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The Vegetation of the Sandwich Islands as Seen by Charles Gaudichaud in 1819

A Translation, with Notes, of Gaudichaud's "Îles Sandwich"

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INTRODUCTION

THE FIRST BOTANIST to publish a report on the localized flora of the Hawaiian Islands was the Frenchman Charles Gaudichaud-Beaupré. He was born at Angoulême, France, on September 4, 1789, and died on January 16, 1854. He studied pharmacy at Cognac and at Paris, graduating at the latter place, where his botany professors were R. L. Desfontaines and L. C. Richard. In 1810 he joined the marine military as a pharmacist and served at the port of Anvers. While there, he was in a quarrel that ended in a duel, and he was wounded by a sword thrust through his chest. After a long, painful convalescence, he returned to his duties, this time at Rochefort.

In 1816 Gaudichaud was appointed pharmacy botanist on the world scientific cruise of the *Uranie*. The commander was Capt. Louis Claude de Saulses de Freycinet, who became noted as a military man, an explorer, a scientist, and a politician. The *Uranie* arrived at Kailua, Hawai'i, on August 8, 1819, sailed to Lahaina, Maui, on August 15, and to Honolulu on August 26. The ship was 20 days in the archipelago, and Gaudichaud was able to spend 7 days on shore. He discovered, collected, and later described numerous Hawaiian plants, including new genera and new species. These were published in *Livre II* of his *Botanique,* the fourth volume of *Le Voyage autour du Monde* (Gaudichaud 1826 [-30]).

On the way home, after rounding Cape Horn, the *Uranie* was wrecked on the Falkland Islands. Before the broken ship disappeared, part of the cargo was salvaged, including some of the bundles of plants collected by Gaudichaud. These were soaked with sea water, and the botanist

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worked for days trying to dry them adequately before an open bonfire on the beach. He later reported that of the 4,175 species he had collected, 2,500 were lost in the shipwreck (Hoefer 1857:650).

Gaudichaud

Gaudichaud made a second scientific cruise in 1830 on the *Hermine* under Capt. Henri de Villeneuve-Bargemont, and explored Chile, Peru, and Brazil. In 1836-37 he sailed on the *Bonite* on another world scientific cruise, under Capt. Auguste Nicolas Vaillant, arriving at Kealakekua, Hawai'i, on September 28, 1837. This visit by Gaudichaud was of considerable length, and he made a much larger collection of plants. Maui, O'ahu, and Kaua'i were also visited. On his return to France he studied his collection of higher plants, and had drawings made of the novelties. Although these were later published, no word of text accompanied them. Apparently, Gaudichaud lost interest in systematic botany, abandoned his projected book, and with enthusiasm took up the study of morphogenesis of plants. He proposed the theory that a plant was made up of numerous separate individuals, each of which he called a phyton. Every phyton had a radical part that grew down to combine with others and form the root, and a cauline part that grew up to make the herbage. At the time, this theory was met with much opposition, but Gaudichaud repeatedly defended it and carried on a prolonged acrimonious public controversy over it. Recently, the phyton theory has been forgotten. His later years were spent as a professor of pharmacy. In 1837 Gaudichaud was elected a member of the Académie des Sciences.

We are translating into English Gaudichaud's "Îles Sandwich," which was published as Chapter XVI of *Livre I* of his *Botanique* (Gaudichaud 1826 [-30]). This is the first published account of the ecology and phytogeography of the islands, and it records many Hawaiian vernacular plant names. Gaudichaud botanized on Hawai'i, Maui, and O'ahu, starting from the harbor on foot and heading for the mountains. He merges his observations of the three islands into a single account, describing the vegetation of the shore, the lowland, the lower drier forest, and finally the rainforest. He gives the altitudes of the zones quaintly in fathoms, which are easily converted to meters when divided by 2.

We have endeavored to provide an accurate and useful translation of Gaudichaud's account. Where appropriate, we have inserted in brackets revised scientific names of plants and modernized spellings of the Hawaiian names that were rendered by Gaudichaud in a French system. Because Gaudichaud did not uniformly refer the reader to plates where new species were illustrated in the accompanying folio atlas, or to pages where new species were described in *Livre II* of the *Botanique*, we have inserted these references in brackets, where necessary, to aid the reader of the present translation. Gaudichaud's own numbered footnotes have been retained using a symbol system; translators' notes are numbered and appear at the end of the paper.

For this translation we have selected two of Gaudichaud's fine illustrations of Hawaiian plants. These were published in the folio atlas accompanying the *Botanique;* to our knowledge, they have not been published elsewhere. The portrait of Gaudichaud herein, from Van Steenis-Kruseman (1950:186), is the only known likeness of the botanist.

THE SANDWICH ISLANDS

Charles Gaudichaud-Beaupré

BEFORE ENTERING upon any descriptive detail of the extraordinary vegetation of this archipelago, above all before pointing out the astounding anomalies furnished by the same plants of many genera, I believe that it is indispensable here, and indeed here more than elsewhere, first to cast a general look over the character of the soil which nourishes them, as well as on the diverse influences under which they grow.

All these islands, issued from the bosom of the waters, owe their origin to the volcanoes, which, according to my observations, appear to have burned [been in eruption] at different epochs, following, more or less, a course of west to east (N.W. to S.E.). In effect, in the islands of the west, the decomposition of lava is more advanced than in those of the east. If that [western] lava had been composed of the same ingredients and if they were in a like state of fusion and vitrification, this presumption would have surely changed, but to what extent can we admit it?

Time has already rendered the islands of the west amenable to culture throughout all their parts. Heat and humidity combined are beginning to have the same effect upon Hawai'i, which I have chosen for the subject of my general observations because, situated in the east, it is the largest and the most lofty in the archipelago.

Decomposition of the lava proceeds under conditions which I shall indicate, for it is to those conditions that I attribute the singular diversity of forms, which is revealed in the major part of the plants of the islands.

The lava is vitrified, brilliant in color near the shore. At 150 fathoms it is still hard, but opaque and rough, and already near this point it shows the first degree of decomposition. At an elevation of 250 to 300 fathoms, the simultaneous action of heat and the clouds, which constantly bathe this part of the mountains, decompose this lava, and there only begins the natural vegetation of the islands. It is quite different, actively different, than what one sees at several isolated points of the shore lands, where, strange in a way, it is maintained only by the threads of water that fall from the mountains and are bordered by vegetated soil.

In spite of my longing to do so, I have never [had the experience] of breaking through the cloud level—always stable at an elevation of at least 300 to 600 fathoms. Therefore it has been impossible for me to study the alpine plants, wind-borne, which surely must be below the clouds.

It is possible that at this height their abundance and their vigor tend to decrease, and one probably ends up by finding that the lava is bare at the summit of the mountains, as one also notes from the base.

These first considerations naturally lead to my parceling out my observations into three regions. The first embraces the vegetation of the cultivated shores and will be preceded by a listing of the cryptogams, which are all plants of daily use. The second will indicate the nature and the state of the few plants which are found between this point and the lower cloud level. In the third I shall examine the vegetable growth, the cloud zone vegetation, truly indigenous, of this part of the mountains entirely under cloud.

The order that I shall follow in this exposition seems the most methodical and the most natural. However, the opposite—would it not serve as well, because the cloudy part of the mountains has been the first to send forth vegetation appropriate to the terrain? But such procedure, opposite the ordinary course, would have the serious inconvenience of putting the observer brusquely into the center of the unknown land, among new productions, instead of allowing him to arrive there by a gradual progression. Let us follow nature more closely and not stray from the usual routes.

First Region

The few days that we have spent on this island[1] have not allowed us to explore the shores in the manner which could reveal here in detail their riches in marine plants, which, nevertheless here seem to be as numerous as varied.

We will cite particularly *ceramium rubrum* [*Centroceras clavulatum*], *hydrodictyon umbilicatum* [*Microdictyon Setchellianum*], *sphacelaria minuta, solenia compressa* [*Enteromorpha compressa*] with which the enormous blocks of lava that border the shore are ornamented, *ulva lactuca* [*Ulva fasciata*], *sphaerococcus concinnus* [*Ahnfeltia concinna*], [*S.*] *intricatus* [*Gelidiopsis intricata*], and [*S.*] *musciformis* [*Hypnea nidifica* or *H. cervicornis*], *sargassum aquifolium* [*S. echinocarpum*], and [*S.*] *cuneifolium* [*S. obtusifolium*], *amansia intricata* [*Amansia glomerata*], etc., which the sea vomits each day upon the beaches in great abundance. These productions are common on almost all the islands of Oceania and at many other regions.

The littoral plants, so abundant in the Moloques [Moluccas] and the Mariannes [Marianas], begin to desert the shores of the Sandwich Islands. Shall we search for the cause in the isolation of this archipelago, or the broken form of their shore edges, in the nature of their brilliantly colored rocks, often vitreous, the hardness of which resists the efforts of the sea?

The settlements situated along the shore are watered by some little brooks that escape from the abysses of the mountains,* or are hollowed by the work of man. Situated here and there, they always give notice of the presence of a beach or a stream of sweet water,† and indicate it at some distance. Separated, one from the other, by valleys entirely sterile, they offer bouquets so beautiful that they contrast singularly with the grey, sombre tint, and the aridity of the part of the mountain that forms the base of this scene.

The coconuts (*niou*) [*niu*] grow on the sands; they are less vigorous, it is true, than those of the Moluques [Moluccas] and the Mariannes [Marianas], but nevertheless form domes of verdure of the greatest magnificence; they shade the thousands of huts, near which the indolent Sandwich Islanders join each other when eating, or giving themselves up to various sports, and tasting the sweet [joys] of sleep.

Here one finds also some vast fields of bananas (*maya*) [*mai'a*], of paper mulberry (*oua-ouké*) [*wauke*], brought from the mountains, where it is very common and is multiplied [by the people] by cuttings.‡ The breadfruit (*ourou*) ['*ulu*], and candlenut (*koukoui*) [*kukui*], the *cordia sebestena* [*C. subcordata*] (*to*) [*kou*], the *eugenia malaccensis* (*aya*) ['*ōhi'a-'ai*], with rosy fruits of very large size; the *gossypium indicum* [*G. tomentosum*] (*mao*) [*ma'o*] and [*G.*] *arboreum* [*Kokia drynarioides; koki'o*], the *hibiscus tiliaceus* (*haou*) [*hau*], a new *hibiscus* of section 5 (*furcaria*) of Decandolle (*h. youngiana*) [*hau-hele*], the *morinda citrifolia* (*noui*) [*noni*], the *ricinus inermis* [*R. communis*] (*aïla*) ['*aila*], etc., all of which could not have come to these islands [by themselves], as I shall explain later, but by sea, arriving either by currents or carried here by man. Among them one finds also, and with profusion, melons (*matiana*), watermelons (*ibou-aoré*) [*ipu-haole*], pumpkins, calabashes (*ibou*) [*ipu*], which attain surprising dimensions, and from which the natives make containers of the greatest usefulness: several stalks of vine, introduced a few years ago, have been cultivated here with success; onions (*akakaye*) ['*aka'akai*], garlic (*akakaye-péou*) ['*aka'akai-pilau*], sweet potato (*ouala*) ['*uala*], yams (*oufi*) [*uhi*], the pimento (*niô-i*) [*nīoi*]; purslane (*akouri-kouri*) ['*ākulikuli*]; tobacco (*pak*) [*paka*], as

*Numerous rivulets are constantly formed in the wooded parts of these islands, but all lose themselves at a short distance, below the crevices which seem to riddle the sides of the mountains. Also, in many parts of this section of the island, although the earth seems to be covered with several feet of soil, we have heard frightening noise beneath our feet, and in a manner to prove to us that water is held within, and indeed not far from the surface, in immense caverns.

†Kayakakoua [Kealakekua] is an exception to this rule.

‡The bark serves in the fabrication of one of the strongest materials [for clothing] made by the natives.

well as the turnip, the cabbage, etc. which now grow in the shade of the breadfruit and the sandalwood.

Vast inundated fields border almost all the swift-running streams: they are planted with rice or *caladium esculentum* [*Colocasia esculenta*] (*taro*) of many varieties, roots of which supply the principal food substance used in these islands; growing here also are several varieties of sugar cane (*nouï*) [*kō*], the stalks of which sometimes reach ten feet in height by two and a half to three inches in diameter; an intoxicating pepper (*auoa* and *kékoé-koïui*) [*Piper methysticum; 'awa*] which furnishes a spirituous liquor (*étao*) [*ekao*]; the *dracaena terminalis* [*Cordyline terminalis*] (*tii*) [*ti* or *ki*], serves the same purpose: the liquors that are produced by these two are indiscriminately called *râma* [*rama* or *lama*].

Cultivated also is the *curcuma longa* [*C. domestica*] (*oréna*) ['*ōlena*], etc., the ginger (*amomum zingiber*) [*Zingiber Zerumbet*].

Found also, outside of cultivation, throughout the ravines and paths, a semiwoody *euphorbia* (*koko*), a cucurbit (sicyos) (parounou) ['*ānunu*]; the *plumbago zeylanica* (*ouo-ouo* ['*uo-'uo*], (*éï-rié*) [*hilie'e*]); the *sida rotundifolia* [*S. cordifolia*], which casually goes under the names *rima, irima, ouirima* ['*ilima*]; the *sida incana* [*Abutilon incanum*] (*mao*); the *convolvulus tuberculatus* [*Ipomoea cairica*] (*poéï*) [*koali*], *c. ovalifolius* [*Jacquemontia sandwicensis*] (*tatou-aï-ata, maripa, mouroukoa* and *kouaourou*) [*kākū'ai-aka, kākua-o-Hi'i-aka*], *c. insularis* [*Ipomoea congesta*] (*palakaï-oré* [*pilikai-ole*] and *kouripéoune* [*koali-poni*]), *c. pentaphyllus* [*Merremia aegyptia*] (*oniou*) ['*ōniu*], *c. bononox* [*Ipomoea alba*] (*kori-péoune, koari-péoune* and *plitè*) [*koali-pilikē*]; a *cuscuta* (*kanonoa*) [*kauna'oa*]; *heliotropium orientale?* (*ono-ono*) ['*onu'onu*] var. *glauque* [*H. curassavicum*]; *cardiospermum halicacabum* (*éoule*) [*ēoule*]; *oxalis repens* [*O. corniculata*] (*émoloa*) ['*emoloa*]; a *lythrum* [*L. maritimum*], (*kamoré* and *pou-kamoré*) [*kamolē* and *pūkāmole*]; *plectranthus australis* [*P. parviflorus*] (*aroué-nouï, oué-nouï* and *ouai-nouï*) ['*ala'ala-wai-nui*]; a *chenopodium* [*C. oahuense*] (*aoué-oué*) ['*āweoweo*]; an *amaranthus* [*A. viridis*] (*pakè*) [*pakai*]; *tribulus cistoïdes* (*ékoré-garigari, noo*) ['*ekole-kalikali, no'ono'o*]; *waltheria americana* (*égoloa* and *alola-pouloa*) [*hi'aloa* and *alola pouloa*]; *boerhaavia mutabilis* [*B. diffusa*] (*kamanou-manou,* [*kāmonomano manou*] *kamanou-poé, poé, poréna* [*polena*], *paoma-naou-naou* or simply *naou-naou*); a woody *solanum* [*S. Nelsoni*] (*ouaou*) [*wau*]; *capparis mariana* [*C. sandwichensis,* var. *Zoharyi*] (*piro*) [*pua-pilo*]; an *adenostemma* [*A. Lavenia*] (*okolékrêmékari*) [*okole-kalemekali*]; a *myoporum* [*M. sandwicense*] (*ekrikri-nayo* and *nayo*) [*ekalikali-naio*]; *santalum ellipticum* (*mao-loa*) and a crowd of herbaceous plants common upon all the shores previously visited, such as *agrostis pungens* [*Sprobolus virginicus*], *digitaria villosa,*[2] *panicum hirtellum* (*Oplismenus hirtellus*), *heteropogon contortus* (*pili*), *andropogon acicularis* [*Chrysopogon aciculatus*], several *Cyperaceae* of the genera *cyperus* (*kâ-â*) [*ka'a*], *mariscus, eleocharis* [*E. obtusa*], *chaetospora* [*Rhynchospora lavarum*] and a new genus, *morelotia,* pl. 28, close to *gahnia* [*M. gahniaeformis*].

Second Region

As soon as one leaves the shore settlements, so remarkable for the freshness of their vegetation, and, in order to proceed toward the mountain, takes one of the numerous trails through the least precipitous country, then one enters a land where the rock, still vitreous, offers only arid sterility. Infrequently here and there, pockets of earth join each other between the scattered rocks, and here rare growths have fallen, as it were, from the mountain, disfigured in their fall, growing painfully, and they present a most singular mass of anomalies.

The few plants which one finds in this area (300 fathoms, more or less) all have their counterparts on the shores of Asia.

Plate 64 from Gaudichaud's folio atlas—*Prasium glabrum,* now *Phyllostegia glabra* (Gaudichaud) Bentham.

Among this number is the *convolvulus ovalifolia* [*Jacquemontia sandwicensis*], remarkable for its singular varieties, which, according to location, and often in the very same, are alternately glabrous, pubescent, hairy, or heavily downy, even [entirely] covered: in response to these diverse states, the plant carries the names *maripa, mouroukoa, kouaourou,* and *tatou-aï-âta* [*malipa, muluhoa, kua'uru, kaku'ai-aka*]. The *convolvulus bona-nox* [*Ipomoea alba*], always with lobed leaves among dwellings, displays here simple leaves; the *euphorbia,* [*E. Degeneri*], first found in an herbaceous state near the shore, becomes progressively woody, and we see it in a shrubby state, as a shrub and as a tree, according to the elevation we reach. The *panicum* (*neurachne*) *torridum* (*kakona-kona*), new species, abounds here, as well as the *verbesina* [*Lipochaeta lavarum*], (*koko-loa* and *néé*) [*ne'e*]; several plants of *aleurites triloba* [*A. moluccana*], but entirely stunted and with entire leaves, smaller and smaller and whitish; as to the *cordia,* and several other plants previously observed, they are not found any more except in a remarkable state of degeneracy.

These areas, where the plants are already so miserable, doubtless expect one day to have riches as great as those of the explored shores, since one part of their mountains is already very fecund.

But now it is in vain that one searches for a moss, a lichen, the least cryptogam which ordinarily precede vegetation. There the animals are even more rare, and we have seen neither birds, reptiles* nor insects of any species; all of them have fled the destructive heat.

As one climbs higher, one sees the first indigenous plants appear. Their thinness tells the state of their suffering; a menisperm of the *cocculus* genus (*C. Ferrandianus*), called *oué-oué* [*huehue*], *kiguérigè* [? *kikuelike*], and *inaléa-pii* ['*inalua-pi'i*];† the *dioscorea bulbifera* (*ô-i*) [*hoi*], *jussiaea angustifolia* [*Ludwigia octivalvis*] (*kamoré*) [*kāmole*], *tephrosia toxicaria* [*T. purpurea*] (*aou-pii*) [*au-pi'i*], *cleome spinosa,* (*kékoé koïni*) [*kēkoē ko'ini*], a *gnaphalium* [*G. sandwichensium*] (*éna-éna*) ['*ena'ena*], an *erigeron* [*E. canadensis*]; *bidens micrantha,* pl. 85; a *senecio*[3] (*pamokani*); an *achyranthes* [*A. splendens*], a shrub of 4 to 6 feet; *erythrina monosperma* [*E. sandwichensis*] (*ouïliwiri*) [*wiliwili*], with single-seeded pods, pl. 114; *brunelia sandwichensis* [*Pelea sandwichensis*]; *dodonaea ciliata* [*D. sandwichensis*] (*arhihi*) [*a'ali'i*], glabrous, sticky; and *dodonaea pubescens* [*D. eriocarpa*] (*alii*) [*a'ali'i*], pubescent, velvety, or tomentose, which are perhaps, one or the other, only varieties of *d. eriocarpa* of Smith; the *lepidium piscidium* [*L. o-waihiense*] (*pâoma* and *maou-maou*) ['*ānaunau*], usefully employed in the treatment of syphilitic maladies. These plants only resist the action of stifling heat, which is felt as high as 250 and 300 fathoms. Also, it is at this height that one comes across a *mimosa* (*koa-i*), with linear leaves, which we recognize as the *mimosa* (*acacia*) *heterophylla* [*Acacia Koaia*]; a *metrosideros* (*oéga*) ['*ōhi'a*] of 3 to 4 feet [tall], with crowded heart-shaped leaves velvety or tomentose, which is actually an astonishing anomaly of the *metrosideros polymorpha,* pl. 108 and 109; a woody *cassia* (*mamaké*) [*māmaki*] with narrow short pods, the *edwardsia chrysophylla* [*Sophora chrysophylla*], (*oui-oui*) [*wīwī*], with four-sided pods, winged and with yellow seeds; a new *rumex* [*R. Skottsbergii*] (*paouaré*) [*pāwale*]; a member of the *Compositae, raillardia linifolia,* with ternate or whorled leaves, linear, pictured on pl. 83, and of the same family, and a closely related tribe, *dubautia plantaginea,*[4] pl. 84.

In this region, more and more affected by the variations of temperature, and/or humidity, one begins to observe *oxalis erecta* (*é-i, émoloa*) ['*emo-loa*];[5] *neraudia melastomaefolia* (*koko-koré*) [*koko-kole*], [p. 500 and] pl. 117, and *neraudia pyrifolia,*[6] member of the *Urticaceae,* with a berry-like calyx, colored, and with the nut shaped like a top, upside down; the *plantago*

*Everyone tells me that there is not one in these islands.

†This last name is the most common; it indicates the poisonous property of the seeds of this plant, and the uses made of it to poison fish.

queleniana, [p. 445 and] pl. 50; a *lythrum* [*L. maritimum*] (*kamoré* [*kāmole*] and *palapalaye* [*palapalaie*]), *poa* (*eragrostis*) *variabilis* (*ala-â-la*) [*'ala'ala*] and its numerous varieties,[7] the *panicum* (*neurachne*) *montanum* [*P. nubigenum*], a very pretty new plant which I have had engraved, pl. 26 [and p. 411]; a new *parietaria* (*kokona-kona*);[8] the *piper methysticum,* in its wild state; *scirpus iridifolius* Bory, *machaerina* of other authors, named *ouki* and sometimes *outi* [*'uki*],[9] [pl. 28]; the *lycopodium venustulum,* (*oua-oua-yole*) [*wawaiole*] [p. 283 and] pl. 22; a *phytolacca* with 5-6 stamens and 5-6 styles [*P. sandwicensis*]; *dolichos galeatus* [*Canavalia galeata*], (*kahéhé*) [*kahēhē*], [p. 486 and] pl. 115; a *glycine* [*Strongylodon ruber*], a *dianella* [*D. sandwichensis*], *polypodium* (*vulgare*) *propinquum,*[10] *polypodium* (*pleopeltis*) *atro-punctatum* [*Polypodium atri-punctatum* or *Pleopeltis nuda*] (*mao*), *vittaria rigida* Kaulf., *pteris pedata* [*Doryopteris decipiens*], etc.

Third Region

Here the aspect of the soil and the temperature change progressively, the fields of *convolvulus batatas* [*Ipomoea Batatas*] of *dioscorea alata,* of *caladium esculentum* [*Colocasia esculenta*], of *portulaca oleracea,* etc. flourish; the shrubs noted in regions below take on strength and finish by becoming trees; the sun, first obscured by light clouds, successively loses its heat and ceases to torment the vegetation, which reveals itself in all its magnificence and offers almost at once the verdure and the image of eternal spring. One is actually transported into another region and believes he has passed from the torrid to the temperate zone.

The rarefied air, burning, which one breathed painfully a few fathoms lower down, refreshed, tempered by little breezes escaping from the clouds which dominate and shade these places, is here agreeable and salubrious. These enduring clouds which continually give birth to storms, pursued by impetuous winds, burst from their habitual mood sometimes, and arrive at inundating and stimulating with their light vapors the lower fringe where the forest begins to live; but rarely do they pass beyond this limit, which seems here to be an insurmountable barrier, seized at once by the direct and reflected heat of the sun, they vanish, disappear instantly, to condense again at the top of the mountain and return soon after, bringing new treasure to the vegetation. Pushed by violent winds which are continually formed within their own bosom, they can be seen frequently to break off a column which sinks and skims over the plain, but rarely does it reach the shore.

This phenomenon which I have seen reproduced twenty times has always astonished me by the speed at which it takes place.

One would think that an elastic force launches into space this cone of vapors which, soon after, seems to return into itself, but that is only an illusion; on approaching nearer, one sees that the cloud evaporates with promptitude. These gusts of wind, frequently repeated, nourish greatly the vegetation beneath in cooling it and stirring up the wind incessantly, they carry with them the only source of restored humidity, perhaps the only one observable in these parts.

In this area, close to the clouds, are found, united, all necessary conditions for vegetation: excellent soil and a super-abundance of warmth and humidity. Also, it is here that one can find, on the island of Owhyhi [Hawai'i], that establishments of agriculture are worthy of the name.

On Mowi [Maui] and especially on Wahou [O'ahu], the less elevated ones [islands], and ones which we believe of more ancient origin, it is in the valleys and along the streams, that they [agricultural developments] are situated exclusively.

Many habitations bordering the virgin forests of this country are shaded by thousands of *cocos* [coconuts], *eugenia* [mountain apple], *artocarpus* [breadfruit], *broussonetia* [paper mulberry], and *musa* [banana], *aleurites* [*kukui*], *ricinus* [castor bean], and near them grow all the useful vegetables previously observed along the border of the sea. They are irrigated by thousands

of little streams, which, flowing down from the mountain, disappear soon after, along their banks, where they form subterranean torrents of which one often hears the murmur beneath one's very feet. The birds and the butterflies, adorned with the most vivid colors, fly about at this elevation; indeed the whole scene breathes an air of freshness and of life which one seeks in vain elsewhere.

At 50 to 100 fathoms higher, one enters suddenly into the clouds, where the airs acquire a density more and more heavy and end up in rain.

Penetrated by their humidity, I have there, many times, felt uncomfortable in a sharp cold, produced, no doubt, less by a great fall of the temperature than by a too swift change from the excessive, stifling heat to a more gracious, softer heat, which, far from hurting the vegetation, seems, on the contrary, to favor it in a surprising manner.

There are found numerous tree ferns; the *pinonia splendens,* [*Cibotium splendens*] pl. 21 [and p. 369], its trunk covered with golden silk; the *blechnum fontanesianum* [*Sadleria cyatheoides*], pl. 15 [and p. 397];[11] *asplenium* (*athyrium*) *poiretianum* [*Athyrium microphyllum*] (*o-ï-é*) [*ʻoiō*], pl. 13 [and p. 321];[12] *polypodium keraudrenianum* [*Dryopteris Keraudreniana*], pl. 7;[13] *aspidium dubreuilianum,* pl. 9;[14] *doodia kunthiana,* [p. 401 and] pl. 14; *acrostichum crassifolium* [*Elaphoglossum crassifolium*] and its numerous varieties; *polypodium pseudo-grammitis* [*Grammitis tenella*] [p. 345]; *polypodium thouinianum* [*P. spectrum*], with climbing stems and with ivy-like leaves [p. 348 and] pl. 5; *polypodium pendulum* [*P. Adenophorus*] [p. 349]; *asplenium erectum* [*A. Macraei,* forma *sphenolobium*]; *asplenium laceratum,*[15] and its variety with confluent fructifications; *pteris excelsa,**[16] [*p.*] *decomposita* [*Pteridium aquilinum,* var. *decompositum,* p. 393];[17] [*p.*] *alata,* [*P. irregularis*] [p. 391 and] pl. 19; the [three] elegant *adenophorus,* [*a.*] *tripinnatifidus* [*Polypodium tripinnatifidum*], [*a.*] *bipinnatus* [*P. tamariscinum*], [*a.*] *minutus* [*Polypodium hymenophylloides*] [p. 365 and] pl. 8, figs. 1, 2, and 3; *aspidium apiifolium,* [*Tectaria Gaudichaudii*]; *nephrodium exaltatum* [*Nephrolepis exaltata*], terrestrial and with erect fronds;[18] *dicksonia villosa;*[19] *trichomanes davallioides* [*Vandenboschia davallioides*] [p. 378]; *hymenophyllum recurvum* [*Mecodium recurvum*] [p. 376]; and along the brooks and torrents, *adiantum capillus veneris;*[20] *hydrocotyle vulgaris* [*H. verticillata*], *marsilea quadrifolia* [*M. villosa*], *potamogeton pusillum* [probably *P. foliosus,* var. *macellus*]; *conferva sandwicensis,* bearing an innumerable quantity of opaline *cypris.*

At this elevation one begins to find charming woody *Pandanaceae,* with scarlet bracts and among them the *freycinetia arborea,* (*oé, ï-é, ï-é-ï-é*) [*ʻieʻie*]; a *pandanus* (*lagouara*) [*lakuala*], lost in the shipwreck, with lemon-yellow fruits, from which the gallant, lovely Sandwich Islands women make a good-looking garment; the *euphorbia,* several times mentioned, here arborescent but here the trunk reaches and sometimes exceeds a diameter of 3 to 4 inches; a fragrant *Apocynaceae* of the genus *gynopogon,* (*g. olivaeformis; alyxia,* R. Brown);[21] *osteomeles anthyllidifolia* (*ouré*) [*ʻūlei*], with white fruit but little sought for by the natives; *artocarpus incisa* [*A. altilis*]; *broussonetia papyrifera* [*wauke*]; *mimosa heterophylla* [*Acacia Koa,* and *A. Koaia*] (*koâ* [*koa*], *koâ-ï, koâ-koaï* [*koaiʻe*]), resembling the one on Bourbon [Reunion] Island, and similar to those of Nouvelle-Hollande [Australia];† *metrosideros polymorpha* (*ôéga, ôéa*) [*ʻōhiʻa*], [p. 482 and] pl. 108 and 109, not less remarkable in the diversity of its leaves. This last tree is abundantly loaded with a special species of *viscum, v. metrosideri* (*paou-ma*).[22] It is the only parasitic plant observed in this country.

It is probable that some day, in the higher regions, one will come across numerous orchids,

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*The unfortunate Hawaiian who accompanied me never stopped, in spite of the sickness which appeared to be caused by the cold, from eating the tender summits and croziers of these ferns, and particularly those of *pteris excelsa.*

†M. Aubert du Petit-Thouars, who collected this plant at Bourbon Island, has observed an opposite phenomenon, the leaves become more and more simple and straight, according to its growth, higher and higher up the mountain. This is explained by the great height that this famous naturalist reached on the mountain. I believe that the botanists [of the future] that will pierce the wooded cloud region of the island of Hawaiʻi will make the same comment.

perhaps related to those of the Île de France [Mauritius] and Île de Bourbon [Reunion Island]; but I am obliged to state that up to this moment I have not seen one individual of that family.*

Here also may be found numerous *lobéliacées*† of the genera *clermontia* (*c. oblongifolia,* pl. 71 [and p. 459]; *c. persicifolia,* pl. 72 [and p. 459]; *c. grandiflora,* pl. 73 [and p. 459]); *rolandia* (*r. persicifolia,*[23] pl. 74); *cyanea* (*c. grimesiana,* pl. 75);[24] *delissea* (*d. acuminata* [*Cyanea acuminata*] pl. 76 [and p. 457], *d. subcordata,* pl. 77 [and p. 457], *d. undulata,* pl. 78 [and p. 457]), all these remarkable for their woody stems, the large size of their flowers and their fleshy indehiscent fruits; *scaevola chamissoniana,* pl. 82 [and p. 461], and *s. montana* [*S. Gaudichaudi*] (*papaé-kiri*) [*papae-kili*] [p. 460]; also very large trees of the family *Urticaeae, boehmeria* (*mamaki* [*Pipturus*] and [*olonā, Touchardia*]); *labordia fagraeoidea,* pl. 60 [and p. 450]; a tree of the *loganiaceae,* which furnishes several species, abundant on all these islands; *santalum freycinetianum,* (*oié-ara*) [*oie-ala*], pl. 45 [and p. 442], the wood of sandal which is furnished by this tree forms the principal object of commerce of this archipelago.

These places also produce trees of the family of the *amaranth,* the *charpetiera ovata,* pl. 47 [and p. 444], and *c. obovata,* pl. 48 [and p. 444]; *vaccinium penduliflorum,* [*V. dentatum*] (*ôélo*) [*ōhelo*], pl. 68 [and p. 454]; an epacrid of the genus *cyathodes* (*cyathodes banksii*) [*Styphelia Tameiameiae*], (*poutéaoué* and *poitavao*) [*pūkeawe*; *poikawa'u*],[25] previously observed by the celebrated Banks and Rob. Brown; an *exocarpus* [*E. Gaudichaudii*] (*é-u-ou*) [*e'u'ou*]; the *melanthium* (*astelia* R. B. *veratroïdes*);[26] an araliad (*aralia trigyna*) [*Cheirodendron trigynum*] [p. 474 and] pl. 98; numerous *Rubiaceae,* such as *bobea elatior* [*B. Gaudichaudii*], a tree of the Guettardia tribe, with multiple stigmas, [p. 473 and] pl. 93; and a *hedyotis* (*h. conostyla*) [*H. coriacea,* forma *conostyla*], [p. 471 and] pl. 94; *gunnera petaloïdea* [p. 512], the *prasium parviflorum* [*Phyllostegia parviflora*] (*éné-éné, énéé*) ['*ene'ene*], [p. 453 and] pl. 65, fig. 1; [*p.*] *grandiflorum* [*Phyllostegia grandiflora*], [p. 453 and] pl. 65, fig. 2; [*p.*] *macrophyllum* [*Phyllostegia macrophylla*], [p. 453 and] pl. 65, fig. 3;[27] [*p.*] *glabrum* [*Phyllostegia glabra*], [p. 452 and] pl. 64; *cyrtandra triflora,* pl. 52 [and p. 447]; *c. garnotiana,* [p. 447 and] pl. 53; *c. lessoniana,* [p. 447 and] pl. 54, *c. grandiflora,* [p. 447 and] pl. 55, *c. cordifolia,* [p. 446 and] pl. 56, and several other species illustrated which all bear the name (*fafara*) [*hahala*]; *amomum zingiber*[28] (*aoua pouye*) ['*awapuhi*], of which the flowers furnish a viscous sap, aromatic, very sugared, employed with success against the influenza to which the people who inhabit this mountainous region are continually exposed. *Curcuma longa* [*C. domestica*] (*oréna*) ['*ōlena*], several herbaceous peppers (*poukamoré* and *péki*) [*pūkāmole* and *peke*], *tacca pinnatifida* [*Tacca Leontopetaloides*] (*hâou-houkâou*) [*hau-puhau*] compose the extraordinary vegetation of these places, which despite the cold which tormented me, despite the care and the embarrassment of my collections, nevertheless I could not leave without much regret.

I recollect that in one of these excursions, I suffered cruelly from change of temperature.

The guides, who, with the hope of a light payment, attached themselves constantly to my steps, refused to accompany me any longer; it was only through much trouble and glowing promises that I succeeded in persuading the most intrepid of the troop to endure longer with me the wet cold which enveloped us. The abundant collection with which we quickly loaded ourselves, the chest pains, with cramps in the kidneys, the benumbed and truly pitiable look of my companion, the frigid air, all forced me soon to quit an area in which I stayed too long for my health, but not long enough for science.

I consider the region that the clouds occupy as the veritable homeland of the plant life which belongs to these islands.

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*M. Adelbert de Chamisso told me that he thought he had one in his collections.

†The family of *Lobeliaceae* is so natural, that it seems, at first examination, to be composed of but one genus *lobelia,* but after a more careful examination, and the need to divide the numerous species which compose it, we have determined to make several genera which at least will make excellent sections, which we shall attempt to make clear in the article *Lobeliaceae*.

Below these limits, if one finds again vestiges of these plants, they represent varieties, singular anomalies, which seem to perpetuate themselves in the same forms through recalling their first origin.

It is therefore at about 300 fathoms between the part which one can term torrid and that where the clouds ordinarily remain fixed, where polymorphism permeates everything. In this region of the mountain, the plants are alternately refreshed, dampened by the clouds, and dried, burned indeed, by the fires of the sun. These sudden transitions, these successive influences, force them to submit to special transformation, remarkable modifications, and these phenomena do not fail to confuse the young naturalist, and even the man already versed in the study of life, if he has not the time to reflect upon the causes of this strange vegetation, so contrary to the normal order.

Nothing in the world, in effect, is more remarkable than the *Metrosideros polymorpha* [see pls. 108 and 109], with leaves that are linear toward the summit of the mountain, and successively linear-lanceolate, lanceolate, oval, oboval, elliptical, rounded, even cordate, as one gradually descends [the mountain] and which, from being glabrous and shining, as they may have been primitively, become pubescent, velvety and more and more downy.*

The *mimosa heterophylla*, placed in the same circumstances, presents at first bipinnate leaves, with numerous pinnules; if one descends a few more fathoms it is evident that the pinnules diminish in number and size, and soon disappear entirely. One can then observe a fact not less curious: the petioles of the compound leaves under observation which were linear, lightly membranaceous, or winged, are progressively enlarged, in a manner of constituting, in their new state, simple leaves, shining, linear-lanceolate, lanceolate, and sometimes oval. Beginning at this place, where the little leaflets cease to be apparent, and where the foliaceous petioles have taken on their greatest development, always developing such changes toward the lower regions, one can observe these petioles decrease, retreat gradually, and no longer form definite expansions, linear, thick, whitish and grayish, and even scurfy.

If more authority is needed to prove that these plants, so diverse, belong to the same species, I shall add that the natives here called them by the same name, in reuniting all the names that doubtless signify the modifications.

If the hypothesis set forth related to these anomalies is true, in general, it shows, nevertheless, in accordance with the localities, some exceptions which seem to prove that the partial or complete transformations, once established, can, as I have already stated, perpetuate themselves, and perhaps forever in the same manner.

What confirms my opinion in this regard is that twenty times I have seen not only numerous examples of *mimosa heterophylla* [*Acacia Koa*] with different leaves growing beside one another but also the same *mimosa* bearing at the same time pinnate leaves, simple, leaf-like petioles, enlarged, and foliaceous linear petioles, placed in such a way that, in another country, one would be able to believe that grafting had assembled several species in one individual.

I shall not end these observations without recalling the attention of the naturalists to the astonishing reduction affected, according to the localities, upon the dimensions of certain plants of these islands, without calling attention again to that *euphorbia* (*euphorbia multiformis*) which, as a tree, fairly tall, on the mountain, becomes rapidly a shrub, a smaller shrub, an under-shrub, more and more insignificant as it gradually reaches the shores. There, even in the cultivated areas, it is not found except in the less woody state, or herbaceous.

Since the Sandwich Islands emerged—burning—from the bottom of the waters, how have their plants developed? Here lies a field of vast conjecture: I shall not pause at this point more than a moment for fear of losing myself, as have almost all others that have preceded me in their career. Is it not more natural to attribute the plant life of this land and of all others that have a like origin to the air or marine currents, to the birds, to men, than to search for the germs of all living things of

*I have placed specimens of all these varieties in the herbarium of the Jardin du Roi.

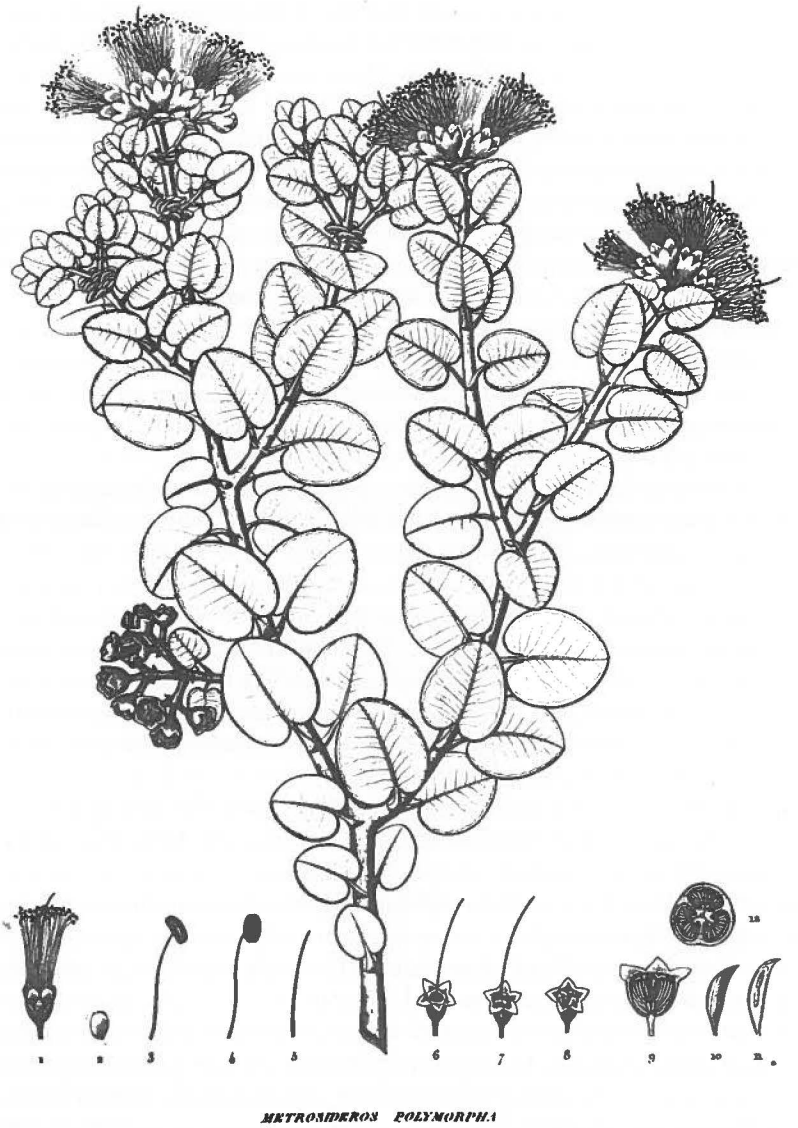

Plate 108 from Gaudichaud's folio atlas—*Metrosideros polymorpha* Gaudichaud.

these islands, within the center of the earth where the vulcanism would have involved them in essential destruction in the incandescent, unorganized lava.

If we examine the thalassophytes which live along the borders of these islands, we shall not hesitate to perceive that they have their analogies along all the shores of the western ocean; from this cannot we conclude that the plants of the shores have been brought here by the currents or by the hand of man?

But the origin most probable for the mountain plants is it not connected with the action of the winds, and especially of the clouds; and in this case, the name for the vegetation, aeolian, used by M. Neraud* is it not perfectly appropriate for this use?

**Voyage Ile-de-France,* p. 23.

I realize that there will be objection, as has been made frequently, that this mode of migration, easy to conceive for the light seeds, wrinkled, winged, tufted, or syngenesia [Compositae]* will not be the one for those that are heavy, smooth, etc., I am far from sharing this viewpoint. I think, on the contrary, that terrible storms, such as those that often desolate the intertropical regions, which within the last few years have ravaged many times the Antilles, the Ile de France [Mauritius], and the island of Bourbon [Reunion], and the part of India which lies in their direction, may also bear fruits, even the most bulky, and transport them to considerable distances.†

In fact, the unleashed winds that lift up houses, root up trees, and overturn whole forests have such great speed that in estimating it at 10 to 12 leagues [30 to 36 miles] an hour, one would not be far from the truth. Also, in their habitual duration of 36 to 48 hours, they cross whole regions, marking their path with all kinds of destruction.

But let us not invoke here the evidence of the too common floods of our time, and relative to large fruits, perhaps of a secondary epoch, such as that of the coconuts, the Pandanus, the jambosiers [mountain apple], etc., let us leave to men their origin, the onus of having transported them.

For the seeds of middle size, which we suppose have been moved by the winds, it is, we hasten to say, very much less the action of storm winds than of a particular force of the clouds to which its transport must be attributed. This assertion, which is involved with the phenomena of electricity is not the only one which is brought to the aid of a like theory, but in order not to plunge [myself] into the uncertainty of systematic explanations, I abandon this subject, upon which I may have already extended myself too far. The route which I point out will soon be traveled; it will lead, I hope, to results more satisfying than those which have been reached to this day.

Let us observe again, however, in application of our supposition, and in the case that it shall be worthy of some credit, that, in effect, part of the Sandwich Islands where the clouds ordinarily arrive at condensation, is precisely where the lava is decomposed first and where consequently vegetation began, then extended up and down. It is therefore evident that the entire surface of these [lava rocks] submitted to a successive, and continuous decomposition, will be covered some day by vegetation, and will not offer to the eye anything other than one observes already on the western islands of this archipelago,‡ one vast field of cultivation which will extend to the edge of the sea.

Now, from what ancient lands have come the seeds? One could answer that it is from all because one finds plants from Europe, America, Asia, New Holland [Australia] especially. It is useless to say that this vegetation should have numerous analogies with the highest parts of the islands of the Great Ocean.

From all these observations, this result therefore follows:

1. The plants of the Sandwich Islands are manifestly of two origins.
2. Those of the shores, already indicated under the term of the oceanic shores (ammophiles), must have come from the archipelagoes situated east of Asia.
3. They must have arrived through the force of the waves of the sea, perhaps as well as by the first island navigators.
4. The plants of the mountain region, constantly bathed by the clouds, (néphélolitic) must have been brought originally by air currents, and above all by the electric vapors.
5. The plants of these upper regions, or the shores that penetrate into this fiery part of the mountain, a part which we have termed torrid insensibly reveal diverse alterations,

*The syngenesia (or compositae) seem to be dominant over all areas over the globe.

†Has one gathered certain observations as to the epochs in time, the constant or variable direction of these hurricanes, the spaces over which they have spread, etc.? I think that positive data on this point will be very favorable to the development of theories which involve the study of geography of plants.

‡According to voyagers and the statements which have been communicated to us by several responsible persons.

particular changes, which then self-perpetuate, even though many of these plants remain in the same circumstances.* All the same, however, beneath the mask which covers them, one can recognize again some [which] have the form which they had originally.

This phenomenon of transformation is not peculiar to the Sandwich Islands: one finds it in New Holland [Australia] and on some of the islands neighboring this continent. It has made itself evident in a very pronounced manner at the Ile de France [Mauritius], and the island of Bourbon [Reunion], as we have formerly announced and everything points [to the belief] that it exists also in many other areas submitted to the same equatorial and meteorological influences.

The fear of repeating myself too often and my leaning more heavily than is necessary on these facts, will prevent me from registering here the numerous reports which exist concerning the plants of the mountains of the Sandwich Islands and those of America, with those of New Holland [Australia], the Ile de France [Mauritius] and Bourbon [Reunion] Island.

I shall not leave this subject, however, without mentioning that the *mimosa heterophylla* [*Acacia Koa*], the *macharina restioïdes* [*Morelotia gahniaeformis*], the *acrostichum splendens* [*Elaphoglossum hirtum,* var. *micans*], the *asplenium erectum* [*A. Macraei,* var. *sphenolobium*], the *sida rotundifolia* [*S. cordifolia*], etc., which have been figured among the plants of the Bourbon [Reunion] Island, flourish on the heights of the Sandwich Islands, which are separated by a space of 3000 leagues.[29]

Cannot I also demand whether the *quivisia,* the *fagara,* the *ludia,* the *teizia,* and many other heterophyllics of the Ile de France [Mauritius] do not owe their singular characters, unexplained until this day, to the causes upon which I have hazarded above my conjectures.

Medicinal plants used in these islands are very numerous: I have already noted some; and I propose to speak of them later in a general article devoted to the state of medicine among primitive people, on the curative methods that they use, to the preparation of their medicines, etc.[30]

But I shall indicate here the plants which furnish the principal colors with which they paint their fabrics, their instruments, their boats, etc.

All these colors are formed from the sap drawn from the leaves and the bark of *koukouï* (*aleurites triloba*) [*kukui; Aleurites moluccana*], united with one or several other materials. Thus the color yellow (*koukouï, aréno*) derives its name from the *koukouï* [*kukui*], already noted, and from *aréno,* which is the *curcuma* [*C. domestica; 'ōlena*]; the color red (*koukouï nouï*) from the *nouï* or *morinda citrifolia* [*noni*]; and the color black (*koukouï karou*) from the carbon of the wood of *karou â-ou* [*kalu a-u*].[31] When this last color serves to paint their canoes they give it the name *ouaï-élé-élé* [*wai 'ele'ele*], black water, or ink.

The trees with a strong bark, with which they make fabric, fish nets, rope, etc., abound in these islands; they belong to the family of the nettle [*Urticaceae*] and several to the mallow family [*Malvaceae*]. The most important, judged by their utility, are *broussonetia papyrifera* (*ouaouké*) [*wauke*]; several species of *boehmeria* or *procris,* called by the names *mamaki* and *olona* [*olonā; Pipturus albidus* and *Touchardia latifolia*]; the *neraudia melastomaefolia* and [*n.*] *ovata,* called *koko-loa,* because of the large quantity of milky sap.

The *hibiscus tiliaceus* is also very common in these islands, but, as we have observed in almost all of our ports called at in Western Oceania, it no longer grows on the shores, but surely on the high mountains where they branch out considerably, and in general produce a fairly feeble development. Its fibers and those of several other Malvaceae serve in the fabrication of thread, cords and other twines used to bind together the parts of canoes, etc.

It is indeed rare to encounter one of the natives of this archipelago who does not have an ornamental plant on his head or neck or some other part of his body.

*Of analogous phenomena, but produced by an opposite cause, may they not have taken place above the clouds, there where the alpine region begins?

If the men vary little in their tastes in this regard, if they always make use of the same productions from the earth, it is not so with the women, who change them according to the seasons, and for whom all the fragrant plants, all flowers, and even the colored fruits, serve as attire, one after another. These women, and especially those of the chiefs, habitually wear crowns and collars made of the golden-yellow fruit of one species of Pandanus which grows in the higher regions of the mountains. It is named *lagouara* [*lakuala*].

The young girls of the people, those of the island of Hawai'i especially, seem to be fond of the *cordia sebestena* (*to*) [*C. subcordata; kou*], a tree very abundant in all the cultivated areas. They seek also the numerous *Malvaceae* and especially the *sida rotundifolia,* named *lima, rima,* and *ilima;* the rose and red fruits of the *Eugenia* [*E. malaccensis*] *aya* ['*ōhia ai*], etc.

The young girls of the mountains, who live near the forests, give their preference to the flowers of the *erythrina,* the *rudolfia* [*Canavalia* sp.] and notably those of a herbaceous plant of the last genus (*avoukivéki*) ['*awikiwiki*], the lively color of which makes magnificent garlands.

Such natural attire is much more rich, much more striking, than all the dazzling creations of the elegant European ladies. Unfortunately, I have not found the plant that produces the last one [mentioned], also I have had to content myself for my herbarium with the crown of one of the young girls, who, through the great hollow [valley] of Honolulu, accompanied me during one whole day. I have deposited it in the general collection of the Jardin du Roi.

The men are not as passionately [fond] of this kind of adornment and they are less versatile in their choice. Those which, at Hawai'i and Maui, as well as O'ahu, guided me into the mountains, never missed offering me a crown of the branches, still tender and very slender, of the *alyxia olivaeformis,* each time, after making me smell the perfume and pronounce the word *maïré* [*maile*], a word which, if it is not the name of the plant, must signify good odor, suave odor.

To all these ornaments furnished by the plant kingdom, I must add that which the men pull off the banana leaves, still fresh but even so a little yellowed by the action of the sun.

They take off the lengthwise half of a leaf, taking care to leave a small part of the principal side [midrib] and split the blade into strips of three to six widths.

This leaf, so prepared, serves to make crowns, belts, garters and collars; often after they have made a turn around the neck they cross them over the breast, make it pass under the arms, and tie the ends behind the back, which forms a garment remarkable for its grace and originality.

That which, at first, I took for an object of coquetry had, as I understood later, a doubly useful purpose. In effect, a very intelligent man on the island of Maui made me observe that these strips [of banana leaf] put into movement by those wearing them, or by the wind, fill at the same time the office of a fly-flap and a fan. These thongs, placed like rays around the head, and other parts of the body, do they not need a man's movements or that of the air to produce a sense of freshness independent of their substance?

We made a sojourn of only twenty days at the Sandwich Islands and I could have only seven ashore.

Also I was forced to neglect, in the interest of botany, a mass of other observations that I had planned for myself. The examination of the waters is of this number, yet what I have said is sufficient, I think, to prove 1. that they are abundant, live, and fresh, on the high mountains of Hawaii, while near the shore they are rare, impure and fouled. 2. they are more and more abundant as one moves toward the west, to Maui, to O'ahu, and to Kaua'i.

I think that the causes are sufficiently demonstrated.

NOTES

1. As noted in the introduction, Gaudichaud visited 3 islands. However, this account is written as a composite of his experiences and collections, and he writes as if only one island were visited.

2. On p. 410 he lists *D. consanguinea* (probably=*D. setigera).*
3. This appears as *S. capillari (=Luteidiscus capillaris)* on p. 468.
4. See p. 469 and pl. 84.
5. This South African species, a synonym of *O. caprina,* is unknown in Hawai'i. It is bulbous, stemless, and with purple-violet flowers. The plant seen by Gaudichaud was probably *O. debilis,* var. *corymbosa.*
6. The name *N. pyrifolia* was printed without a description. On p. 501 Gaudichaud gave it the binomial *N. ovata* and described it. He listed *kohokoré* and *koko koré* as vernacular names.
7. On p. 408 *emo-roa, karamaro, taramaro* ['*emoloa* and *kalamalo*] are listed as vernacular names.
8. This "new" parietaria was not described by Gaudichaud; the vernacular name is now unknown.
9. Gaudichaud described this as *Morelotia gahniaeformis* on p. 416.
10. There was no *P. propinquum;* this was Gaudichaud's way of stating that the fern was in the propinquity of the European *P. vulgare;* it was doubtless *P. pellucidum.*
11. On p. 397 *amaou-maou* and *amao-mao* ['*āma'uma'u*] are listed as vernacular names.
12. On p. 321 Gaudichaud added *o-ïo* and *â-eo* to *o-ï-é* as vernacular names.
13. On p. 362 *aloué* and *karoré* [*aloue* and *kalole*] are listed as vernacular names.
14. This appears as *Polystichum dubreuilianum* [*Dryopteris cyatheoides*] on p. 333, where *kikawouéko* and *ki-ka-oué-ko* [*kikawaiō*] are listed as vernacular names.
15. This binomial was never validated.
16. On p. 388 *courué, kouroué* and *touroué* [*kūlou-e*] are listed as vernacular names.
17. On p. 393 *a-oué, awoué,* and *manou* [*aue* and *manu*] are listed as vernacular names.
18. On p. 336 *kakoué-maho* and *kikaoue-maho* [*kakawe mahū* and *kikawe mahū*] are listed as vernacular names.
19. There is no description for this binomial.
20. On p. 404 *karoré* [*kālole*] is listed as a vernacular name.
21. This appears as *Alyxia olivaeformis* on p. 451.
22. This epithet was never validated.
23. Published as *R. lanceolata* on p. 458.
24. On p. 458 *toué-noui* [*koue-noui*] is listed as the vernacular name.
25. No description was published here by Gaudichaud, but by de Candolle (1839:742).
26. This appears on p. 420 and pl. 31 as *Astelia veratroïdes.*
27. On p. 453 *ené-é* [*ene'e*] is listed as a vernacular name.
28. A mistaken identification of *Zingiber Zerumbet.*
29. These 5 plants, as to their Hawaiian specimens, were all misdetermined.
30. Such an article was never published.
31. Unidentified.

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