

The Flora of Madagascar.
By the Rev. RICHARD BARON, F.L.S., F.G.S.

[Read 1st November, 1888.]

(With MAP.)

It may now be said with perfect truth that the vegetable productions of Madagascar have been, though not thoroughly, very extensively explored, and that the majority of the plants inhabiting the island are known to science. The country has been traversed by botanists in many different directions, its highest mountains have been ascended, its lakes and marshes crossed, its forests penetrated, and large collections of plants have been made from time to time, which have been examined and described in various publications. Our knowledge of the flora of Madagascar is due, in the first instance, to the labours of Flacourt, Dupetit Thouars, Commerson, Chapelier, Bernier, Lantz, Boivin, Pervillé, De Lastelle, Richard, Grevé, Hilsenberg, Bojer, Goudot, Bréon, Vesco, Grandidier, Thompson, Lyall, Ellis, and others, most of whom collected plants chiefly in the east, north, and north-west parts of the island. M. Grevé, however, gathered many, if not all, of his specimens on the south-west coast; while Messrs. Hilsenberg, Bojer, Lyall, and Ellis explored the botanical treasures of the eastern forests and the central highlands.

Within the last few years our knowledge of the flora of the island has been very materially increased; so that, whereas until recently less than 2000 species of plants were known, there are now [1889] named and described about 4100, though many of these will doubtless prove repetitions when they are properly compared and worked out. Dr. Rutenberg, who, in the year 1878, was probably murdered in Western Madagascar, and Dr. Hildebrandt, who died in Antananarivo in 1881, made extensive botanical collections, chiefly in the north-west and central parts of the country. Mr. Borgen, of the Norwegian Missionary Society, gathered, a few years ago, a valuable series of mosses, chiefly, if not entirely, on Ankaratra Mountain in Imerina. Miss Gilpin, of the Friends' Foreign Mission Association, and Mrs. Pool, of the London Missionary Society, have largely added to our knowledge of the fern-flora of the interior, especially of the forests; and Dr. Fox, of the Friends' Foreign Mission Association, has materially increased our knowledge of the orchids of Imerina. M. Humblot has recently explored the large forest in the north-

east of the island. Mr. Langley Kitching, Dr. Parker, and Mr. Cowan have discovered a considerable number of novelties in the Imerina and Betsileo provinces, and I myself have sent to Kew several cases of plants collected in various parts of the island. The greater number of the plants gathered by these various collectors in different localities have been examined by Mr. J. G. Baker, F.R.S., of Kew, and the novelties have been described by him in the Linnean Society's 'Journal' and the 'Journal of Botany.' Mr. Ridley has, however, described the new orchids and a few other plants. The French collections have been chiefly taken in hand by M. Baillon, and the German collections by Vatke, Freyn, Buchenau, Körnicke, Radlkofer, O. Hoffmann, and others.

Botanizing in Madagascar, as those who have travelled in wild and uncivilized regions in other parts of the world will easily believe, is a totally different experience from botanizing in England. Your collecting materials are carried by a native, who may be honest or not, in which latter case the drying paper will begin gradually and mysteriously to disappear, and the leather straps with which the presses are tightened will, one by one, be quietly appropriated. For a Malagasy bearer has a special weakness for leather straps, they being largely used for belts; so that both for the sake of your own comfort and the honesty of the men, the sooner you dispense with them the better. As for the dried plants themselves, they are secure from all pilfering; for of what possible use or value they can be, it puzzles the natives to conceive. You might leave your collection in a village for a whole month, and you would find on your return that it was still intact. If, after the day's journey, you sit down in a hut to change the sheets of paper containing the specimens, the villagers will be sure to come in and, standing round in a circle, gaze at you in mute astonishment turning over the plants so well known to them. After a few minutes' silent gaze, there will perhaps be a sudden outburst of amused laughter, or it may be a little whispering, which, if it were audible, would be something to this effect:—"Whatever in the world is the man doing?" or, "What strange creatures these white men are!" Some of the people doubtless think that you are a kind of sorcerer. For these dried plants—whatever can you do with them? You cannot eat them. You cannot make them into broth. You cannot plant them, for they are dead. You cannot form them into bouquets or wreaths,

for they are brown and withered. Is it surprising, then, if some of the natives think that you are dabbling in the black art, and that your plants, in the form of some strange and mysterious decoction, are to supply, it may be, a potent rain-medicine or a love-philter, or a disease-preventing physic? For among the natives themselves there are many herbal quacks, who, for a consideration, are able, not only to prescribe for the cure, and even prevention, of disease, but also to furnish charms against fire or tempest, locusts or lightning, leprosy or lunacy, ghosts, crocodiles or witches. The explanation which I have most frequently heard given, however, by the more intelligent of the natives as to the use of the dried plants is that the leaves are intended to be employed for patterns in weaving.

It is not, then, the natives that you have to fear in regard to your collections of plants, it is the weather—it is those heavy showers that, unless protected with extreme care by waterproof coverings, succeed in soaking your specimens and your drying paper, so that you have occasionally to spend half the night in some dirty hovel in doing what you can, by the aid of a large fire, to save your collection from destruction.

There are many discomforts, too, connected with botanizing in Madagascar, which it is not necessary to mention here. Suffice it to say that all the difficulties and discomforts are far more than outweighed by the pleasure you gain in the exercise—a pleasure which is enhanced by the consciousness that you are probably the first that has ever plucked the flowers from Nature's bosom in that particular locality, and that a large number of the specimens will probably prove to be new to science.

The fullest liberty to gather plants is allowed to the botanist. There are no laws which forbid his roaming at will amid the extensive forests, or which prevent him from breaking off whole branches of trees, or, if need be, even felling the trees themselves. In the open country, too, he may wander to the right hand or to the left, or in any direction he pleases, without having the uncomfortable feelings and apprehensions of a trespasser. The traveller may occasionally be prevented from collecting mineral specimens, but he is never prevented from gathering plants.

In Madagascar a considerable area is covered by primeval forest. On the eastern side of the island (that is, the part eastward of the highest range of mountains which forms the chief watershed) there is a forest which extends probably 800 miles

from north to south, almost, if not entirely, without a break, and which, if what is frequently stated be true, continues round the island, forming a complete, or almost complete, belt some distance from the sea. Whether the forest does thus actually encircle the island is somewhat questionable. There can, however, be no doubt that in the western part of Madagascar there are forests, mostly, I believe, narrow, which run for long distances in a northerly and southerly direction, but how far these are continuous is not yet known. In regard to the large eastern forest, it attains its greatest dimensions in the north-east part of the country. Here it reaches, in many places, from the mountains of the interior right down to the sea, and is probably 60 (in North Antsibanaka perhaps 80) miles in width. If we take its average width on the eastern side of the island at 30 miles and its length at 800, we get an area of 24,000 square miles of forest-clad country, not reckoning the innumerable patches of wood on the lower slopes. If we include these, probably two fifths, if not one half, of the eastern side of the island is clothed with trees. In the whole of Madagascar, if one may be allowed to make a rough estimate, there will not unlikely be an area of 30,000 square miles of forest-covered country; and if we reckon the area of the island at 228,000 square miles, about one eighth part of it may be said to be so covered.

It is grievous to relate, however, that the forests of Madagascar are being destroyed in the most ruthless and wholesale manner by the natives. Every year thousands of acres of country are cleared, the trees being burned to the ground, and that for no other purpose than to provide ashes as manure for a mere handful or two of beans, or a few cobs of Indian corn, or a little rice to be grown in the clearing. Moreover, all the towns and villages with Hova Governors are surrounded by palisades, frequently in a double series, made of the trunks of young trees, six or eight inches in diameter, fixed in the ground and placed in contact with each other. I once counted the trees that had been thus used in a certain village, and found that there were about 10,000. These trees, moreover, in many of these places are renewed every eight or ten years. When we remember the great number of villages thus provided with these palisades, we see that many hundreds of thousands of trees must be thus foolishly destroyed within a comparatively few years! Even where stone and lime or other suitable materials are abundant and close at hand, the people

prefer, or are obliged, to make these timber barricades, though the forest may be miles away, and though the trees have to be dragged along the ground or carried on men's shoulders, involving indescribable labour, hardship, and loss of time, and forming a much less impregnable and permanent barricade when finished than would be the case if the other materials were employed. All this seems to a European the very essence of waste and folly. But as though the timber was absolutely of no value, I once saw a road which had been cut through the forest for a long distance, for no other purpose than to allow passage for the dragging of a tombstone which had been quarried in the neighbourhood. To make this road no fewer than 25,000 trees had been cut down! Again, in getting planks for building purposes from the forests, there is most extravagant waste of timber. A tree is felled, and the native woodmen, not having saws, set to work with their hatchets on each side of it until the timber is reduced to the required thickness, and thus each tree, however large, supplies but a single plank. It is truly lamentable to see how the forests, containing, as they do, fine valuable timber, are, in these and other ways, being consigned to destruction. The laws of the country forbid the people to burn or otherwise destroy them; but these laws have been hitherto practically a dead letter, and consequently the area covered by trees is being rapidly reduced year by year. Happily there seems to be now, on the part of the Malagasy Government, a growing consciousness of the immense value of the extensive forests of the island, and, let us hope, a growing determination also to stop the fearful havoc at present going on.

There are now known in Madagascar, as has been already stated, about 4100 species of plants, and although there is still a considerable number of novelties in every fresh collection sent from the island, the percentage of such is rapidly diminishing, and I think it may with certainty be said that the great bulk of Madagascanian plants have already been gathered*, so that we

* In the Kew 'Bulletin of Miscellaneous Information' for May, 1888, it is stated that "the flora of the lowlands of Madagascar is very imperfectly known at present. Mr. J. G. Baker, Principal Assistant in the Kew Herbarium, has for many years devoted attention to the flora of the mountainous parts of Madagascar." This is only partially true. I am convinced that nearly all the vegetable forms found on the east coast of the island, and, at any rate, the majority of those found on the west coast, are now known to science. The flora of

now have sufficient data to enable us to draw a few general conclusions as to the character and distribution of this very interesting and remarkable flora.

The following figures will show at a glance the number of Natural Orders and genera of flowering plants represented in Madagascar as compared with those known throughout the world, according to Bentham and Hooker's 'Genera Plantarum':—

Total known in the World: Orders 200, Genera 7569.
,, ,, Madagascar: ,, 144, ,, 970.

The number of genera here given comprises those only that are indigenous to the island. If we include the numerous plants that have at one time or other been introduced, the total number of the genera would be raised probably to about 1050.

Of the 4100 indigenous plants at present known in Madagascar, about 3000 (or three fourths of the total flora) are, remarkable to say, endemic. Even of the Gramineæ and Cyperaceæ about two fifths of the plants in each Order are peculiar to the island. There is but one Natural Order confined to Madagascar, the Chlænaceæ, with 24 species, which, however, M. Baillon places under Ternstrœmiaceæ. Of Ferns more than a third are endemic, and of Orchids as much as five sixths, facts which in themselves are sufficient to give a very marked individuality to the character of the flora.

Of the 4100 known plants, there are:—

Dicotyledons	3492
Monocotyledons	248
Acotyledons*	360
	4100

the lowlands of the southern part of the country is least known of all. The plants, moreover, which Mr. Baker has examined are by no means only those "of the mountainous parts of Madagascar." They have been gathered in the lowlands as well as in the higher parts of the island, though not, perhaps, to so great an extent.

* This includes only the Filices, Equisetaceæ, Lycopodiaceæ, and Selaginellaceæ. The remaining Acotyledonous Orders are as yet very imperfectly known. Of Mosses about 250 have been described, and of Rhizophoræ 5.

The following list shows the number of species in the Orders most largely represented, and their percentage of the total flora (*i. e.* of the 4100 plants mentioned above):—

	No.	Per cent.
Leguminosæ	346	8·4
Filices	318	7·8
Compositæ	281	6·9
Euphorbiacæ	228	5·6
Orchideæ	170	4·1
Cyperacæ	160	3·9
Rubiaceæ	147	3·6
Acanthaceæ	131	3·2
Gramineæ	130	3·2

The Palms and Asclepiads are as yet imperfectly known. Of the former only 18 are described, although the island undoubtedly possesses a large number. Many Asclepiadaceæ plants have been collected, but the majority of them are still lying unnamed in various European herbaria.

Since Mr. Baker read his paper on “The Natural History of Madagascar” at the meeting of the British Association at York, in 1881, a goodly number of new genera of plants from the island have been described, so that the list he there gives needs many additions, so many in fact as to justify its revision. The number of endemic genera then known was about 80, it now reaches about 148. The following is a list of the endemic genera with the number of species as at present known:—

MENISPERMACEÆ	Rhaptanema (1), Spirospermum (1), Burasaia (4), Strychnopsis (1), Orthogynium (1), Gamopoda (1).
BIXINEÆ	Tisonia (3), Prockiopsis (1).
PORTULACÆ	Talinella (1).
GUTTIFERÆ	Sphærosepalum (1), Leioclusia (1).
CHLÉNACEÆ	Sarcolanena (4), Leptolanena (5), Xerochlamys (4), Eremo- lanena (1), Rhodolanena (4), Schizolanena (5), Sclero- lanena (1).
STERCULIACEÆ	Cheiolanena (1), Speirostyla (1).
TILIACEÆ	Ropalocarpus (4).
LINÆÆ	Rhodoclada (1).
MALPIGHIACEÆ	Microsteira (1).
GERANIACEÆ	Trimorphopetalum (1).
OLACINEÆ	Tridianisia (1), Petrusia (1).

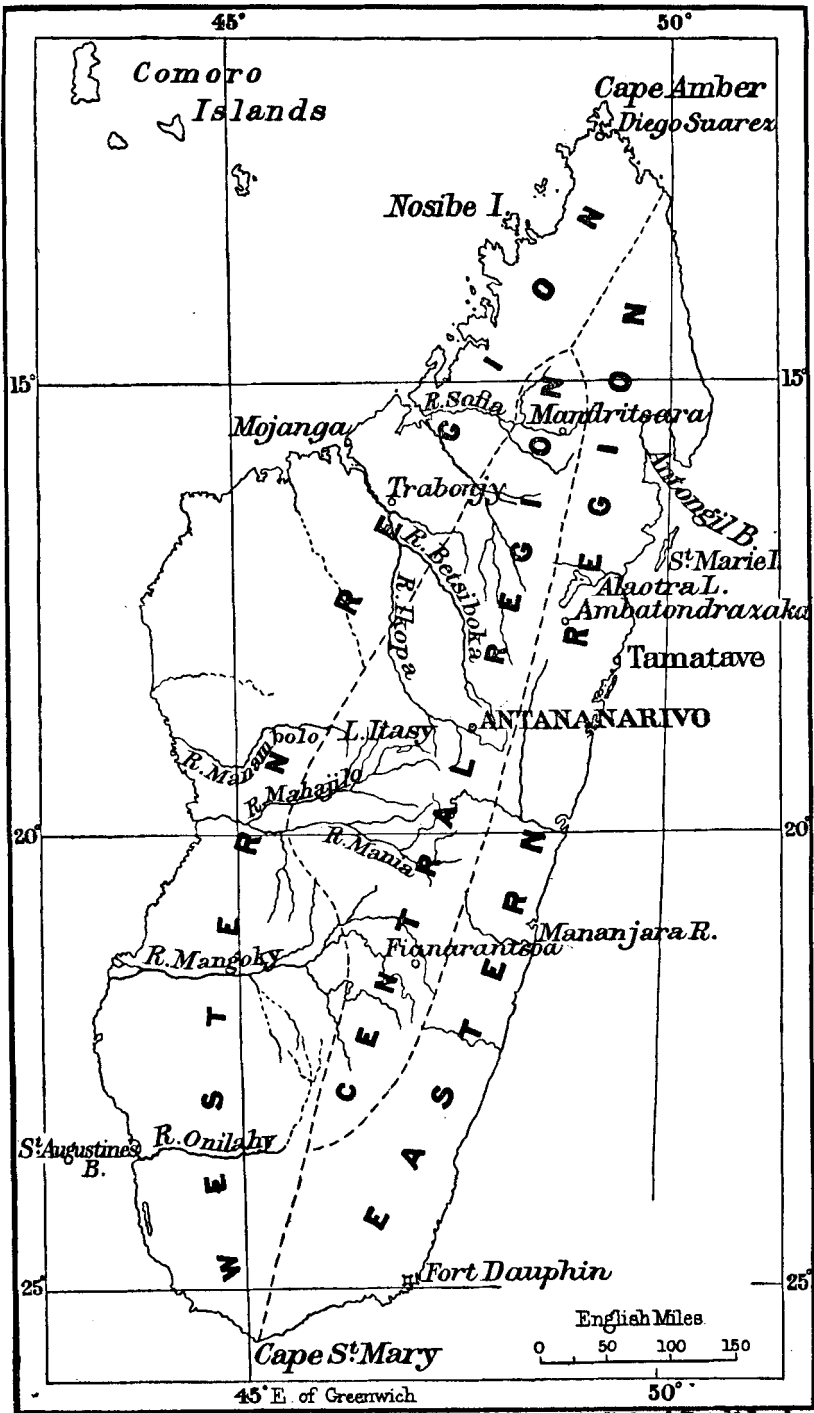
- CELASTRINEÆ** *Ptelidium* (1), *Polycardia* (5), *Macrorhamnus* (1).
SAPINDACEÆ..... *Macphersonia* (4), *Eriandrostachys* (1), *Pseudopteris* (1)
Tina (9).
ANACARDIACEÆ *Micronychia* (1).
LEGUMINOSÆ *Chadsia* (8), *Baukea* (1), *Colvillea* (1), *Neobaronia* (2),
Xanthocercis (1), *Aprevalia* (1), *Baudouinia* (2),
Brandzeia (1).
SAXIFRAGACEÆ *Grevea* (1).
HAMAMELIDEE..... *Dicoryphe* (14).
RHIZOPHOREÆ *Macarisia* (2).
COMBRETACEÆ *Calopyxis* (8).
MELASTOMACEÆ *Dichatanthera* (7), *Veprecella* (4), *Rousseauxia* (1),
Gravesia (3), *Rhodosepala* (1), *Amphoracalyx* (1),
Phornothamnus (1).
LYTHNACEÆ *Rotantha* (1).
SAMYDACEÆ *Calantica* (2), *Nisa* (7), *Asteropeia* (3), *Franchetia* (1).
TURNERACEÆ *Hyalocalyx* (1).
PASSIFLOREÆ *Deidamia* (5), *Physena* (2), *Hounea* (1).
CUCURBITACEÆ *Delognæa* (1), *Trochomeriopsis* (1).
UMBELLIFERÆ *Phellolophium* (1), *Anisopoda* (1).
ARALIACEÆ *Cuphocarpus* (2).
CORNACEÆ *Melanophylla* (2), *Kaliphora* (1).
RUBIACEÆ *Breonia* (1), *Carpalia* (4), *Paracephaelis* (1), *Tama-*
tavia (1), *Chapelieria* (1), *Nematostylis* (1), *Leio-*
chilus (1), *Saldinia* (2), *Schismatoclada* (4), *Holo-*
carpa (1), *Gomphocalyx* (1), *Payera* (1), *Solenixora*
(1), *Canephora* (1).
COMPOSITE *Centauropsis* (3), *Rochonia* (3), *Glycideras* (1), *Hen-*
ricia (1), *Synechodendron* (2), *Synecephalum* (1),
Sphacophyllum (1), *Micractis* (1), *Epallage* (6),
Apodocephala (1), *Astephanocarpa* (1), *Tennolepi*
(1), *Brachyachenium* (1).
CAMPANULACEÆ *Dialypetalum* (1).
MYRSINEÆ *Oncostemon* (20).
EBENACEÆ *Tetraclis* (1).
OLEACEÆ *Noronhia* (1).
APOCYNACEÆ *Craspidospermum* (1), *Plectaneaia* (1), *Mascarenhaisia*
(12).
ASCLEPIADEÆ *Harpanema* (1), *Pycnoneurum* (1), *Decanema* (1),
Pervillæa (1), *Vohemaria* (1).
LOGANIACEÆ *Hymenocnemis* (1), *Adenoplea* (2).
GENTIANACEÆ *Tachiadenus* (6).
CONVOLVULACEÆ *Bonamia* (1), *Humbertia* (1), *Cardiochlamys* (1).
SCROPHULARIACEÆ *Hydrotriche* (1), *Rhaphispermum* (1), *Tetraspidium*
(1).
ACANTHACEÆ *Periblema* (1), *Brachystephanus* (3), *Lasiocladus* (2),
Forsythiopsis (1), *Pseudocalyx* (1), *Monacho-chlamys*
(1).

VERBENACEÆ	Adelosa (1), Acharitea (1).
LABIATÆ	Tetradenia (1).
AMARANTACEÆ	Henonia (1).
PHYTOLACCACEÆ	Barbenia (1).
MONIMIACEÆ	Ephippiandra (1).
LAURINÆ	Ravensara (6), Potameia (2), Bernieria (1).
PROTEACEÆ	Dilobeia (1).
BALANOPHOREÆ	Cephalophyton (1).
EUPHORBIACEÆ	Leptonema (1), Comelia (2), Tannodia (1), Sphaerostylis (1), Didierea (1).
URTICACEÆ	Pachytroche (1), Ampalis (1).
ORCHIDEE	Bicornella (3).
LILIACEÆ	Rhodocodon (1).
PALMACEÆ	Dypsis (7), Bismarekia (1), Chrysalidocarpus (1).
CYPERACEÆ	Aerulus (1).
GRAMINEÆ	Pœcilostachys (2).

A few words regarding some of these endemic genera may not be out of place. The Chlœnaceæ are shrubs or trees, of which there are at present known 24 species comprised under 7 genera. The majority of the plants are found in Eastern Madagascar, all the *Rhodolœna* entirely so. The only species of *Sclerolœna* (*S. Richardi*) is found in the north and north-west, and the four species of *Xerochlamys* in the central, parts of the island. *X. pilosa* and *X. pubescens* are low wiry shrubs found on some of the hills and mountains of the interior, and are used by the natives in the manufacture of rum, but are said to cause vomiting of blood if used incautiously. They are known as "Hatsikana." Four of the species of *Leptolœna* occur in the large eastern forest, though *L. multiflora* is found also in the north-west part of the island, where *L. cuspidata* finds its home. *Leptolœna pauciflora* is a hard-wooded tree, from the trunk and branches of which, at a certain season of the year, there is a ceaseless dropping of water, sufficient indeed to keep the ground quite damp. This is caused by a number of hemipterous insects crowding together in a slimy liquid. May this afford an explanation of the similar well-known phenomenon exhibited by the Tamai-caspi, or Rain-tree, of the Eastern Peruvian Andes? The various species of *Rhodolœna*, which, with the exception of *R. altivola*, a semi-scandent shrub, are large trees, have handsome bright purple flowers about 2 inches in diameter; and *Sarcolœna grandiflora*, a tree found on the east, and probably also on the north-west, coast, possesses a white flower, also about 2 inches in diameter. *Cheirolœna linearis*

“is a close ally of the nearly extinct blackwood and redwood of St. Helena.” *Rhodoclada* is a doubtful member of the Order Linaceæ. *Trimorphopetalum* is an insignificant monotypic herb, nearly allied to *Impatiens*, inhabiting the streams in the forest on the eastern confines of Imerina. *Colvillea* is a plant possessing a long raceme of large handsome red flowers and somewhat sensitive leaflets. The two species of *Neobaronia*, noticed later on, are amongst the most remarkable trees in the whole island. The *Dichatantheræ* are forest trees, which are very beautiful when in full bloom. *Schismatoclada*, of which four species have been described, are shrubs or trees closely allied to *Cinchona*. The bark may possibly be worth analysis. *Pycnoneurum*, of which there is but one species, is an insignificant herb growing in the open country. The species of *Tachiadenus* are herbs with white or blue, crateriform, very long-tubed, corollas. *T. longiflorus* is said to possess purgative properties. *Dilobeia* is a large tree with leaves doubly bifid when young, and singly bifid when mature. It possesses diœcious inconspicuous flowers and a hard indehiscent oblong fruit about $1\frac{1}{4}$ in. long.

I have long been convinced that the flora of Madagascar may be divided into three Regions, and the data given below will, I think, justify the conviction. These Regions run in a longitudinal direction, following approximately the longer axis of the island. I propose to call them Eastern, Central, and Western. The Central Region includes the elevated plateau of the interior, that is to say, the territory bounded on the east by the western edge of the great forest, on the west by the high land, from which there is generally a more or less distinct descent into the western lowlands, on the north by Lat. 14° , and on the south by the tropic of Capricorn. Its limits may be more definitely traced thus:—From the tropic of Capricorn and Long. $46^{\circ} 50'$ the line runs about 15 miles east of Ihosy, thence to Ikalamavony, passes a few miles to the east of Ankavandra, turns north-east to Malatsy and Antongodrahoja, on to Isomboana, follows the range of mountains in the province of Befandriana, then up to a point halfway across the island in Lat. 14° ; coming south, it skirts the great forest until it reaches the mountain of Ambiniviny, it then takes a direction a little west of south until it again reaches the forest to the west of Ambatondrazaka (thus shutting out the great Antsihanaka province), which it skirts until it meets the tropic of Capricorn. By connecting the northern point with Port Lonky (or Loquez), and the southern point with the mouth of



Comoro
Islands

Cape Amber
Diego Suarez

Nosibe I.

15°

15°

Mojanga

R. Sofla

Mandritsara

Traborogy

ANTONÉIL B.

R. Bealokaka

REGION

S^t Mariel

Alaotra L.

Ambatondraxaka

Tamatave

ANTANANARIVO

L. Itasy

R. Mahabo

R. Mahajilo

20°

20°

R. Mania

R. Mania

R. Mangoky

Fianarantsoa

Mananjara R.

S^t Augustines
B.

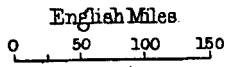
R. Onilahy

25°

25°

Fort Dauphin

Cape St. Mary



45° E. of Greenwich

50°

Stanford's Geog. Estab^s, London.

the River Andrahona, the divisions will be complete. All the territory to the west of the limits thus defined, with the island of Nosibé and all others near the mainland, constitute the Western Region, and that to the east the Eastern. Of course it is not pretended that these Regions can be defined with great accuracy, the divisions in the extreme north and south of the island between the Eastern and Western Regions, where they come in contact, being almost arbitrary. To what points north and south the Central Region should extend is also somewhat uncertain. The limits, however, of the three divisions as thus defined may be accepted as substantially correct. Inasmuch as these Regions range through about thirteen degrees of latitude (the Eastern and Western Regions being chiefly, and the Central entirely within the tropics), there must necessarily be considerable variation in the character of the vegetation in a northerly and southerly direction, but the variation is gradual and by no means so marked or distinct as it is in an easterly and westerly direction.

A few general figures (particulars will be given further on) will show that this division into Eastern, Central, and Western Regions is fair and natural. Of the 3178 *species* of plants whose localities I have been able to determine, there are:—

Common to the three Regions	100
" " Eastern and Central Regions . . .	190
" " Western and Central " ..	74
" " Eastern and Western " ..	128
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Peculiar to the Eastern Region	1108
Not peculiar to E. Region, but occurring in it . .	418
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Total in the Eastern Region	1526
Peculiar to the Central Region	872
Not peculiar to C. Region, but occurring in it	364
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Total in the Central Region	1236
Peculiar to the Western Region	706
Not peculiar to W. Region, but occurring in it	302
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Total in the Western Region	1008

In regard to the *genera* whose distribution I have been able to determine, there are :—

Common to the three Regions	184
„ „ Eastern and Central Regions	131
„ „ Western and Central „	32
„ „ Eastern and Western „	119
Peculiar to the Eastern Region	153
Not peculiar to E. Region, but occurring in it	434
	<hr/>
Total in the Eastern Region	587
Peculiar to the Central Region	130
Not peculiar to C. Region, but occurring in it	347
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Total in the Central Region	477
Peculiar to the Western Region	115
Not peculiar to W. Region, but occurring in it	335
	<hr/>
Total in the Western Region	450

There are, as shown by one of the preceding tables, 3178 species of plants whose distribution in the island I have been able to make out. There remain to be determined about 1000. Some of these occur in the extreme north of the island, both on its eastern and western sides, and therefore belong to both the Eastern and Western Regions; but as the boundary line between the two in this part of the country is more or less arbitrary, I have not taken them into account. The names of the parts of the island where other plants have been found are sometimes given in publications, but, owing to inaccuracy on the part of the collectors, or blunders in copying, I have been frequently unable to locate them, as, for instance, “Anànlsinàhina bozaba.” What part of the island is meant by such a blundering combination of letters it is impossible to say. “Chasak mountains” is also given in one publication. Possibly this is meant for Ankaratra mountains! These localities, when quite unrecognizable, I have also omitted.

Although the figures in the above and the following tables will doubtless require alteration when we become acquainted with the localities of the remaining plants, and though some of those which at present are only known to occur in one of the three Regions

will probably in the future be found in one or both of the others, the proportion of the plants peculiar to the respective Regions will not, I am convinced, be seriously disturbed, or the floras be shown to be even approximately identical.

In regard to the Orders, there are several which appear to be absolutely confined, and more which are nearly confined, to one or other of the three Regions, but these will be noticed further on.

The table on the next page shows the Orders most largely represented, and their percentage of the total flora, in the respective Regions. In this table the following facts are prominent:—In the Eastern Region the two most abundantly represented Orders are Filices and Compositæ; but the former are more than double the latter in the number of species, forming respectively 13·1 and 6 per cent. of the flora of this Region. It will be noticed that Filices do not appear in the second or third column at all, the reason being that I have not sufficient data for determining their relative positions. Possibly they might occupy the third or fourth place. In the Western Region the Leguminosæ stand at the head of the list, and these are followed by Euphorbiacæ; but the difference between the two is very great the proportion being about 5 to 2. The table shows that 18·8 per cent. of the flora of the Western Region consists of Leguminosæ. The Compositæ appear to be poorly represented, forming only 3·2 per cent. of the flora. In the Central Region, on the other hand, the Compositæ are at the head of the list, with a percentage of 13. Rubiaceæ, again, which one might expect to be largely represented in the Western Region, only form 3·2 per cent. of the flora. The Eastern, Central, and Western Regions therefore might, if we take the most largely represented Orders into account, be fairly called the Fern Region, the Composite Region, and the Leguminous Region respectively.

Turning to the table showing the distribution of the species, we see that 190 are common to the Eastern and Central Regions, and 74 to the Western and Central. But the majority of these may be reckoned as intruders which do not far exceed the boundaries of one or other of the two Regions to which they more properly belong.

EASTERN REGION.			CENTRAL REGION.			WESTERN REGION.		
No. of species.	Per cent.		No. of species.	Per cent.		No. of species.	Per cent.	
Filices	13.1		Compositæ.....	13.0		Leguminosæ.....	18.8	
Compositæ.....	6.0		Leguminosæ.....	8.4		Euphorbiaceæ.....	7.7	
Leguminosæ.....	5.2		Cyperaceæ.....	6.7		Tiliaceæ.....	3.6	
Rubiaceæ.....	4.9		Orchideæ.....	5.7		Compositæ.....	3.2	
Orchideæ.....	4.8		Graminæ.....	3.6		Rubiaceæ.....	3.2	
Euphorbiaceæ.....	3.7		Labiata.....	3.2		Sterculiaceæ.....	3.1	
Acanthaceæ.....	3.3		Euphorbiaceæ.....	3.0		Acanthaceæ.....	2.9	
Graminæ.....	2.6		Acanthaceæ.....	2.9		Malvaceæ.....	2.9	
Urticaceæ.....	2.5		Rubiaceæ.....	2.9		Convolvulaceæ.....	2.8	
Myrsinæ.....	2.2		Crassulaceæ.....	2.4		Cyperaceæ.....	2.7	
Cyperaceæ.....	2.1		Geraniaceæ.....	2.0		Graminæ.....	2.6	
Tiliaceæ.....	1.8		Malvaceæ.....	1.4		Anonaceæ.....	1.4	
Total of the above ...	793		682			552		
Total in the Region	1526		1236			1008		

There are only 100 plants common to the three Regions. A list of these may be here given:—(a) ENDEMIC: *Gomphia deltoidea*, *Piptadenia chrysostachys*, *Dichrostachys tenuifolia*, *Mimosa latispinosa*, *Combretum coccineum*, *Calantica cerasifolia*, *Vernonia grandis*, *Pterocaulon Bojeri*, *Emilia citrina*, *Ficus megapoda*, *Lagarosiphon madagascariensis*, *Cynorchis flexuosa*, *Dioscorea heteropoda*, *Raphia Ruffia*, *Arundo madagascariensis*. (b) MASCARENE: *Aphloia theæformis*, *Gouania tiliaefolia*, *Tristemma virusanum*, *Phyllanthus casticum*. (c) CHIEFLY TROPICAL AND WIDELY SPREAD: *Cissampelos Parcira*, *Nymphæa stellata*, *Polycarpæa corymbosa*, *Portulaca oleracea*, *Haronga madagascariensis*, *Sida rhombifolia*, *Urena lobata*, *Melochia corchorifolia*, *Waltheria americana*, *Triumfetta rhomboidea*, *Desmostachys Planchonianus*, *Cardiospermum Halicacabum*, *Paullinia pinnata*, *Crotalaria retusa*, *C. striata*, *Indigofera hirsuta*, *Sesbania punctata*, *Æschynomene sensitiva*, *Desmodium paleaceum*, *D. salicifolium*, *D. mauritianum*, *Abrus precatorius*, *Dolichos axillaris*, *Eriosema cajanooides*, *Cassia occidentalis*, *C. mimosoides*, *C. Tora*, *Mimosa asperata*, *Albizzia fastigiata*, *Ammannia senegalensis*, *Woodfordia floribunda*, *Jussiaea repens*, *J. erecta*, *Ludwigia jussæoides*, *Melothria tridactyla*, *Ageratum conyzoides*, *Psiadia dodonæefolia*, *Blumea lacera*, *Gnaphalium luteo-album*, *Eclipta erecta*, *Gynura cernua*, *Vinca rosea*, *Gomphocarpus fruticosus*, *Buddleia madagascariensis*, *Limnanthemum indicum*, *Heliotropium indicum*, *Ipomœa palmata*, *I. medium*, *I. leucantha*, *I. sessiliflora*, *Solanum nigrum*, *Scoparia dulcis*, *Buchnera leptostachya*, *Asystasia gangetica*, *Ocimum canum*, *O. suave*, *Hyptis pectinata*, *H. spicigera*, *Amarantus spinosus*, *Achyranthes aspera*, *Celosia trigyna*, *Polygonum serrulatum*, *Euphorbia pilulifera*, *E. indica*, *E. thymifolia*, *Phyllanthus nummularifolius*, *Dalechampia ternata*, *Sponia affinis*, *Obetia ficifolia*, *Boehmeria platyphylla*, *Smilax Kraussiana*, *Floscopa glomerata*, *Imperata arundinacea*, *Heteropogon contortus*, *Andropogon hirtus*, *Sporobolus indicus*, *Phragmites communis*, *Gleichenia dichotoma*, *Lycopodium cernuum*, *Azolla pinnata*, *Marsilea diffusa*.

It will thus be seen that the great bulk of the plants common to the three Regions are widely-spread tropical species. Of plants that reach right over the island from the east coast to the west coast there are but few. Of these may be mentioned *Haronga madagascariensis*, *Abrus precatorius*, *Dolichos axillaris*, and *Raphia Ruffia*. Perhaps the commonest and most widely spread species in the whole island is a fern, *Gleichenia dichotoma*.

The following is a list, though probably not complete, of the plants which I find to be common to the Eastern and Western Regions:—*Sauvagesia erecta*, *Burasaia madagascariensis*, *Ionidium buxifolium*, *Alsodeia latifolia*, *Placourtia Ramontchi*, *Sarcocœna grandiflora* (?), *Leptolœna multiflora*, *Schizolœna elongata*, *Sida cordifolia*, *S. urens*, *Hibiscus vitifolius*, *H. surattensis*, *H. tiliaceus*, *Thespesia populnea*, *Heritiera littoralis*, *Dombeya crassipes*, *D. parviflora*, *Cheirolœna linearis*, *Grewia viscosa*, *Corchorus olitorius*, *Erythroxyton pyriformium*, *Murraya exotica*, *Gomphia dependens*, *G. obtusifolia*, *Chailletia Dichapetalum*, *Ilex madagascariensis*, *Colubrina asiatica*, *Gouania aphrodes*, *Lœca guineensis*, *Schmidelia racemosa*, *Cossignia madagascariensis*, *Macphersonia madagascariensis*, *Gluta Turtur*, *Agelœa Lamarckii*, *A. Koneri*, *Æschynomene micrantha*, *Æ. patula*, *Desmodium umbellatum*, *D. triflorum*, *D. lasiocarpum*, *D. incanum*, *Clitoria lasciva*, *Teramnus labialis*, *Mucuna pruriens*, *Dioclea reflexa*, *Canavalia obtusifolia*, *Psophocarpus longepedunculatus*, *Pterocarpus advenus*, *Derris uliginosa*, *Sophora tomentosa*, *Cæsalpinia Bonducella*, *Colvillea racemosa*, *Poinciana regia*, *Cassia Petersiana*, *Bauhinia Hildebrandtii*, *Azelia bijuga*, *Trachylobium verrucosum* (?), *Cynometra madagascariensis*, *Entada scandens*, *Piptadenia Pervillei*, *Albizzia Lebbeke*, *Hirtella Thouarsiana*, *Brexia madagascariensis*, *Weinmannia madagascariensis*, *Rhizophora mucronata*, *Bruguiera Rheedii*, *Bryophyllum calycinum*, *Terminalia Catappa*, *Calopyxis malifolia*, *Pemphis acidula*, *Jussiaea villosa*, *Casearia nigrescens*, *Asteropeia multiflora*, *Modecca peltata*, *Physena madagascariensis*, *Pentas mussœndoides*, *Mussœnda arcuata*, *Guettarda speciosa*, *Canthium pallens*, *Sphæranthus sphenocleoides*, *Ambrosia maritima*, *Diospyros gracilipes*, *D. haplostylis*, *Tetraclis clusiæfolia*, *Alyxia erythrocarpa*, *Orchippeda Thouarsii*, *Alafia Thouarsii*, *Mascarenhaisia lisianthiflora*, *Strychnos spinosa*, *Ipomœa Pes-capræ*, *Striga hirsuta*, *Brachystephanus Lyallii*, *Justicia haplostachya*, *J. tenella*, *Lippia nodiflora*, *Stachytarpheta indica*, *Premna integrifolia*, *Ocimum gratissimum*, *Leonotis nepetæfolia*, *Piper subpeltatum*, *P. borbonense*, *Tambourissa religiosa*, *Euphorbia pyriformis*, *E. Boivini*, *E. adenopoda*, *E. tetraptera*, *Acalypha urophylla*, *Macaranga cuspidata*, *Tragia furialis*, *Dalchampia tamifolia*, *Urera acuminata*, *Casuarina equisetifolia*, *Crinum Hildebrandtii*, *Amomum Daniellii*, *Ravenala madagascariensis*, *Flagellaria indica*, *Typhonodorum Lindleyanum*, *Cyperus distans*, *C. dubius*, *Fuirena*

capitata, *Olyra latifolia*, *Coix Lachryma*, *Eleusine indica*, *E. ægyptiaca*, *Eragrostis ciliaris*, *E. Chapelieri*, *Nastus capitatus*, *Asplenium bipartitum*.

That the flora of the Central Region should differ widely from the floræ of the Eastern and Western Regions is accounted for by the great elevation above the sea of the central part of the island. But how are we to explain the existence of so great a difference between the floras of the Eastern and Western Regions, occupying, as they do, the same latitudinal and altitudinal positions, for of the 2206 plants found in the Eastern and Western Regions only 128 (not reckoning the 100 occurring in all the three Regions) are common to both? I believe the explanation to be simple. The central elevated plateau of the island, which runs from north to south, is undoubtedly of very great antiquity, having existed not improbably from Palæozoic times, and has therefore always formed a barrier between the floras of the Eastern and Western Regions. The floras therefore, even if they were formerly similar, which is doubtful, have had abundance of time to become differentiated in character; and if they were originally different, they have been kept, by the existence of the mountain barrier, distinct to the present day.

The flowering season in Madagascar, generally speaking, is from October to January, but November and December are the months in which more especially the great majority of plants are in bloom. In no part of the year, however, does the climate become sufficiently winterly to cause more than a comparative cessation in the flowering of plants, and very few of the trees and shrubs shed their leaves even in the coldest season. Very many species are in flower for six or eight months, and a goodly number all the year round. Of the latter may be mentioned *Solanum erythracanthum*, *S. auriculatum*, *Geranium simense*, *Cassia occidentalis*, *Rubus rosafolius*, *Tristemma virusanum*, *Emilia citrina*, *Lobelia serpens*, *Scoparia dulcis*, *Achyranthes aspera*, and *Euphorbia splendens*.

There are comparatively few plants having beautiful flowers in Madagascar. There are no meadows anywhere in the island that can at all compare with our English meadows for floral beauty. Neither do the forests supply what is lacking in the meadows. Any one entering a Malagasy forest with the anticipation of seeing innumerable beautiful flowers would be utterly disappointed, for they are extremely rare. There are indeed pretty

flowers in the woods and in the fields, but they have to be looked for; they are so few and far between that they very rarely produce any marked effect in the landscape. Of the plants with beautiful flowers, the first place must be given to the Orchids. *Angræcum sesquipedale*, *A. Ellisii*, *A. superbum*, and some other species of *Angræcum* have long occupied a high position in orchid culture. In the interior of the island there are two or three striking ground orchids. One of these, *Cynorchis flexuosa*, has a flower with a pretty yellow labellum; another, *Disa incarnata*, which grows in marshes in Eastern Imerina, has a very handsome compact spike of brilliant scarlet flowers; and a third, *Disa Buchenaviana*, found on the hillsides of Eastern Imerina near the forest, has a spike of most beautiful blue flowers. In the Anokay plain I have occasionally seen the pretty yellow-flowered *Thunbergia alata*. In the open country in the central parts of the island *Vinca rosea*, with its pretty rose-coloured corolla, is common, as is also *Commelina madagascariensis*, with its delicate petals of a very rich blue colour. *Euphorbia splendens*, an inhabitant of a few of the higher rocky hills, and extensively used for hedges in Imerina, has a flower with scarlet or yellow bracts. *Clematis Bojeri* (with its varieties *C. oligophylla* and *C. trifida*), the only erect *Clematis* in Madagascar, and *Tachadenus longiflora*, belonging to the Gentian Order, and having a large white corolla with a tube about four inches long, occur frequently on the hillsides of the interior of the country. *Tachadenus platypterus*, found in East Betsileo, is similar to the last mentioned, but has a blue corolla. A small tree, which occurs sparingly on the western slopes of Ankaratra, *Dombeya longicuspis*, has a pretty red flower. *Aristea Kitchingii*, a marsh plant, and *A. angustifolia* possess very pretty blue flowers. *Harpagophytum Grandidieri*, a shrub belonging to the Order Pedalinea, and found to the north-west of Mandritsara, has bunches of gorgeous red flowers proceeding from a tuft of leaves at the ends of the branches. Among other plants found in Central Madagascar which are noteworthy for their floral beauty may be mentioned *Sparmannia discolor*, four species of *Salvia*, found in the higher parts of Vakin' Ankaratra; *Tristellateia madagascariensis*, a climbing plant with spikes of rich yellow flowers; *Vitis microdiptera*, *Agauria salicifolia*, three species of *Pachypodium*, and two or three species of *Sopubia*. *Stenocline inuloides* is a small shrub with pretty flowers, and is strongly scented, though no

plant in the island probably possesses so strong or sweet a scent as *Stenocline incana*, one of the shrubs known by the natives as "Rambiazina." The prettiest flowers found in the eastern forests belong probably to species of *Rhodolena*, *Dichæanthera*, *Impatiens* (especially *I. Lyallii*), and various Acanthaceous plants. On the east coast there are the *Ixora odorata*, *Stephanotis floribunda*, *Poinciana regia*, *Astrapæa Wallichii*, and *Sarcolena grandiflora*. *Hemistemma Aubertii* is a shrub with large striking yellow flowers, which is found from Eastern Imerina to the east coast. In Alaotra Lake the well-known *Lotus* of the Nile occurs. In the western part of the island there exist several species of *Ipomæa*, with variously coloured flowers; also *Gloriosa virescens*, *Kigelia madagascariensis*, a shrub or small tree with large red trumpet-shaped flowers, and *Combretum coccineum*, a shrub covered in the season with abundant brilliant scarlet flowers. Scattered about the country in various places there are several species of *Crinum*; and *Buddleia madagascariensis*, a beautiful shrub with panicles of golden yellow odoriferous flowers, is common almost everywhere. This list might of course be considerably enlarged.

A few particulars may now be given with regard to the character of the three botanical Regions.

THE EASTERN REGION.

The Eastern Region occupies the narrow strip of country lying between the Indian Ocean and the great mountain-range which runs almost the whole extent of Madagascar, and forms the chief watershed of the island. This strip of territory averages probably 60 or 70 miles in width, and is over 800 miles long from north to south. It consists, for the most part, of a littoral belt, behind which is a tract of hilly country succeeded by several mountain-ranges. The littoral belt is not more than a few feet above the sea-level, and has doubtless been formed, not by elevation of the land, but by the silting up of sand by the sea, aided by the wind. It varies much in width, but, I believe, never exceeds more than eight or ten miles. It consists of numerous very slightly elevated grass-clothed sand dunes parallel with the sea-coast, with numerous lagoons and swamps occupying the hollows. The tract of country to the west of the littoral belt ranges from 100 to about 2500 feet above the sea, and consists of innumerable rounded hills thrown together in wild confusion, reminding one,

as has been frequently remarked, of a suddenly congealed stormy sea. To the west of this tract again there rise two or three mountain-ranges running, with more or less continuity, almost the whole length of Madagascar, the highest and the most westerly of which rises about 4500 feet above the sea. And as there are three stages in the physical features of the country from the sea to the highest range of mountains, so there are, more or less corresponding with them, three botanical zones; for although there is no distinct break in the flora, it varies considerably according to elevation. Moreover, in a Region ranging through 12 degrees of latitude, it is not surprising if we find considerable variety in the character of its vegetation, according as we approach or recede from the equator. Notwithstanding this, however, the Region is substantially one.

The soil, with the exception of the sandy littoral belt and alluvial deposits in the great Anka and Antsihanaka plains and along the courses of the rivers, consists almost wholly of decomposed rocks of the crystalline schist series, especially gneiss. Granite and basaltic rocks here and there also make their appearance*.

The region is traversed by numerous short rivers which rise in the hill-ranges to the west. Many of these rivers, in their attempt to discharge themselves into the sea, form lagoons. These lagoons, which constitute so prominent a feature in the character of the east coast, exist almost continuously for a distance of about 300 miles.

There is a copious supply of rain on the eastern side of Madagascar. This is due to the south-east trade-winds, which, coming from the Indian Ocean, precipitate the greater part of the moisture with which they are laden on the forest-clad slopes before reaching the higher plateau of the island. The only statistics we have in regard to the rainfall of the Eastern Region are those given by Mr. Shaw for the year 1882. He says that at Tamatave the amount of rainfall for that year was 94·94 inches. There can be no doubt, however, that the Region generally possesses a much higher rainfall than any other part of the island, the probability being that the average annual fall reaches from 90 to 100 inches, or even more.

* For further particulars of the Geology of the island see my paper, "Notes on the Geology of Madagascar," in the 'Quarterly Journal of the Geological Society' (Vol. xlv. Part 2, No. 178).

The temperature of the Region of course varies considerably according to elevation and latitude; but statistics are altogether too scanty to be of much service. Mr. Shaw tells us that at Tamatave "the greatest amount of heat registered by the insulated solar radiation thermometer was on the 22nd December, when it stood at 163°. The highest temperature in the shade in a good circulation of air was 93°, which it attained on 24th December and 15th and 25th January. The lowest temperature during the night was 58° on 28th June, and 9th and 10th July."

Of the three botanical Regions into which I have divided the island, the Eastern is by far the most abundantly clothed with vegetation, although probably the number of species of plants which it contains does not greatly exceed that of the Central or Western Regions. Probably no less than two fifths of its area is covered with dense impenetrable continuous forest. The greater part of the country not thus covered is to a large extent occupied by innumerable patches of wood, once probably forming part of the great forest; and even where there are no such patches, vegetation is profuse.

As will be seen from the table on page 260, the Ferns occupy the most prominent position in the flora of the Eastern Region, their proportion being as much as 13·1 per cent. With this exception, there is no Natural Order unduly represented. Compositæ and Leguminosæ come next to the Ferns; but these constitute only 6 and 5·2 per cent. respectively of the flora. Neither is there any genus of plants unduly predominant. The flora, as is the case also with the other Regions, is not characterized by any special or predominant forms of vegetable life. The Guttiferæ, Rutaceæ, Melastomaceæ, Araliaceæ, Myrsinæ, Loganiaceæ, Monimiaceæ, Laurinæ, Balanophoreæ (2 spp.), and Loranthaceæ are almost confined to this region; the Cactæ (2 spp.), Goodenoviæ (2 spp.), Nepenthaceæ (1 sp.), Coniferæ (1 sp.), Proteaceæ (2 spp.), and Cycadaceæ (1 sp.) entirely so. The genera most abundantly represented are:—*Asplenium* (33 species), *Vernonia* (32), *Polypodium* (25), *Dombeya* (19), *Nephrodium* (17), *Ficus* (17), *Angræcum* (16), *Hypoestes* (16), *Danais* (15), *Acrostichum* (15), *Cyperus* (14), *Viscum* (13); then come *Hibiscus*, *Grewia*, *Oncostemum*, *Diospyros*, *Cyathea*, and *Davallia*, with 12 species each; *Elaeocarpus*, *Weinmannia*, *Ardisia*, *Clerodendron*, and *Loranthus*, with 11 each; *Medinilla*, *Liparis*, and *Lycopodium*, with 10 each; *Desmodium*, *Eugenia*, *Panax*, and

Ipomœa, with 9 each; *Erythroxyton*, *Gærtnera*, *Solanum*, *Vitex*, *Macaranga*, *Pandanus*, *Bulbophyllum*, *Pteris*, and *Lomaria*, with 8 each; *Symphonia*, *Impatiens*, *Evodia*, *Helichrysum*, *Peperomia*, *Tambourissa*, *Croton*, *Panicum*, *Pilea*, and *Selaginella*, 7 each; *Garcinia*, *Toddalia*, *Gomphia*, *Crotalaria*, *Æschynomene*, *Oldenlandia*, *Psychotria*, *Senecio*, *Justicia*, *Plectranthus*, *Dypsis*, *Polytachya*, *Mystacidium*, and *Trichomanes*, 6 each; *Sida*, *Elæodendron*, *Cassia*, *Embelia*, *Polygonum*, *Piper*, *Habenaria*, *Cynorchis*, *Hymenophyllum*, and *Pellœa*, 5 each.

The narrow littoral belt contains perhaps the most attractive scenery in the whole island, its soft green sward and numerous clumps of trees and shrubs giving quite a park-like aspect to the country. It might almost be said to constitute a botanical sub-region in itself, so many are the forms of vegetable life found here which do not occur elsewhere in the island. Not only so, but even the very coast-line possesses numerous trees and shrubs peculiar to itself; and any one coming from the interior of the country must be struck with the great and sudden change in the flora when he gets within about a hundred yards of the sea. Here is to be found the tall fir-like *Casuarina equisetifolia*, or beef-wood tree; the beautiful-leaved *Catophyllum Inophyllum*, which yields the oil known in India as Pinnay oil; the *Sarcocœna grandiflora*, one of the finest of the Chlænads; *Afzelia bijuga*, known to the natives as "Hintsina," and affording a useful wood; *Trachylobium verrucosum*, which supplies the Gum Copal exported from the island (the east coast of Madagascar probably being its original home, from whence it has spread to Africa and other places); *Brexia madagascariensis*; *Terminalia Catappa*, the Indian almond, with its large leaves reddening in their decay on the remarkably horizontal branches; *Terminalia Fatrœa*; *Barringtonia speciosa* and *B. apiculata*; *Fœtidia obliqua*; *Ixora odorata*, with its beautiful clusters of delicate white fragrant flowers; *Sœvola Kœnigii* and *S. Plumieri*; *Tanghinia venenifera*, the celebrated Tangena shrub, the juice of whose apple-like fruit or nut was formerly, and doubtless in some places still is, used in the Tangena ordeal as a means of testing the innocence or guilt of accused persons; *Cœsalpinia Bonducella*; *Stephanotis floribunda*, with its well-known lovely large white flowers; the beautiful endemic fern-palm, *Cycas Thouarsii*, from which I believe the natives obtain a kind of false sago. Among herbs may be mentioned *Vinca trichophylla*, *Tachadenus carinatus*, and

Ipomœa Pes-capræ, which straggles far and wide on the sand of the sea-shore. There are also a few as yet undescribed palms. The cocoa-nut palm frequently occurs near villages, where it has been planted; but it is not a native of the island.

Not confined to the sea-coast, but found within the littoral belt, the most prominent vegetable forms are the following:—Several species of *Pandanus*, more especially *P. concretus*, an exceedingly common screw-pine. Another species of screw-pine, probably unknown to science, exists abundantly in the swamps. Its leaves, which are about 4 feet long by 6 or 8 inches wide, are employed, to the exclusion of almost everything else, for wrapping round packages carried from the coast into the interior of the country, and prove effectual in protecting from the rain. They are also extensively used (as are probably also those of *P. concretus*) by the Betsimisaraka and other tribes for the walls and the thatch of their huts. The widely spread *Hibiscus tiliaceus*, which yields so valuable a fibre, is also common here. The natives say that its large flowers are yellow in the morning and red in the evening, which phenomenon I have never seen recorded elsewhere, though I think the native statement is probably correct. *Poinciana regia* also is said to occur in this part of the island. Mr. Ellis describes it as a tree “rising sometimes to the height of 40 or 50 feet, and between the months of December and April presents, amidst its delicate pea-green pinnated leaves, one vast pyramid of bunches of bright dazzling scarlet flowers.” The *Astrapæa Wallichii*, a shrub or small tree growing along the sides of streams, is also striking for its beautiful bunches of flowers. Sir Joseph Paxton and Dr. Lindley say that it is “one of the finest plants ever introduced; and when loaded with its magnificent flowers, we think nothing can exceed its grandeur.” The *Brehmia spinosa* also inhabits this part of the island, its large, orange-like, hard-shelled fruit possessing a flavour by no means disagreeable. Along the sides of the lagoons and marshes in scattered places may be found the curious pitcher-plant, *Nepenthes madagascariensis*. It is a shrub about 4 feet high, whose jug-shaped pitchers, 4 or 5 inches in length, contain abundant water and numerous insects. *Ouvirandra fenestralis*, the beautiful lace-leaf plant, one of the most curious and remarkable of vegetable phenomena, abounds in the rivers of this part of the country. It is, however, by no means confined to this littoral belt; it exists throughout the Eastern Region, and is found,

though not so commonly or so abundantly, in the streams of the high plateau of the island which forms the Central Region. In the marshes are to be found, among numerous other plants, the widely spread *Typha angustifolia*, which is known as "Vondrona." This also occurs in the central parts of the island, where in some places, notably Antsirabe, it is cultivated for the sake of the potash which it yields. Another plant common in the marshes is *Lepironia mucronata*, known by the natives as "Penja." It is a sedge belonging to the Order Cyperaceæ, and is used largely by the native women in the manufacture of sugar-bags which are exported to Mauritius. Straw hats are also made of it. In the north-east of Madagascar, probably not far from the sea, is to be found a liana belonging to Leguminosæ, which has the longest, though not the finest, flower of all the known members of this extensive Order of plants. The total length of the flower, which is probably yellowish, is 30 to 32 centimetres. The plant belongs to the genus *Bauhinia*, and has been named by M. Baillou *B. Humboldtiana*. In the western part of this littoral belt are to be seen here and there woods composed of a tree known as "Sanga" (lit. a bunch of hair on the front part of the head), from the fact of its bearing the branches near the summit. What the tree is I do not know, but not improbably it is a species of *Weinmannia*. Several beautiful Orchids are found on the east coast, of which, however, two only, remarkable for their abundance and beauty, need here be referred to, *Angræcum superbum* and *A. sesquipedale*. The former, with its long spike of large and numerous flowers, which are in blossom in June and July, is extremely abundant and beautiful. Whatever else may escape the notice of the traveller, this magnificent Orchid, seated in large numbers on many of the shrubs and trees, forms far too striking an ornament to be passed by unheeded. The *A. sesquipedale*, remarkable for the length of its spur, is not so common as *A. superbum*; nevertheless it is comparatively abundant, generally choosing, I believe, as its habitat, trees which overhang the rivers or lagoons.

To the west of the littoral belt comes that portion of the Eastern Region which I have spoken of as hilly country, consisting, as it does, of innumerable rounded hills. It reaches from about 100 to 2500 feet above the sea. In this second zone the flora begins to assume a different aspect from that of the littoral belt. I can only here notice a few of the vegetable forms which, from their

prominence or peculiarity, impress their mark upon the landscape. There is, first of all, that remarkably elegant bamboo, the *Nastus capitatus*, which, in many places, completely covers the hillsides and gives quite a character to the scenery. It waves its bent head gently and gracefully with every breath of air, and, with its bright green constantly nodding plumes, affords one of the most striking and beautiful vegetable phenomena in the whole island. This, or a similar species, also occurs, though by no means so abundantly, in the north-west part of Madagascar. Other hillsides in this second zone are almost exclusively occupied by *Psiadiado donææfolia*, known to the natives as "Dingandingana," a composite shrub. In the months of September, October, and November this shrub is covered with orange-yellow flowers, producing, from their abundance, a bright cheerful effect in the landscape. It is also found in the Central and Western Regions, but is much less frequent than in the Eastern. *Rubus rosæfolius* is a shrub also found plentifully in this part of the island. It is common about villages and in some of the valleys, and extends westwards as far as the Central Region, where, however, it occurs sparingly. It seems to be in flower and fruit throughout the year; its large red fruit, though somewhat deficient in flavour, being by no means unacceptable. The plant is found also at the Cape, and is common in Tropical Asia. In the more open places the shrub *Leea speciosa* is to be met with. Among epiphytic plants apparently confined to this intermediate zone may be mentioned two species of the American genus *Rhipsalis*:—*R. horrida*, endemic in Madagascar, and the widely spread *R. Cassytha*, occurring in the Mascarene Isles generally, in Tropical Africa, Ceylon, and Tropical America. The curious *Pothos Chapelieri*, a plant only found in Madagascar, may also commonly be seen here, with its paddle-shaped leaves, climbing to great heights up the tree-trunks. It is, I believe, limited in its range to the woods on the lower slopes of the eastern side of the island. Another member of Aroideæ is the *Typhonodorum Lindleyanum*, a gigantic Arum endemic in Madagascar, and growing on river-sides and in marshes to the height sometimes of 12 or 15 feet, and possessing a large white spathe of more than a foot in length. It is also common in the western parts of the island. The natives occasionally use the fruit as an article of food. Among the plants which are abundant in individuals in this intermediate zone may be mentioned *Urena lobata*,

Haronga madagascariensis, *Mussaenda arcuata*, *Scoparia dulcis*, *Sabicea diversifolia*, *Emilia amplexicaulis*, *Elephantopus scaber*, the last of which, in some parts of the Tanala country, grows so abundantly as seriously to impede travelling, various species of *Sida*, *Clitoria lasciva*, with its large, beautiful, shell-like, blue flowers, and *Piper subpeltatum*, both of which are also found in Western Madagascar, and *Orchippeda Thouarsii*, known to the natives as "Kaboka" or "Kangarano," a small tree with abundant milky juice, and a fruit (often two together) about the size of an apple. The tree grows in almost all the warm valleys from the coast to an elevation of about 3000 feet above the sea, as also in the valleys of the western part of the island. But perhaps among the plants most abundant in individuals, *Amomum Daniellii*, the Malagasy Cardamom, occupies the most prominent place. It commences in the littoral belt, but reaches its maximum development at an elevation of from 2000-3000 feet above the sea, in some places almost covering the whole country. This also is one of the plants common to the Eastern and Western Regions. Finally, the famous "traveller's tree," *Ravenala madagascariensis*, finds its most congenial home in this intermediate belt, though it occurs also in the north-west of the island. The tree ranges from the sea-coast to the height of about 1500 feet, after which it begins rapidly to disappear. At an elevation of about 1000 feet it is extremely abundant, much more abundant in fact than any other tree, and with its twenty or thirty large leaves arranged on the summit of the stem like a gigantic fan, is the one striking and peculiar feature in the vegetation. It is not found so much in the forests as on the hillsides in the open country. Its uses, like its native names, are various. The stem yields an edible substance, probably a sweet liquid. The leaf-sheaths contain a supply of pure cool water, from which peculiarity indeed the tree derives its name of "traveller's tree," though, as a matter of fact, it generally grows where fresh cold water is obtainable in abundance. The blade of the leaf, very similar to that of the banana, is largely used by the natives in building their frail huts, and, while still green, as substitutes for spoons, plates, and tables. The tree is known to the Betsimisaraka as "Ravinala," "Ravimpotsy," and "Fontsy." Among other tribes it is called "Bemavo," "Bakabia," and "Akondrohazo." In the whole of Madagascar, where it is endemic, there is no more remarkable vegetable form than the "traveller's tree," and certainly none

which affects so much the aspect of the vegetation. The Rofia palm (*Raphia Ruffia*) is also abundant in many of the valleys.

Proceeding westward we reach the third and last stage in the Eastern Region. It consists chiefly, as I have said, of long, more or less continuous, mountain-ranges, which are, for the most part, covered with dense impenetrable forest. Although we still meet with many vegetable forms found on the two lower platforms, there is a considerable change in the character of the vegetation, innumerable trees, shrubs, and herbs here gradually making an appearance which are not found on the lower slopes. The forest, as before remarked, probably occupies two fifths of the entire Eastern Region and is remarkable for its great variety of plant forms, there being no single species, genus, or Order of plants predominant over the rest, or which influences to any great degree the general physiognomy of the vegetation.

A few of the vegetable denizens of this upper zone may be here referred to. The Guttiferæ are represented by about half a dozen species of *Symphonia* and *Garcinia*, some of which yield a kind of gamboge used by the natives for various purposes. Of Sterculiaceæ there are several species of *Dombeya*; and of Tiliaceæ several species of *Grewia*. Belonging to Geraniaceæ there occur some six or eight species of *Impatiens*, one of which, *I. Lyallii*, possesses sufficiently attractive flowers to render it "very suitable to introduce for horticultural purposes." Myrtaceæ has 9 species of *Eugenia*. The Melastomaceæ are chiefly confined to this upper belt and consist of the genera *Dionychia*, *Tristemma*, *Dichætanthera*, *Phornothamnus*, *Veprecella*, *Gravesia*, and *Medinilla*. A few of the members of this Order are handsome shrubs or trees, among which may be specially mentioned *Dichætanthera arborea* and *D. oblongifolia*. The Order Araliaceæ is also almost entirely confined to this forest area, and consists, for the most part, of species of *Panax* and *Cussonia*. As for Rubiaceæ the genera most largely represented are *Danais* (15 spp.) and *Schismatoclada* (4 spp.), a genus closely allied to *Cinchona*. The Myrsineæ also find their headquarters in this higher belt, being represented by a goodly number of *Ardisia* and *Oncostemum*. Here, too, is the special home of the plants belonging to Loganiaceæ, comprising several species of *Gaertnera*, *Nuxia*, and *Anthocleista*. One species of *Anthocleista*, *A. rhizophoroides*, is remarkable for its very large cabbage-like leaves. Its Malagasy name is "Landemy," and it supplies a native

remedy for malarial fever, though whether or not it is an effectual one I cannot say. Acanthaceæ are well represented by species of *Justicia* and *Hypoestes*, and some of the prettiest flowers to be found in the forests belong to plants of this family. *Strobilanthes madagascariensis*, though not remarkable for its beauty, is very common in the deepest parts of the forests. The natives know it as "Belohalika." Of Piperaceæ there are several species of *Piper* and *Peperomia*; *Piper borbonense* and *P. pachyphyllum* affording the natives a kind of Cubebs pepper. The Loranthaceæ inhabit these upper forests almost exclusively. There are about a dozen species each of *Loranthus* and *Viscum*. Of Euphorbiaceæ there are a goodly number of *Euphorbia* and *Macaranga*. Of Urticaceæ there are a dozen or more species of *Ficus* and several of *Pilea*. Of Scitamineæ there are among others the well-known *Maranta arundinacea*. It is found in the forests, but I am not aware that the natives know it as one of the plants that yield arrowroot. It is not an indigenous plant, but is a native of America. The Palms contain some half-dozen species of *Dypsis* and one or two of *Phloga*. Ferns are abundant in the forest, and the tree-ferns, of which about 20 are known, chiefly belonging to the genus *Cyathea*, give a special charm to the vegetation.

A large number of trees in the forests afford valuable timber, among which may be mentioned the following:—Various species of *Weinmannia*, known to the natives as "Lalona," especially *W. Bojeriana*, *W. minutiflora*, and *W. eriocarpa*; several species of *Elæocarpus*, as *E. rhodanthus*, *E. quercifolius*, and *E. dasyandrus*, all of which, with others belonging to the same genus, are known as "Vanana" or "Voanana"; one, if not more trees, belonging to the genus *Elæodendron*, which the Malagasy call "Hazondrano." "Valanirana" (*Nuxia capitata*) and "Lambinana" (*N. sphærocephala* and *N. terminalioides*) also afford timber much used in house-building. There are also several species of *Macaranga*, called by the natives "Mokarano," as *M. obovata*, *M. alnifolia*, *M. myriolepida*, and *M. ferruginea*, the last of which supplies abundant resin, the nature of which is unknown. Then there is a species of pine, *Podocarpus madagascariensis*, called by the natives "Hetatra," the only species of the Pine Order (Coniferæ) known in the island. It affords a valuable timber much used in house-building. It is not, as stated in the Kew 'Bulletin of Miscellaneous Information' for May, 1888, "doubtfully native," but truly so. The genus *Tambourissa* contains two

or three small trees known as "Ambora." *Dalbergia Baroni*, and probably one or two other members of the genus, which the Malagasy know as "Voamboana," supply a very useful and valuable wood much used by the natives in the manufacture of furniture, &c. *Neobaronia phyllanthoides* is a very remarkable tree with compound phylloclades, from the edges of which spring small bright purple papilionaceous flowers and a coriaceous and indehiscent pod about an inch and a half long. Its native name is "Harahara," and it affords an extremely hard wood used for various purposes. (*N. xiphoclada*, also called "Harahara," possesses similar wood, but it is found in the Central Region.) *Dilobeia Thouarsii* also supplies a hard wood used in carpentry and house-building. It is known as "Vivaona." Then there are several species of *Diospyros*, but whether any of them yield ebony I cannot say. *Diospyros haplostylis*, *D. megasepala*, and *D. sphaerosepala* are found in the forest east of Antsihanaka. *D. gonoclada* occurs somewhere between Imerina and the sea, and *D. fusco-velutina* is found on the east coast. *Tetraclis elusiæfolia*, an endemic genus of Ebenaceæ, probably also supplies a useful wood. There are also several trees known by the generic term "Varongy" (not *Calophyllum Inophyllum*, as given in some publications, for this is the "Foraha"), which supply wood much used in house-building. One of these is *Ocotea trichophlebia*, belonging to Laurineæ. Another tree affording a useful wood is "Famelona," but apparently it is as yet unknown to science.

Among trees or shrubs supplying useful products, &c., are *Landolphia madagascariensis* and *L. gummifera*, climbing plants from which is obtained the india-rubber exported from the island; *Urophyllum Lyallii*, which is probably the shrub known by the Malagasy as "Fatray," which yields a bark used by them in the manufacture of rum; *Ravensara aromatica*, called "Havozoman-gidy," with very aromatic bark, probably also used in the manufacture of rum. Another tree, possibly also a species of *Ravensara*, with the native name "Havozomanitra," possesses a strongly but agreeably aromatic bark (or wood?). The "Nato" tree (possibly *Labramia Bojeri*), found in certain localities, affords a bark largely employed by the natives in dyeing. A tree with a large delicious fruit is the "Voantsimatra" (*Salacia dentata*?), which would doubtless be a welcome novelty to gardeners. *Elaeocarpus sericeus* also deserves mention, as its young leaves when pressed and dried form the beautiful objects known as "gold leaves." A

bamboo known as "Volotsangana" (*Cephalostachyum Chapelieri*) is one of the most useful of all the vegetable products found in the forests. It is used by the natives for all sorts of purposes, which it would be wearisome to enumerate.

THE CENTRAL REGION.

The Central Region, whose boundaries have been already defined, occupies the elevated plateau of the interior. Its height varies from about 2500* to 8500 feet, the average possibly being about 4000. Speaking generally the Region consists of bare, brown, desolate, undulating moorlands which, from their lack of verdure, are extremely monotonous and dreary. Trees and shrubs are few and far between; green grass is only occasionally to be seen; and flowers possessing much beauty are scarce. There are, however, a few localities here and there to which this description will not apply, but these are mere oases in the great wilderness. The valleys in some places contain a few shrubs and trees, and several of them in the western portion of the Region are almost filled with the shrub *Smithea chamaechrista*. A few patches of forest are also occasionally to be found, but they are so few and so small as to produce little change in the dreary aspect of the country. The Region for the most part is covered with coarse, wiry, brown grasses growing chiefly in tufts. Among the most common of these grasses are *Pennisetum triticoides*, *Aristida Adscensionis*, *A. multicaulis*, *Setaria glauca*, *Andropogon Schœnanthus*, *A. hirtus*, and *A. Cymbarius*. The last two, especially *A. Cymbarius*, grow so thickly and to such a large size (10 or 12 feet) in many of the uninhabited portions of the western part of the Region as to render travelling almost impossible.

The Region includes numerous mountains, among which is Ankaratra, the highest in the island. It is an old much denuded volcano, and is therefore composed of lava, chiefly basaltic, which has flowed from the mountain and covered an area of country probably not less than 1500 or 2000 square miles. In some places there are large alluvial tracts, but with these and a few other exceptions the soil consists of decayed gneiss and allied rocks, for the Central Region, as is the case also with the Eastern Region, is occupied by Crystalline (probably Archaean) schists, chiefly gneiss. The Region, having been dry land for many geological periods, has suffered extensively from denuda-

* The Mandritsara valley is even less than that.

tion, and the rock, in many parts, has decayed to a depth of nearly 200 feet. The many rivers and streams, unceasingly at work, have wrought, in the course of ages, great changes; the river Kitsamby, to the west of Ankaratra, may perhaps be specially mentioned, for the enormous gap it has made in the surface of the country.

I have long been convinced that the soil of Madagascar has been far too highly praised; probably in the western parts of the island, where the rocks are sedimentary, the soil, in many places, would be suitable for agriculture; but in Central Madagascar especially, where the soil consists chiefly of decayed gneiss, it cannot be said to be, as a rule, fertile.

The temperature of the Region varies of course with elevation and latitude. At Antananarivo (the Capital), Mr. Richardson, of the London Missionary Society, has taken observations for some years back, and from figures which he gives ('Antananarivo Annual,' No. xi. pp. 394-396) we learn that, in the year 1887, the greatest heat registered in the shade by a self-registering barometer at a height of 4540 (4700?) feet above the sea was on the 6th of November, when it reached 85° Fahr. The coldest day seems to have been August 23rd, when the mercury, at its highest, reached 54°. The next coldest day was June 15th, the mercury standing at 56°. The hottest nights were in January, when the mercury on several occasions did not fall below 70°. The coldest night was on June 16th, the temperature being 38°.

The rainy season occupies the five months from November to March, but during only about a hundred days is there any rainfall, and on many of these the downpour is slight. As a rule the rain commences in the afternoon, about 3 o'clock, and lasts for two or three hours, though sometimes much longer. The time in which there is the greatest rainfall is from about the middle of December to the end of February. During the seven months of the dry season rain very rarely falls. In the year 1887 only 8.37 inches fell in these months, and more than half of that was in September and October. Mr. Richardson, who has for a long time registered the rainfall at the Capital, tells us that the average for the seven years 1881-1887 was 53.46 inches.

The Central Region has been much more thoroughly explored botanically than either of the other two Regions, and it may be safely said that there are comparatively few novelties left to

reward future explorers. Herbs and small wiry suffruticose plants preponderate in the flora, trees and shrubs being comparatively few. Of the 1236 species found in the Region about 900 belong to the former and 336 to the latter: that is to say, about three fourths of the plants are herbaceous or suffruticose. In the Eastern Region, on the other hand, and probably also in the Western, more than half of the flora is composed of trees and shrubs.

Another peculiarity of the flora of the Central Region is that, as might be expected, it is of a more temperate character than that of either of the other two Regions. Anonaceæ scarcely seem to occur; Guttiferæ have but one or two representatives; Piperaceæ are rare; Palms do occur, but they are by no means abundant. It is much the same with other tropical Orders. Many of the tropical genera, too, found in the other Regions are either entirely or almost absent in the Central. On the other hand, forms of a temperate type are comparatively abundant. Of Ranunculaceæ there are 18 species in the island (14 of *Clematis* and 4 of *Ranunculus*), about half of which are confined to the Central Region. All the Cruciferæ, of which, however, there are but 3 or 4 species, also belong to it, though *Cardamine africana* slightly oversteps the eastern boundary. At least 30 out of the 34 plants belonging to Crassulaceæ are confined also to this Region. There are only 4 members of Caryophylleæ known in the island, belonging to as many genera, only one of which is found outside the limits of the Region. Of the 18 species of Umbelliferæ the greater number occur here alone, *Peucedanum capense* and *P. Bojerianum*, as also *Carum angelicæ-folium**, being only found at a considerable elevation (6000 feet and upwards). Nearly all the members of Ericaceæ are also confined to this Region. The 5 species of Primulaceæ (4 of *Anagallis* and 1 of *Lysimachia*) also occur only here. Of the 24 species of Gentians nearly all are either confined within the limits of the Region or just exceed them. This is the case also with Iridææ. The only Madagascarian willow (*Salix madagascariensis*), and the only two representatives of the Sandal-wood Order (*Thesium madagascariensis* and *T. cystoseiroides*) also belong here, the willow being abundant at the east foot of Ankaratra mountain,

* This name and some others mentioned in the present paper will be found in Mr. Baker's "Further Contributions to the Flora of Madagascar" which follows this article.

and the latter being small plants confined to the highest mountains.

Here also we have such temperate or sub-temperate genera as the following, those marked with an asterisk being quite confined to the Central Region:—*Linum* *, *Pelargonium* *, *Lebeckia*, *Argyrolobium* *, *Genista* *, *Alchemilla*, *Crassula*, *Kitchingia* *, *Cotyledon* *, *Epilobium*, *Telephium* *, *Hydrocotyle*, *Pimpinella*, *Anthospermum* *, *Helichrysum*, *Stabe* *, *Cineraria* *, *Hieracium*, *Lactuca*, *Wahlenbergia*, *Vaccinium*, *Agauria*, *Philippia*, *Cynoglossum* *, *Halleria*, *Harveya* *, *Streptocarpus*, *Micromeria* *, *Selago* *, *Salvia* *, *Stachys* *, *Ajuga* *, *Corrigiola* *, *Chenopodium*, *Rumex*, *Aristea* *, *Geissorhiza* *, *Kniphofia* *, *Cesia* *, *Scirpus*, *Carex*, and *Bromus* *. In addition to these may be mentioned the following species:—*Viola abyssinica* *, *Geranium simense* *, *Caucalis melanantha* *, *Drosera ramentacea*, *Agauria salicifolia*, *Sanicula europæa*, *Hypericum japonicum* *, *Cotula multifida* *, *Limosella aquatica* *, *Juncus effusus* *, *Asplenium Trichomanes*, and *Aspidium aculeatum*.

Viola abyssinica, the only Madagascarian violet, is confined to the higher elevations of the Central Region. *Geranium simense*, the only *Geranium* in the island, exists abundantly in woody places. *Caucalis melanantha* inhabits the more elevated localities. *Drosera ramentacea* occurs everywhere in Central Madagascar in damp places. *Agauria salicifolia* inhabits chiefly the mountains of the interior, although it slightly invades the Eastern Region. *Sanicula europæa* also occurs in the higher portions of the island. The common bracken (*Pteris aquilina*) and *Lycopodium clavatum* occur also in great abundance, the former near, and the latter in and about, the forests of the interior. The royal fern (*Osmunda regalis*) and the male fern (*Nephrodium Filix-Mas*) are very plentiful in the Central and the higher portion of the Eastern Regions.

Very remarkable is the distribution of the first six of the above plants. The Violet occurs, as Mr. Baker has remarked, at the height of 10,000 feet in Fernando Po, and 7000 feet in the Cameroons in West Africa, almost under the equator, and in the mountains of Abyssinia, as well as in Madagascar from 6000 feet to the summit of Ankaratra, 8494 feet, the highest point in the island. Mr. Thompson has also recently discovered it on the mountain of Kilima-njaro. The *Geranium* has a precisely similar range of distribution. *Caucalis melanantha* occurs in Central

Madagascar, at an elevation of 9000 feet in Abyssinia, of 7000 to 8000 feet in the Cameroons, and of 7000 feet in Fernando Po; and has also lately been found by Mr. Thompson on Kilima-njaro. *Drosera ramentacea* (as also *Lonchitis occidentalis*, found in North-east Madagascar) appears on the mountains of Angola and Guinea; and *Agauria salicifolia* is common to the mountains of Madagascar, Reunion, the Cameroons, and the high land about Lake Nyassa. *Sanicula europæa* "occurs in Central Madagascar, the mountains of Abyssinia, the Cape, 4000 to 7000 feet in the Cameroons, 4000 feet in Fernando Po, and is widely spread through Europe and other parts of the north temperate zone." It may be added that *Cyanotis nodiflora* var. *madagascariensis* finds its home in Angola and Madagascar; and that *Commelina Lyallii*, a variety of *Commelina Mannii* of the Cameroons, also inhabits the interior of the island. These interesting facts point plainly to the existence of a former cold (or temperate) climate within the tropics, followed by a warmer period when these temperate plants, in order to maintain an existence, were compelled to retreat up the mountains, where they remain to the present day.

The genera most largely represented in the Central Region are:—*Helichrysum* (36 species), *Cyperus* (32), *Senecio* (31), *Vernonia* (22), *Habenaria* (20), *Philippia* (18); *Hypoestes* and *Cynorchis*, with 16 each; *Kalanchoe* (16), *Scirpus* (15); *Indigofera* and *Kitchingia*, with 14 each; *Oxalis*, *Crotalaria*, and *Euphorbia*, with 12 each; *Psorospermum* and *Ficus*, 11 each; *Hibiscus*, *Dombeya*, *Desmodium*, *Ipomœa*, and *Panicum*, 10 each; *Clematis*, *Impatiens*, *Mundulea*, and *Conyza*, 8 each; *Hydrocotyle*, *Stenocline*, *Polystachya*, and *Fimbristylis*, 7 each; *Polygala*, *Grewia*, *Vitis*, *Solanum*, *Stachys*, *Eulophia*, *Angræcum*, and *Aloe*, 6 each; *Gymnosporia*, *Eriosema*, *Rubus*, *Oldenlandia*, *Psiadia*, *Utricularia*, *Thunbergia*, *Salvia*, *Phyllanthus*, *Satyrium*, *Vellozia*, *Carex*, and *Andropogon*, 5 each.

Ankaratra, about 20 or 30 miles south-west of the Capital, is as has been already said, the highest mountain in the island, reaching to 8494 feet above the sea. It does not come within the snow-line, snow indeed being entirely unknown in the island. Ice is, however, occasionally seen in the winter season. As this mountain is the highest in the island, it may not be uninteresting if I give here a list of the plants which appear to be confined to it*, and which are endemic in Madagascar. It

* Some of these, and the list does not profess to be exhaustive, may possibly also occur on some of the other high mountains, such as Vavavato.

will be seen from the list that the flora of the mountain has a more or less temperate aspect. The plants are as follows:—*Clematis dissecta*, *Polygala mucronata*, *P. emirnensis*, *Oxalis xiphophylla*, *Impatiens trichoceras*, *Crotalaria orthoclada*, *Indigofera thymoides*, *I. pinifolia*, *Rubus pauciflorus*, *Alchemilla bifurcata*, *Kalanchoe pumila*, *K. brevicaulis*, *Dicoryphe viticoides*, *Rotala cordifolia*, *Telephium madagascariense*, *Hydrocotyle tussilagini-folia*, *Pimpinella ebracteata*, *Peucedanum Bojerianum*, *Panax confertifolium*, *Anthospermum polyacanthum*, *Vernonia inulæfolia*, *V. ochroleuca*, *V. scapiforme*, *Psiadia stenophylla*, *Helichrysum retrorsum*, *H. cryptomerioides*, *Stenocline jlaginoides*, *Aspilia Baroni*, *A. Bojeri*, *Hieracium madagascariense*, *Lightfootia subaphylla*, *Agauria littoralis*, *Philippia oophylla*, *P. pilosa*, *P. macrocalyx*, *Lysimachia parviflora*, *Anagallis peploides*, *Jasminum puberulum*, *Cynoglossum cernuum*, *C. discolor*, *Alectra pedicularioides*, *Tetraspidium laxiflorum*, *Hypoestes ascendens*, *Micromeria flagellaris*, *Salvia porphyrocalyx*, *Stachys oligantha*, *S. sphærodonta*, *Ajuga robusta*, *Corrigiola psammotrophoides*, *Euphorbia ensifolia*, *Croton emirnensis*, *Acalypha Radula*, *Aristea angustifolia*, *Kniphofia pallidiflora*, *Rhodocodon madagascariensis*, *Scirpus multicosatus*, *Cladium pantopodum*, *Carex sphærogyna*, *Stipa madagascariensis*, *Eragrostis brizoides*, *Cœlachne madagascariensis*, *Bromus avenoides*, and *B. arrhenatheroides*.

THE WESTERN REGION.

With the exception of Southern Madagascar, no part of the island is so little known as that included in this Western Region, especially perhaps the territory between Lat. 16° and Lat. 20°. The Region, as a whole, is not very mountainous. There is a mountain-chain, however, of no great height, known as Bongolava, which runs with remarkable regularity parallel to the longitudinal axis of the island for many hundred miles. To the west of this, again, there is the long mountain-range of Bemaraha parallel with Bongolava. But the Region, generally speaking, slopes very gradually down to the sea, and consists of wide, comparatively level or slightly undulating stretches of country, covered with coarse grass and innumerable groves and patches of wood. Running north and south for hundreds of miles, at a distance generally of eight or ten leagues from the sea, there are extensive forests, but how far these are continuous it is impossible to say. These forests, as a rule, are much less crowded with undergrowth,

and are therefore less impenetrable, than those on the eastern side of the island.

The country is drained by numerous rivers, of which the Sofia, Betsiboka, Manambolo, Tsiribihina, Kitombo (or Mangoky), and Onilahy, all of which take their rise in the mountains of the interior, are the largest. As for the geology of the country, the rocks apparently belong almost entirely to the secondary formations, and chiefly to the Jurassic and Cretaceous series; indeed the eastern boundary of the Region almost coincides with the limit of the sedimentary strata. As a rule these strata have been but little disturbed and, roughly speaking, have a very slight dip towards the west coast. They consist chiefly of sandstone and limestone, with beds of shale and clay.

The heat is much greater in the western than in the eastern part of the island, but what the temperature may actually be is at present unknown. In the north-west of the island in the month of November I have seen the mercury rise to 140° Fahr. in the sun; but as this was the highest figure on the thermometer, the actual heat was probably greater. In regard to the temperature of the south-western portion of the island, the Rev. A. Walen says:—"In the so-called rainy season the heat on the south-west coast is most intense and, in the middle of the day, is almost unbearable."

Very little also is known in regard to the rainfall of the Region, no record, so far as I am aware, ever having been kept. But there can be no doubt that there is much less rain in Western than in Eastern Madagascar, the moisture brought by the south-east trade-winds being almost entirely absorbed by the eastern mountains. Mr. Walen says:—"The soil of the country is fertile, but on account of the very small rainfall during the rainy season (there are frequently long droughts), it produces very often but little return to an agriculturist, being liable to failure of crops and years of scarcity. During the two years I spent on the coast there was scarcely any difference in the rainfall between the rainy and the dry seasons. The rain was very scarce indeed all the year round. Only slight showers occasionally fell in both seasons of the year, varied by some few heavy squalls from the north-west The rainy season (from October to March) is also the hurricane season. As to the amount of rain there is a great difference between the east coast and the west coast, the former of which gets a superabundance

of it all the year round. A year of scarcity has perhaps never been known on the east coast, but it is no uncommon thing on the west coast."

The flora of the Western Region is not yet so well known as that of the other two Regions, and the majority of the 1008 plants I have enumerated as belonging to the Region have been gathered in the north-west, from Lat. 16° 30' to Cape Amber (including the islands near the mainland, especially Nosibé), and in the country about Ankavandra in Lat. 19°. A few have also been collected in the south-west. The general aspect of the country as regards verdure is much less luxuriant than the eastern side of the island. Vegetation is least dense in that portion of it which adjoins the Central Region, the shrubs and trees being largely confined to the banks of the rivers and streams. The "Rotra," a large tree, which is a species of *Eugenia*, the "Sodindranto" or "Sohihy" (*Cephalanthus spathelliferus*), and a kind of "Lalona" (*Weinmannia lucens*) are the commonest of the trees which occupy the river-courses in this portion of the Region. The two former, however, seem to be abundant on the river-banks in all parts of Western Madagascar, but in the parts nearer the sea they are accompanied by numerous other shrubs and trees, which form a flora peculiar, or almost peculiar, to the river-sides.

The numerous warm valleys of the western part of Madagascar are chiefly occupied by the following trees and shrubs:—A species of *Ficus* (*F. cocculifolia*), *Orchippeda Thouarsii*, the *Eugenia* common on the river-banks, *Hibiscus phanerandrus*, *Alyxia lucida*, the Tamarind (*Tamarindus indica*), and some other trees and shrubs. Some of the valleys are almost exclusively occupied by the Rofia Palm (*Raphia Ruffia*), one of the most abundant trees in the island, though always found in valleys. In the elevated Central Region it exists sparingly, the climate being somewhat too cold for it. The Mango tree, escaped from cultivation, also frequently occurs in abundance in the warm valleys, and attains the dimensions of a very large tree. In marshy hollows and on river-sides the "Viha" (*Typhonodorum Lindleyanum*) is very common. The *Ficus* above mentioned, whose native name is "Adabo" or "Adabovavy"* , has a fruit

* Literally, "the female Adabo." Whenever there are two species of trees, shrubs, or herbs of similar outward appearance (which may or may not be botanically allied), the natives affix the word "vavy"=female, to the one with

from four to six inches in diameter. It is one of the very commonest trees in the western parts of the island, although it is chiefly confined to the valleys and the river-banks. A second species of *Ficus* (*F. sakalavarum*), very similar to this in outward appearance, known as "Adabolahy," but with a much smaller fruit, is also somewhat common, but by no means so abundant as the "Adabovavy." *Alyxia lucida*, a climbing shrub belonging to the Apocynaceæ, has a pod-like, bright scarlet fruit composed of a series of oblong joints. The natives call it "Andriambavifohy," and use the bark and leaves in the manufacture of rum. As for the Tamarind-tree, its original home is unknown. At the present time it occurs in Madagascar (in the Western Region only), Tropical Africa, India, North Australia, Mauritius, and Rodriguez. Now I am strongly of opinion that the tree is truly indigenous in Madagascar, for, in the first place, it does not merely occur (as introduced plants almost always do) near villages, or along the roadsides, or in scattered patches; it is equally distributed and widely spread throughout the whole of Western Madagascar, whether in valleys or on the open plains. It has, moreover, purely native names, which is not always the case with introduced plants. Its names are "Madilo" and "Madiro." It is also called "Kily," from which the word "Sikidy" (divination) is probably derived, the seeds of the tree being employed in the working of the divination board. For these reasons, but chiefly from the mode of its distribution, I am convinced that the tree is truly a native of Madagascar, and that, if it is not also indigenous in other countries, the western part of the island forms its original home. The Sakalava, it may be remarked, employ an infusion or decoction of the leaves as a vermifuge and as a remedy for disorders of the stomach; they also obtain from the tree a kind of black dye.

On the west coast, especially perhaps near the mouths of rivers, there are numerous and extensive mangrove swamps. One of the most common of the mangroves is the *Rhizophora mucronata*, which occurs on the sea-shore in many parts of the tropics of the Old World. The Malagasy name of the tree, as probably also of other mangroves, is "Ifonko."

the larger leaves (or occasionally larger fruit), and the word "lahy" = male, to the one with the smaller leaves (or smaller fruit). The reason for this I do not know, but it is the universal practice.

The Leguminosæ, as may be seen from the table on page 260, is by far the most abundantly represented Order in the Western Region, occupying as much as 18·8 per cent. of the flora. The Euphorbiacæ come next, but these are only represented by 7·7 per cent. The Compositæ, which in the Central Region comprise 13 per cent. of the flora, being the head of the list, as also Rubiaceæ, here stand at 3·2 per cent. There seem to be but two Orders, the Hydrophyllacæ (2 spp.) and Aristolochiacæ (1 sp.), which are confined to this Region. On the other hand, a goodly number of Natural Orders represented, though in some cases by but one or two species, in the other Regions, are entirely or almost absent from the Western Region. Rutaceæ, Cactæ, Goodenoviæ, Araliacæ, Vacciniacæ, Ericacæ, Primulacæ, Myrsinæ, Lentibulariæ, Selaginæ, Illecebracæ, Phytolaccacæ, Nepenthacæ, Protacæ, Balanophoræ, Santalacæ, Coniferæ, Cycadacæ, Salicinæ, Burmanniacæ, Irideæ, Hypoxidacæ, Naiadacæ, and Eriocaulonæ are apparently quite absent from the Region; and Ranunculacæ, Cruciferæ, Guttiferæ, Geraniacæ, Crassulacæ, Melastomacæ, Umbelliferæ, Campanulacæ, Loganiacæ, Gentianacæ, Scrophulariacæ, Gesneracæ, Labiatæ, Monimiacæ, Laurinæ, Loranthacæ, Urticacæ, and Liliacæ have in it but few representatives.

The most abundantly represented genera are:—*Grewia* (28 species), *Hibiscus* (21), *Ipomæa* (18), *Dalbergia* (18), *Euphorbia* (18), *Indigofera* (15); *Croton* and *Cyperus*, with 12 each; *Dombeya* and *Desmodium*, 11 each; *Bauhinia*, *Mimosa*, and *Albizzia*, 9 each; *Alsodeia*, *Buettneria*, *Erythroxylon*, *Mascarenhaisia*, and *Ficus*, 8 each; *Popovia*, *Polygala*, *Commiphora*, *Orotalaria*, *Terminalia*, *Homalium*, and *Acalypha*, 7 each; *Tristellateia*, *Æschynomene*, *Cassia*, *Phyllanthus*, and *Tragia*, 6 each; *Clerodendron* and *Macaranga*, 5 each. It will be seen from this that there is no genus of plants in the Region forming an undue proportion of the flora.

I shall now briefly refer to some of the trees and shrubs which most largely influence the vegetable physiognomy of the Region, or which, as affording valuable timber, or being otherwise remarkable, deserve special mention. Among the commonest trees and shrubs are *Ficus cocculifolia*, the Tamarind, the Rofia Palm (*Raphia Ruffia*), the "Rotra" (*Eugenia*, sp.), the "Sohihy" (*Cephalanthus spathelliferus*), and *Weinmannia lucens*, all of which have been already referred to. In addition to these there

are the following :—*Hyphæne coriacea*, a small, probably endemic, fan-palm, which is exceedingly abundant, in some places covering the whole face of the country. The natives call it “Satramira,” and use its fruit very largely in the manufacture of rum. Another fan-palm (probably a species of *Hyphæne* or *Latania*), called “Satrambe,” is also extremely common. It is a much taller tree than “Satramira.” The Sakalava often use its leaves with graceful effect in building their huts. Another fan-palm, a much larger one than the two former, though not so common, is that known as “Befelatanana” (=the big hand); it is possibly *Bismarckia nobilis*. None of these fan-palms occur in either the Central or Eastern Region, except in places where they have been planted. The “Sakoana” (*Sclerocarya caffra*) is also one of the commonest trees in the Region. It possesses an acrid edible fruit used, I believe, by the natives in the manufacture of rum. *Acridocarpus excelsus* is also widely spread. It has long, slender, straggling branches, and looks as though it had but recently given up the habit of climbing, common to so many members of its family. Its native name is “Mavoravina” or “Kirajy.” *Albizzia Lebbeck*, which the Malagasy call “Bonara” (=Bois Noir), *Brekimia spinosa*, *Urena lobata*, *Erythroxylon platyclados*, called by the natives “Tampia” or “Tampiana,” and *Phyllanthus Casticum* must also be ranked among the most common shrubs and trees of this part of the island. All the above live in the open country, and from their abundance and wide distribution give a distinct character to the general vegetable physiognomy of the Region.

Inhabiting this part of the island also is the *Eriodendron anfractuosum*, known as “Hamba” or “Moraingy.” It is a somewhat strange-looking tall shrub, a member of the family Malvaceæ. The natives use the hairs from the seeds in stuffing cushions; if, however, they get into the eye, they are said to injure it, if not actually to induce blindness. On the west coast a species of Baobab (*Adansonia madagascariensis*) is plentiful. Of this tree M. Baillon says :—“Son écorce est textile; elle sert à couvrir les cases et à faire des cordages. Le bois est tendre et spongieux; à l'époque de la végétation active, il fournit par incisions une sève qui n'est guère que de l'eau et qui est bonne à boire. Il y a, à Mouroundava, des maisons de commerce qui exploitent en grand les semences. M. Grevé ne dit pas quel usage on en fait; mais je suppose qu'il doit s'agir d'une extraction d'huile. Les fruits renferment outre les semences, une pulpe comestible,

analogue, sans doute, à celle du Baobab commun. Mais ce qu'il y a de remarquable, c'est que les maisons de commerce dont il est question exploitent aussi la portion la plus blanche et la plus molle de l'écorce. Peut-être est ce pour en tirer une substance gommeuse ou mucilagineuse, cette sorte de suc laiteux dont parle Bernier." The Malagasy names of the tree are "Reniala," "Bontona," and "Za."

Among the most common plants found in woody places may be mentioned the "Manary" (*Dalbergia trichocarpa*, and probably one or two other species of *Dalbergia*), which afford, I believe, a useful timber (exported to Europe?), and the "Amokombe" (*Gardenia succosa*), from which exudes a kind of gum. In similar places is to be found the "Agy" (*Mucuna axillaris*), a climbing plant which is remarkable for the very virulent stinging properties of the hairs which cover its pod. Not far from the sea grows the "Sorindrana" (*Sorindeia madagascariensis*), a tree with bunches of sweet edible fruit. On the west coast (as also on the east coast) occurs the *Guettarda speciosa*, the tree which yields the wood known by cabinet-makers as zebra-wood. The Sakalava call it "Tambaribarisa."

Of the trees and shrubs found in the forests of the Western Region we possess as yet little definite information, although a large number of them are now known to science. The well-known Malagasy ebony is apparently an inhabitant of these forests. Its wood is smuggled out of the country by the Sakalava, and exported to Europe. But to what species of *Diospyros* the ebony belongs has, I believe, never yet been ascertained. At present there are 22 species of *Diospyros* known in the island. Thirteen of these, if not more, are found in the Eastern Region. It is not unlikely that the tree (or trees) which supplies the ebony is one (or more) of the following:—*Diospyros gracilipes*, *D. toxicaria*, *D. Pervillei*, *D. parvifolia*, *D. lenticellata*, or *D. microrhombus*, the last of which is described as:—"Ebenier de Madagascar; son bois est superbe."

CHARACTER AND RELATIONSHIP OF THE MADAGASCARIAN FLORA.

Mr. Baker, in the paper he read at the meeting of the British Association at York in 1881, has described the general character of the flora of Madagascar, and has shown its geographical relationship. Of genera that are cosmopolitan he says that "nearly

all are represented in the island." As instances he gives the following:—*Cyperus*, *Panicum*, *Polypodium*, *Acrostichum*, *Asplenium*, *Pteris*, *Ficus*, *Piper*, *Phyllanthus*, *Croton*, *Loranthus*, *Psychotria*, *Indigofera*, *Vernonia*, *Solanum*, *Eugenia*, *Ipomœa*, *Vitis*, *Gouania*, *Hibiscus*, *Gomphia*, *Ochna*, *Desmodium*, *Crotalaria*, *Acalyphæ*, *Cleome*, *Capparis*, *Cassia*, *Dalbergia*, *Eragrostis*, *Commelina*, *Dioscorea*, *Dalechampia*, *Andropogon*, *Scleria*, *Kyllingia*, *Mimosa*, *Jussiaea*, and *Homalium*.

Of widely-spread species Mr. Baker reckons that there are in the island probably no fewer than 150.

Of tropical species widely dispersed through the Old World there are probably no less than 100 occurring in Madagascar. "Amongst these latter aquatic plants are represented by such species as *Nymphæa Lotus* and *stellata*, *Limnanthemum indicum*, and *Utricularia stellaris*; trees and shrubs of the muddy swamps of the sea-shore by the mangroves and their associates (such as *Rhizophora mucronata*, *Bruguiera gymnorhiza*, *Sonneratia alba*, *Lumnitzera racemosa*, *Thespesia populnea*, and *Avicennia officinalis*); and shrubs not especially maritime by such plants as *Schmidelia racemosa*, *Colubrina asiatica*, *Ormocarpum sennoides*, *Desmodium lasiocarpum* and *umbellatum*, *Premna serratifolia*, and *Securinega obovata*."

The close affinity of the flora with the floræ of the other Mascarene islands Mr. Baker illustrates by showing "the range of a few genera which are confined to the Mascarene group." As instances he mentions *Danais*, *Aphloia*, *Fœtidia*, *Obetia*, *Radamœa*, *Phyllarthron*, *Colea*, and *Stephanodaphne*.

Mr. Baker also shows that there is a close affinity between the flora of Madagascar and that of Tropical Africa, on the one hand, and the flora of the central elevated parts of the island with those of the Cape and the mountains of Central Africa, on the other. This he illustrates by instances too numerous to be here enumerated. There is, however, let me add, probably a closer alliance between the flora of Tropical Africa and that of the Western Region of Madagascar, than with the floras of the Central and Eastern Regions.

Finally, Mr. Baker shows that there is a slight special affinity between the flora of Madagascar and the floras of Tropical Asia and the Malay isles. This is evidenced by the existence in the island of, for example, *Cyclea madagascariensis*, *Murraya exotica*, *Nepenthes madagascariensis*, *Stephanotis floribunda*, *Strongylodon madagascariensis*, *S. Lastellianum*, *Hernandia pel-*

tata, *Azelia bijuga*, *Barringtonia speciosa*, *Alyxia erythrocarpa*, *Lophatherum geminatum*, *Strobilanthes madagascariensis*, *S. hispidula*, *Lagerstroemia madagascariensis*, *Eriocaulon fluitans*, and *E. fenestratum*, all of which, except the last four, are found in the Eastern Region, and several on the east coast only.

The data upon which the above affinities are based might now be considerably increased, but as further particulars would only serve to confirm the relationship of the flora as shown in the above paragraphs, it is needless to enumerate them.

In regard to the fauna of Madagascar, it has long been known that a considerable number of creatures living in the island at the present time are closely allied to American forms. This affinity is specially marked in some of the reptiles and insects. Now there is also, strange to say, a certain though slight amount of affinity between the flora of Madagascar and that of America. Of the genus *Omphalea*, for instance, belonging to the Order Euphorbiaceæ, there are 8 species, 7 of which belong to Tropical America and 1 to Madagascar. Of the genus *Pedilanthus*, belonging to the same Order, 2 are found in Madagascar, and all the rest (about a dozen) in tropical America. Of the Order Scitamineæ, again, the genus *Myrosma* has one species in Madagascar and 11 in tropical America. The well-known Malagasy "traveller's tree" (*Ravenala madagascariensis*), belonging to the Order Musaceæ, finds its representative in *Phenakospermum guianense*, Endl. (really a species of *Ravenala*), which inhabits N. Brazil and Guiana, and is the only other species of this genus. Of the grasses, *Echinolaena* has one species in Madagascar and one in Guiana and Brazil. *Lycopodium dichotomum*, of the Order Lycopodiaceæ, seems to be confined also to Madagascar and America.

Doubtless this list might be enlarged, but it is sufficient to show that there is a slight relationship between the flora of Madagascar and that of tropical America; and this relationship, whatever the explanation of it may be, is probably to be accounted for by the same causes as those which have brought about the affinity between the two faunas.

In considering the flora of Madagascar as a whole, one of the first things that strikes us is that the island must be of immense antiquity. About three fourths of the species and a sixth of its genera of plants are endemic! And this is as it should be; the genera have for the most part survived the untold ages that have elapsed since their first appearance, while the species have

been subjected to enormous modification. Such a very large amount of specific differentiation seems to me to point in the clearest manner to long isolation. The antiquity of the island is also abundantly evidenced by the remarkable character of its fauna, a subject, however, which need not here be discussed. At what period the island was connected with the adjacent continent it is impossible to state with certainty, but as Nummulitic limestone occurs on a great part of the west coast of Madagascar, there seems to have been probably no land connection in Eocene times; and as the inroad of the higher forms of mammals into South Africa from the Euro-Asiatic continent took place, as Mr. Wallace shows, probably in later Miocene or early Pliocene times, Madagascar must have been cut off from the mainland at least not subsequent to the later Pliocene period, as the absence of such mammals in the island proves. This would allow time for the migration of the mammals to South Africa, which would not unlikely keep pace with the gradual lowering of the temperature going on in the northern hemisphere. This also would explain the existence of the "comparatively cold period" succeeded by "a warm period," during both of which, or some part of which, as Mr. Baker points out in one of the propositions given below, Madagascar must have been joined to the mainland. For it is now well known that in the northern hemisphere in Tertiary time there was a gradual lowering of the temperature from that of a tropical to a temperate or even a cold climate. This being of course reversed in the Southern hemisphere, we should have a cold period followed by a warm one. It seems probable, therefore, that Madagascar was joined to the African continent during some part or parts or the whole of the Miocene (including Oligocene) and early Pliocene periods.

In summing up the character of the flora of Madagascar, Mr. Baker lays down the following propositions:—

1. "The flora of the tropical zone throughout the world is remarkably homogeneous in its general character, and to this general rule Madagascar furnishes no marked exception. There is no well-marked plant-type largely developed in the island which is not found elsewhere, and none absent that one might *à priori* expect.

2. "About one in nine* of the genera are endemic; but they

* More correctly about one in six.—R. B.

are all small genera, mostly belonging to the large Natural Orders, and closely allied to cosmopolitan generic types.

3. "There is a close affinity between the tropical flora of Madagascar and that of the smaller islands of the Mascarene group.

4. "There is a close affinity between the tropical flora of Madagascar and that of the African continent.

5. "There are a few curious cases in which Asiatic types which do not occur in Africa are met with in Madagascar, and these bear a very small numerical proportion to the great mass of the flora*.

6. "There is a distinct affinity between the flora of the hill-country of Central Madagascar and those of the Cape and the mountain-ranges of Central Africa."

The history of the island, as indicated by the plants, Mr. Baker sums up as follows:—

1. "A very early comparatively cold period, during which Madagascar was joined to the mainland. The plants which remain from this period now have their head-quarters in Cape Colony, and are found upon the high mountains of continental Africa and Madagascar. When I say cold, I mean a temperate climate, not very unlike ours at the present day.

2. "A warm period, during which (or some part of which) Madagascar was joined to the continent of Africa, and also to Mauritius, Bourbon, and the Seychelles. Shown by the present extension to Madagascar and the lesser isles of the characteristically tropical African species and genera.

3. "A lengthened period of isolation."

In the form of an Appendix I may here give a list of plants introduced into Madagascar by human or other agency which, though many of them have established themselves in the island and become naturalized, can scarcely be incorporated in the native flora.

INTRODUCED PLANTS.

Brassica campestris occurs in the Central Region; *Sinapis juncea*, Cent. Reg.; *Senebiera didyma*, Cent. Reg.; Arnotto

* I may here mention my belief, though I have not gone into the matter with sufficient care absolutely to prove it, that the Asiatic element in the Madagascarian flora is mostly confined to the Eastern Region.—R. B.

(*Bixa Orellana*), apparently subsponaneous in E., Cent., and W. Regs., in Imerina it is called "Sahy" (=bold), because, as I have been told by the natives, an infusion of its leaves invigorates people in dancing, public speaking, &c., and in former times was given to fighting-bulls to make them fierce; *Hibiscus Abelmoschus*, Cent. and E. Regs.; *H. Sabdariffa*, Cent. and E. Regs.; *Zizyphus Jujuba*, E. and W. Regs.; *Moringa pterygosperma*, E. and W. Regs., on the coast near villages; *Crotalaria fulva*, Cent. Reg.; *Dolichos axillaris*, Cent. and E. Regs., in some places escaped from cultivation; *Fagelia bituminosa*, *Cæsalpinia sepiaria*, largely planted throughout the island for fences and stockades round villages; *Hæmatoxylon campeacheanum*, E. coast, it is the Bois de Campêche, which yields logwood; *Cassia lævigata*, Cent. and E. Regs., chiefly near villages; *C. Sophera*; *C. Fistula*, N. Madag; *Parkinsonia aculeata*, E. coast; the Sensitive Plant (*Mimosa pudica*), subsponaneous on E. coast; *Leucæna glauca*, Cent. and W. Regs.; *Telfairia pedata*, *Opuntia ferox* (?), used largely throughout the island for fences and stockades; *Eupatorium triplinerve*; *Ipomœa purpurea*, Cent. and E. Regs., subsponaneous; *Ipomœa Bona-nox*, W. Reg.; *Solanum auriculatum*, Cent. and E. Regs., said by the natives to be of comparatively recent introduction; *S. Richardi*, E. Reg.; Cape Gooseberry, Cent. and E. Regs., common in woody places; *Nicandra physaloides*, Cent. and E. Regs.; Stramonium (*Datura alba* and *D. Tatula*), Cent. Reg., waste places; *Angelonia Gardneri*; *Martynia diandra*; *Barleria Prionitis*, Cent. and W. Regs., chiefly near villages; *Verbena bonariensis*, E. coast; *Vitex trifolia*, E. coast; *Amarantus hypochondriacus*, Cent. Reg., near villages; *Gomphrena globosa*, W. Reg.; *Chenopodium ambrosioides*, widely dispersed; *Rivina lævis*; *Myristica fragrans*; the Candle-nut tree (*Aleurites triloba*); *Jatropha Curcas*, throughout the island near villages; Jack-fruit and Bread-fruit; *Canna indica*, E. Reg., near villages; Guinea-grass (*Panicum jumentorum*), subsponaneous in E., Cent., and W. Regs.; *Pennisetum spicatum*, E. Reg.; and *Azolla pinnata*, E., Cent., and W. Regs.

Of plants that are probably introduced may be mentioned the following:—*Stellaria media*, Cent. Reg.; *Malva crispa*, Cent. Reg.; *Abutilon angulatum*, Cent. Reg.; *Hibiscus esculentus*, Cent. and E. Regs.; *H. diversifolius*, Cent. and E. Regs., rarely occurs except in hedges near towns and villages; *Clitoria ternata*, W. Reg. *Phaseolus Mungo*, W. Reg.; *P. adenanthus*, W. Reg.;

P. trilobatus, W. Reg.; *Pterocarpus Marsupium*, E. Reg.; *Poinciana pulcherrima*; *Acacia Farnesiana*, Nosibé; *Bidens leucantha*; *Lactuca indica*, E. Reg.; the Sowthistle (*Sonchus oleraceus*), Cent. Reg.; *Vinca rosea*, now widely spread, especially in Cent. Reg.; *Beaumontia grandiflora*; *Amarantus tristis*, Cent. and E. Regs.; *Myristica philippensis*, N. Madag.; *Phyllanthus distichus* and *P. Urinaria*; *Croton Tiglium*; *Pistia Stratiotes*; and the Ginger-grass (*Andropogon nardus*).

The trees and shrubs cultivated in gardens are too numerous to mention, but the following are among the most common:—*Garcinia Gerrardi*, Cent. Reg.; *Hibiscus Rosa-sinensis*, *H. mutabilis*; *Melia Azederach*; *Acacia heterophylla*; *A. podalyriæfolia*; *Eucalyptus Globulus*; *Callistemon lanceolatus*; the Passion-flowers, *Passiflora incarnata*, *P. cærulea*, and *P. suberosa*; *Luffa acutangula*; *Trichosanthes anguina*; *Zinnia elegans*; *Tugetes erecta*; *Plumbago zeylanica*; *Carissa edulis*; *Nerium Oleander*; *Petunia nyctaginiflora*; *Tecoma capensis*; *Gendarussa vulgaris*, used for hedges; *Stachytarpheta mutabilis*; *Verbena chamædrifolia*; *Salvia coccinea*; *Bougainvillea spectabilis*; the Camphor-tree (*Cinnamomum Camphora*), known by the natives as “Ravintsara”; *Agave Ixtli*; and *Furcraea gigantea*.

Of introduced fruits, cereals, vegetables, &c., there are:—The Chinese Litchi, on E. coast; Custard-apple, E. and W. coasts (?); *Anona senegalensis*, W. coast, probably introduced; *A. squamosa*; *Spondias dulcis*, E. coast; Cashew-nut, W. coast; Mango, mostly throughout the island; Loquat; Jamrosa; Pomegranate; Guava (common and Chinese, the former almost naturalized in some places); Papaw, E. coast; Banana; Avocado Pear; Orange; Lemon (*Citrus Aurantium*, almost naturalized in some places); Lime (?); Pineapple; Mulberry; Peach; Plum; Apple; Quince; Strawberry; Grapes; Figs (the last seven not being as yet largely cultivated). Then there are the common Indigos, *Indigofera tinctoria* and *Crotalaria incana*, both of which are subsontaneous; the Earth-nuts, *Arachis hypogæa* and *Voandzeia subterranea*; *Phaseolus lunatus*; *Vigna sinensis*; *Dolichos Lablab*; the Pigeon-pea (*Cajanus indicus*), largely cultivated, especially in South Betsileo, for silkworm-feeding; Peas; the Bottle-gourd (*Lagenaria vulgaris*); *Benincasa cerifera*; Melon (*Cucumis Melo*); Water-Melon (*Citrullus vulgaris*); Red Pumpkin (*Cucurbita maxima*); *Momordica Charantia*; Tilseed (*Sesamum indicum*); the Capsicums, *Capsicum frutescens* and *C. annua*;

Castor-oil plant; Cloves (?); the Egg-plant (*Solanum Melongena*); Vanilla; Henna dye (*Lawsonia alba* and *L. inermis*), N., N.E., and N.W. coasts; Hemp; Cotton (*Gossypium barbadense* and *G. herbaceum*); *Piper Betle*, E. coast; Tobacco; Turmeric (*Curcuma longa*); Cocoa-nut, sometimes planted on the coast; Arrow-root (*Tacca pinnatifida* and *Maranta arundinacea*); Millet (*Sorghum vulgare*, *S. halepense*, and *Panicum miliaceum*); the Bajree of India (*Pennisetum spicata*), cultivated in a few places; the Natchull or Ragee of India (*Eleusine coracana*), cultivated occasionally; Yams (*Dioscorea sativa* and *Colocasia antiquorum*, which latter is the Taro of the South Seas and the common "Saonjo" of the Malagasy); Wheat; Maize; Manioc; Rice; Sweet Potato; Sugar-cane; Coffee; Chicory (rare); Tea is being tried at the present time, but only, I believe, by the inexperienced natives; Potato; Cabbage; Turnip; Radish; Beetroot; Carrot; Onion; Celery; Parsley; Mint; Tomato; Watercress; Lettuce; *Spilanthes Acmella* and *S. oleracea*; and *Brassica juncea*.

Further Contributions to the Flora of Madagascar.

By J. G. BAKER, F.R.S., F.L.S.

[Read 1st November, 1888.]

(PLATES L.-LIII.)

THE following plants are the principal novelties contained in a large collection which the Rev. R. Baron brought home last September. They were collected principally on a journey through the North-west of the island and are more tropical in general character than the collections on which my previous papers have been based. As he has himself laid before us a general summary of the distribution of the plants which he has gathered, it is not necessary for me to say anything more than that the present set of plants does not materially modify any of the geographical conclusions which I have previously advanced.

PITTIOSPORUM CAPITATUM, n. sp.

P. ramulis glabris, foliis breviter petiolatis oblanceolato-oblongis acutis rigide coriaceis glabris, floribus in paniculam ramis multifloris dense cuspidatis dispositis, pedicellis brevissimis, sepalis oblongis glabris, petalis oblanceolatis calyce 3-4plo longioribus, staminibus brevibus, ovario piloso.