BOTANY.

By Is. Bayley Balfour.

Introductory Remarks.

When in 1691 Leguat sighted the island of Rodriguez his eyes fell on mountains "richly spread with great and tall trees," over which flowed streams with banks "adorned with forests," and altogether the scene was such as to call forth from him the designations of "a lovely isle," "an earthly paradise," "a little Eden." He speaks of it thus (New Voyage to the East Indies, p. 248):—"'Tis, as I have hinted, composed of lovely hills, covered all with fine trees, whose perpetual verdure is "entirely charming;" and "between these great and tall trees one may walk at "ease and find such refreshing coolness in their shade at noon, so sweet, so healthy, "that 'twould give life to those that are dying. Their spreading and tufty tops, "which are almost all of an equal height, joyn together like so many canopys "and umbrellos, and jointly make a ceiling of an eternal verdure, supported by "natural pillars which raise and nourish them." Such is his picture of the aspect of the vegetation of Rodriguez. Is such its character now? No. The great and tall trees have now almost entirely disappeared, the eternally verdant canopy formed by their boughs no longer exists, and the "little Eden" is now a dry and comparatively barren spot, clothed with a vegetation mainly of social weeds, and destitute of any forest growth save in unfrequented and more inaccessible parts in the recesses of the valleys; and, we may ask, what has wrought this change?

We find in the history of the vegetation of Rodriguez a case similar to that of St. Helena. The same causes which destroyed the peculiar and most interesting Flora of that fertile island have operated, and I regret to say still operate, in Rodriguez, and have effectually changed the face of the island.

Goats, introduced long ago, are now found in enormous numbers, eating the young shoots and leaves of any herb, shrub, or tree within their reach; and now too several thousand head of cattle graze on the island, and effectually keep down the vegetation of the spots they frequent. Fires have occurred with great frequency, and every now and then at present sweep across parts of the island, destroying everything within reach. And then there are introduced foreign plants. These are now in great abundance, and in many cases completely occupy the ground to the exclusion of the native vegetation, which is driven to the secluded parts of the island. Perhaps one of the best instances of their power in this respect is found in the case of "*L'Acacie*" (*Lucæna glauca*). This plant, introduced about 30 years ago, is now found covering the ground for acres, forming so dense a scrub

that it is impossible to penetrate it, and beneath which nothing will grow. Originally planted in the valley near Port Mathurin, it is now found in almost every valley in the island, spreading from the banks of the streams up the sides of the valley. It owes its spreading in a great measure to the cattle and goats, which are exceedingly fond of the leaves and pods, and thus the seeds are carried about. Finally, a certain amount of destructive influence is attributable to the settlers indiscriminately cutting down the trees over large tracts. This, however, has now received a check, as the cutting of timber is forbidden by law. These agencies, then, have directly effected the destruction of a great part of the vegetation of the island, so that over large areas hardly a tree or shrub is seen, and the ground is covered by only a scanty clothing of grass and tropical weeds.

But fires and the hand of man, through the alteration in the climate consequent on their destruction of the forests, have effected indirectly a more permanent injury on the Flora; for now we have a bare, parched volcanic pile, with deep stream-courses for the most part dry, in place of the verdant well-watered island of 200 years ago.

Can we wonder, then, that we find but a remnant of what we may consider the old vegetation still extant in Rodriguez? That the island had originally a rich Flora there can be little doubt, judging from its position and from analogy with the sister islands. Unfortunately Leguat, from whose account we derive all our early information regarding the island, does not enter in any great detail into the native plants of the island at the time of his visit, occupying himself more with those which he and his companions found useful, and with those they introduced into the island, and we thus have really no record of the exact nature of the primitive luxuriant vegetation. He only mentions 10 plants as found on the island, and these, though often rather curtly described, I have been able to identify in every instance save one, at least generically. The following is the list of plants he mentions, and alongside of each is placed the name of the plant with which I believe they can be identified:—

Purslain - - - -	*Portulaca oleracea.*
Tree with fruit like olive - -	*Elæodendron orientale.*
Nasty Tree - - - -	*Clerodendron laciniatum.*
Pepper - - - -	*Capsicum frutescens.*
Ebony - - - -	*Diospyros diversifolia.*
Plantane - - - -	*Latania Verschaffeltii.*
Palm Tree - - - -	*Dictyosperma alba* var. *aurea.* *Hyophorbe Verschaffeltii.*
Pavilion - - - -	*Pandanus.*
Rodrigo Kesta - - -	*Ficus.*)

Flower white as a lily and like a jessamine.

I know of no plant on the island which answers the description of the one last mentioned, which runs as follows:—"There's a certain admirable flower in this "island which I should prefer to Spanish jessamine, 'tis as white as a lily and "shaped some think like common jessamine. It grows particularly out of the trunks "of rotten trees, when they are almost reduced to the substance of mould. The "odour of this flower strikes one agreeably at a hundred paces distance."

I can only suppose it to be some species of Orchid. The comparative absence of Orchids, as I shall show, is a notable feature on the island, and it is probable that Leguat refers to a species now passed away.

The vegetation of Rodriguez at the present time is thus very different from what it was at a comparatively recent period, and a very potent influence in altering its character has been cultivation. The island, though an outlier of the Mascarene group, at a great distance from the other members, and, as it were, out of the way, has seen many changes in this respect. Leguat gives a curious account of the cultivation of the soil by himself and his companions, and of the plants they grew. He says they sowed Water-melons, Ordinary Melons, Succory, Wheat, Artichokes, Purslain, Turnips, Mustard, Gillyflower, Clover-grass. Some of these seem to have thriven, but others did not, and it is curious to read of the wheat, "Of three grains of wheat that came up, we could preserve but one plant; it had above 200 ears, "and we were full of hopes that it would come to something, but it produced "only a sort of tares, which very much troubled us as you may imagine. How-"ever, we should not from hence conclude that wheat corn will always turn to "tares here, since in Europe such like degenerations are often to be met with." His observation rather militates against the plant being true Wheat,—more probably Millet. Some of these plants are now cultivated or occur spontaneously on the island. When the island was in the possession of the French many settlers lived and cultivated large estates, but with the liberation of the slaves cultivation decreased in amount. It thus happens that at the present day only a relatively small acreage of land is cultivated. The staple of the cultivation now is the Patate, or Sweet Potato, which is grown very widely, and in almost equal quantity is the Manioc, whilst of other roots Yams are chiefly grown. Of the cereals fair crops of Maize and Millet are obtained, and Rice also grows very well, but is not cultivated in quantity sufficient for the use of the inhabitants. Wheat formerly largely sown is now seldom seen, and this mainly because of the parroquets and Java sparrows which abound. Beans (*Phaseolus lunatus*), Lentils (*Ervum lens*), Gram (*Cicer arietinum*), Dholl (*Cajanus Indicus*), Pistache (*Arachis hypogea*) are all grown to a certain extent, though the rats are great enemies. Of other vegetables Garlic (*Allium sativum*), Giroumon (*Cucurbita Pepo*), Margose (*Momordica balsamina*), Melon d'eau (*Citrullus vulgaris*), Oignon (*Allium Cepa*), Papingaye (*Loffa acutangula*), and Patole (*Trichosanthes anguina*) are the most common. Ginger, Safran (Turmeric), and Arrowroot are also cultivated. Of economic plants

Coffee has formerly been largely grown, but now is never cultivated, as the hurricanes so frequently destroy the crops. Fair-sized trees, the remnant of old plantations, are now found fruiting freely. Vanilla grows well, and is tried in some spots. The want of water is now a great difficulty in the way of manipulating the Sugar-cane, which is therefore not much grown. Formerly Indigo plantations covered some of the central portions of the island, but now its cultivation has ceased.

That the soil of the island is good, and that water was formerly abundant, the fact of so many plants being cultivated clearly proves; but at the same time their cultivation must have acted very prejudicially on the indigenous vegetation.

From all these causes then indigenous plants have suffered, and the aspect of the vegetation now is a very peculiar one.

The elevation in the island is not sufficient to render possible any marked difference betwixt the vegetation of the higher and of the lower parts, and the relative amount of moisture is about the same in the two regions, as the hill-tops are seldom enveloped in mists. But we do find some plants which only occur in the upper parts, while others are found only on the lower districts or on the shore. Although altitude does not much affect the vegetation, difference of soil does so to a great extent. In most places the soil is volcanic, but there are many wide expanses of upraised coral reef forming a limestone soil, and, as we might expect, there are very marked differences between the vegetation on them.

Commencing at the shore we find first of all that we have representatives of a Phænogamic Flora below high-water mark in two species of *Halophila*, abundant on the reefs, and which are also found in many other tropical islands; but we miss the Mangrove which is found in Mauritius. At the mouth of some of the rivers *Ruppia maritima* and *Zannichellia palustris* occur. The shore at high-water mark is freely strewn with *Sesuvium portulacastrum*, while *Ipomœa pes-caprœ*, *Canavalia obtusifolia*, and *Zoysia pungens*, are found carpeting sandy flats. Of other shore plants *Psiadia Coronopus* is sparingly found, and so is *Phyllanthus dumetosus*, both only on the south side of the island, whilst *Clitoria Ternatea*, *Teramnus labialis*, *Boerhaavia diffusa*, and *Achyranthes aspera* are also found abundantly on the shore. Of trees *Hibiscus tiliaceus* forms dense thickets close to the sea, and with it *Thespesia populnea* and *Pisonia viscosa* are also found. Where coralline limestone exists on the shores and on the coral islets on the reef such plants, as *Suriana maritima*, *Pemphis acidula*, *Oldenlandia Sieberi*, *Tournefortia argentea*, *Ipomœa fragrans*, *I. leucantha*, *I. nil*, *Lycium tenue*, and *Myoporum mauritianum*, specially occur.

As we pass inland we meet in the valleys at the embouchures of the rivers with the following plants,—*Cardiospermum microcarpum*, *Cæsalpinia Bonducella*,

Physalis peruviana, *Datura alba*, *Ricunus communis*, *Erythrina indica*, *Carica Papaya*, and *Coix Lachryma*, in abundance; and, on continuing up the rivers, *Nasturtium officinale*, *Herpestis Monnieria*, *Alocasia macrorhiza*, *Colocasia antiquorum*, *Chara Commersoni*, and such *Algæ* as species of *Batrachospermum*, *Cladophora*, and *Conferva* are found in their waters. The banks of the streams in most valleys are covered, especially in the lower parts, for about twenty yards on each side of the stream by a dense thicket of *Leucæna glauca*, giving place in the upper parts in many valleys to *Eugenia Jambos*, and close to the stream may be found *Oxalis corymbosa*, *Hydrocotyle bonariensis*, *Salvia coccinea*, *Plantago major*, and *Rumex crispus*. On moist rocks at the tops of valleys *Lobelia vagans* and *Pilea Balfouri* are abundant, and many Mosses and *Algæ* are to be found coating the rocks along with *Hepaticæ* and *Trichomanes cuspidatum*.

The undergrowth is very rank in many places, and the plants which most commonly contribute to its formation are such as *Malvastrum tricuspidatum*, *Sida carpinifolia*, *Abutilon indicum*, *Urena lobata*, *Gossypium barbadense*, *Melochia pyramidata*, *Corchorus trilocularis*, *Triumfetta glandulosa*, *Oxalis corniculata*, *Crotalaria retusa*, *Atylosia scarabæoides*, *Rhynchosia minima*, *Rubus rosæfolius*, *Ageratum conyzoides*, *Vinca rosea*, *Trichodesma zeylanicum*, *Stachytarpheta indica*, *Achyranthes aspera*, *Cassytha filiformis*, *Commelyna communis*, *Nephrolepis acuta*, and species of *Cyperaceæ* and *Gramineæ*. Rocks and stones are everywhere covered with Lichens, chiefly species of *Lecanora*, *Lecidea*, and *Pertusaria*.

On the slopes of the valley are found occasionally such plants as *Toddalia aculeata*, *Gouania retinaria*, *Scutia Commersoni*, *Indigofera argentea*, *Tephrosia purpurea*, *Canavalia ensiformis*, *Daucus Carota*, *Danais corymbosa*, *Eupatorium cannabinum*, *Plumbago zeylanica*, *Tanulepis sphenophylla*, *Heliotropium indicum*, *Solanum sanctum*, *Barleria Prionitis*, *Agave americana*, *Fourcroya gigantea*, and *Aloe lomatophylloides*.

The commonest tree intermixed with these is *Pandanus heterocarpus*, and on the higher parts of the island *P. tenuifolius*; but the following trees and shrubs are also very common: *Pittosporum Senacia*, *Quivisia laciniata*, *Elæodendron orientale*, *Albizzia Lebbek*, *Terminalia Benzoin*, *T. Catappa*, *Fœtidia mauritiana*, *Mathurina penduliflora*, *Fernelia buxifolia*, *Pyrostria trilocularis*, *Scyphochlamys revoluta*, *Carissa Xylopicron*, *Ardisia sp.*, *Olea lancea*, *Securinega durissima*, *Ficus rubra*, *F. consimilis*, *Dracæna reflexa*, *Dodonæa viscosa*, *Eugenia uniflora*, *E. cotinifolia*, *Punica Granatum*, and *Phyllanthus Casticum*.

Confined to limited areas in unfrequented spots a few plants such as the following are found: *Aphloia mauritiana*, var. *theæformis*, *Dombeya ferruginea* *D. acutangula*, *Zanthoxylum paniculatum*, *Allophylus Cobbe*, *Sclerocarya castanea*, *Eugenia Balfouri*, *Randia heterophylla*, *Psychotria lanceolata*, *Psiadia rodriguesiana*, *Sideroxylon sp.*, *Buddleia madagascariensis*, *Hypoestes rodriguesiana*, *Obetia*

ficifolia, Peperomia Rodriguezi, P. hirta, Viscum tænioides, Oberonia brevifolia, and *Bulbophyllum incurvum.*

In the vicinity of habitations or old plantations we usually meet with such plants as :

Anona muricata.
Argemone mexicana.
Brassica juncea.
Gynandropsis pentaphylla.
Moringa pterygosperma.
Eriodendron anfractuosum.
Triphasia trifoliata.
Citrus decumana.
Indigofera tinctoria.
Abrus precatorius.
Hæmatoxylon Campechianum.
Poinciana regia.
Phaseolus lunatus.
Cajanus indicus.
Acacia Farnesiana.
Prunus communis.
Eugenia Jambolana.
Lagenaria vulgaris.
Momordica balsamina.
Citrullus vulgaris.
Opuntia Tuna.
Coffea arabica.
Parthenium Hysterophorus.
Siegesbeckia orientalis.
Bidens pilosa.
Lobelia Cliffortiana.
Ipomœa Batatas.
Lycopersicum Galeni.
Solanum Melongena.
Nicotiana Tabacum.
Mirabilis Jalapa.
Leonurus sibiricus.
Amaranthus tristis.
Chenopodium ambrosioides.
Basella rubra.
Persea gratissima.
Tetranthera laurifolia.
Euphorbia peploides.
Phyllanthus Niruri.
Manihot utilissima.
Musa paradisiaca.
Ravenala madagascariensis.
Dioscorea alata ?

On looking at the vegetation as it now clothes the island, one perceives at once that a line may be drawn across the island which will separate portions very different in aspect. Thus starting from the mouth of the Rivière Saumatre, and passing up to the head of the valley, thence striking somewhat south-west to a point on the opposite side of the island about the mouth of Rivière Coco, we have on the east a lofty district intersected by many deep ravines, the slopes coming somewhat abruptly down to the sea. The sides of the hills are in this region covered with a thick undergrowth and scrub, often in great part of Ferns, and dotted over them are a fair number of small shrubs and trees, notably abundance of Screw-pines. The valleys themselves in their upper parts are here filled with a tolerably dense growth of trees and shrubs. To the west of the line stretches a hilly country of lower altitude, sloping gradually to the south-west, cut by ravines, which are not so deep and whose sides are not so steep as those on the east. The higher land on this side is covered with a great number of small stones and débris of volcanic rocks, and is quite barren

of any trees or shrubs, save perhaps a stray stunted Vacoa, Palmiste, Latanier, or Citron, and the ground is over wide areas coated by but a scant covering of *Cyperaceæ* and Grasses mixed with social weeds; whilst the valleys are as a rule quite destitute throughout of a covering of tree or shrub, except it may be a few stragglers at the margins of the streams. As we pass south-west, however, we come, on the banks of the Rivière Quitorze, to an abrupt line of demarcation betwixt this bare district and one on which vegetation is relatively more abundant and varied. Crossing the line we enter on an extensive coralline limestone plain occupying the whole south-west end from Anse Peril to Anse Topaze. This is covered with a poor vegetation, but one that is very characteristic, such herbs abounding as *Tridax procumbens*, *Premna serratifolia*, *Senecio linearis*, *Sarcostemma viminale*, *Cassytha filiformis*, *Ipomœa leucantha*, and *Boerhaavia diffusa*; whilst of trees and shrubs *Ludia sessiliflora*, *Terminalia Benzoin*, and *Antirrhœa frangulacea*, are specially abundant, and more rarely *Gastonia cutispongia*; and sparingly such herbs as *Nesogenes decumbens*, *Dichondra repens*, *Hypoestes inconspicua*, and *Selaginella Balfouri*, occur. On the north-west where none of this coralline limestone is found and the volcanic rock passes directly into the sea the barrenness continues.

The difference in landscape offered by the two regions, eastern and western, of the island are very striking, and the abruptness of the line of demarcation is very remarkable. On sailing round from Port Mathurin to the Anse Topaze, as we did in going to the caverns where the bones of Solitaire are found, we had occasion frequently to observe this. In the valley of Rivière Saumatre the features are very well marked, for on one side the valley is thickly covered with vegetation, whilst the opposite side is quite barren. The difference is no doubt due to the fires, lighted to clear portions of land for cultivation without due care being taken to prevent their spreading and fanned by the prevailing south-east wind, sweeping across the south and north-west of the island more especially; they have thus converted the paradise into a wilderness.

When we come to consider more closely the Flora of Rodriguez we find that it is composed of 470 species and varieties, belonging to 293 genera included in 85 natural orders. This then is a proportion of about $5\frac{1}{2}$ species to each family, and hardly 2 species to each genus.

This ratio is, however, brought about by the comparatively large number of Cryptogams, for the 470 species comprise no less than 173 Cryptogams. There are therefore 297 Phænogams. Speaking of the Flora we shall deal separately with the two divisions.

Of Phænogamic plants then we have 297 species belonging to 214 genera included in 75 natural orders. An analysis of these shows us the extraordinary fact that 108 species or over one-third are introduced plants, in many cases relics of former or escapes from present cultivation. These I have thought it well to retain

in the list and record as having been found on the island however sparsely, as at some future period any one of them may occupy a more prominent position in the Flora. In taking cognizance, however, of the extent of the Flora at present they must be expunged. From the total number we must also subtract 14 species which are not finally determinable, owing to imperfect specimens having been obtained. And here I may state that from the same cause, in some cases, the determination of species has been very difficult and can only be considered provisional, for our visit to the island happened unfortunately at a time of year when few plants were in flower, and it was just when we were leaving the island that plants were coming into bloom. In all cases of difficulty, however, I have indicated it under the specific name. Of the 14 species I here allude to some most probably are endemic plants whilst others are perhaps widely spread. The following is a list of them so far as can be determined.

Desmodium, sp.
Mucuna, sp.
Eugenia, sp.
Olea, sp.
Ardisia, sp.
Sideroxylon, sp.
Asclepiads, 2 sp.
Stachys, sp.
Asparagus, 2 sp.
Angræcum, sp.
Cyperus, sp.
Bambusa, sp.

This leaves 175 Phænogams belonging to 119 genera and 57 orders which we consider the indigenous Flora, though even some of the plants in this number may have to be excluded. We have thus a ratio of about 3 species to each order and about 2 to each genus,—a very small proportion. Of the total number, Monocotyledons constitute 49 or about two-sevenths, a comparatively large proportion for a tropical island. Endemic species number 35 or one-fifth of the whole, 6 of them being Monocotyledons; 31 species or about two-elevenths are peculiarly Mascarene, of which number one-fifth are Monocotyledons; and of the rest, 8 species or more than one-twentieth are African plants which do not occur in Asia, whilst 14 species or nearly one-twelfth are found in Asia, but do not reach Africa. The remaining 88 species comprise a certain number which are widely spread in the tropics of the old world, 22 species in all or one-eighth of the Flora being of this nature, whilst 66 species or three-eighths are universal tropical weeds. Thus half the indigenous Phænogamic vegetation consists of common weeds of the tropics.

Amongst indigenous Dicotyledons the prevailing orders are, *Gramineæ*, represented by 21 species; *Leguminosæ*, by 14 species; *Convolvulaceæ*, 11; *Malvaceæ*, 9; *Rubiaceæ*, *Cyperaceæ*, and *Euphorbiaceæ*, each 8; *Liliaceæ*, 6; *Compositæ* and *Amaranthaceæ*, each 5. These, it will be observed, are all orders which as a rule compose a great part of the vegetation of any tropical island reached by civilization; but the number of *Rubiaceæ* is specially worthy of attention, more especially when compared with the number of *Compositæ*.

Gramineæ constitutes then three-sevenths of the whole indigenous Monocotyledons, and about three twenty-fifths of the whole Phænogams, a fairly large number compared with continental areas,—a usual characteristic of tropical islands. The species call for no special mention; none are peculiar, though a form of *Panicum* is Mascarene. The majority are widely spread, cosmopolitan, or old world species, a few being Asiatic.

Leguminosæ, represented by fourteen species, forms two-twenty-fifths of the whole Flora. It contains as usual a great number of species found along or near the shores, such as *Canavalia obtusifolia*, and *Clitoria Ternatea*, and includes many of the commonest plants. Very few plants of Rodriguez besides the endemic ones are absent from Mauritius, but curiously this family contains three species not found in Mauritius; these are *Canavalia ensiformis*, *Mucuna gigantea*, and *Rhynchosia minima*. Species of the genera of the two former are found, but not of the latter. Most of the Rodriguez plants of this family are universal in the tropics.

Convolvulaceæ is next most numerously represented, chiefly by species of *Ipomœa*, of which eleven are known. Many of the species are littoral, such as *Ipomœa pes-capræ*, *Ip. leucantha*, *Ip. nil*. *Ip. fragrans*. The three last mentioned do not occur in Mauritius.

Malvaceæ, with nine species, includes, with one exception (*Hibiscus liliiflorus*), widely spread tropical plants.

Cyperaceæ and *Amaranthaceæ* call for no special notice, and the other families are noticed in the account of the endemic Flora.

The endemic Flora consists of 35 species, or one-fifth of the whole Phænogamic plants. Of this number 29 are Dicotyledons, and 6 are Monocotyledons.

The following is a list of the species :—

Zanthoxylum paniculatum.
Quivisia laciniata.
Sclerocarya castanea.
Eugenia Balfouri.
Mathurina penduliflora.
Danais corymbosa.
Randia heterophylla.
Pyrostria trilocularis.
Scyphochlamys revoluta.
Psychotria lanceolata.
Psiadia Coronopus.
Psiadia rodriguesiana.
Abrotanella rhynchocarpa.
Lobelia vagans.
Diospyros diversifolia.
Tanulepis sphenophylla.
Sarcostemma Odontolepis.
Hypoestes rodriguesiana.
Hypoestes inconspicua.
Nesogenes decumbens.
Clerodendron laciniatum.
Pisonia viscosa.
Ærua congesta.
Pilea Balfouri.
Peperomia hirta.
Peperomia reticulata.
Peperomia Rodriguezi.
Euphorbia daphnoides.

Phyllanthus dumetosus.
Listrostachys Aphrodite.
Aloe lomatophylloides.
Latania Verschaffelti.
Hyophorbe Verschaffelti.
Pandanus heterocarpus.
Pandanus tenuifolius.

Of the Dicotyledonous orders in which endemic species occur *Rubiaceæ* is the most remarkable, presenting the greatest amount of peculiarity. Of the eight species it contains, five are endemic, and they all belong to different genera. One of these, *Scyphochlamys*, is peculiar to Rodriguez, and the genera of two others—*Pyrostria* and *Danais*—are essentially Mascarene, the latter extending into Madagascar. The two remaining species belong to the widely-spread genera *Randia* and *Psychotria*, of which the former is unknown in the other Mascarene Islands, but may have a representative there in the nearly allied *Gardenia*, which is absent from Rodriguez.

Three species of *Rubiaceæ* are peculiarly Mascarene, two belonging to genera of wide range, *Antirrhœa* and *Oldenlandia*, but the Mauritian type of the species of *Oldenlandia* is modified into a distinct variety in Rodriguez; the third is a species of *Fernelia*, a Mascarene genus.

This comparative abundance and peculiarity of the *Rubiaceæ* is very interesting when compared with similar features seen in other oceanic islands of like nature; and it is further interesting to note that in *Euphorbiaceæ* we have an order co-extensive, though not presenting so great peculiarity. The eight species composing it belong mainly to *Phyllanthus* and *Euphorbia*, of each of which there is a peculiar species. There is also a Mascarene species of *Phyllanthus* which derives interest as one of the plants collected by Commerson, and originally described from his specimens; in addition there is a species of *Claoxylon*, and one of *Securinega*, both Mascarene.

Compositæ and *Piperaceæ* are equally numerously represented by peculiar species, each containing three. In the first-named order, of which five species in all occur, the endemic plants belong to two genera. *Psiadia*, a Mascarene type of *Astereæ* extending into Africa, but not Asiatic, includes two of the peculiar species. Both are suffruticose, one, *Ps. rodriguesiana*, growing only on the higher levels, and there sparingly, has the velutinous character so well developed in many of the Bourbon species, the other, *Ps. Coronopus* is glutinous, occurring only on the shores in small quantity, and is interesting as being one of the few plants brought from Rodriguez by Commerson, and originally described as *Sarcanthemum Coronopus* by Cassini. The third peculiar Composite is a species of *Abrotanella*, a small genus of *Cotuleæ*, ranging through Australia, New Zealand, and some Antarctic islands, and unknown in any other of the Mascarene group. A fourth Composite is a *Senecio* confined to the Mascarene Islands, very variable in its character, and the remaining one is the world wide *Sonchus oleraceus*.

In the *Piperaceæ* we have three peculiar species of *Peperomia* with a strong East Indian affinity.

Asclepiadaceæ, *Acanthaceæ*, and *Verbenaceæ* each contain two endemic plants. The Asclepiadaceous *Sarcostemma* comprises two species, of which one is a novelty, and there is a climber, common on the island, the type of a new genus *Tanulepis* closely allied to the East Indian *Brachylepis*. The two peculiar Acanthads are species of *Hypoestes*, and in *Verbenaceæ* one of the novelties is a species of the hitherto monotypic *Nesogenes*, a genus confined to a few of the Polynesian Islands, whilst the other is a species of the common tropical *Clerodendron*.

Of other Dicotyledonous orders none contain more than one peculiar species. *Anacardiaceæ* has a single species of the African genus *Sclerocarya*, which differs, however, very considerably from the generic type. Of three *Myrtaceæ* one species of *Eugenia* is endemic, whilst another is mainly Mascarene, though occurring elsewhere in the tropics, and the third is the Mascarene *Fœtidia mauritiana*.

I shall only specially mention another order, *Turneraceæ*, of which one generically peculiar plant is found, *Mathurina penduliflora*, whose nearest congener is a central American genus *Erblichia*, and it is worthy of note that this family has hitherto been unknown in the Mascarene Islands. The remaining families with endemic species are *Rutaceæ*, *Meliaceæ*, *Campanulaceæ*, *Ebenaceæ*, *Nyctaginaceæ*, *Amaranthaceæ*, and *Urticaceæ*.

Looking next at the 6 peculiar Monocotyledons we find that they are included in 5 genera belonging to 4 orders. The Monocotyledons from this island are specially interesting, as they include those plants which give a character to the vegetation. Every visitor to Rodriguez will be struck at once by the peculiar features impressed on the landscape by the prevalence of the Screw-pines. They are indeed the physiognomic plants, and far outstrip in numbers any other species; but it is remarkable that though individually so numerous, specifically the family is not rich, there being only two species of *Pandanus* on the island, *P. heterocarpus* and *P. tenuifolius*, both peculiar and very distinct from any other of the indigenous Mascarene forms. Three other species have been registered by various authorities, they are *P. odoratissimus*, *P. utilis*, and *P. muricatus*. None of these are Mauritian or Bourbon species, the first being a native of Asia and the two latter both Madagascar species, and the evidence of their occurrence in Rodriguez is faulty.

Next in interest amongst the Monocotyledons come the Palms, and they are very peculiar. We find three species indigenous, and these belong to different genera which are all Mascarene. They are *Latania Verschaffelti*, *Hyophorbe Verschaffelti*, and *Dictyosperma album*, var. *aureum*. *Latania Vershaffelti* has been for some time known to European nurserymen as *Latania aurea*, and *Hyophorbe Verschaf-*

felti has also been known to horticulturists under the name of *Areca Verschaffelti*. Each of the genera, *Latania* and *Hyophorbe*, includes three species, which present a remarkable correspondence in distribution.

The *Latania Verschaffelti* of Rodriguez is represented in Mauritius by *L. Commersoni*, which grows also in Bourbon, and on Round Island a third species, *L. Loddigesi*, is found. Of *Hyophorbe*, the Rodriguez plant *H. Verschaffelti*, is represented in Mauritius and Bourbon by *Hyophorbe indica*, and on Round Island *H. amaricaulis* occurs.

The genus *Dictyosperma* is Mascarene, and has been created by Wendland to include the type of Palm, originally described by Bory St. Vincent (Voy. I. 306) as *Areca alba*. The Mascarene palms, formerly described as species of Areca, are all removed from that genus, the non-spiny forms now constituting *Dictyosperma*, and the spiny forms, *Areca crinita* and *A. rubra*, combining to make the genus *Acanthophœnix*. *Dictyosperma* is montoypic, but the species is very variable, and in Rodriguez assumes a very graceful and delicate habit; the characters, however, are hardly specific, and it is therefore merely a variety. This palm is the well-known *Areca aurea* of nurserymen.

Of the other endemic Monocotyledons one is a species of *Aloe* which is very distinct. *Liliaceæ* altogether constitutes one-twenty-ninth of the Flora, and in addition to this peculiar Aloe comprises a Mascarene species of *Asparagus*. An *Asphodelus* which has a tolerably wide range is to be noted as occurring only on two of the small coral islets on the southern reef, Gombrani and Pierrots, and is absent entirely from the main island.

A marked feature in the Flora is the paucity of *Orchidaceæ*. Only four species have been determined; a fifth, a species of *Angrœcum*, was found, but in too imperfect a state for identification. These belong to genera two of which range into Africa and not into Asia, and one is Asian but not African. One species of *Listrostachys* is peculiar, an *Oberonia* and a *Bulbophyllum* are Mascarene, and a distinct variety of a Mauritian *Aeranthus* occurs. The dryness of the soil and climate no doubt have to do with the scarcity of the family, and also to a large extent the destruction of the old forests, as no epiphytic forms now exist. This paucity is the more remarkable when contrasted with the profusion of this family in the sister islands.

Analysing the relationship of the endemic plants, we find that three genera are endemic, of these one, *Mathurina*, has a near American affinity, another, *Tanulepis*, has a close Asiatic connexion, whilst the third, *Scyphochlamys*, has its nearest congener peculiarly Mascarene. Five are Mascarene genera,—*Quivisia*, *Danais*, *Pyrostria*, *Latania*, and *Hyophorbe*. In the case of four, *Sclerocarya*, *Psiadia*, *Listrostachys*, and *Aloe*,—we have genera of peculiarly African range; and of the

rest, *Abrotanella* is an Antarctic genus and *Nesogenes* is Polynesian, the remainder being four old world and twelve generally distributed tropical genera. We may tabulate these as follows:—

Endemic.	Mascarene.	African.	Old World.	Cosmopolitan in Tropics.
Mathurina.	*Quivisia.*	*Sclerocarya.*	*Sarcostemma.*	*Zanthoxylum.*
Scyhochlamys.	*Danais.*	*Psiadia.*	*Hypoestes.*	*Eugenia.*
Tanulepis.	*Pyrostria.*	*Listrostachys.*	*Ærua.*	*Randia.*
	Latania.	*Aloe.*	*Pandanus.*	*Psychotria.*
	Hyophorbe.			*Lobelia.*
Antarctic.				*Diospyros.*
				Clerodendron.
Abrotanella.	Polynesian.			*Pisonia.*
				Pilea.
	Nesogenes.			*Peperomia.*
				Euphorbia.
				Phyllanthus.

The African affinity of the endemic Flora thus becomes manifest.

We have stated that 31 species of Phænogamic plants in the Flora are peculiarly Mascarene, of which 25 are Dicotyledons, and the rest Monocotyledons. They are,—

Pittosporum Senacia.
Aphloia mauritiana.
Hibiscus liliiflorus.
Dombeya acutangula.
Dombeya ferruginea.
Toddalia paniculata.
Elæodendron orientale.
Gouania retinaria.
Fœtidia mauritiana.
Terminalia Benzoin.
Gastonia cutispongia.
Oldenlandia Sieberi.
Fernelia buxifolia.
Antirrhœa frangulacea.
Senecio linearis.
Olea lancea.
Carissa Xylopicron.
Buddleia madagascariensis.
Solanum macrocarpum.
Myoporum mauritianum.
Obetia ficifolia.
Phyllanthus Casticum.
Securinega durissima.
Claoxylon parviflorum.
Viscum tænioides.
Oberonia brevifolia.
Bulbophyllum incurvum.
Aeranthus arachnites.
Asparagus umbellulatus.
Dictyosperma album.
Andropogon foliatus.

Several of these I have already referred to, and I now mention specially the occurrence of the curious *Myoporum mauritianiam*, very sparingly found on the island, which differs very markedly from the type of *Myoporineæ*, and is perhaps endemic in Rodriguez, as the evidence of its occurrence in other Mascarene Islands is faulty.

An analysis of the relationships of these plants shows us that,—

Six belong to genera which are essentially Mascarene; these are *Aphloia*, *Fœtidia*, *Gastonia*, *Fernelia*, *Obetia*, and *Dictyosperma*, and two, *Dombeya* and *Aeranthus*, are essentially African. Ten of the remainder are old world genera, and the remaining twelve are spread tropical genera, but curiously one of these, *Antirrhœa*, is not African. Here we have evidence of the individuality of the Mascarene Flora and also of its primary relationship with the African rather than the Indian type.

Tabulating these we have:—

Mascarene.	African.	Old World.	Cosmopolitan in Tropics.
Aphloia.	*Dombeya.*	*Pittosporum.*	
Fœtidia.	*Aeranthus.*	*Toddalia.*	*Hibiscus.*
Gastonia.		*Olea.*	*Elæodendron.*
Fernelia.		*Carissa.*	*Gouania.*
Obetia.		*Myoporum.*	*Terminalia.*
Dictyosperma.		*Claoxylon.*	*Oldenlandia.*
		Viscum.	*Antirrhœa.*
		Oberonia.	*Senecio.*
		Bulbophyllum.	*Buddleia.*
		Asparagus.	*Solanum.*
			Phyllanthus.
			Securinega.
			Andropogon.

The connections exhibited by the plants of other countries indigenous in Rodriguez are not very strong. There are a few, eight, species which have specially an African distribution, and there are fourteen of specially Asiatic range which do not reach Africa: that is, more than one-twentieth of the whole Flora have African and nearly one-twelfth Asiatic distribution.

The African plants are,—

Ludia sessiliflora.
Desmodium mauritianum.
Desmodium incanum.
Sarcostemma viminale.
Lycium tenue.
Ipomœa fragans.
Dracœna reflexa.
Andropogon finitimus.

The Asiatic and non-African are,—

Calophyllum Inophyllum.
Toddalia aculeata.
Allophylus Cobbe.
Erythrina indica.
Mucuna gigantea.
Atylosia scarabœoides.
Eugenia cotinifolia.
Ipomœa peltata.
Cassytha filiformis.
Dracœna angustifolia.
Carex gracilis.
Panicum Balfouri.
Stenotaphrum subulatum.
Zoysia pungens.

It will be observed that the African species are all of a more restricted range than the Asiatic.

Of the 88 generally distributed tropical weeds I need say nothing. They will be seen to be such as one would expect to meet in an island which has passed through such vicissitudes as Rodriguez.

Of the introduced Phænogamic plants, 108 in number, of 90 genera included in 56 natural orders, the prevailing families are—

Leguminosæ	15	species
Solanaceæ	9	,,
Gramineæ	6	,,
Compositæ	6	,,
Myrtaceæ	5	,,
Convolvulaceæ, *Cucurbitaceæ*, *Rutaceæ*	4	,,

orders commonly and widely distributed, and including those social weeds which follow man's footsteps over the world. I need not further refer to them.

Besides those Phænogams I have recorded as occurring on the island, there are a few others reported as existing, but of none of them have I seen authentic specimens from the island, and as I did not find them there, I do not include them in the list. They are the following:—

Achillea, sp.
Lantana, sp.
Ficus, sp.
Pandanus muricatus.
Pandanus odoratissimus.
Pandanus utilis.

In estimating the relationship of the Cryptogamic Flora of Rodriguez, we find more difficulties to encounter from the fact that excepting the Vascular Cryptogams, little comparatively has been done amongst the Cryptogams of the other Mascarene Islands. The lower forms from Rodriguez have, however, been carefully worked out, and I find that there are now known from the island, 173 species of Cryptogams (this number excluding marine *Algæ*). Thus the Phænogams and the Cryptogams are almost equal in number.

Of this number, 26 species or about one-seventh are *Filices*, *Ophioglossaceæ*, and *Lycopodiaceæ*. *Musci* constitute about two-elevenths, numbering 33 species, whilst of *Hepaticæ* I have 18 species, and there is one species of *Chara*. *Lichens* are most abundant of all, there being 75 species, or over three-sevenths of the whole Cryptogams; whilst *Fungi* number 8 species, freshwater *Algæ* 13, and I have only 39 species of marine *Algæ*.

In Vascular Cryptogams, the Rodriguez Flora contrasts very unfavourably with that of the other Mascarene Islands. The 25 species known, of which 20 are Ferns, is a number relatively and absolutely very small. The scarcity of this group of plants is accounted for by the dryness of the island, and in confirmation of this fact, we observe the Tree Ferns of the other Mascarene Islands have here no representatives, and of the large moisture loving genera *Trichomanes* and *Hymenophyllum*, so abundant elsewhere in the group, the former is here typified in one species only, *T. cuspidatum*, whilst the latter is absent. And when we consider the nature of the species which do occur, they are those characteristic of dry and arid regions, such for example as *Adiantum caudatum*, *Asplenium furcatum*, *Asplenium falcatum*, *Nephrodium unitum*, *N. molle*, *Polypodium phymatodes*, *Nephrolepis acuta*.

None of the species are novelties; all occur in the Mascarene Islands, and three of them, *Trichomanes cuspidatum*, *Davallia mauritiana*, and *Nephrodium crinitum*, are peculiarly Mascarene, but most are widely spread tropical species. Whilst some, as *Pellœa hastata*, *Pteris flabellata*, and *Nephrodium elatum*, are found in Africa, but not in Asia; on the other hand we have the Asian but not African *Asplenium hirtum*, and *Polypodium adnascens*. Three Ferns, *Lindsaya acutifolia*, another *Nephrolepis* and another *Lastrea* are reported from Rodriguez, but I have seen no authentic specimens, and as I did not find them myself, I have not included them in my list.

The *Lycopodiaceæ* further exemplify the dry character of the island. Only four species are known. Two are widely spread *Lycopodium Phlegmaria* and *Psilotum triquetrum*, whilst two species of *Selaginella*, *S. Balfouri* and *S. rodriguesiana*, are novelties.

Mosses may be considered as fairly represented in Rodriguez by 33 species, though this is a small number compared with those found in Mauritius; the number of species in that island, according to the latest enumeration I have seen, being 104. Of the 33 species found, 17 are peculiar; and of the remainder, 13 occur in the other Mascarene Islands, or in Africa, a few corresponding with those from the western coast of tropical Africa; and it appears from what little is known of the Mosses of the eastern coast, that some species have an enormous range on the African continent. Two other species are found in Asia, and one, *Weisia controversa*, is cosmopolitan.

Of the Rodriguez species all except one belong to genera which are represented in the Mascarene Islands. The genus *Ectropothecium* is most abundantly represented by four species, and they are perhaps the commonest on the island. It is curious that *Hypnum*, which occurs so extensively in the sister islands, should include but one species in Rodriguez. Of all species, the most interesting is *Orthotrichum plicatum*, which is not uncommon on the island, previously known only from the specimens gathered in Bourbon by Du Petit Thouars, and described and well figured by Schwaegrichen; it is undoubtedly a member of the family of

the *Orthotricha*, but its characters as a genus are, according to Mitten, intermediate, and its position in that family unique. One of the most elegant as it is one of the rarest species is the endemic *Macromitrium astroideum*, found trailing over boulders at the top of the valley of the Rivière aux Huitres, and along with it is also found *M. aciculare*. *Octoblepheum albidum* is by no means common, growing in tufts on decayed branches of trees and rich vegetable humus in the same valley, and this is also the only station for *Neckera lepineana* and *Meteorium involutifolium*, and sparingly on trees also occurs *Pterogonium curvifolium*. On the moist clay rocks at the sides of the beds of streams in shady places, the various species of *Ectropothocium* are found most abundantly, *E. doleare* especially forming a thick covering, and this is probably the commonest Moss on the island; with it also species of *Sematophyllum*, notably *S. incurvifolium*, are commonly found as also *Callicostella læviuscula*, *Rhacophilum africanum*, and occasionally species of *Fissidens*. On moist rocks near the stream sources we find species of *Bartramia; Bryum* occurs commonly over the island, and *Weisia* and *Calyperes* are also frequently met with.

The island possesses 18 species of *Hepaticæ* included in 6 genera, and of these 13 are novelties. Of the remainder, three, *Chiloscyphus oblongifolius*, *Frullania squarrosa*, *Anthoceros fuciformis*, are Mascarene or African, one, *Lejeunia minutissima*, is found in the Eastern Archipelago, and *Anthoceros lævis* is the only cosmopolitan species. *Lejeunia* is the most extensive genus, embracing seven of the total number of species, and six of these are endemic. Of the species, *Lejeunia Balfouri* is one of the commonest, occurring on moist clay rocks at the sides of streams, and in similar situations with it *Chilocyphus oblongifolius* and *Radula appressa* are found, and in great abundance *Anthoceros lævis* and *A. fuciformis*. *Lejeunia furva* is rare, but in similar situations. The stems of the Screw-pines are frequently clothed with *Frullania squarrosa*, *Fr. Apicalis*, and *Fr. obscurifolia*, though they also occur more sparingly on other trees, as does *Phragmicoma carinata*.

One species of *Chara* is found in many of the rivers, and it also occurs in Mauritius and Bourbon.

Looking now at the Lichens, we find that of all Cryptogams they occur most abundantly. Altogether, 76 species and varieties were collected in a determinable state. Of these, the large number of 35 or nearly one half are novelties, whilst of the remainder, 11 are known from Mauritius, and 7 or 8 from Bourbon. This large number of Lichens is very remarkable when compared with the number in Mauritius and Bourbon. From the former island, 89 species and varieties are enumerated by Weddell (Trans. Roy. Soc. Arts and Scien. Maur. vii. 163) and Nylander (Ann. Sc. Nat. 4th ser. xi. 248) determines 112 species in Bourbon. But I think this relatively large proportion is due rather to our imperfect knowledge of the Lichen Flora of these islands than to their poverty in species as compared with Rodriguez. In addition to the species determined, there are fragments of other species, mainly

crustaceous, in my collection which are quite undeterminable, being either sterile or with imperfectly developed apothecia.

Of the Rodriguez species, all save two belong to genera represented in the other Mascarene Islands. The two exceptions are *Heppia*, of which we have a single endemic species found very sparingly on the island, and *Pyrenastrum*, a single species of this genus, *P. Americanum*, occurring very abundantly on the bark of trees.

The most abundantly represented genus is *Lecanora*, which includes twenty-one species and varieties, and fourteen of these are peculiar; and next to it comes *Lecidea*, with nine species, of which six are novelties. Of the other genera *Ramalina* is most numerously represented, having five species and varieties, of which two are peculiar. *Arthonia* has two peculiar species, and *Cladonia*, *Pyxine*, and *Opegrapha* have each a single species, which is endemic. The scarcity of species of *Cladonia* is curious, as the genus is well developed in the other Mascarene Islands.

Of the species, one, which will at once attract the attention of any who visit the island, is the beautiful *Usnea dasypogioides*, only occurring in the higher parts of the island; it there hangs beard-like in great abundance from the tree branches, and along with it *Ramalina subfraxinea* is usually found. Close to these may be seen on the rocks the small tufted *Ramalina gracilenta* and *R. gracilenta* f. *nodulosa* intermingling with white patches of *Lecanora atra* f. *succedanea*, with its large black apothecia. *Parmelia latissima* is a not uncommon species in dry spots along with *Sticta aurata*, and on the boulders *Physcia speciosa* is found in abundance. The stems of the Screw-pines are invariably dotted over with stellate patches of *Physcia picta*, and many species of *Verrucaria* and *Graphis* also find thereon a suitable nidus, as well as *Lecanora achroa;* whilst their withered and dried leaves give a home to *Arthonia phylloica* and *A. dendritella*.

The features imposed on the rocks in many places by certain Lichens is very striking. Where such species as *Lecanora obliquans*, *L. conizopta*, *Pertusaria impallescens*, *Lecidea continens*, and *L. configurans* are abundant, one might suppose that the rocks had been whitewashed, this character being visible at a long distance. Again, on the more decomposed or cindery rocks, *Lecanora subfusca* f. *pumicicola*, *L. apostatica*, *L. cinnabarina*, *Lecidea spuria*, *L. achroopholis*, and *L. immutans* unite to give a dull mottled and variegated aspect to the rocks.

The stems of other trees besides the Screw-pines are favourite sites for certain species, notably we may mention Bois Gandine and Bois Puant; of the former, more especially, the bark is usually quite concealed by lichens, giving it a very white or grey appearance. On it alone *Lecanora leucoxantha* occurs with its orange apothecia, and also the pure white *Pertusaria velata; Lecanora punicea* and *Coccocarpa molybdæa* are found on trees with rough bark, and so is the scarlet *Trypethelium cruentulum;* whilst on decayed and decorticated wood forms such as *Opegrapha difficilior*, *Lecanora conizœa*, and *Pannaria rubiginosa* grow in profusion.

Fungi are poorly represented in my collection by 8 species. I found a few more species on the island, but in course of transmission to Britain I regret they have disappeared. The family is not however abundant on the island. Of the eight species which have been determined, three turn out to be novelties. One of them, *Polyporus aspidolopus*, is perhaps the commonest form on the island, growing abundantly on the stems of trees, but apparently with a preference for Screw-pines. The widely spread *Schizophyllum commune* and the common British *Hirneola Auricula Judæ* occur sparingly on trees in the island; and on the barren ground, towards the south-west, *Bovista lilacina* grows in considerable quantity.

The short time devoted to the collection of marine forms accounts for the smallness of the collection of *Algæ* from Rodriguez. Of the 52 species and varieties enumerated, 39 are marine, a number so small that it evidently cannot be considered as a fair representation of the marine Algal Flora. None of them call for special mention, as they are all widely spread in the Indian Ocean and South Seas. The remaining 13 are fresh-water forms. Six of these have a general range throughout Europe, and some of the six are quite cosmopolitan. The rest are more restricted in distribution. Two species only, *Thorea violacea* and *Cladophora pannosa*, are peculiarly Mascarene; *Chantransia cærulescens* is curiously enough a Cayenne species, whilst *Conferva Ansoni* and *C. Moluccaæ* are each confined to a single island in the Eastern Archipelago, and there is also *Cladophora Rottleri*, a restricted Indian species. In addition to those enumerated in the list, fragments of *Vaucheria* and *Odontidium* occur amongst the specimens, but in too imperfect a state for determination.

The variability of species in the Rodriguez Flora is a very remarkable characteristic. The number of genera, to species of which it is difficult to assign a limit, is indeed not very large; but the number of genera, species of which exhibit variations in size and form during their stages of growth, and the amount of this variation, is remarkable, and probably is not exceeded in any Flora of similar extent.

Of the genera whose species vary greatly we find, leaving out *Scutia*, *Eugenia*, *Senecio*, *Lobelia*, *Achyranthes*, *Cyperus*, and such like widely distributed genera, which are variable wherever found, and which present their ordinary variations in Rodriguez, several genera endemic or of limited extent, such as *Aphloia*, *Danais*, *Dombeya*, *Quivisia*, *Sideroxylon*, and *Psiadia*, which in the Mascarene group exhibit great variation in their species. In Rodriguez, where we have so small a Flora, and they are represented by usually a single species, the limit of variation is not wide, and specific characters are fairly precise and easily discerned. In only three genera, *Oldenlandia*, *Dictyosperma*, and *Aeranthus*, do we find a Mascarene species so altered in Rodriguez as to be recognisable as a distinct variety. But in the genus *Pandanus* we have examples in Rodriguez of exceedingly variable species, and it is necessary to have a very large series of forms before determining specific

limits. We can recognise that there are two distinct species, but these vary so much, and approach one another so nearly, that of some forms it is almost impossible to say to which species they ought to be referred. The variation occurs in every part of the plant, but more specially in the fruits. Whether hybridisation has to do with this or not is a matter of dispute, but I am inclined to allow that this is a cause in some instances.

But the more marked feature of variability in the vegetation, and one deserving great attention, is the diversity in form, size, and habit exhibited in the leaves of many plants at different periods of their growth. The variation is confined almost absolutely to small trees or shrubby plants, the only exception being the small Composite *Abrotanella*. In species exhibiting this heteromorphism the young plant produces leaves of, as it were, a lower stage of development than the adult, and as the individual increases in age the leaves successively produced approach more nearly the mature, or as we must consider it, the type form, until at a certain stage of its growth only the typical leaves of the adult are found; and once this stage is reached all the leaves produced on the branches of the tree are of the typical adult form. But should any adventitious shoots develope from the base of the trunk, or appear on the stem anywhere below its first branching, these always have the juvenile and not the adult form of leaf. And, as may be supposed, if a tree be blown or cut down and from the stumps young shoots develope, those always bear juvenile leaves. An interesting point to determine would be whether shoots arising from a branch so treated would produce juvenile or adult leaves, and to what extent variations in foliage might be so produced. It seems to me there is room here for some interesting observations and experiments which I would press on the attention of those who have opportunity of making such investigation. In the following 17 species this heterophylly is extremely marked.

Ludia sessiliflora.
Aphloia mauritiana.
Hibiscus liliiflorus.
Dombeya ferruginea.
Quivisia laciniata.
Elæodendron orientale.
Terminalia Benzoin.
Fœtidia mauritiana.
Mathurina penduliflora.
Randia heterophylla.
Fernelia buxifolia.
Pyrostria trilocularis.
Scyphochlamys revoluta.
Abrotanella rhyncocarpa.
Diospyros diversifolia.
Carissa Xylopicron.
Clerodendron laciniatum.

In all the heterophylly is not of the same kind or to the same extent, but whilst the heteromorphism of the vegetation of the island as a whole varies greatly both in degree and kind, each species presents variations always of the same kind, and this holds true of a species if it grows also on the sister islands. Whether all the species of one genus in the island exhibit the same kind of variation is a point I had no

opportunity of determining, as in no case did I find two species of one genus heterophyllous; but it is certain that the representatives in adjacent islands of heterophyllous species do not when they produce diverse formed leaves always have the same kind of variation. In the Mascarene Islands I only know of two genera possessing representative species which exhibit heteromorphism. In one of these, *Quivisia*, the type of variation is the same in both species; in the other, *Clerodendron*, it is different. The phenomenon is confined to no special order, though I may note that in four species of *Rubiaceæ* it is very well marked. For the sake of clearness I shall consider the kinds of variation observed as of three types.

1st. Variation dependent on imperfect or arrested development of the whole leaf in the young plant, the lamina developing equally.

In plants which exhibit this type the leaves of the juveniles are to a certain extent miniatures of the adult. They are very small, but possess the same or almost the same relative proportion of length of lamina and breadth thereof as is seen in the adult. The lamina is developed equally and is not lobed, and the margin may be entire, but sometimes the parenchyma towards the edge of the lamina is somewhat deficient, and thus, the veins being left prominent, the leaf has a spinose margin. With advance in age of the plant the leaves both increase in absolute and relative size, and also the edges of the lamina fill up in those cases where the margin was spinose, so that the spinoseness disappears. Sometimes, however, there is a tendency to the perpetuation of a certain amount of the spinoseness in the adult, especially at the apex of the leaves, which may be hard and sharp pointed. Three of the species have this type of heterophylly,—

Ludia sessiliflora.
Fernelia buxifolia.
Carissa Xylopicron.

These are all species which in habit somewhat resemble the Box tree (*Buxus sempervirens*) and their leaves are small and coriaceous. The resemblance between the two latter species, when adult, is very close, but the first and last resemble each other most nearly when young. *Fernelia buxifolia* has the leaves in the young plant entire and not spiny. In the other two they are spiny. The three are Mascarene species, but I have record of *Ludia sessiliflora* only as presenting heterophylly in the sister islands.

2nd. Variation arising from non-development of the young leaf in one direction, the transverse, usually but not always accompanied by an increase in the other direction, the longitudinal, the lamina developing equally.

In plants which have variation after this type, and it is the commonest, the young leaves are usually greatly elongated, frequently being two or three times as long as the adult. Thus in *Randia heterophylla* the young are usually over a foot long, the adult vary from $2\frac{1}{2}$ to 6 inches. More rarely the juvenile leaves are not elongated and may even be shorter than the adult, but it is only in species in which

the adult leaves are not large and have a firm and coriaceous consistence that this is observed, a curious point when considered along with what I have noted in the first type of variation. But whether the leaves be elongated or short, the relative proportion betwixt the length and breadth of the lamina in the juvenile is vastly different from what is observed in the adult. The juvenile are usually linear, always very greatly narrowed, often only one-twentieth the breadth of the adult, and the contrast in such a case is, as may be imagined, very striking. For example, take *Scyphochlamys revoluta*, the juvenile form is only $\frac{1}{8}$th of an inch in breadth, while the adult averages $1\frac{1}{2}$ to $2\frac{1}{2}$ inches. The lamina developes equally at the margins, which are never spiny, and though any crenatures or dentations which characterise the mature form, may be represented, the lamina is never lobed or deeply cleft. As I have said this is the commonest type of variation, occurring in no less than nine, that is, in more than half of the heterophyllous species, these are:—

Dombeya ferruginea.
Elæodendron orientale.
Terminalia Benzoin.
Fœtidia mauritiana.
Mathurina penduliflora.
Randia heterophylla.
Pyrostria trilocularis.
Scyphochlamys revoluta.
Diospyros diversifolia.

The first four of these are peculiar Mascarene species, the remainder are endemic. *Elæodendron orientale* presents the same variations in the sister islands, and judging from a remark of Cavanilles (Diss. III., 121), *Dombeya ferruginea* is also heteromorphic; I have no information regarding variation in the other two species. Of the endemics, the *Pyrostria* and *Diospyros* are the only two species in which the linear juvenile leaves are shorter than or at least do not exceed the adult. Another species *Eugenia cotinifolia* is probably heterophyllous after this type, but the specimens I found represented differences only to so slight an extent as hardly to warrant my including it in this list.

3rd. Variation due to unequal development of the lamina in the young leaves.

In the plants included in this group the young leaves are not much less, may even be greater in absolute size than the adult, and the relative proportion of length to breadth of the lamina is the same, but the lamina developes unequally, so that a lobed or cleft, sometimes very deeply cleft leaf is produced. The lobation gradually disappears in the older leaves, though frequently slight traces of it remain, especially in an emargination of the apex. If the mature form of leaf has a pinnately arranged venation, then the young leaves are of the pinnatifid type; if the veins are radiate the palmatifid type is seen. The amount of lobation in the juvenile greatly varies, and the primary lobes are sometimes again once or twice cleft. Four species exhibit this variation,—

Aphloia mauritiana.
Hibiscus liliiflorus.
Quivisia laciniata.
Clerodendron laciniatum.

Of these *Hibiscus liliiflorus* has palmatifid young leaves; in all the others they are pinnatifid. The first two are Mascarene species, the others are endemic.

Aphloia Mauritiana is as variable in Mauritius, and so also probably *Hibiscus liliiflorus*. *Quivisia laciniata* and *Clerodendron laciniatum* are each represented in Mauritius by a heterophyllous species. But whilst *Quivisia heterophylla* of Mauritius varies in the same manner as the Rodriguez plant, *Clerodendron heterophyllum* has the second type of variation developed.

Abrotanella rhyncocarpa I may mention here; it is heterophyllous, but after a different manner. It is a small tufted herb, with very persistent leaves. The young leaves, those at the top of the shoots, are entire and oblanceolate, but the older leaves below are markedly pinnatifid. We have thus the converse, as it were, of this last type of variation.

Some species, in addition to the differences in form and size, exhibit variations in habit of the leaves at different periods of their growth. This is most marked in *Dombeya ferruginea*, of which the young leaves are quite green and glabrous on both sides, but in the adult are clothed on the under surface with a dense brown tomentum. The converse is seen in some to a slight extent, thus *Clerodendron laciniatum*, *Terminalia Benzoin*, and *Randia heterophylla* have pubescent young leaves, while in the adult the leaves are glabrous.

As might be expected, when the leaves of young plants are not so perfectly developed as in the adult, they are often of a more firm and rigid consistence. This is specially apparent in species varying according to the first type, in which there is deficiency in parenchymatous tissue, for instance, in *Ludia sessiliflora* and *Carissa Xylopicron*; but it is also apparent in plants varying after different types.

In 17 species then, belonging to as many genera, of 13 natural Orders, the heterophylly exists; and it is a fact of great significance that every * one of them is either endemic or Mascarene only, that is, one fourth of the whole endemic and Mascarene species on the island. Further, on considering the genera, we find that two of them are endemic, four are Mascarene alone, three extend to Africa, and of the remainder seven are cosmopolitan, and one Polynesian.

Our information regarding the variability of the plants of Mauritius and Bourbon is too slight to enable us to say whether an equal amount of variation occurs there. But certainly some of the Mascarene species, which vary in Rodriguez, present, as I have already noticed, the same amount and kind of variation in these islands though in other cases the heterophylly may not be to such an extent. So that I think there can be little doubt that the heteromorphism in foliage is a feature of the whole Mascarene Flora.

In concluding this subject it is of interest to note that *Hibiscus* (*Paritium*) *tiliaceus* is not heterophyllous in Rodriguez, though it is recorded as such from Africa (Oliv. Flor. Afr. Trop. i., p. 208). A plant of *H. tricuspis*, a South Sea Islands species growing in the Saharampore gardens, is described † as having sent up from a

* I must qualify this. One species, *Ludia sessiliflora*, passes into Africa.

† Bell in Trans. Bot. Soc. Edinb. VII. 565. King in Linn. Soc. Journ. XV. 83.

rooting decumbent branch a plant with entire leaves very different from the parent, and indeed like those of *H. tiliaceus*. Prof. Thiselton Dyer suggests that *H. tricuspis* is an insular form of *H. tiliaceus*, which I think is not at all improbable. But it is strange that in Rodriguez, where heteromorphism is so prominent a feature, *H. tiliaceus* does not exhibit the peculiarity; although I may remark there are two distinct varieties of the tree on the island, which I have noticed under the species.

Such is the aspect and nature of the vegetation of Rodriguez, and a consideration of the Flora leads us, I think, to the following conclusions :—

1. It is a small Flora, and fragmentary.

2. It is that of a dry rather than of a moist region, as is exemplified in the paucity and nature of some groups, such as Ferns, Orchids, and the abundance of such others as Lichens.

3. It is an insular Flora, as indicated by—

   a. The relative proportion of species, genera, and orders.

   b. The almost total absence of indigenous annuals.

4. Its facies is tropical.

5. It is essentially Mascarene, though possessing a fair amount of individuality.

6. It presents affinities with the Floras of many other parts of the globe. Its strongest relationships are with the African, but it has also very strong Eastern connections, and some close American and Polynesian affinities.

7. Many species exhibit a great amount of variation, but within certain sharply defined limits.

Our knowledge of the Flora of all the other Mascarene Islands is as yet too scant to allow us to adjudge the exact extent of the affinities subsisting between the Floras of the individual islands of the group. But enough may be learned from what I have indicated of the vegetation of this single island to point strongly in the direction of their being fragments of a once more extensive Flora, which has been gradually broken up by geological and climatic changes. How far the geological evidence bears this out is indicated elsewhere.