridge on right side of head of Makua Valley to summit ridge & along it to Piko Trail, Oahu.
6/22/32 Up Pig God trail to cabin & far beyond, Punaluu, Oahu.
6/11/32 Puuiki Gulch, Oahu (Formerly called it "gulch north of middle ridge between Puu Kamaohanui & Puu Pane, Oahu")
6/10/32 On east ridge of Manoa Valley, Oahu.
6/9/32 Bidens & Pleomele collected by Will Bush, Waimea Canyon, Kauai
6/4/32 Middle ridge of Niu Valley and on its western slope, Oahu
5/28/32 Pupukea-Kahuku, Oahu.
5/22/32 Pig God Trail to top and beyond Kaluanui Stream where most of the plants were collected, Oahu
5/8/32 Between Barber's Point & Pearl Harbor along beach chiefly, Oahu.
5/1/32 Lualualei Valley 1 mile east of Mauna Kuwale for Marsilea. Bidens from 500 ft. northwest of Puu Kailio near Kolekole Pass, Oahu.
4/27/32 Kaena Pt., Oahu.
4/24/32 Southwest slope of Kaala, Waianae Valley, Oahu.
4/17/32 Ridge north of South Halawa Gulch & then down into North Halawa Gulch, Oahu.
4/10/32 Waianae, Oahu. Roadside.
4/4/32 Head of Makua Valley, Oahu.
3/27/32 Kaipapau, Oahu.
3/24/32 Keawaula into Makua, Oahu.
3/23/32 Keaau Valley, Oahu.
3/20/32 South & east side within Palolo Crater, Oahu.
3/13/32 Kaala base, northeast side, Oahu.
3/5(6?)/32 Pupukea-Kahuku region, Oahu.
2/14/32 Bidens on grassy slopes near cliffs on hog-back leading from shore near Heeia to cliffs, Oahu.
2/7/32 Keaau Valley; first gully makai south side, Oahu.
1/31/32 Up Keawaula trail to plateau & then down Kaena Point along ridge, Oahu.
1/24/32 Pupukea-Kahuku Trail - along Kahuku divide - Oahu.
1/20/32 Kailua marsh, Oahu.
1/17/32 Pig God Trail to summit, Punaluu, Oahu.
1/10/32 Puuiki Gulch, Oahu.
1/3/32 Southeast side of Makua Valley near its head, Oahu.
12/13/31 Mokapu Peninsula, Oahu.
12/6/31 Pupukea-Kahuku along summit divide toward east, Oahu.
11/29/31 Narrow northeast gully in Ohikilolo Valley, Oahu.
11/28/31 Up trail in Keawaula Valley to top & then down gully on northeast side of Kahanahaiki Valley, Oahu
11/22/31 Gully southeast of Kahuku entrance of ~~Pupukea-Kahuku entrance of~~ Pupukea-Kahuku Trail, Oahu.

11/14/31 Narrow middle Waialae ridge up to where it meets large eastern Waialae ridge, Oahu.
11/11/31 Wilhelmina Rise to divide, Oahu.
11/8/31 Kaipapau streambed, Oahu.
11/1/31 Southern slope of Kahanahaiki Valley, Oahu.
10/25/31 Second ridge east of Kuliouou Valley, near summit, Oahu.
10/18/31 Up Paumalu Ridge, Waialee, Oahu.
10/11/31 Western ridge of Kaipapau Valley, Oahu.
10/4/31 Pig-God Trail, Punaluu, Oahu.
9/27/31 Between Puu Manawahua & Palikea along ridge, Oahu.
9/13/31 Between end of Kawaihapai Road & Kaena Pt, up the cliffs, Oahu.
9/7/31 First large side valley on south of Makua Valley, Oahu.
9/6/31 Ohikilolo Valley, Oahu.
8/30/31 Barbers Pt., & vicinity, Oahu.
8/16/31 Waimanalo, Oahu.
8/11/31 Pig God Trail, Punaluu, Oahu.
8/5/31 Punaluu, Oahu.
8/2/31 Makaha Valley, Oahu.
7/26/31 Tantalus rim, Oahu.
7/19/31 Pupukea-Kahuku, Oahu.
(7/9/31 Puuwaawaa Region, Hawaii coll. Nishina)
7/5/31 Kanehoa, Oahu.
6/28/31 From Makua Valley along railroad tracks to Kaena Pt.,Oahu.
6/24/31 Waikane, Oahu.
6/12/31 From Makapuu Head to valley opposite eastern side of Koko Crater, Oahu.
6/6/31 Pig-God Trail, Punaluu, Oahu.
5/30 (31?)/31 Pig God Trail to summit stream, Oahu.
5/17/31 Pupukea-Kahuku, Oahu, T.H.
5/10/31 Small gulch on south side of upper Makua Valley, Oahu.
4/26/31 West branch of valley at pali in Waianae Valley near Kolekole Pass, Oahu.
4/20/31 East ridge of Niu Valley, Oahu.
4/12/31 Hills east of Kawaihapai, Oahu.
4/4/31 Waikane-Schofield Trail, Oahu.
3/31/31 South side Koko Crater, Oahu.
3/22/31 Mauka , about 2 miles from Kaena Pt., toward Kawaihapai, Oahu.
3/21/31 Walked along beach from near Kawaihapai to Kaena Pt., Oahu.
3/16/31 Kahana ditchtrail, Oahu.
3/15/31 Waiahole trail, Oahu.
2/28/31 Kahuku, Oahu.
11/16/30
9/28/30 Valley east of Kawaihapai Station, Oahu
5/16/30 Thurston Lava Tube, Kilauea, Hawaii.
5/9/30
5/7/30 Hilea & Punaluu, Hawaii.
5/4/30 26 Miles, Hawaii.
5/2/30 Puna, Hawaii.
4/27/30 Lua Manu & also 23 Mile Forest, Hawaii.
4/25/30 29 Miles, Hawaii.
4/19/30 29 Miles, Hawaii.
4/16/30 Bird Park, Kilauea, Hawaii.
4/15/30 Bitd Park & Mauna Loa trail, Hawaii.
4/13/30 Punaluu, Hawaii, T.H.
4/12/30
4/10/30 Hilo & Olaa, Hawaii.
4/9/30 Kilauea, Hawaii.
4/2/30 Returned from Puna trip.
4/1/30 Kailua - left in morning. Hawaii.
3/31/30 Hookena & Kailua, Hawaii.
3/30/30 Between Ohia & Koa Mills opp. road leading to Hoopuloa, Hawaii.

3/29/30 Between Ohia & Koa Mills, Hawaii.
3/25/30 Between Waimea & Honokaa also near Acacia koaia place.
3/24/30 Halawa (endemic Chenopod.) also Mookini heiau (Ipomoea),Hawaii.
3/23/30 Niulii also Pololu, Hawaii.
3/22/30 Started for Kohala & c mped at Niulii, Hawaii.
3/17/30 Punaluu, Hawaii
3/12/30 Puna, Hawaii.
3/6/30 South side Hilo Bay, Hawaii.
2/22/30 Makaopuhi Crater, Hawaii.
2/18/30 Aa kipuka between Honuapo & Hilea, Hawaii.
2/17/30 " " " " " "
2/7/30 Fern in opem,wet,ditch between Olaa & Pahoa also Bidens on 1788 flow between Pahoa & Kalapana, Hawaii.
2/3/30 Puna for Bidens; Clermontia at Pahoa & Kapoho, Hawaii.
2/2/30 Near Anuhea Golf Course, Glenwood, Hawaii.
1/27/30 Kipuka NeeHee, Hawaii.
1/25/30 Napau Crater, Hawaii.
1/24/30 Hawaii National Park, Hawaii.
1/20/30 Near Hind Ranch, Puuwaawaa, and aecund rest of island by way of Laupahoehoe, Hawaii.
1/18/30 Huehue & Puuwaawaa, Hawaii.
1/17/30 Milolii, Hawaii.
1/13/30 27 Miles, Hawaii.
1/5/30 Punaluu, Hawaii.
1/3/30 Wet jungle along pig hunters' trail running northwest of 27 milepost, Kilauea, Hawaii.
12/15/29 Honuapo aa kipuka,Hawaii
12/12/29 Between Volcano House and Glenwood Golf Course, Hawaii. also Naalehu, Hawaii
12/7/29 Bird Park, Kilauea, Hawaii.
12/5/29 Near Napau Crater, Hawaii.
11/29/29 Lua Manu, near Kilauea, Hawaii.
11/22/29 Between eastern Fern Forest trail & Glenwood Golf Course,Hawaii.
11/17/29 Near Treefern forest, Kilauea, Hawaii
11/13/29 " " " " "
11/10/29 " " " " "
11/9/29 Near Hilo entrance of Hawaii National Park, Hawaii.
11/5/29 Near Treefern Forest, Hawaiil
11/1/29 Between Volcano House & 29 Miles, Hawaii. Woods.
10/31/29 Near Fern Forest, Kilauea, Hawaii.
10/30/29 " " " " "
10/28/29 " " " " "
10/21/29 Sadleria Hille. near Sulphur Banks, Kilauea, Hawaii.
10/15/29 Bottom og Kilauea-Iki, Hawaii.
10/14/29 Kau Desert near Kilauea, Hawaii.
10/13/29 Chain of Craters road. also Jungle near Volcano House, Ha awaii.
10/1/29 Byron camp, Kilauea, Hawaii.
9/30/29 Kawaihae, Hawaii.
9/29/29 Kawaihae, Hawaii.
9/28/29 Puuwaawaa, Hawaii.
9/27/29 Punaluu, Hawaii, T.H.
9/26/29 Kalapana, Hawaii (awa from Pahoa)
9/25/29 Kalapana, Hawaii.
9/24/29 Kalapana, Hawaii.
9/23/29 Leave Keei and go Hilo, Hawaii.
9/22/29 Keei, Hawaii.
9/21/29 Milolii; arrive at Keei, Hawaii.
9/20/29 Milolii (near Hoopuloa), Hawaii.
9/18/29 Pukawaakauhi, Hawaii.
9/17/29 South Point, Hawaii.
9/16/29 East of South Point, Hawaii.

9/13/29 Nearer Kaalualu, Hawaii. Dry aa desert forest.
9/12/29 " " " " " "
9/10/29 Tree-covered aa kipuka half way between Kaalualu & Waiohinu, Hawaii.
9/9/29 same
9/8/29 same
9/7/29 same
9/6/29 Halfway between Kaalualu & Waiohinu, Hawaii.
9/2/29 Btween Kaalualu & Waiohinu hospital, Hawaii.
8/31/29 Kipuka Puaulu, Kilauea, Hawaii.
8/23/29 On way to Waikapuna, Hawaii.
7/9/29 Bird Park region, Kilauea, Hawaii.
7/8/29 Bird Park, Hawaii.
6/[illegible](30?)/29 27 Miles, Glenwood, Hawaii.
6/28/29 In jungle between Glenwood & 29 Miles, Hawaii.
6/27/29 Hilo, Hawaii.
6/24/29 In jungle between Glenwood & 29 Miles, Hawaii.
6/23/29 Near Glenwood jungle, Hawaii.
6/22/29 Near Onomea, Hawaii.
6/19/29 Glenwood jungle, Hawaii.
6/18/29 Glenwood & 29 Miles. Wet jungle. also Uwekahuna, Hawaii.
6/16/29 40 miles from Hilo in Kau Desert, Hawaii.
6/15/29 Between Glenwood & 29 Miles, Hawaii. Wet jungle.
6/12(13?)/29 Olaa, Hawaii.
6/11/29 Glenwood, Kilauea region, Hawaii.
6/9/29 Glenwood region, Hawaii.
6/7/29 29 Miles, Hawaii.
6/4/29 Left Honolulu for Hilo, Hawaii.
5/27/29 Diamond Head, Oahu.
5/12/29 Near Pupukea end of Pupukea-Kahuku trail, Oahu.
4/1/29 Near summit of Pupukea-Kahuku Trail, Oahu. Rainforest.
3/31/29 Pupukea-Kahuku summit, Oahu. Hesperomannia flowers!!!
3/29/29 Pupukea end of Pupukea-Kahuku Trail, Oahu.
3/3/29 Olomana Needle, Oahu.
2/26/29 West side of Kahana Valley, Oahu.
2/17/29 Koko Head, Oahu.
2/3/29 East ridge of Manoa Valley, Oahu.
1/27/29 Kawaihapai, Oahu.
1/20/29 base of cliffs to right of Nuuanu Pali, Oahu, Wooded, quite wet.
1/13/29 East crest of Manoa Valley, Oahu. Lower forest. Coll. O.D.
Bidens & Lipochaeta from Topping Collected along Niu Ridge, Oahu.
1/4/29 Tantalus Crater rim, Oahu.
8/19/28 Leave Wailau Valley, Molokai.
8/18/28 Wailau Valley, Molokai.
8/17/28 Wailau Valley, Molokai. (Brighamia about this date)
8/16/28 Wailau Valley, Molokai (Tacca)
8/15/28 Wailau Valley, Molokai.
8/14/28 Wailau Valley. Molokai.
8/13/28 Wailau Valley, Molokai.
8/12/28 Wailau Valley, Molokai.
8/11/28 Wailau Valley, Molokai
8/7/28 I leave Wailau Valley, Molokai.
8/6/28
8/5/28 Wailau Valley alonh shore, Molokai.
8/4/28 Wailau Valley along shore, Molokai.
8/3/28 Wailau Valley, Molokai.
8/2/28 Wailau Valley, Molokai.
7/31/28 Mapulehu Valley, Molokai.
7/30/28 Kaunakakai, Molokai.
7/29/28 One of the dry valleys between Kamalo and Kaunakakai, Molokai.
7/26/28 Valley west of Kamola, Molokai.

check if Kamalo

7/27/28 Branch of Mapulehu Valley, Molokai.
7/25/28 Mapulehu, Molokai.
7/24/28 Mangrove near Pakanaka Pond; Colubrina near Pauwalu, Molokai.
7/23/28 Western branches of Mapulehu Valley, Molokai.
7/21/28 Maunahui, Molokai.
7/20/28 Western branches of Mapulehu Valley, Molokai.
7/17/28 On East Ohia Ridge, Molokai.
7/16/28 Up valley west of East Ohia, Molokai.
7/13/28 Along road in vicinity of Pukoo, Molokai.
7/12/28 East arm of Kaluaaha Valley, Molokai.
7/11/28 Ualapue to Kamalo & return, Molokai.
7/10/28 To Kaunakakai from Ualapue & back & beyond Mapulehu, Molokai. Road.
7/3/28(Up ridge back of Hitchcock house) East part of Kaluaaha plateau, Mk.
7/2/28 Cut foot swimming
6/30/28 Gulch west of Ualapue, Molokai..
6/29/28 Kamalo Gulch, Molokai.
6/28/28 Kaluaaha, Molokai. Rain-forest.
6/27/28 Second eastern gulch, Wawaia, Molokai.
6/26/28 Between Ualapue & Hoolehua. Roadside weeds.
6/25/28 Up Kapulei Ridge to east of white Kaholoapele Mt. & then back in east gully, Molokai. Arid region.
6/24/28 Kaluaaha, Molokai. Brackish marsh.
6/21/28 Walked from Halawa Valley along trail to Halawaiki Gulch near its head where we found Bidens - then toward coast until we reached stream east of Puahaunui Pt. Umbellifer between Puahaunui Pt. & Kaonihu in small ravine just off coast - saw a few others on coastal cliffs - saw Brighamias again.
6/20/28 West side, Halawa Valley, Molokai.
6/19/ From Leper Path to east, passing 2 prominent gullies into second of which we walked until blocked by passable waterfall; saw 2 violets along leper path on cliffs;
6/18/28 From Leper Path leading to Kalaupapa to west along coastal cliffs, Molokai.
6/17/28 Moved out of Maunahui for good & into Kaluaaha, Molokai.
6/13/28 West Molokai.
6/11/28 East Fork of Kawela Gulch, Molokai
6/9/28 Up Mapulehu Valley to top overlooking Wailau Valley, Molokai.

6/7/28 Mokomoko Gulch, Molokai.
6/6/28 Along Papaala Pali, Molokai.
6/5/28 Kahuaawi Gulch & up unnamed left branch.
6/4/28 Kahuaawi Gulch, Molokai.
6/3/28 6 ft. high Santalum in dry part Mokomoko Gulch, Molokai.
6/2/28 Kaunakakai & 5 miles along road to east. Molokai.
6/1/28 Kahuaawi Gulch, Molokai.
5/31/28 Kahuaawi Gulch, Molokai.
5/30/28 Kahuaawi Gulch, Molokai.
5/27/28 I sick.
5/29/28 To Dr. Goodhue at Kaunakakai, Molokai.
5/25/28 Ravine just north of cabin, Molokai. Infected foot.
5/24/28 Head of Waihanau Stream, Molokai.
5/23/28 Head of Waihanau Stream, Molokai.
5/22/28 Ravine northwest of Puu Makaliilii (where precipice makes further descent impossible), Molokai.
5/21/28 Ravine northwest of Puu Makaliilii, Molokai.
5/20/28 Small ravine northwest of Maunahui, Molokai.
5/18/28 Near Laianui, Molokai.
5/17/28 North of Hoolehua, Molokai, Coastal cliffs.
5/16/28 Almost reached Kamakaipo, West Molokai.
5/12/28 Kahuaawi Gulch, Molokai.
5/10/28 From Pepeopae north to around Ohialele'i Pali along which we walked to East, Molokai.

5/9/28 Walked to Pepeopae bog & then southeast for almost mile toward prominent bare hill that we had no time to reach, Molokai.
5/8/28 Continued trail through Pepeopae bog to Ohialele Pali, Molokai.
5/6/28 West side of Pohakunui gulch and Kapale Gulch, Molokai.
5/5/28 Up East Fork of ~~KWAK~~ Kawela Valley, Molokai.
5/4/28 Top of Halawa Valley also East of Pukoo, Molokai.
5/3/28 Pepeopae Bog, Molokai.
5/1/28 Continued trail.
4/29/28 Walked along Hauakea Pali & gulch north of Puu Nana. Molokai.
4/28/28 Kepuhi along shore to Kaa, Molokai.
4/26/28 Near Hakina Gulch, Molokai.
4/25/28 Moomooma & beyond, Molokai.
4/24/28 At upper end of Hanalilolilo pipeline, Molokai.
4/23/28 Continued trail & almost reached Pepeopae Bog, Molokai.
4/21/28 West side of Waikolu Valley, Molokai.
4/19/28 Near Waiahewahewa Gulch, west Molokai.
4/18/28 Near Waiahewahewa Gulch, West Molokai.
4/17/28 Near Puu o Wahaula, Molokai.
4/16/28 Makai of Maunahui, Molokai.
4/15/28 Ravine just south of Maunahui camp, Molokai.
4/14/28 Near Homelani Cemetery, Molokai.
4/13/28 South of Pepeopae, Molokai.
4/12/28 West of Pepeopae, Molokai.
4/11/28 South of Kaulahuki, Molokai.
4/10/28 Wet gullied region between Waikolu Valley & probably northern base of Puu Alii, Molokai.
4/9/28 (Lycium sandw.)
4/8/28 From Maunahui toward Cook's mt. house overlooking Waikolu Valley, Molokai.
4/7/28 Overlooking head of Waikolu Valley, Molokai.
4/6/28 Hoolehua, Molokai.
4/5/28 Mauna Loa, Molokai, T.H.
4/4/28 Hoolehua, Molokai.
4/3/28 Arrive at Hoolehua.
3/17/28 Punaluu, Oahu.
3/5/28 Waipio-Waiawa Ridge, Oahu.
2/28/28 East rim of Manoa Valley up toward Mt. Olympus, Oahu.
2/ 25/28 Pauoa Flatts toward Konahuanui, Oahu.
2/24/28 Waimanalo & Kailua, Oahu.
2/20/28 Castle Trail along Tantalus to Pauoa Flatts, Oahu.
2/17/28 Palolo Valley, Oahu.
2/15/28 Pupukea-Kahuku Trail, Oahu.
2/12/28 Palolo Valley, Oahu.
2/11/28 Mt. Kaala, Oahu.
2/7/28 Tantalus crater rim, Oahu.
2/6/28 Both Konahuanui sides of Nuuanu Pali, Oahu.
2/3/28 Kaimuki, Honolulu, Oahu. Roadside weeds.
1/25/28 Makawao, Maui. Garden.
1/20/28 Haleakala, Maui.
12/11/27 Head of Kuliouou Valley, Oahu.
11/13/27 Hauula, Oahu.
10/14/27 Brown's Ranch, etc., Molokai.
9/25/27 Hauula Valley, Oahu.
9/24/27 Manoa Valley, Oahu.
9/5/27 Last for Mt. Eke, Maui.
8/31/27 (Apparently) Mt. Eke, Maui.
8/30/27 Summit of Mt. Eke, Maui.
8/29/27 Summit of Mt. Eke, Maui.
8/27/27 Near last ditchman's house on way to Mt. Eke & summit Mt. Eke, Maui
8/26/27 Makawao, Maui.
8/25/27 Makawao, Maui.
8/20/27 Kaupo Gap, Haleakala, Maui.
~~8/20/27 Kaupo Gap, Haleakala, Maui.~~

8/19/27 Koolau Gap, Haleakala, Maui.
8/18/27 On dry hills near Holua Cave, Within Haleakala, Maui.
8/17/27 Koolau Gap, XXXX Haleakala, Maui.
8/16/27 Haleakala, Maui.
8/15/27 Koolau Gap, Haleakala, Maui
8/13/27 Haleakala, Maui.
8/12/27 Koolau Gap, Haleakala, Maui.
8/11/27 Koolau Gap, Haleakala, Maui.
8/10/27 Koolau Gap, Haleakala, Maui.
8/9/27 Haleakala, Maui.
8/8/27, Olinda, Maui.
8/7/27 Near Ulupalakua, Maui.
8/6/27 Olinda, Maui.
8/5/27 Lower plateau, Mt. Eke, Maui.Coll. Topping; I sick.
8/4/27 From Olinda to West Maui. Coll. Topping; I sick
8/3/27 Olinda, Maui. Coll. Topping
8/2/27 Iao Valley, Maui. Coll. Topping
8/1/27 Hana to Olinda, Maui. Coll. Topping; I with infected foot.
7/31/27 Olinda to Hana, Maui. Coll. Topping.
7/30/27 Olinda pipeline trail, Maui. Coll. Topping
7/29/27 Olinda pipeline trail, Maui.
7/27/27 Near hill northeast of Olinda, Maui. (Greensword) alse Olinda pipe line trail, Maui.
7/26/27 Pipeline trail, Olinda, Maui.
7/25/27 Punaluu, Oahu.????????
7/23/27 Ridge north of Pohakea Gulch into rainforesr, XXXXX Maui.
7/21/27 Half mile north of Keahikauo, Maui.
7/19/27 Keanae Valley, Maui.
7/16/27 Olinda pipeline trail, Maui.
7/15/27 Within Haleakala near Koolau Gap, Maui.
7/14/27 Ditchtrail from Haiku through Honomanu Valley to Keanae, Maui.
7/12/27 From Papawai Point toward Puu Anu through Manawainui Gulch, Maui.
7/11/27 Pohakea Gulch, West Maui.
7/10/27 Barren hills at McGregor, West Maui.
7/9/27 Wailuku aeolian deposits, Maui.
7/7/27 Opuola Stream in Vicinity of ditch trail, Maui.
7/4/27 North mauka of Ulupalakua, Maui.
7/3/27 "Near Eke", Maui
7/2/27 Near Mt. Eke from Waihee & vicinity, West Maui.
7/1/27 XXXXXX Kahului, Maui. Brackish marsh.
6/30/27 On way to Ulupalakua, Maui.
6/29/27 Near Koolau Gap, Haleakala, Maui.
6/27/27 Olinda pipeline trail, Maui.
6/26/27 Olinda pipeline trail, Maui.
6/24/27 Olinda, Maui.
6/23/27 Ulupalakua, Maui.
6/22/27 Olinda pipeline trail, Maui.
6/21/27 Olinda pipeline trail, Maui.
6/20/27 Olinda pipeline trail, Maui.
6/19/27 Olinda pipeline trail, Maui.
6/18/27 Olinda pipeline trail, Maui.
6/17/27 Olinda pipeline trail, Maui.
6/16/27 Olinda pipeline trail, Maui.
6/15/27 Hill mauka of Olinda on way to Haleakala, Maui.
6/14/27 Olinda pipeline trail, Maui.
6/13/27 Hana, Maui.
6/12/27 Hana, Maui.
6/11/27 Hana, Maui.
4/13/27 Waimanalo, Oahu.
4/10/27 Haumla Valley, Oahu.
3/20/27 Halawa Valley, Oahu.
3/19/27 Kawaihapai, Oahu, T.H.

Rosetta Stone

2/20/27 , Oahu.
2/6/27 Manoa Caves, Oahu.
1/15/27 Near Mauna Kapu & Palikea, Waianae Range, Oahu.
1/9/27 Mt. Olympus, Oahu.
12/5/26 Kaimuki, Honolulu, Oahu.
11/27/26 Kawaihapai, Oahu.
11/26/26 Northeast of Nuuanu Pali, Oahu.
11/25/26 Mountains east of Wahiawa, Oahu.
11/20/26 Slope northeast of Nuuanu Valley, Oahu.
10/25/26 Pauoa Flats, Oahu.
10/10/26 Makapuu Point, Oahu.
8/26/26 North of Alika Lava Flow, Hawaii also rainforest above Punaluu, Hawaii, T.H.
8/24/26 Slope of Hualalai between Huehue & Puuwaawaa, Hawaii.
8/23/26 Between Puuwaawaa & Huehue, Hawaii.
8/22/26 Between Puuwaawaa & Huehue, Hawaii.
8/21/26 Between Puuwaawaa & Huehue, Hawaii.
8/20/26 Along road 20 miles from Waimea toward Kona, Hawaii.Aa desert.
8/18/26 Same as above also Between Puuwaawaa & Huehue, Hawaii.
8/17/26 20 miles from Waimea toward Kona, Hawaii.
8/16/26 10 miles along road from Waimea toward Kealakekua. Hawaii Rocky, arid cattle range.
8/15/26 Between Puuwaawaa & Huehue, Hawaii.
8/14/26 17 miles from Kohala toward Waimea, Hawaii.
8/13/26 Between Kawaihae & Waimea, Hawaii. Arid cattle range.
8/12/26 Near Hawi, Hawaii.
8/11/26 Pololu Valley, Kohala, Hawaii.
8/10/26 Kohala ditch trail, Hawaii.
8/9/26 Kohala, Hawaii. Rocky shore.
8/8/26 Kohala, Hawaii. Forest reserve.
8/6/26 Niulii & exposed coast, Hawaii.
8/1/26 17 miles along road from Kohala toward Waimea,Hawaii.Fog-swept pastur
7/31/26 Between Waimea & Kohala, Hawaii. Arid coast.
7/28/26 Honokaa, Kohala, Hawaii. Mauka cane in pasture region.
7/27/26 Between Glenwood & Volcano House, Hawaii.
7/26/26 Ranch 8 miles west of Volcano House also between Glenwood & 29 Miles, Hawaii.
7/25/26 Near Punaluu, Hawaii.
7/25/26 1926 Lava Flow, also Waiohinu & Punaluu, Hawaii.
7/24/26 Wet jungle between Glenwood & 29 Miles, Hawaii.
7/23/26 29 Miles, Hawaii.
7/22/26 Honuapo & vicinity, Hawaii.
7/21/26 In kipuka near road about 7 miles west of Volcano House, Hawaii.
7/20/26 Wet jungle, Glenwood, Hawaii.
7/19/26 Waiakea, Hilo, Hawaii.
7/17/26 East of Kilauea-Iki, Hawaii. Aa desert.
7/16/26 Kau Desert east of Kilauea-Iki, Hawaii.
7/15/26 Between North Kona & Kau Desert, Hawaii.
7/9/26 Kahuku, Oahu.
7/6/26 Lihue, Kauai.
7/5/26 Kokee, Kauai.
7/4/26 Kalalau Trail near Kokee, Kauai.
7/3/26 Olokele Canyon, Kauai.
7/2/26 Waimea Canyon, Kauai.
7/1/26 Waineke Swamp, Kokee, Kauai. actually Kelikuamakanoi not shown on U.S.G.S. maps of time.
6/30/26 Along Kokee Stream also Waimea Canyon near Kokee, Kauai.
6/28/26 Waineke Swamp, Kokee, Kauai.
6/27/26 Halemanu, Kauai.
6/26/26 Halemanu, Kokee, Kauai.
6/25/26 Kokee, Kauai.
6/23/26 Kokee, Kauai

6/22/26 Along Kokee Road, Kauai.
6/21/26 Damp ravine, Kokee, Kauai (Also listed as Hanapepe Falls????)
6/20/26 North of Wahiawa, Kauai.
6/19/26 Hanapepe Falls, Kauai.
6/18/26 Koloa, Kauai. Roadside also Kukuiula, Kauai. Coastal rocks.
6/17/26 Northeast of Kipu, Kauai.
6/16/26 Kapaa, Kauai.
6/14/26 Haupu Point, Nawiliwili Bay. also Niumalu Bay, Kauai.
6/13/26 Haeeleele Valley also Valley northwest of Barking Sands also Haulaula Valley, Kauai.
6/12/26 Halenanahu, near Kilohana Crater also Mana, Kauai.
6/11/26 Halii Valley also west slope of Kilohana Crater, Kauai.
6/10/26 Kilohana Crater, Kauai.
5/1/26 East of Manoa Valley, Oahu.
4/18/26 Between Konahuanui & Pauoa, Oahu.
4/2 (12?)/26 Toward summit of Konahuanui, Oahu.
3/28/26 Ridge northeast of Nuuanu Pali, Oahu.
3/20/1926 Tantalus, Oahu.
2/21/26 Kawaihapai, Oahu.
12/30/25 Kawaihapai, Oahu.
11/22/25 Pauoa Flats, Oahu.
10/ /25 Kolekole Pass & firebreak trail, Oahu.
9/8/25 Near Salt Lake Crater, Oahu.
8/30/25
7/29/25 San Diego, Calif.
7/26/25 Owens Lake, Calif.
7/25/25 Bishop, Calif.
7/23/25 East of Yosemite, Calif.
7/22/25 Yosemite, Calif.
7/21/25 Yosemite, Calif.
7/20/25 East of Tioga Pass, Calif.
7/17/25 Stoney Lagoon,
7/16/25 Near Rogue River, Oregon
7/15/25 Half way between Grants Pass, Oregon, and Crescent City, Calif.
7/14/25 The Dalles, Oregon
7/13/25 Near Willow Creek, Oregon also Lapine, Oregon. In arid volcanic ash
7/12/25 Terrebonne, Oregon also Echo, Oregon. Desert prairie. also Palouse fire.
7/11/25 Spokane, Washington.
7/9/25 Cranebrook, B.C. also Sandpoint, Idaho
7/8/25 Crow Nest also Cardston, Alberta, Canada
7/3/25 Bowdwin, Montana. Desert prairie also Near Chinook. Montana. Prairie
7/2/25 Near Poplar Montana also Near Wolf Point, Montana. Arid plain.
7/1/25 Tagus, North Dakota. 6/26/25 near Odanah, Wisc.
6/25/25 Near Iron Mountain, Michigan. (Mosse Lake, near Kibbing,)
6/23/25 Cheboygan, Michigan.
6/22/25 Oscoda, Michigan. Along beach also Near Tawas City, Michigan.
5/3/25 Puu Kaua, Oahu Topping Collector
11/23/24 Pupukea-Kahuku Trail, Oahu Topping Coll.
8/15 - 22/24 Gay Head, Mass.
8/3/24 Quissett, Mass.
7/27/24 Woods Hole, Mass. Dry RR. embankment. "Northern Michigan" was near Rogers City
7/5/24 Quissett, Mass. 7/20/24 — Provincetown, Mass
12/16/23 Byron Trail, Kilauea, Hawaii.
9/2/23 New Orleans, La. Sunny rocky roadside.
8/30/23 El Paso, Texas. Along railroad tracks.
7/10/23 Hauula, Oahu.
7/8/23 Valley east of Wilhelmina Rise, Honolulu, Oahu.
7/5/23 Ridge east of Manoa Valley, Oahu.
7/3/23 Ridge east of Manoa Valley, Oahu.
7/1/23 Pauoa Flats overlooking Nuuanu Valley.
6/25/23 Waimanalo-Makapuu Point, Oahu.
6/18/23 Wilhelmina Rise, Honolulu, Oahu.

6/11/23 Tantalus, Oahu.
5/29/23 - 6/2/23 Haleiwa, Oahu.
5/31/23 Haleiwa, Oahu. Dry sunny pasture.
5/27/23 Upper Manoa Valley, Oahu.
5/25/23 Waimanalo & Makapuu Point, Oahu.
5/27/23 Upper Manoa Valley, Oahu.
5/15/23 Northeast of Nuuanu Pali, Oahu.
5/5/23 Foot hills of Konahuanui (Mt. Olympus??), Oahu.
4/22/23 Tantalus & Pauoa Flats, Oahu.
4/8/23 From Nuuanu Pali to Waimanalo around Koko Head to Kaimuki, Oahu.
4/1/23 Black Point, Oahu.
3/30/23 Tantalus, Oahu.
3/18/23 Blow Hole, Oahu.
3/11/23 Ridge on other side of Nuuanu Valley, Oahu.
3/10/23 Tantalus & Pauoa Flats, Oahu.
3/3/23 Tantalus, Oahu.
2/26/23 Black Point, Oahu.
2/19/23 Kolekole Pass, Oahu.
2/19/23 Black Point, Oahu.
2/18/23 Tantalus, Oahu
2/13/23 Tantalus, Oahu.
(12/29/22 Left Hilo for Honolulu)
12/28/22 Fern Forest, Kilauea, Hawaii.
12/26/22 Kau Desert near Bird Park, Kilauea, Hawaii.
12/24/22 Mauka of Volcano House, Kilauea, Hawaii.
12/22/22 Bird Park, Kilauea, Hawaii, T.H.
12/21/22 Mauna Loa & Kau Desert, Hawaii.
12/19/22 Near Volcano House & Cockett's Trail, Kilauea, Hawaii.
12/18/22 Halemaumau also Fern Forest, Hawaii.
12/17/22 Byron Trail, Kilauea, Hawaii.
12/16/22 Byron Path & Kilauea-Iki, Hawaii, Hawaii.
12/15/22 Tree Fern Forest, Kilauea, Hawaii.
12/14/22 Byron Path, Kilauea, Hawaii.
12/13/22 Crater walk; Bird Park, Kilauea, Hawaii.
12/12/22 Hilo Harbor, Hawaii.
12/10/22 Hilo, Hawaii.
12/3/22 Tantalus, Oahu.
11/12/22 Makiki Valley, Oahu.
11/5/22 Makiki Valley, Oahu.
10/30/22 Makiki Valley, Oahu.
10/29/22 Nuuanu Pali & beyond, Oahu.
8/28/22 Makiki Valley, Oahu.
10/22/22 Mauka of Ft. Shafter, Oahu.
10/14/22 Tantalus, Oahu.
10/13/22 Tantalus, Oahu.
10/6/22 Tantalus, Oahu.
9/17/22 Nuuanu Valley, Oahu.
9/16/22 Manoa, Oahu.
(9/10/22 Arrive Honolulu)
9/9/22 Olokele Canyon, Kauai.
9/8/22 Waimea Canyon, Kauai.
9/7/22 Koloa; Spouting Horn; Lawai Beach; Kukuiolono Park, all Kauai.
9/6/22 Hanalei Bay & Caves, Kauai.
9/1/22 Honolulu, Oahu
8/30/22 Kula & Ulupalakua, Maui.
8/29/22 Iao Valley, Maui.
8/28/22 Pauuilo, Hawaii.
8/27/22 To Hilo via Puna Coast, Hawaii.
8/26/22 Kilauea, Hawaii.
8/25/22 Kilauea, Hawaii.
8/24/22 Napoopoo & Honaunau, Hawaii.
8/23/22 Arrive Kailua, visit Keauhou, slepp at Wall's, Hawaii.
8/20/22 Haleiwa, Oahu.

8/17/22 Haleiwa, Oahu.
8/16/22 Hauula, Oahu.
8/11/22 Haleiwa, Oahu.
8/10/22 Punchbowl Crater, Honolulu, Oahu.
8/8/22 Arrive Honolulu; leave San Francisco 8/2/22
8/1/22 Mt. Tamapais, Muir Woods, Calif.
7/24/22 - 8/2/22 San Francisco, Calif.
7/22/22 Portland, Oregon
7/20/22 Paradise Valley, Mt. Rainier, Wash.
7/19/22 Mt. Rainier, Washington.
7/18/22 Tacoma, Washington.
7/17/22 Seattle, Washington (& Victoria, B.C.)
7/15/22 Vancouver, B.C.
7/14/22 Sicamous, B.C.
7/13/22 Glacier, B.C. Rocky clearing near Illecillewait Valley.
7/12/22 Glacier, B.C.
7/11/22 Field RR station, B.C.
7/9/22 Emerald Lake, B.C.
7/7/22 Lake Louise, Albe ta also Glacier, B.C.
7/5/22 Sulphur Mountain, Alberta.
7/2/22 Banff, Alberta/
7/1/22 McGregor, Canada.
6/28/22 Montreal, Canada.
6/27/22 Amherst, Mass.

Man and Sugar in Hawaii

by
Otto Degener
Author of "Plants of Hawaii National Park", "New Illustrated Hawaiian Flora"
Formerly Botanist of University of Hawaii and Naturalist of Hawaii National Park

For many thousand years stalwart bands of seafarers, whose original home was in the Indian Archipelago or perhaps in southwest Asia, wandered eastward over the Pacific. They sailed in huge peleleu or double canoes consisting of two logs laboriously hollowed out with the aid of fire and of stone adzes. Each log might be 50 to 100 or more feet long. Between them a platform, called pola, was built to extend three to four feet above the surface of the water. This was covered and often shaded with mats. The paddlers sat in the canoes while the passengers remained on the pola. Such complicated rafts often carried chiefs and retainers to wait upon them, priests with thier idols, astrologers, and musicians for entertainment. Enough food was taken to last for many weeks: dried or salt fish, aipaa or prepared taro, bananas, yams or dioscoreas, sweet potatoes, breadfruit, ti or dracena, and stalks of sugar cane. For drink there were fresh coconuts and gourd calabashes filled with water. Livestock, consisting of pigs, dogs and chickens, was also carried along. Seeds or cuttings of medicinal and fiber plants were not forgotten.

A single double canoe of this kind might set out in search of an island suitable for a home. At times as many as fifteen would form a fleet. During the day, as they sailed or paddled along, they would spread in a broad line to increase the chance of discovering land. At night, on the other hand, the canoes would keep close together to avoid separation. Bronzed navigators of the Polynesian Race thus peopled the thousands of islands dotting the Pacific, enriching their flora and fauna with useful plants and animals. One or more branches of this same race similarly reached the Hawaiian Islands. This occurred about 3,000 years ago and set the stage for the drama of Man and Sugar in Hawaii.

By the time Captain James Cook discovered the Hawaiian Islands in 1778,

the natives had developed a civilization perhaps recalling Homeric Greece to mind. They were cultivating the sugar cane in a crude way and had actually developed more than a score of kinds. These they knew by special names. This classification was based largely on the color of the stem and also, to a lesser extent, on its texture. Thus the kōkea, lāhi and uāla have pale yellow to greenish stems; the ho-nua-ula and ko-ele-ele have dark red to purplish stems; and the ma-nu-le-le has a variegated stem. Many of these varieties had special uses. The manulele, for example, was employed as an aphrodisiac by the kahuna or sorcerer; the koeleele as a medicine in childbirth; and the kokea, because of its thin rind, preferably for munching out of hand.

Besides its importance as food and medicine, the cane plant was valuable to the natives in several other ways. Its leaves were used to thatch their grass huts. The feathery tassels of flowering cane were used in embalming their dead. As a sign that the crops in a field were tabu, or not to be taken by the common people, it sufficed for a chief to place a stick of sugar cane in its corner. The penalty for breaking such a tabu was death.

The coming of Captain Cook was the beginning of a new era in Hawaiian history. From that time on the Hawaiian Race began to die out and especially to "marry out" into other races of mankind, thus gradually losing its identity. This mingling or gradual mixing of races went hand in hand with the rise of the sugar industry.

A Chinese, coming to the Islands in 1802 on one of the junks sent from Canton to trade for Hawaiian sandalwood, brought with him a stone mill for crushing cane, and a boiler for concentrating the expressed juice into sugar. This primitive sugar mill, after grinding one small crop, was abandoned when its owner returned to his native land. Don Francisco de Paula Marin, a Spaniard, made sugar for the king in Honolulu seventeen years later. Marin, we know, had sufficient wives and children to "occupy a small village by themselves"

Lavinia, an Italian, made sugar in 1823 by pounding the cane with a stone pestle on a wooden trough, and boiling the juice in a small, copper kettle. Wilkinson, an English gardener, set out 100 acres of cane and coffee in 1825 in the vicinity of Honolulu for Governor Boki, a Hawaiian chief named, curiously enough, in honor of a dog. The cane was planted by the natives with their oo or wooden digging sticks for the wage of 25 cents per day. Though these plantings grew vigorously, they were abandoned by Boki on Wilkinson's death in 1827. The following year Silva, a Portuguese, made sugar on the Island of Maui, one of the larger islands of the Hawaiian group, where he had erected a crude mill. Just a hundred years ago Ladd & Company, a firm which on its failure involved the Hawaiian Governement in considerable difficulties with foreign countries, received a grant of land on the Island of Kauai from the king for the planting of cane. This was the first successful sugar enterprise in the Islands on a large scale. Two years later the first sugar and molasses were exported. Around 1840 about a score of sugar mills were in operation in the Islands, two run by water power and the rest by bullocks.

With the gold rush in California in '49, agriculture in the Hawaiian Islands was greatly stimulated, Not only sugar produced in the lowlands but even wheat and potatoes grown on the cool, high slopes of the extinct volcano of Haleakala were exported to the miners. Due to the decline of the native population and the large number away from the Islands on New England whaling vessels, as well as to the exodus of many white men to California in search of gold, the shortage of laborers for the local plantations became acute. This inaugurated the importation of men from many foreign countries. The first of these to come were 195 coolies from China. They arrived in 1852 and proved so industrious that more were desired by the planters.

Fearing that the native population of his realm would be supplanted by an alien race of Caucasians and Orientals, the Hawaiian king tried to re-

cruit Polynesian laborers for the planters. Consequently in 1859 ten South Sea Islanders were brought here, and during the following twenty-five years more were imported from various islands to a total of about 2,000 men. As many of these did not prove satisfactory as laborers, friction began. The king preferred Polynesian men with their Polynesian wives and children as permanent settlers to white landholders and yellow laborers; he could not readily supply his wants as payment of their passage to his country was more than the condition of his treasury allowed. The planters, on the contrary, were not interested in settlers but clamored for more coolies and these, for all they cared, could find wives among the native populace already in the Islands. Furthermore, the planters possessed funds for their importation. Free passage, consequently, was given to additional Chinese immigrant men, and many more paid their own passage to reach the promised land. By the time of the annexation of Hawaii as an integral part of the United States in 18 , at least 37,000 Chinese had come to the Islands.

The cost of Chinese brides was high; Hawaiian maidens were lovable, often owned a little land, and in most cases were not averse to marrying out of their race. Statistics show that many of these early Chinese immigrants raised mixed offspring usually of such high quality in both mentality and physique that the successful outcome of such a marriage has become proverbial.

Not only Chinese and Polynesian from the South Seas were brought to Hawaii. In 1868 the first Japanese laborers came as a little band of 148 men. They, however, were not the first men of that nationality to reach these islands in historical times, some shipwrecked fishermen finding asylum here as early as 1832. Then with the signing of the Reciprocity Treaty in 1876, which admitted all unrefined sugars from the Islands into the United States free of duty, the industry enjoyed a period of unprecedented prosperity. This still further increased the demand for labor.

In 1878 the Portuguese began to come in large numbers. Many of them

hailed from Madeira and the Azores where, in many cases, they are more or less mixed in blood with African stocks. In 1881, about 600 immigrants came from Norway and about 125 men, women and children from Germany. Most of these Germans settled on the Island of Kauai. The next group of Japanese arriving in the Islands after those of 1868 were about 2,000 who came in 1885. From that time on to 1907, Japanese immigration was continuous, the largest number of immigrants of that nationality for one year being a little short of 20,000. In 1903 the first Koreans came expressly as plantation laborers, ~~many finding conditions distasteful in their recently conquered country.~~ In 1907 the first Spaniards to the number of 2,246 came, and two years later the first Russians. Puerto Ricans, many with the blood of the Negro, the Spaniard and the Carrib Indian coursing in their veins, also added their quota to the population.

McBride's "Practical Folk Medicine of Hawaii,"
and opinions about
Tacca hawaiiensis versus Tacca leontopetaloides
and other taxa
Otto & Isa Degener

Sent Newsletter, Hawn Bot Soc.

The occasion for printing a review of a botanical or other work gives us the opportunity not only to express our opinions regarding it, but to discuss the identifications of any plants involved. Some discrepancy in the use of names arises from our tendency to be "splitters," emphasizing the difference in plants; while the author may tend to be a "lumper," emphasizing the likenesses of plants.

Not Reviewed Sur Issue

L. Richard McBride, former Ranger of Hawaii Volcanoes National Park and presently Lecturer at Kilauea Military Camp, has authored his sixth book: "Practical Folk Medicine of Hawaii." This book of 104 pages is illustrated with 84 figures, over half of plants used by the ancient kahunalapa'au, or medicine man. McBride, under one of his nine headings, warns the reader that his "doctor be consulted" before using a home remedy. Hence the book is not a danger to health and even life of the gullible reader as is the disaster authored by Kaalakamana and Akina in 1922 and unfortunately recently reprinted. Pages 22 through 75 deal primarily with the plants, or simples, and the parts used; and their descriptions and habitats. McBride gives the plants used their vernacular and, according to his judgement, their scientific names. As mentioned above, we as "splitters" prefer such changes be made as Allium, on page 23; Pariti, p. 34; citrifolia, p. 55; gaudichaudii, p. 58; and quinquefolia, p. 62. The illustration for page 39 appears to be just a printer's error. A discussion of "Ailments commonly Treated in Hawaii Folk Medicine" follows the botanical part of the book.

Three scientific names used by the author intrigue us:

McBride (p. 57) uses for our ohia lehua, Metrosideros collina subsp. polymorpha, a trinomial popularized by J.F. Rock over fifty years ago. As we have no incontestable proof that this is correct, we stubbornly still use our catchall "M. polymorpha Gaud., s.l.," for most of these common Hawaiian trees. We have collected Metrosideros taxa in the wild in Fiji, and both in the wild and as a beautiful street tree in New Zealand. Should we relegate all such ohia lehua to merely subordinate taxa of M. collina, native of far off Tahiti! That the seeds are wind-disseminated is not sufficiently convincing for us to change our opinion. We are eagerly awaiting a monograph of the genus based, not on casual observation of herbarium sheets, but on facts gleaned with the use of the most recent tools of Science.

They don't look it.

"Solanum nigrum" (p.67), a binomial we have followed for years, is evidently a misidentification. Our popolo is Solanum nodiflorum subsp. nutans R.J. Henderson (1974).

In the Flora Hawaiiensis for November 3, 1932 one of us printed an illustrated description of the local pia he had collected at Kapoho, Hawaii, as Tacca hawaiiensis Limprecht f. Today most workers seem to equate this species with T. leontopetaloides

(L.) Ktze., based on a specimen, according to Linnaeus (Sp. Pl. 313. 1753.), with its "Habitat in India." In fact, Linnaeus refers his binomial to the description and illustrations published by Amman(n) in 1741. As this work is generally unavailable, E.D. Merrill reprinted the Amman(n) plates in the Journ. Arn. Arb. 26: Plate II. 1945. To us, who have had the Hawaiian pia growing in our Mokuleia Beach garden for about forty years and have collected Tacca species in the Hawaiian and Fiji Islands since, T. hawaiiensis and T. leontopetaloides are not conspecific at all but distinct. Doubters should compare the living Hawaiian plant or ~~the Plate Hawaiiensis plate~~ with Merril's plate ~~available to them in leading university libraries and museums.~~

"Practical Folk Medicine of Hawaii," selling for $4.50 per copy, caters to the resident and tourist interested in Hawaiiana ~~and tacca~~ and ~~50~~ local plants in general; not so much to the professional botanist. It is of value to workers in pharmacology of the world as it gives them a clue as to which Hawaiian plants deserve assay. Who knows what medicinal discoveries the kahunalapa'au has made, and how modern chemists may improve on them to enhance their efficacy?

Orfel. to Tuyama

NATURAL HISTORY OF THE BONIN ISLANDS

Otto & Isa Degener

The two volume work quaintly entitled "The Nature of the Bonin Islands" and "Compiled by Takasi Tuyama and Shigeo Asami" arrived as a Christmas gift from Dr. Tuyama Professor of Botany, Ochanomizu University, Tokyo. Dr. Tuyama, and Dr. Charles Lamoureux of the University of Hawaii, had visited at our home on the north shore of Oahu some months before with a package of Bonin herbarium specimens for comparison with Hawaiian taxa. A chain-smoker, after our study in the wind-free house, we entertained our foreign guest out of doors, enthralled by his description of his plant exploration in his chosen archipelago, known to the Japanese as Ogasawara-jima. Due to our bombarding the group in August 1943, we may remember that the fifteen or so "larger" islands with a total area of forty square miles, are of volcanic origin and part of Micronesia. They are not low, coral atolls with a monotonous biota.

We have prepared the present review for our peers as neither we, nor you (we surmise) are versed in the Japanese language. The volumes are in board covers, about 7 1/2 inches wide and 10 1/2 inches high, and have an excellent quality of filled paper. The number of pages, shown in Arabic, for Volume I comes to 271; but about a score more unnumbered pages occur with maps showing often on grids elevations, soils, rainfall, etc. The frontispiece is a colored plate of a beautiful aerial scene of the rugged coastline, while following it is a Pacific blue and leaf green two-page spread of the entire archipelago in relief. Nearer the middle of the book and beyond are four colored plates, one depicting nine gaudy marine organisms, such as bryozoons and sea urchins, and the remainder displaying an assortment of 56 typical marine mollusks. Beside a good sprinkling of black and white half-tones of geologic and other diagrams, of photos of plants (some not too clear), of prints of birds, this volume contains 32 full-page additional plates in black and white. These are a mêlange of scenes showing the typical vegetation from an understory of Marattia to a shore predominantly of Pandanus; from close-ups of the most interesting Flowering Plants to "land shells," insects, crustaceans and diagrams of the commoner sea birds in flight; and human interest, such as showing Drs. Tuyama and Asami with student assistants, of village scenes, of outrigger canoes, of some World War II ship and 'plane wreckage and, at the very end a monument in good taste flying the Japanese and American flags side by side to the tragic victims of a conflict stimulated by population pressure.

For us, specializing in the Hawaiian flora, Volume I is useful as the scientific names of the Ferns and Flowering Plants (as are those of the animals as well) are given in English, though the descriptions in Japanese are beyond our understanding. We can thus see how closely the two floras approach each other. This hardly pertains to species, excepting for some ferns and some ocean disseminated halophytes like Colubrina asiatica; but certainly to genera.

For the non-specialist, for those unacquainted with the Japanese language, and for those for whom the Bonin Islands are little more than a name, we do not recommend investing in this book.

Volume II is decidedly a "horse of another color." It is truly outstanding! There is no text at all; instead, there are 228 magnificently executed colored plates comprising about 475 separate photographs. Among the first are important views of Chichi-jima, Futami Bay, andesite and marine cliffs, green olivine sand called uguisisuna, agate, Tertiary rocks, semi-fossil snail shells, "Oni-iwa, an ogreish stack," northernmost Haha-jima, pinnacled islets of Harino-iwa, etc. All this is the groundwork for understanding the environment for the Bonin Island biota. Then follow plates 43 to 130 comprising 213 exquisite color photographs of mostly native plants, many so easy to recognize as they or their relatives are likewise found in the better-known Hawaiian Islands. Some of the identical species, for example, appear to be Ipomoea pes-caprae var. emarginata, Cassytha filiformis, Calophyllum inophyllum, Psilotum nudum and Necttopteris nidus. Personally prejudiced in noting the occurrence of the same, uninteresting, horribly beautiful ornamentals of gardens the world around threatening a fascinating native flora, we regret Drs. Tuyama and Asami's wasted film on the southeast Asian Melia azedarach, the American Leucaena "glauca" now found to be actually leucocephala, the American Psidium guajava, the American Cassia (or as we "splitters" prefer, Ditremexa) occidentalis, the African Thunbergia alata and its Indian relative T. laurifolia, the American Schinus terebinthifolius, the American Nicotiana tabacum beloved by Dr. Tuyama, an atypical African Hibiscus schizopetalus with Asiatic admixture, the more southern Codiaeum variegatum hort., the American Allamanda cathartica, the American Poinsettia pulcherrima hort., the East ? Indian Bryophyllum pinnatum, the American Agave americana and a variety of the American Passiflora foetida. We should have so much preferred endemics or even natives instead. But that, of course, is a matter of taste as the old lady maintained when she kissed the cow.

Plates 131 - 134 show magnificently black fruit bats, not unlike the larger brown flying foxes sampled broiled in Fiji by one of the reviewers; the diminutive deer Cervus mariannus (note double "n"), fleeing feral goats; and an example of erosion described as "Patches of grassland, result of cattle-bite." The nine plates following of birds will delight the viewer whether he be ornithologist or not. Another plate shows the toad Bufo marianus (note single "n"), not to be confused with the Cuban toad B. marinus naturalized in the Hawaiian Islands. Four plates are devoted to colorful insects; about 25 to intricate corals, overlapping somewhat with about as many plates devoted to fishes and marine invertebrates. The last dozen or so are of human interest: scenes of a model village, a meteorological station, a Christian (!) church, a school, shipping of specimens and ships, a scene of the Metropolitan Governor giving an address, a very appropriate!

nor giving an address, and a very appropriate!

nor giving an address, and very appropriately at the very last a solemn "Monument of the war dead, Iso-jima." One question, however, bothers us. Where are the native Micronesians? Did all fall victims to the horrors of war, or were they evacuated never to return?

Pictures are well nigh a universal language; and Volume II consists only of these, each with captions in Japanese and English. This book we highly recommend to the geologist, to the professional botanist specializing in plants of the Pacific, to the general botanist interested in the plant world as a whole, to zoologists of various disciplines, to the armchair traveler, and to the Veterans of World War II who now can show their families and friends the type of islands they defended with devastation and how Nature in about thirty years healed the scars of human conflict.

From the Japanese blurb we cannot tell the price of the work, nor whether sets can be broken. Due to the excellence of Volume II, we hope the Hirokawa Publishing Company, 27 - 14, Hongo - 3, Bunkyo-ku, Tokyo, Japan, will soon publish an English translation of Volume I for the sake of reaching a wider reading public.

Ivy Degener Herb. 4
Stewart
Aug. 1962

OPINIONS
Degener & Degener

I am not here of my own choice but at the request of my Chief, Asst. Director Pierre Dansereau of the N.Y. Botanical Garden. I do not claim any expert knowledge about botanical gardens; nor does my wife, Dr. Isa Degener, formerly on the staff of the Bot. Garten u. Museum, Berlin-Dahlem. If a large group of the better educated citizens of the State want a Botanical Garden, by all means let us help them. But according to our opinions as local taxonomists, the type of botanical garden ideal for the Continents is hardly the type desirable for this geographically isolated archipelago.

1. The Islands themselves constitute the most superb botanical garden anywhere, with 99% of the native Flowering Plants endemic. This endemism is so extreme thanks to lack of effectively destructive glaciation and other factors that certain taxa are endemic to certain gulches or to certain ridges where they have grown relatively undisturbed for hundreds of thousands of years. This surprising fact is not the exception but rather the general rule. For example, for Oahu alone St. John in his manuscript claims 100 species of Cyrtandra. At that rate, the Archipelago may possess close to 1,000. What about the status of our other genera?

2. A man-made botanical garden of local and exotic plants is like a guilded lily - hardly authentic - in comparison to our wild, undisturbed, open spaces. A species cultivated out of its wild, ecological niche, to us, is like a sentence out of context.

3. Our estimate for the number of endemic species and varieties of Vascular Plants for the Archipelago is between 20,000 - 30,000.

4. Knowledge of the local flora is still but fragmentary: huge areas have never been explored botanically, and thanks to introduced weeds and so-called timber trees as well as to introduced herbivores such as goats, mouflon, antelope, axis and black-tailed deer, their cover of native vegetation is being stripped before even representative specimens can be collected for dried museum specimens!

5. Monographs of certain genera have appeared, lulling the foreign botanist and the local plant lover into the erroneous belief that our flora is well known:

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OPINIONS
Degener & Degener

I am not here of my own choice but at the request of my Chief, Asst. Director Pierre Dansereau of the N.Y. Botanical Garden. I do not claim any expert knowledge about botanical gardens; nor does my wife, Dr. Isa Degener, formerly on the staff of the Bot. Garten u. Museum, Berlin-Dahlem. If a large group of the better educated citizens of the State want a Botanical Garden, by all means let us help them. But according to our opinions as local taxonomists, the type of botanical garden ideal for the Continents is hardly the type desirable for this geographically isolated archipelago.

1. The Islands themselves constitute the most superb botanical garden anywhere, with 99% of the native Flowering Plants endemic. This endemism is so extreme thanks to lack of effectively destructive glaciation and other factors that certain taxa are endemic to certain gulches or to certain ridges where they have grown relatively undisturbed for hundreds of thousands of years. This surprising fact is not the exception but rather the general rule. For example, for Oahu alone St. John in his manuscript claims 100 species of Cyrtandra. At that rate, the Archipelago may possess close to 1,000. What about the status of our other genera?

2. A man-made botanical garden of local and exotic plants is like a guilded lily - hardly authentic - in comparison to our wild, undisturbed, open spaces. A species cultivated out of its wild, ecological niche, to us, is like a sentence out of context.

3. Our estimate for the number of endemic species and varieties of Vascular Plants for the Archipelago is between 20,000 - 30,000.

4. Knowledge of the local flora is still but fragmentary: huge areas have never been explored botanically, and thanks to introduced weeds and so-called timber trees as well as to introduced herbivores such as goats, mouflon, antelope, axis and black-tailed deer, their cover of native vegetation is being stripped before even representative specimens can be collected for dried museum specimens!

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O. D.

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DOUBLARDIA, THE SILVERSWORD

By Otto Degener, M. S., Naturalist, Hawaii National Park, 1949

Today, the first plant to attract the attention of the visitor to our famed rift-valley, known as Haleakala Crater, is the silversword. This wondrous plant, beginning as a silvery ball of narrow incurved leaves, at length puts forth to a height of three to six feet a magnificent erect cluster of nodding flowers. After these have matured their many seeds, the entire plant dies.

In early days the silversword was so abundant on the cinder cones in Haleakala as to make "the hillside look like winter or moonlight." The Hawaiians made leis of them but, if they did not abide by certain rituals, their offended mountain gods brought rain. Later, tourists were accustomed to uproot the largest specimens, merely to watch them roll down the slopes like giant snowballs. Up to about 1915, these plants were gathered in great numbers, dried, and shipped to the Orient as ornaments. As a result of such vandalism by man, and the ravages of hungry feral goats and of insect pests, the silversword was threatened with extinction.

My first experience with the silversword came in 1922 when a friend smuggled a young one from Haleakala to me in Honolulu. To do so she unfortunately broke a wise law forbidding the picking or destruction of these beautiful plants. In 1927 I studied especially the silversword during a three-weeks' stay in Haleakala, finding protection for myself and assistants at night in a cave near Koolau Gap. At that time the silversword population in Haleakala had dwindled to barely 100 plants! Heeding the danger, the National Park Service instituted a program to aid the silversword to stage a successful comeback. In 1935, a census showed 1,470 of these beautiful plants growing on a single cinder cone, 88 of them ready to bloom that year.

The silversword, because of its beauty, is now well known to most na-

kamaaina visitors and to all kamaaina residents. But neither kamaaina nor kamaaina know its fascinating botanical history. This I shall briefly sketch, drawing liberally upon my imagination and my experience with this plant and its relatives.

Eons ago the Hawaiian Islands arose from the sea a barren mass of lava. They became clothed with vegetation by winds blowing seeds to them, migratory birds flying them there or ocean currents washing them there. Because of the archipelago's extreme isolation from other land masses, such seed transportation was exceedingly rare. For that very reason, the few lucky ones that did reach the Hawaiian Islands in a viable state and sprouted were little exposed to the danger of being crowded out and killed by aggressive plants so abundant on the Continents. They had the Islands all to themselves.

One of the earliest seeds to reach the Hawaiian Islands (or one of the islands to the west, like Laysan or Midway, which were of considerable size and height before the elements eroded them down to just a shadow of their former selves) came from some plant belonging to the Compositae Family and growing very probably somewhere in the South Pacific. Like no human visitors and residents alike, it found the Hawaiian Islands a land flowing with milk and honey. It grew and multiplied. Its offspring and its offsprings' offspring, over hundreds of thousands of years, spread throughout the archipelago. Some eventually became adapted to thrive on arid lava flows near sea level; others, in arid cinders on our highest mountains; still others, in rain-drenched forests. In short, the multitudinous progeny of this one original lucky seed became fairly well scattered throughout the Islands, growing under varying conditions of heat or cold, dryness or wet, low or high elevation, sterile or fertile ground, intense sunlight or deep shade, and almost all combinations of these ecological conditions. Plants adapted to grow in the dark rain-forest, as every one knows, are quite different from those growing on arid cinders open to the intense rays of the sun at high altitudes. The one may have

smooth leaves suited to absorb as much light as possible and to shed the superabundant supply of rain; the other may have narrow, silvery-hairy leaves necessary to reduce evaporation and to repel, not unlike a mirror, the superabundant supply of burning sunshine. Not only have these plants become molded by their particular environment. Other factors may have altered them, like the irreplaceable loss of certain genes, the aftermath of inbreeding by being isolated on different islands or mountains.

Today, the plants descended from the original seed that came here eons ago can be recognized as having evolved into four distinct major groups, termed genera. They are Railliardia, named in 1830 in honor of the French Royal Marine Officer L. Railliard who presumably collected one of these plants; Dubautia, named the same year after the French Officer J. E. Dubaut, evidently another amateur collector; Wilkesia, named after Commander Charles Wilkes of the famed "United States' Exploring Expedition;" and Argyroxiphium, named awkwardly from the Greek for "silver" and "sword," and intending to characterize the fanciful appearance of the leaves of these plants.

Of Railliardia and Dubautia, known to the Hawaiians as naenae, I have collected scores of kinds. These, with the collections of other workers, have been monographed by the expert, Dr. Earl Sherff, for the Bishop Museum. All naenae are peculiar to the Hawaiian Islands, indicating their origin here from the one single immigrant seed discussed above. Of the distantly related Wilkesia, called in Hawaiian iliau, only one kind is known. It is peculiar to Kauai, my specimens coming from the Kokee region. In flower it resembles a dull, sparingly branched, spindly silversword, and reaches a height of twelve feet. Like the famed silversword, it dies after flowering. This plant is the most modified or degenerate of the assemblage, lacking petal-like florets. Of Argyroxiphium, its most intimate relative, five or six kinds are known. This is the botanical group to which the ahinahina or true silversword belongs.

I have often heard people maintain that only one silversword exists, and that it is found only on Haleakala; others maintain that silverswords grow on the high mountains of Japan. Both statements are wrong. The silversword of Haleakala, Maui, was named A. Macrocephalum by Asa Gray, while the plant growing on the barren slopes of Mauna Loa, Mauna Kea and Hualalai, Island of Hawaii, above 7,000 feet elevation, was named A. sandwicense by DeCandolle. This Hawaii plant was probably first collected by David Douglas, for whom the Douglas fir was named. He used its dead stalks for fuel for his camp fire not long before his murder by the escaped Manila convict who, afraid his Hawaiian wife might be captivated by the young Scot's charm, pushed him into a pitfall to be gored and trampled to death by a recently trapped wild bull. Because the silverswords are so variable I thought, perhaps correctly, that the Maui and the Hawaii plants are distinct kinds. Dr. David Keck, who studied preserved material available to him in the States, concluded, perhaps in error, that they are the same. Only more extended collecting and study of the plants in the field and in the cytological laboratory can decide which view is the correct one.

Haleakala houses a second silversword. I have found it on the outer rim and in Koolau Gap where the fog rolls in nearly every afternoon. Thus protected from excessive dryness and intense sunlight, it has strap-shaped, pale green leaves instead of narrow, silvery ones. Its scientific name is A. virescens, and in the vernacular it is known as the green silversword or, briefly, greensword. Hybrids between the two Haleakala plants were discovered by J. F. Rock a score or more years ago.

Its features deeply wrinkled by erosion, West Maui is known to be geologically very old, perhaps older than the once separate island of East Maui, now dominated by Haleakala. I imagine its volcanic slopes were well covered ages ago with vegetation, and that the plants growing there at that time were about the same as those growing on East Maui. Among these plants, we might reasonably expect the silver- and greensword. ~~In 1927~~

they probably flourished at an elevation above 7,000 feet on one of its high volcanoes. In 1927 I crawled through several tunnels, before irrigation water was lead through them, to reach this volcano's northern base. Camping there, I could readily climb to what was left of its summit, now only 4,500 feet high and consisting merely of its hard inner core. This is known to us now as Mt. Eke. There I came upon a plateau scarce half a mile across, pocked with dangerously slippery sink holes and "bottomless pits." Every time I was there, the summit became enshrouded with clouds by 10 o'clock in the morning, raising its yearly rainfall to 248 inches. As a result it is an acid, tree- and shrubless bog. The astounding feature of this region is the presence of a silversword, named A. caliginis and what I consider a greensword and named in my book on "Plants of Hawaii National Park" as the distinct species A. Mai. Both are dwarf and are characterized by dividing and creeping profusely over the ground and progressively dying back at the base, thus isolating the branches into seemingly independent plants. Actually, some may be thousands of years old. The silversword was so abundant with its one- to six-foot creeping branches that it was often impossible for me to keep from stepping upon them. Of all these plants, I could find the remains of but one single flower stalk. Of the greensword I found none at all. These plants evidently reproduce mainly vegetatively.

At the precipitous edge of the Eke plateau I recognized a new kind of silversword with its almost hairless leaves in a continuous close spiral. This I named Argyroxiphium Grayanum. In its vicinity I discovered a hybrid between it and some kind of Dubautia, or naenae. This was named by Sherff in 1944, using the hybrid name of Argyroxiphium Degeneri for it.

In conclusion, we know of five or six kinds of silversword today, all peculiar to Maui and Hawaii. Yet, I imagine some unexplored mountain top on Molokai or elsewhere may secrete a few more kinds or perhaps even a plant with golden leaves to be named by its discoverer the "goldsword." Let us all search for it.

PART I

POPULAR ACCOUNT OF THE NODDING CLUBMOSS (Lycopodium cernuum).

The Nodding Clubmoss represents a very ancient type of plant that is found in most tropical countries in various slightly different forms. It grows on all the larger islands of the Hawaiian group, being especially abundant in the open forest in the vicinity of Kilauea.

This plant is known by three distinct names in the Hawaiian Islands. The common English name, Nodding Clubmoss, is appropriately applied because the ends of the fruiting branches droop in a characteristic way. The botanical, or scientific, name, on the other hand, is Lycopodium cernuum. "Lycopodium" is a word coined by Carl Linne' in 1753 from the Greek for "wolf" and "foot" and applied to all clubmosses because of some fancied resemblance to the foot of a wolf. The word "cernuum", meaning "nodding" in Latin, was chosen by him to denote our particular kind of plant and to distinguish it from all the others. The Hawaiian name is "wawae iole", which, curiously enough, means "rat's foot". Because of the similarity in meaning between this name and the derivation of the scientific one, it is not unlikely that "wawae iole" is merely a free and corrupt translation of "wolf's foot" into Hawaiian since the coming of the missionaries. As the wolf was unknown to the Hawaiians, their word for rat may have been substituted.

The nodding clubmoss is a very strange plant that may be considered a little-modified survivor of the Coal Period. It is not like the Ferns or Flowering Plants growing about us. It is beset with innumerable awl-shaped leaves less than a quarter of an inch long. Its stem trails over the ground in a series of long arcs that root at their ends (Plate). From here other stems arise and grow upright to a height of one to three or more feet. These, in turn, bear numerous short, forking branches of which the ultimate tips frequently droop and bear compact fruiting cones called strobili. These are composed of a short stem bearing closely pressed aggregated leaves, each containing in its axil a small purse-like receptacle called sporangium. Upon ripening, the leaves of the strobilus spread apart and the sporangia open to liberate

countless microscopic, yellow reproductive bodies called spores. Because of their small size, these can be scattered by the wind for hundreds of miles.

Probably only one spore ( ) out of many hundred thousand ever reaches a location favorable for its further development such as is furnished by a moist, moss-covered embankment or preferably a volcanically heated crevice. Then the many small spores burst open along three delicate grooves to allow the single naked cell within to swell and divide into two. This is the beginning of a new generation of clubmoss very unlike its parent, the plant being now termed a gametophyte or prothallus. The gametophyte continues to grow in size until it has become a delicate club-shaped structure still too small to be visible to the naked eye ( ). Beyond this stage further growth seems impossible unless a special kind of microscopic fungus, called mycorrhiza, is at hand to bore into the cells of the gametophyte and in some strange way supply it with part of its nourishment. This mycorrhiza very superficially resembles the mold so frequently observed on spoiling preserves or stale bread. With this fungus living in its tissues, the gametophyte clubmoss is enabled to continue growth. At length it develops into a light green, flat-tened but thick, body about the size of the head of a pin or larger ( ). At that stage it produces microscopic sex organs called antheridia and archegonia. Within the antheridia numerous sperm ( ) are produced, each one of which bearing two fine threads called cilia. Upon ripening, these sperm are liberated from the antheridium and by means of their cilia actually swim around in the dew or rainwater that surrounds the gametophyte. Probably by the secretion of some chemical, the sperm are attracted to the archegonia, of which each one contains a single egg. Sperm and egg then unite and from this union arises the next generation called the sporophyte, which consists of the leafy clubmoss so familiar to all of us. Thus the large leafy generation with asexual reproductive bodies invariably gives rise to the small shapeless generation with sperm and eggs. Such an alternation of unlike gene-

tions occurs in all ferns and flowering plants but is often so obscured that only the botanist can follow it.

The sexual generation, termed gametophyte or prothallus, of the clubmosses existing today is so rare and difficult to find that it has been discovered for only a small percentage of kinds. The plants apparently rarely reproduce by the germination of spores or fertilized eggs but, instead, creep over the ground and branch extensively. These branches, rooting at various intervals, finally appear as distinct individuals because of the ultimate death of their attachment to the older part of the plant. It is therefore of some interest that the gametophyte of the nodding clubmoss, so rare that it is known only from two previous accounts, has been found growing in the greatest numbers in volcanically heated crevices near Kilauea Crater. An attempt has been made in PART II of this paper to explain why this gametophyte grows best under these conditions of volcanic heat instead of under normal conditions.

The clubmosses surviving today have slight economic value. The branches are woven into wreaths for Christmas decorations that long retain their color. The ripening strobili are collected in great numbers, especially in Russia, and then allowed to dry and shed their waxy, inflammable spores. These, under the name of lycopodium powder or vegetable sulphur, are then shipped throughout the world. They are used as a remedy in certain skin diseases and as a coating for sticky pills to prevent their adhering to one another and to the sides of their container. Before magnesium powder was generally employed, the spores were used in the manufacture of fireworks or thrown as a cloud into the air and ignited to produce the blinding yellow light necessary for flash-light photography.

The Nodding Clubmoss

Although the Nodding Clubmoss has little value today, its ancestors and the relatives of its ancestors are extremely important to us because they, not peat mosses as formerly supposed, are largely responsible for the formation of coal. These plants flourished during the Carboniferous or Coal Period, 250 million to 350 million years ago, long before the more efficient Flowering Plants had yet evolved. Some were herbaceous while others grew to be huge trees attaining a height of 100 feet or more. These plants bore strobili of proportionate size which shed clouds of yellow spores into the air at certain seasons. Some plants, like the Nodding Clubmoss, produced spores of only one kind that developed into gametophytes bearing both male and female organs. Others, however, developed two kinds of spores. The larger, termed megaspores, grew into distinct female prothalli or gametophytes that bore eggs only, while the smaller, called microspores, developed into male gametophytes that bore sperm.

During the Coal Period, when plants similar to the clubmosses flourished, spores, leaves, twigs, trunks of trees, and countless other vegetable and animal debris blew or fell into ponds or into streams to be swept away to find a final resting place at the bottom of some lagoon. These deposits of carbonaceous material, frequently accumulating in layers of considerable thickness, were often covered by other sediments. Finally they slowly became fossilized and changed into bituminous, or soft, coal. Now let us turn to a piece of such coal broken across the ancient bedding planes of deposition. Here we note shining strips, termed glance by the miners, a tenth of an inch or so in breadth. These represent branches, logs or other essentially woody material that has been crushed flat by the tremendous pressure for millions of years of the overlying strata. Between the layers of glance, however, occur dull bands called mat. These, obviously, are composed of something else. In viewing under the microscope a section of mat that has been cut so thin that it is almost transparent, we can tell with absolute certainty of what it is composed. Three well-marked structures can be recognized, as the illustration plainly shows, by the relative amounts of light

Woodland Clubmoss

that can pass from the microscope mirror through each of them. There are minute black granules scattered throughout the field. These are pieces of charcoal that must have formed during prehistoric forest fires that were at that time more frequent than now because of the great clouds of inflammable spores that the ancient plants shed into the air. There are many brown particles of considerable variation in size. These represent smaller pieces of wood and bark in which all evidence of cellular structure has been lost by the complete collapse of the compressed tissues. This material, as we would expect, displays under the microscope the same characteristics as bands of glance. The third noticeable component of mat consists of innumerable amber-colored loops, all lying with their longer sides parallel to the bands of mat of which they compose such an important part. The majority of loops are small while a few are many times larger. These amber lopps represent the thick, waxy walls of spores which have been crushed flat so that their contents are barely visible as a dark line. The small loops are usually the remains of microspores, or of spores that upon falling on favorable ground could have produced gametophytes bearing both sexes. The large lopps, on the other hand, are the remains of megaspores. That the lopps are crushed spores is irrefutably proved by the occasional presence amid them of an amber ring. This is clearly the remains of a spore that has for some reason been able to withstand the pressure of overlying rocks without collapsing.

Anthracite, or hard coal, is usually of contemporary age and like origin as bituminous coal. The essential difference between the two is that hard coal has been exposed to violent geologic disturbances often accompanied by volcanic heat, so that many of its volatile constituents have been dispelled. It therefore burns with relatively little smoke. Graphite may be considered anthracite that has been still more modified, or metamorphosed, thereby becoming crystalline and soft. This is the material used in the manufacture of ordinary pencils and known to us as lead. Exposure of our clubmoss ancestors to still greater dynamic changes in the earth's crust ultimately results in the formation of diamonds.

over!

The Nodding Clubmoss, though of little value in itself, will always deserve attention. It is one of the survivors of an extremely important group of plants that ~~are~~ is furnishing us with coal, graphite, diamonds and possibly even petroleum. A clue as to why this entire group is on the verge of extinction is given technically in the following pages.

pound with salt and put in
leaf and cook. Then take out
of the leaf, put in the hand and
rub over house.

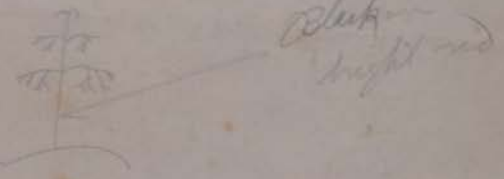
Nodding Clubmoss

THE NODDING CLUBMOSS

(Lycopodium cernuum)

Popular and Technical Account of an Interesting Plant of Hawaii

Otto Degener, B. S., M. S.
Botanist at University of Hawaii, 1925 - '27.
Naturalist at Hawaii National Park, 1929.



PART I

Popular Account of the Nodding Clubmoss (Lycopodium cernuum).

(~~Part I~~ copyrighted 1931)

PART II

Technical Account of the Gametophyte of Lycopodium cernuum in Hawaii

(Adapted with permission from the Botanical Gazette, ~~Vol. LXXX, No. 1, Sept. 1925.~~ 80; 76 - 47. 1925.)

RUMEX OF HAWAII

Otto & Isa Degener

In 1811 appeared the second edition of William Townsend Aiton's "Hortus Kewensis; or, A Catalogue of The Plants Cultivated in The Royal Botanic Garden at Kew." Aiton, as the title page mentions, was "GARDENER TO HIS MAJESTY." On page 323 he describes, as new, Rumex giganteus, calling it "Tall Dock." He adds that it was native "of the Sandwich Islands. Mr. David Nelson." Furthermore, the next line states that it had been introduced in "1796, by Archibald Menzies, Esq."

David Nelson was Captain James Cook's botanist, while Archibald Menzies was Captain George Vancouver's. Automatically, without much thought, we would have considered a Nelson sheet deposited at the British Museum (Natural History) as the lectotype for the species s.s. We maintain, however, that the lectotype should be a sheet at Kew labelled "R. giganteus Ait. H. Kew. Rumex 40 feet high. Climber, Sandwich Isles, A.M., C68." The initials evidently refer to Archibald Menzies. As Aiton was listing and describing the plants growing in the gardens of Kew, he evidently grew the giant Rumex from seed introduced by Menzies about fifteen years before the catalogue went to press.

According to Skottsberg in Acta Horti Gotob. 2:225. 1926, specimen C68 "has leaves with margin and veins pilose, and so is the stem."

In conclusion, after receiving bibliographic and herbarium aid from Messrs. Peter Green, Edgar Milne-Redhead, John F. Reed, Georg M. Schultze and William T. Stearn, we believe at least two main taxa of Rumex giganteus grew (and still survive) in the rainforest mauka of the Kealakekua area, Island of Hawaii, a rainforest that has retreated inland during the past 200 years' attack by Caucasian and Oriental animal and plant invaders:

1. R. giganteus Ait. var. giganteus. A somewhat pilose plant. Type: C68 in herb. British Museum. Though the endemic flora is being rapidly exterminated, we are gratified to have found a liana approaching the type. It is Degeners & L.W. Bryan 32,457. Kahuamoa, South Kona. Hawaii. Rainforest at 3,250 feet. May 29, 1969.

2. R. giganteus Ait. var. nelsonii Deg. & Deg., var. nov. Planta glabra. Unlike the previous variety, this one is glabrous. The type we consider to be the specimen deposited in the British Museum under the legend "Rumex giganteus, 'Sandwich Islands, Dav. Nelson.'" During the past two years we have collected this variety, the less rare of the two, in the rainforest from Kulani around the southwestern slope of Mauna Loa to Hualalai. If the historical Nelson plant for any reason cannot be the type, the lectotype would be "Degeners & Piccos 32,456. Mauna Loa Boys' School, Hawaii. Sprawling tangle in clearing at 5,700 feet. Aug. 10, 1968." A rooted sheet of this liana (renumbered 32,443 and harvested July 26, 1970.)

was planted in the writers' garden at Volcano, Hawaii, next to R. skottsbergii, as described below. Degeners & Piccos 32,458 collected Aug. 15, 1970 "at 2,500 feet, Punaluu mauka, Kau, Hawaii.", is not particularly outstanding because it has a faint tendency to being glabrate; but because it completely fills with its scrambling, overlapping branches, to the exclusion of other plants, a small gulch. Cranwell, Selling & Skottsberg 3,108 is an Island of Hawaii specimen with typical inflorescence, but otherwise a bit strange. It is from the ancient, deeply eroded and somewhat isolated "Kohala Mts., Upper Hamakua ditch trail. 9/17/38."

It is disconcerting, as Skottsberg has indicated for the local taxa of the genus on pages 223-228 and elsewhere, that our species are not clear-cut Linnean ones. Depending on the limited information available to us, we recognize also:
3. R. giganteus var. nelsonii forma annectens Deg. & Deg. Frutex circa 12 dm. altus. This form maintains the same diffuse, red inflorescence; but approaches R. skottsbergii in its low, erect habit.
Type Locality: "Otto Degener, Isa Degener & L.W. Bryan 32,455. West side of Hualalai, Hawaii. Scrub vegetation at 5,000 feet. July 27, 1967." Type at N.Y., as are all our novelties unless extenuating circumstances make it impracticable to deposit them there.
Local Range: Beside the type collection, Degeners & Amy Greenwell 32,454, from Hualalai, "At 7,000 feet; old aa flow. July 9, 1967,", belongs here.

4. RUMEX SKOTTSBERGII Deg. & Deg.
SKOTTSBERG DOCK; PAWALE

Rumex giganteus sensu Hillebr. Fl. Haw. Isl. 377. 1888. (In part.)
Rumex giganteus sensu Skottsberg in Acta Horti Gotob. 2:223. 1926. (In part.) The novelty is named for Dr. Carl Skottsberg, who here gave results of his study of local Rumex taxa.
Rumex giganteus sensu Degener, Plants Haw. Nat. Park 152. 1930; ibid. 1943.
Rumex giganteus sensu Fagerlund & Mitchell in Nat. Hist. Bull. (Haw. Nat. Park) 9:35. 1944.
Rumex giganteus sensu Hubbard & Bender, Trailside Plants Haw. Nat. Park 4:7. 1950.
Rumex giganteus sensu Fosberg in Doty & Mueller-Dombois, Atlas Bioec. Stud. 187. 1966.
Not Rumex giganteus Ait. Hort. Kew. ed. 2:323. 1811. (Rainforest up to about 15 meter long lianas with loose, horizontal to drooping inflorescences brilliantly red but drying castaneous. This complex is represented by an important sheet - R. g. var. nelsonii - collected by David Nelson and deposited in the British Museum (Nat. Hist.) and by one - R. g. var. g. - annotated "Rumex 40 feet high - - - C68.")
Rumex skottsbergii sp. nov. Frutex erectus, 7 - 10 dm. altus; folia ampla elliptica; inflorescentia flavo-viridis. (We believe an illustration is more an "international language" than Latin and should be permitted to substitute for a Latin diagnosis.)

Erect 7 - 10 dm. tall entirely glabrous shrub with many stiffly erect slightly zigzag twiggy longitudinally grooved stems arising from compact rootstalk bearing thick yellowish taproots. Leaves pale green fading yellow: most blades 10 X 4.5 cm., oval with acute apex but toward inflorescence gradually smaller and more ovate- to obovate-elliptic with somewhat cuspidate apex, thick, entire or nearly so and never crisped, with acute to acuminate base; petioles slender, somewhat shorter than lower blades and often longer than upper blades; ocrea thin, castaneous. Flowers extremely numerous, yellowish green, imperfectly dioecious with staminate and pistillate flowers at times in same fascicle, subtended by minute persistent scarious ocreae: pedicels 3 - 5 mm. long, filiform except for thickened top, persistent in fruit; inflorescence stiffly erect, compact, enlarging in fruit to become usually broad-conical and 10 - 20 cm. wide. Pistillate flower: outer sepals concave, oval-cuneate to obovate, with obtuse apex, faintly nerved, almost 1.5 mm. long, spreading at anthesis; inner sepals longitudinally recurved to facilitate lateral extrusion of the longer stigmatic branches, ovate with subtruncate base and usually retuse apex, 3 mm. long and almost 2 mm. wide, erect at anthesis, with veins and especially midrib prominent. Ovary 1 mm. long, ellipsoid-trigonous with sharp angles, short-stipitate; styles filiform, each acutely widening into white-translucent broadly fan-shaped stigma irregularly twice and thrice fringed to form about 40 ultimate flat branches. Staminate flower: sepals concave, obovate with obtuse apex, faintly nerved, grading from about 1 mm. long for outermost to 2 mm. long for innermost, suberect; filaments filiform; anthers pale yellow, exserted, obovoid, 1.5 mm. long, emarginate at base and deeply narrowly cordate at apex; aborted ovary 0.5 mm. long, with spreading flat truncate stigmas each half as long. Fruit yellowish green ripening castaneous; outer sepals reflexed, marcescent, not enlarged; inner sepals erect to closely invest nutlet, 4 - 6 mm. long, undulate to somewhat erose-dentate, obtuse to retuse at apex, broadly cordate at base, conspicuously net-veined except for open margin, with midrib prominent without but sulcate within; nutlet shiny, obovoid, deeply trigonous, 2.5 mm. long, obtuse to a minute truncate stalk at base, somewhat beaked.

Type Locality: D$_e$geners & Piccos 32,453. On 1907 Lava Flow, Kau, Hawaii. On lava rubble at 1,600 feet. July 26, 1968. Type at NY, cotypes widely distributed.

Local Range: At present we know this species complex is native to Hawaii, where it is common on the ash and aa flows from about Kilauea and Kilauea Iki Craters through the aalii, ohia lehua and ukiuki pahoehoe flows of the Kau Desert up the Southwest Rift Zone of Mauna Loa and thence northward into Kona until stopped by forests. It grows from about 2,000 to 7,000 feet elevation. It is strictly a pioneer, springing up like a weed in bulldozed aa lava. The roots of the seedling apparently rush during the rainy season to reach moist depths for the plant's establishment before advent of the dry season. This common erect xerophyte has been mistaken for the gigantic liana R. giganteus with loose, brilliantly red inflorescence first collected by Nelson, presumably mauka of Kealakekua in the rain-

forest. After growing the erect shrub (like Degeners & Piccos 32,453) and the liana (Deg. & Deg. 32,443, Degeners & Piccos 32,456) next to each other for several years at 3,800 feet elevation in our Volcano, Hawaii, garden and noting that both taxa retained their specific characters over several years, we confidently consider R. skottsbergii specifically distinct. In addition to the Island of Hawaii, we suspect this species in several inferior taxa, to be on Maui and Nihoa as explained below.

Extra Range: Not known elsewhere.

"Rumex of Hawaii" concentrates on the genus as it occurs on the "Big Island." We here add some of our observations of, and surmises about, Rumex on the smaller islands as well.

Few readers realize that the Hawaiian Archipelago is close to 2,000 miles long, extending from the northwestern Kure and Midway Islands via such reefs, shoals and islets as Hermes, Laysan and Necker to massive Maui and Hawaii. The northwestern islands, first formed, were once of considerable size and elevation, and have since been mostly peneplaned to ocean level. When the island primordia began forming on the ocean floor is debatable. But an indication of how old such islands may be is shown by the find of fossils of Miocene Age - roughly 25,000,000 years ago - in core samples from Midway. These islands were certainly covered with jungle vegetation - now gone - when high enough to form and intercept rainclouds. The southeastern islands are generally younger, still of considerable size and elevation, and clothed with endemics until present interference by man.

As the crow flies, the Island of Hawaii is less than thirty miles distant from the Island of Maui, separated by the 6,000 foot deep Alenuihaha Channel. The possibility that these two islands have ever been connected by a land bridge is extremely unlikely. Yet we find that on Maui occur at least two taxa resembling the R. giganteus and R. skottsbergii complexes. The former is more or less represented by two sheets, namely 1.) Forbes 1050M, "Keaenae [Keanae] Gap, Halehaku. Crater of Haleakala," East Maui, Aug. 3, 1919. It bears a typical diffuse inflorescence. The area, as we know personally, is a dense, rainy jungle. 2.) G.R. Ewart III & G.C. Munro 63. "W. Maui, Honokowai valley, Amalu branch, valley bottom, alt. 2500 ft. Dec. 21, 1928." This bears a typical diffuse inflorescence.

On the other hand, the members of the R. skottsbergii complex are 1.) C.N. Forbes 1067M. Crater of Haleakala, Maui. Aug. 6, 1919. It bears a compact, erect inflorescence. 2.) James Henrickson 3878. Haleakala Crater. In cindery soil, base of sliding sands. July 15, 1969. It has a compact inflorescence; but the plant is said to be a seven foot high shrub, which is several feet taller than typical R. skottsbergii as we know it in and about Kilauea on the Island of Hawaii. It appears to have red flowers a feature, if true, being more typical of R. giganteus.

Even without special adaptaions for flotation or for transport by animals, these native species of Rumex evidently traversed Alenuihaha

Channel separating Hawaii and Maui, if they did not come from some third island such as Nihoa.

Maui, Kahoolawe, Lanai and Molokai in past ages were once a single island, before that time and after having been variously separated by narrow channels. These now have an average depth of not more than about 600 feet. Here Rumex need not have crossed any water to reach, for instance, from Maui to Molokai from which latter island Hillebrand reported "R. giganteus." He further states that the native name on Hawaii is pawale and on Molokai, uhauhako.

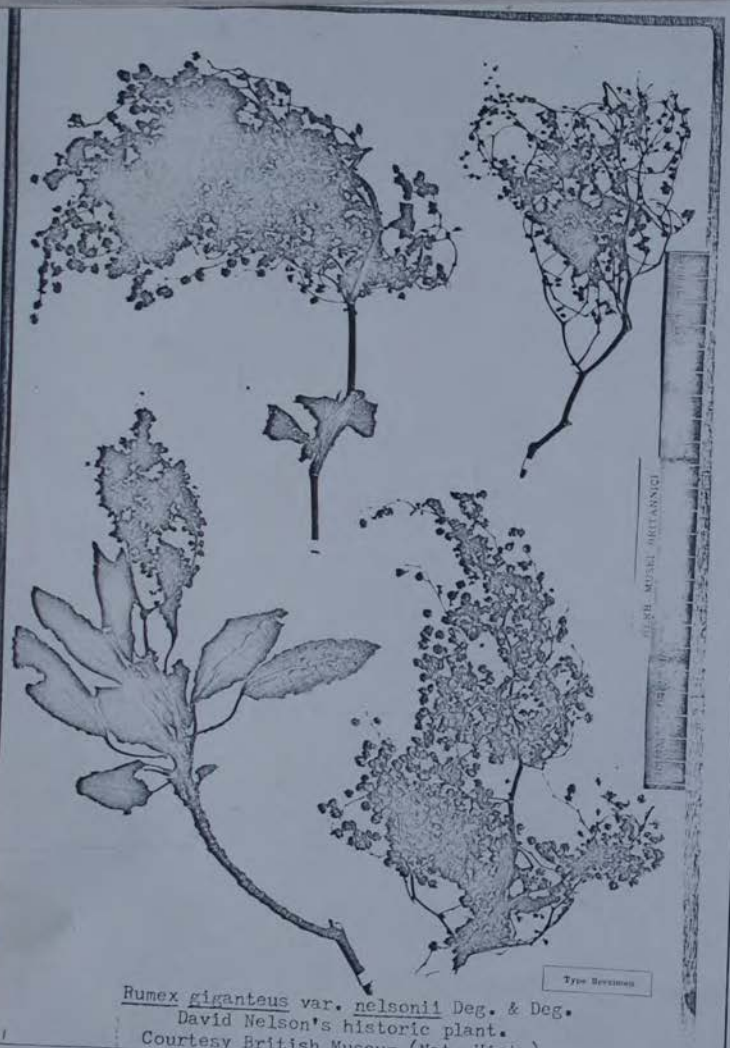
Uninhabited Nihoa, 400 to 500 miles west of Maui where some taxa of R. skottsbergii grow, has 895 foot high Miller's Peak and 852 foot high Tanager Peak. These two are the opposite rims of a large eroded crater. What plants clothed this high land in ages past? Was one of them a Rumex? In what we call the Marie C. Neal Herbarium of the Bernice Pauahi Museum are three sheets. They certainly belong, with their erect, compact, apparently green inflorescences, to the R. skottsbergii complex. Due to their condition, however, we are not prepared to state to which inferior taxon they may belong. They are 1.) E.L. Caum 71. Alt. 300. Height ±30 cm. "Shelves & holes in cliff n.w. near summit peak." June 18, 1923. 2.) E. Christophersen. "Nihoa, cliff under Miller's Peak, N. side, el. 250 - 300 meters." July 10, 1924. 3.) D. Yen 1015. "Devil's Slide, near Miller Peak. 600 ft. alt. May 1969."

It is intriguing to speculate whether the Nihoa Rumex is not a member of a very small relict flora, representing the genus which gradually disseminated eastward from the old, eroded islands to the new, now major, islands of the Hawaiian chain.

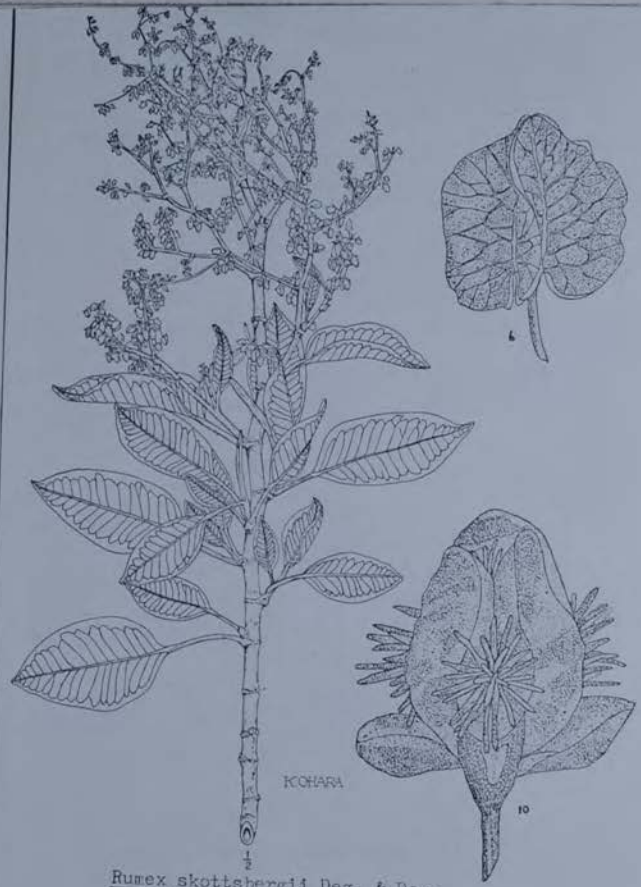
This is not all. We must yet consider Rumex on the islands of Oahu and Kauai. Oahu is separated from Molokai by the 2,300 foot deep and 30 mile wide Kaiwi Channel, and from Kauai by the 6,000 foot deep and 80 mile wide Kaieie Waho Channel. Formerly, Oahu consisted of two separate islands, the eastern one now dominated by the Koolau Range and the western one dominated by the Waianae Range. We know the Koolaus are more recent as well borings have shown that their lava flows overlie those of the Waianaes. No one has ever reported a native Rumex from the Koolaus, but along the precipitous sunny summit cliffs, ledges and slopes of the Waianaes grows the 5 - 8 cm. tall R. albescens Hillebr. It is an herb, rather than a shrub, with leaves crisped and erose-denticulate. Skottsberg, perhaps depending too much on herbarium material, had some difficulty in distinguishing this species from Hawaii plants; while our observations in the field convince us of the correctness of Hillebrand's finding. Though not known from the Koolau Range of Oahu, this taxon, perhaps in several varieties and forms, appears on the Island of Kauai! It is significant that Skottsberg, mentioning Chromosome Numbers in Hawaiian Flowering Plants (Ark. f. Bot., Stockholm) 64. 1953, lists 36 as the 2N for a Kauai plant and 54 or 56 for plant 6,828 from Hawaii.

The more we become familiar with native taxa, the more do we real-

ize how complicated the flora of the Hawaiian Islands is; Rumex is just one example. Although one of us has observed and collected the native taxa since 1922, we have solved just a few puzzles and drawn attention to many, many more. The new generation of botanists should concentrate on collecting more and better material, growing seeds under controlled conditions, making additional chromosome counts, and using newer and preciser methods unknown to workers of the past. The present fad to engage in a wealth of costly ecological experiments and studies without first untangling the taxonomy of our flora is placing the cart before the horse.



Rumex giganteus var. nelsonii Deg. & Deg.
David Nelson's historic plant.
Courtesy British Museum (Nat. Hist.)



Rumex skottsbergii Deg. & Deg.

SUGARCANE OR KO (47)

Sugarcane, Saccharum officinarum L., and its relatives, are members of the Grass Family, termed Poaceae by some botanists and Gramineae by others. To the Hawaiians, sugarcane is known as ko. This giant grass has stems of rather uniform thickness filled with a sweet pith and marked off into prominent joints called nodes. These bear linear leaves and axillary buds in alternate arrangement. Like maize or Indian corn, sugarcane at maturity produces tassels (Plate) that are hairy and silver-gray with a reddish tinge. But unlike maize with its terminal tassel of "male" flowers and its axillary fused tassel or "ear" of "female" flowers that develop into grains of corn, the sugarcane bears terminal tassels only. These normally develop bisexual flowers, namely flowers having both stamens, or "male" reproductive organs, and pistils, or "female" reproductive organs.

Sugarcane originated probably in New Guinea. Chinese writers of the Eighth Century B.C., however, record its importation into their country from India. Furthermore, Nearchos, one of Alexander the Great's generals, reported on his return to Greece about 327 B.C., that the barbarians beyond the Indus knew of a "honey" made without the help of bees, manufactured from a honey-bearing reed.

The plant, in many different varieties and forms, grew in most of the South Seas Islands previous to the coming of the Caucasians, undoubedly purposely transported by Melanesians and Polynesians during their migrations. A hundred fifty years ago the Hawaiians usually carried pieces of cane as a convenient portable provision during their travels on land and water, just as the Amerindians were accustomed to carry maple sugar for the same reason. Before Captain Cook's coming, the natives in the Hawaiian Islands cultivated the cane in a crude way, even within the boundaries of the Hawaii and Maui Parks, like the taro (p.) and the banana (p.). As with many cultivated plants, they distinguished innumerable kinds by special names. This classi-

Hoi, W.M.G. The Native Haw. Canes. Int. Soc. Sugar Cane Tech. Bull. 7:1-8. 1952.
Here are more fully described 38 canes and the derivation of the names of 51. Many of these, as in the case of taro, awa, and some other plants, were named for fishes if their colorations were suggestive of them.

fication was based largely on the color of the stem, but also to a lesser extent on its texture. Thus the kokea, lahi, oliana and uala have pale yellow to greenish stems; the honuaula, koeleele and papaa have dark red to purple stems; the ainakea, akilolo, laukono and manulele have variegated stems; and the puaolo, a cane that was the most vigorous and contained the sweetest juice but which seldom if ever flowered, was intermediate in stem color between the purplish and the variegated types. The laukono and the manulele were used as aphrodisiacs by the kahuna, or sorcerer; the koeleele as a medicine in childbirth; and the kokea preferably for munching out of hand because of its thin rind. Such "eating canes," life savers in times of famine, had their sugary pith mostly brown, not white like that of the kinds cultivated commercially. The juice of toasted sugarcane was fed to babies. Most of the native horticultural forms have become extinct.

sugarcane -

Besides its use as food and medicine to the early Hawaiians, the cane plant important to them in several other ways. Its leaves were occasionally used to thatch their houses (p.). Sometimes the dead were embalmed by wrapping in kapa (p.) with the flowers of the koeleele sugarcane or with the pulu of the hapuu (p.) fern. As a sign that the plants in a field were kapu, or not to be taken by the common people, it was sufficient for a chief to place a stick of sugarcane in its corner.

The dried tassel with its basal stalk, in all about two feet long, was used for darts by children and adults in playing the game of koa pua. The lower end of the dart was tightly bound with string, wetted in the mouth, and then thrust into the earth to become coated with clay. The players in turn ran forward in a stooping position from a slight mound and, with a downward and forward swing of the arm, threw the arrow at such an angle that it just grazed the surface of the ground. From here it occasionally glanced gracefully like a flat stone thrown to skip over the surface of a body of water.

According to tradition

The sugar industry in the Islands had a very modest and desultory beginning in which many races of men have had a part. ~~It is rumored that~~ a Chinaman, coming to the Islands in 1802 on one of the Chinese vessels to trade for sandalwood (p.), brought with him a stone mill for crushing cane and a boiler for concentrating the expressed juice. This primitive sugar mill, after grinding one small crop on the Island of Lanai, was abandoned when the owner returned to his native land. Don Francisco de Paula Marin (p.), the Spaniard who probably first recorded the growth of coffee (p. 276) in the Islands, made sugar for the king in Honolulu seventeen years later. Lavinia, an Italian, made sugar in 1823 by pounding the cane like poi (p.) with a stone beater on a wooden trough and boiling the juice in a small copper kettle. John Wilkinson, an English gardener whom Governor Boki (p. 146) of Oahu brought to the Islands to stimulate agriculture, set out 100 acres of cane and coffee in the summer of 1825. This was planted on the governor's land in Manoa Valley, now part of Honolulu, by the natives with their oo, or primitive wooden diggers, for a wage of 25 cents per day. Though the plantings grew vigorously, they were abandoned on Wilkinson's death in 1827; and when Boki started distilling rum from the cane juice, King Kamehameha's widow had the still broken, and the cane land planted to sweet potatoes. The following year Antonio Silva, a Portuguese, made sugar at Waikapu, Maui, where he had erected a crude mill.

In 1835 Ladd & Co., a firm which on its failure involved the Hawaiian Government in considerable difficulties, received a grant from Kamehameha III of 980 acres at Koloa, Kauai, for the planting of cane. Jealous at seeing this land used by others, the local chiefs forbade the sale of provisions to the resident agent. There were other difficulties. For instance, proper implements were lacking; and at one time for want of oxen, forty natives were hitched to a plow to draw it. Coin was scarce, and the laborers were paid in pasteboard scrip redeemable Saturdays at plantation stores. At that time, hired natives were furnished housing and food at a daily cost of one ~~cent~~ [illegible] cent.

cent. One test acre yielded 12 tons of cane, from which two and a half tons of salable sugar was extracted. In 1837 the first sugar and molasses were exported. Thus Ladd & Co., was the first successful sugar plantation in the Islands on a large scale. In fact, cane is still being grown on this same Koloa land today. By 1840 about a score of sugar mills were in operation, two run by water power and the rest by oxen. Much of t is sugar was sold to supply the crews of merchantmen and whaling ships. In 1974 there were 17 mills, and 16 plantations.

When the gold rush in California in '49, agriculture in the Islands was greatly stimulated. Not only sugar produced in the lowlands but even wheat and potatoes grown on the slopes of Haleakala were exported to the miners. Due to the decline of the native population and the large number away from the Islands on whaling vessels, as well as to the exodus of many Caucasians to California in search of gold, the shortage of laborers for the local plabations became acute. This inaugurated the importation of men from many foreign countries.

~~Indeed, it was recognized as early~~

Indeed, it was recognised as early as 1850 that additional labor was required by Hawaiian sugar and rice plantations. In December 1864 the Kingdom of Hawaii finally established a Board of Immigration. In 1882 the president of the Board, estimating that the planters needed 4,000 additional laborers, wrote that "Four thousand men, with three thousand women and four thousand children would make eleven thousand persons, whose transportation would cost about $800,000. - - - - The argument for imposing the expense of the women and children on the government is a very strong one. Every immigrant becomes a taxpayer. They are producers, and their labor is wealth." Under the employ of The Royal Agricultural Society, Captain Cass of the "Thetis" imported 195 Chinese coolies January 3, 1852 as contract laborers. They were to be engaged at $3 per month in addition to food, clothing, housing and medical attention. Between that year and 1885, China provided the best source. In fact, by 1909, about 45,064 had been imported.

The Hawaiian Government, a bit overwhelmed by the great influx of Orientals as well as Occidentals, thought it desirable to import laborers more akin to the Hawaiians. So a Captain English of the "Mauna Loa" began by importing 84 South Sea Islanders in 1869. Thus a total of 2,450 were finally imported, but neither as laborers nor citizens were they satisfactory. Most returned to their homes. The first Portuguese came from Madeira in 1878; the first Norwegians and Germans in 1881; and the first large contingent of Japanese in 1885./ By 1909 the sugar industry had been instrumental in the arrival of:

140,457	Japanese	1,270	Germans
45,064	Chinese	613	Norwegians
14,670	Portuguese	372	Austrians
6,925	Koreans	200	American Negroes
5,200	Puerto Ricans	100	American Caucasians
2,450	South Sea Islanders	110	Russians
2,299	Spaniards	64	Italians

Though a few Filipino laborers arrived in 1906, the real influx began in 1909, totaling about 118,50 by 1934. Due to the expanding pineapple industry, the total number came to - in 1975.4

Platt, B.L. Immigration and Emigration in the Haw. Sugar Industry. Industrial Relations Section Haw. Sugar Technologists. Nov. 15, 1950.

Classroom observation convinced a former student and faculty member of the University of Hawaii that four great races of man and many subsidiary races, whether pseudopaleolithic or highly endowed with technical gadgets of their own making, are inately different in spite of environment. On the average, some are superior to others in theoretical, practical and social intelligence, or in various combinations of these attributes. But why be a modern Galileo by expressing beliefs considered heretical by the great multitude at the beginning of a new Dark Ages? Hence it suffices to state that out of this melting pot some of the finest alloys are represented by men and women of Chinese-Hawaiian ancestry, with or without additional kinds of forebears.

While the proportion of different varieties and races of man inhabiting the Islands was changing, the different varieties and races of sugarcane here likewise changed. During the latter part of the Nineteeth Century, if not before, many of the old native canes were gradually being displaced by more productive kinds. Their origin failed to be recorded in many cases. One of these early commercial canes, properly called by the Hawaiians ko-pake, was most likely imprted by the Chinese, probably during the time of the sandalwood trade (p.). Another, called Lahaina cane because it was first extensively grown in that vicinity on Maui, was imported from Tahiti on the ship "George Washington" in 1854. This cane soon became very popular because of its high sugar content, hard rind resistant to many insect injuries, and rapid growth. It displaced most of the earlier types grown on the plantations. Then a root disease began to attack the plants, thus threatening the entire industry with failure. Cane comparatively immune to this malady, such as the kinds known as Yellow Caledonia and H-109, was therefore planted instead. The latter is one of 5,000 seedlings developed by the experiment station of the Hawaiian Sugar Planters' Association. It proved to be far superior to other forms of cane in many respects and, consequently, was widely grown. But the geneticists ever continue their breeding projects. Thus, for example, No. 32-8560, a cross developed from an Indian cultigen as the female parent and a Javan as a male parent, replaced H-109 by 1941. Then ten years later 32-8560 in turn gave way to the planting of one of its offspring known as 37-1933. As the experiment station succeeds in breeding better and newer cultigens, the older ones are abandoned. When standing in the midst of a 5,000 acre plantation, the visitor is not surrounded by hundreds of thousands of individual plants, but by a single hybrid plant that has been chopped into separate pieces. In other words, the fields consist of a group of cultivated plant pieces propagated vegetatively from a single original seedling. This accounts

This burning gives off a beautiful mushroom cloud of black smoke, white water vapor or "steam" and some flakes of "Black snow" for a few hours. It kills fungi harmful to cane and the cause of hayfever in man., insect pests and some rats. The practice is certainly superior to having the rubbish slowly putrefy in the field Each of these old, mature leaves going up in smoke had manufactured one teaspoonful of sugar every thirty six hours of sunlight. Sugarcane is one of the most efficient plants for purifying the air amd manufacturing energy. While one acre of wheat develops 1,100,000 calories, sugarcane creates 7,000,000!

for the absolutely genetic uniformity of the fields unless, of course, some exceptionly rare genetic accident of development may give rise to a bud sport.

By breeding, by the control of insect and fungus diseases, by improved methods of culture and of application of fertilizer, as well as by improved processes of sugar manufacture, the local production of raw sugar per acre has steadily increased from less than one ton for the crop of 1850 to 4.75 tons for the crop of 1900 and to 10.86 tons for that of 1974.

Today sugarcane is planted in the Islands from near sea level to an elevation of about 3,000 feet. It is the usual practice to plow the land to a depth of one and a half to two feet. This is done with a tractor. For planting in irrigated fields, furrows fifteen to eighteen inches deep and spaced five to five and one half feet apart are opened and into them a continuous line of so-called "seed pieces," better known by the Hawaiian name pulapula, is laid. Each piece is about 18 inches long and carries at least two nodes with their attached buds. The pulapula then is lightly covered with soil. In about a week a continuous stand of buds breaks through the surface of the soil. This cane is fertilized and irrigated from time to time. While it is young, the weeds are killed by spraying them with a herbicide. As the cane increases in size and shades the ground, weeds become less troublesome. Fertilizer application is completed in the first year. Several months before the time of harvesting, irrigation is reduced or entirely discontinued to concentrate the juice in the stalk. Flowering usually appears in November and December. The fields with the cane still standing are commonly burned over to rid them of as many dead leaves as possible and thus to lighten the labor of handling the crop. ~~At the same time, this burning kills insect pests, harmful fungi and some rats.~~

At the mill, the cane passes through crushers that express the juice. The fibrous residue, called bagasse, then is used as fuel (fig.). The expressed juice, on the other hand, is subjected to various processes to extract from it the "raw sugar." Most of this is shipped to California to be refined for the consumer's use. The simplified diagrams of mill (fig.) and of refinery (fig.) give a general idea of the manufacture of refined sugar from cane.

The plantations usually arrange their work in such a way that while one crop is being ripened for harvest, another is being cultivated. After the first harvest, the cane stools are usually left in the ground to produce a second crop, termed the "first ratoon" crop. Thereafter a second, a third, or even a fourth ratoon crop may be grown, after which the field is plowed anew and replanted to fresh segments of cane. The visitor, consequently, will seldom see idle sugar land, since it is almost never lying fallow nor being planted to other crops in rotation. The scientific application of sugarcane farming has made this intensive culture possible, the fields being more productive now than ever before. An average of 3,000 pounds of fertilizer was applied to each acre of cane in 1974. About 2,000 ~~tons~~ pounds of water was needed to produce each pound of

was grown in 1974,
sugar. In this way about 224,000 acres of cane ~~[illegible]~~ involving the employment of 9,000 people. The crop harvested , amounting to over XXX 1,040,000 tons, was worth about $700,000,000. In terms of sugar, this amounted to a little over 1.2% of the world supply. The United States consumes about ten times the amount of sugar produced in the Hawaiian Islands.

(For Book Review Section)

TRICKS OF THE TRADE

"Publish or Perish" is unfortunately an unwritten law of the Jungle of Science to which too many workers are today subjected. Presidents and Directors, usually non-scientists chosen for their salesmanship in selling the needs of their impoverished eleemosynary institutions to wealthy potential donors of largesse, have neither the time, inclination nor peculiar knowledge to evaluate the articles written by members of their staffs. This is particularly true if a trivial observation is written up in scientific jargon and is given a fancy title in gobbledigook hog Latin.

Now what would you do if you were President or Director of an institution of learning and two of your scientists submitted their annual reports to you? Prof. John Doe in his report might list his publications for the year as 1.) The Number of Sand Grains in a Sand Dune, 2.) The Average Annual Temperature on the Second Floor of Aloha Tower, 3.) The Distribution of Lawn Mowers in the Pacific, and 4.) The Mating Habits of One-Legged Myna Birds. Dr. Richard Roe, on the other hand, might report the titles of his publications for the year as 1.) History of the Tuna Industry, with Recommendations for Improvement of Catch, and 2.) A Monograph of the Genera Pelea and Cyrtandra in the Hawaiian Islands. Nothing more, poor man.

Would you, a busy executive, read these six articles to judge as to their scientific value? You would not. You would count the number of titles each scientist had submitted. Prof. Doe, who had dashed off four articles of questionable worth would be advanced in rank and allocated additional funds to spend on research; while Dr. Roe, who had burned the midnight oil for 365 days of the year, would be reprimanded for his lack of publications and be given an additional number of Freshman courses to teach the ensuing year.

With "Publish or Perish" the unwritten law of the Jungle of Science, we trapped scientists frantically look about for something to publish, particularly before the annual report to our President or Director is due. The article need not be long; it need not be the result of original research; it need not have any practical or academic value - in fact, it can be as useless as last year's telephone directory. All we need are titles, the more the merrier, and such titles are especially imposing if we can embody in them a confusing Latin name for sand grain, Aloha Tower, lawn mower and myna bird.

Among the rash of title-gaining articles written by title-hungry scientists, the reader should recognize Mr. Degener's "Wilhelm Hillebrand, 1821 - 1886," appearing in the Advertiser for Nov. 18. The article is eminently worth while because it deals with an outstanding scientist who came to our islands just one hundred years ago. But please don't inform the author's Director in New York - may the good Lord preserve him and the appropriations at his command - that 80% of the article was based on the midnight-burning-oil research of Dr. Willis Pope, published in Thrum's Annual for 1919.

Another title-gaining article is from the pen of Dr. St. John of the University of Hawaii. Copies, printed in Webbia 1951, appeared in Honolulu just a few days ago and thus the title is elligible for inclusion in this year's annual report to President Sinclair. The professor's article gives the geographical range of "Pisonia ". If the dot on the map was made by Dr. St. John and was supposed to fall where Canton Island stands, the article is in error. "Pisonia " I know is not native to Canton Island or I would have found it during my seven weeks' botanical exploration of this tiny atoll. But, if instead of the author, a fly spotted the map, the article is piddling good.

This research problem of "Pisonia " selected by the

Read Professor of Botany of our University of Hawaii should be of particular interest to residents of the Hawaiian Islands. It shows graphically that "Pisonia ," like 1,000,000 other plants inhabiting this wide world of ours, does not and never did grow in the Hawaiian Islands. (I bet the ancestor did, giving rise to our panala trees, a fact this professor might have stated for the sake of his Hawaiian readers.) It is true that this critic feels disappointed that erudite Dr. St. John did not spend his time monographing our peculiar Hawaiian Peleas, named after the Goddess Pele, and our beautiful native foliage plants Cyrtandra, related to the African violet. I remember his reserving these two groups of plants for monographing about twenty years ago, thus inadvertently discouraging their study ever since by all too eager and efficient coworkers. Will his next article be his monumental monograph of Pelea and Cyrtandra for which we have been waiting these many years or are we in the Hawaiian Islands to be enlightened about the geographical range of the English walnut or the horsechestnut? Perhaps President Sinclair will let us peek into the future.

Otto Degener, Class '23
University of Hawaii

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Otto Degener, Class '23
University of Hawaii

(Otto Degener
Mokuleia Beach
Oahu)

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Tricks of the Trade 18

II

By Otto Degener

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Otto Degener, Class '23

2nd Edited Page

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(For Book Review Section)

TRICKS OF THE TRADE

By Otto Degener

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(To be continued)

WORLD WAR WARRIORS' VALUABLE VEGETARIAN VADE-MECUMS

During this period of world stress, the physicist is perfecting a means whereby our thirsty shipwrecked heroes, cast adrift in an open life boat, can change sea water into fresh drinking water of sufficient purity to pass all sanitary and blue laws. Botanists, likewise, have not been slack in their endeavors to save the lives of the unfortunate not from thirst but from starvation. During March of this year Captain A. B. Godshall, C.E., U.S.A., with the technical assistance of W. R. Lindsay and M. F. Ward of the Canal Zone Experiment Gardens, published "Edible, Poisonous and Medicinal Fruits of Central America." A month later E. D. Merrill, Administrator of Botanical Collections at Harvard University and Director of the Arnold Arboretum, assisted by the illustrator Dillon, had published by the War Department the technical manual "Emergency Food Plants and Poisonous Plants of the Islands of the Pacific." Both manuals are timely; in fact, should have been published and made available for study by our armed forces years ago. They are compact, and easy to stow away in the pocket of a uniform. On their presence or absence in such a pocket may very well depend the survival or the death by starvation of those men of our service who crash in the jungles of Central America or of the islands of the South Pacific, or are shipwrecked on their shores.

The vade-mecum, or constant pocket-companion, for Central America contains 48 sheets of good bond paper printed by the offset process on one side only. Forty-four more or less common

fruit-bearing plants are plainly illustrated in line drawings, and briefly described in non-technical language that any reader of English can understand.

Mr. Walter Lindsay, Director of the Canal Zone Experiment Gardens, has had extensive experience with tropical plants, having begun his studies at the University of Hawaii under the reviewer's guidance 15 or more years ago. This very handy and good booklet might have been still better had Mr. Lindsay filled the 50 blank pages with discussions of the many potherbs of the region he knows so well. A lost traveler, for instance, might then learn how to allay his hunger safely with perhaps a mess of the pantropic stick-tight (Bidens pilosa), boiled a few times to rid it of its yellow juice, should no edible fruit be within reach.

The second paper under review is the War Department's Technical Manual 10-420, entitled "Emergency Food Plants and Poisonous Plants of the Islands of the Pacific:. This was finally released April 15, 1943, and is on sale (15 cents) by the Superintendent of Documents, U. S. Government, Printing Office, Washington, D. C. It was written by Dr. Elmer D. Merrill, long resident of the Philippines and an expert on Asiatic plants.

This Pacific manual comprises 136 pages of text and illustrations, in addition to a dozen or so pages devoted to table of contents and index. This last is unique in actually containing simple, fool-proof keys for the identification of plants or plant parts. The manual describes the uses or properties of 43 plants, devoting one large illustration to each. The general style is similar to that of the Central American manual discussed above.

After devoting a page to the "Purpose and Scope" of the manual, the reader is given a little more space for "Reassurance and Warning." The myth regarding snake infested jungles is debunked. In fact, we are informed that "Poisonous snakes are absent from Polynesia. Malaysia, they are very rare and are seldom seen. The chances of being bitten by a poisonous snake in any part of the Malayan region are very much smaller than in any part of the United States where rattlesnakes and water moccasins occur." The malaria mosquito and the land leech are the pests to avoid whenever possible. The latter, fortunately, is found only in certain countries and there only when the rainfall is heavy. Some relatives of the poison ivy may cause poisoning by contact, and a few tree nettles (Laportea) and cowhage (Mucuna sps.) may inflict considerable pain with their nasty hairs. Procuring "Assistance and Advice of Natives" is next strongly advised and, after a little "Miscellaneous Information," the main part of the work begins on page 5.

The main part is divided into ten sections in which the species are not arranged according to taxonomic relationship but rather according to their utilitarian value and ease of consultation. These sections read: "Edible Ferns", "Edible Herbs", "Edible Palms", "Edible Grasses", "Edible Tubers", "Plants Eaten as Greens", "Edible Fruits", "Edible Seeds", "Poisonous Plants", and finally "Plants Used to Stupefy Fish." This ends on page 137. This pocket manual contains a vast array of vitally important and surprisingly novel information that will delight the reader whether he is in need of sustenance or not. The many illustrations are good excepting a few like that of the tree nettle which is just a bit feathery

and sketchy, in part due to faulty printing.

The Pacific manual, unlike the Central American one, stresses the edible nature of the "cabbage" or terminal bud of most palms. This may be eaten raw, boiled or cooked. In case of the cocomut "The large terminal bud or 'cabbage' is one of the very finest vegetables, and may be eaten in quantity either raw or cooked." To eat the "cabbage" of a palm, thereby killing the entire tree, is a moderately safe custom during a war emergency. The author, however, might have stressed the fact that to continue this practice into peace times will be distinctly frought with danger. Whoever has nursed along a prized coconut palm or two with loving care on a little strip of coral beach (as the reviewer has done), might ambush the veteran palm eater and pepper him with shots of rock salt. ~~It might instigate a Second Civil War.~~

Perhaps one of the manuals might have found space to describe how to make fire by rubbing a hard, pointed stick into the enlarging groove of a softer, flattened one; of using a segment of bamboo as a cooking vessel; of boiling water in a wooden dish by placing red hot stones in it; and the trick of gaining a refreshing drink of watery sap from the stem of the giant bean Entada phaseoloides.

What soldier, even if fortified with either one of these vademecums, would not crave an occasional snack of fish, flesh, fowl or good red herring? So long as these booklets have covers, could they not hold a pocket or two to harbor a dozen fish hooks and a length of line to appease the appetite of the more carnivorous man? Fish poison plants are not ubiquitous in the jungle. An old safety razor blade, also tucked into such a cover would take up practically

no space yet could be fashioned into a most useful cutting tool by a hungry man in need. Both manuals, with these three additions, would be so useful that some shipwrecked youngsters may crave to remain "lost" in a Shan-gri-la of their own making. I almost believe I should. If they treated the natives with democratic friendliness and as natural-born ladies and gentlemen, which most of them are, they would very likely gain their full cooperation. They might learn what rarer jungle foods to enjoy such as Codium and other algae, and the candlenut-loving pepeau or Auricularia; what rarer poisons to avoid such as the brilliant red beans of the Erythrina. To have included such trivial though interesting items in the manuals, however, would simply have made them cumbersome.

Capt. Godshall's "Edible, Poisonous and Medicinal Fruits of Central America" is written for men lost in the jungles of Central America and not elsewhere. He wisely advises his readers to "study the most common fruits now - before you're lost in the jungle. A few minutes study now may save your life later on." Dr. Merrill's manual of about 150 pages dealing with "Emergency Food Plants and Poisonous Plants of the Islands of the Pacific" specializes on the South Seas yet is actually almost pantropic in scope. Capt. Godshall's wise advice should be taken very seriously by service men throughout all warm and tropical regions whether they carry his or Dr. Merrill's excellent work. To do so may save them much grief.

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