# INTRODUCTION

Field studies in Indian Botany is a question yet to be solved. An up-to-date information on the Taxonomy and Distribution of Indian plants requires the efforts of all those interested in the study of Plant Systematics. Research in Taxonomy leads to the publication of the plants of particular place in the form of floras and monographs. In recent years, we do hear about the thorough revision of Hooker's Flora of British India and Cooke's Flora of the Presidency of Bombay and preparation of new floras of those areas which are not explored at all in the past. Then, we have before us the most difficult part, not to say impossible, of finding of the correct identity and working out the nomenclature of plants! There is no book on nomenclature and up-to-date nomenclature of the plants is indeed a difficult enterprise, especially for a field worker, who spends most of his time away from the library. For this we have to work for years in the field and laboratory equipped with best literature on the subject, and the ultimate results will definitely help us to find out as to what plants of economic and medicinal importance is India rich in.

The Flora of Gujarat is indeed in need of precise and critical study. There is not a single flora based on modern lines for the state of Gujarat or even for its part. Of worth mention, Jayakrishna Indraji Thaker (1910) is the only person from Gujarat to have the honour of publishing the Flora of the Barda Hills in Kathiawar, Saurashtra, in Gujarati, one of the regional languages of India. Rev. Fr. E. Blatter (1908) wrote on the flora of Cutch.

Saxton, W. T. & Sedgwick, L. J. (1918) have to their credit the Plants of Northern Gujarat. During the present decade Rev. Fr. H. Santapau has contributed significantly to the Botany of Saurashtra and Dangs Forest, which is bound to turn out in future as the best reference on the systematic Botany of Gujarat.

With a view to contribute to our knowledge of the Flora of Western India in general and of Gujarat State in particular, the author undertook the preparation of the Flora of Pavagadh. Pavagadh Hill, known to one and all in Gujarat, is the only real forest in the vicinity of Baroda from the botanical point of view. The previous knowledge on the subject is next to nil; but for one or two papers, little has been published on the subject. There is no comprehensive flora of the area, at least there is none based on a careful exploration of the district. The successful completion of this field work is the result of three and a half years of intensive study in the field and herbarium. We do not claim that our work is without any deficiency. We are totally aware of its shortcomings. But we do wish that the present work will prove helpful to other botanists in the field.

## The District of Pavagadh and its main features

Pavagadh, known to one and all in Gujarat, is the only hill in the Western districts of Panchmahals, which stands out conspicuously in the land-scape. It is a place of historical importance. The famous temples of Goddess " Kalika Mata " and " Bhadrakali " are situated on this hill. Geologically, it is said that the existence of the hill is due to the Volcanic activity.

From the botanical point of view it is the only real forest in the vicinity of Baroda. It is likely to be the future sanatorium of Panchmahals.

## Geographical position and description of the hill

The peak of the Pavagadh hill according to survey data rises to about 864 m. (2,811 ft.) above sea level, and 738 m. (2,400 ft.) above the surrounding plains. The geographical position of Pavagadh: it lies between 73° 29' & 73° 33' E. & 22° 26' & 22° 30' N. It is about 40 km. (25 miles) South of Godhra (Panchmahal District) and 46.6 km. (29 miles) North-East of Baroda. The river Vishvamitri rises from the Western slopes of the hill. The hill is about 11 km. (7 miles) in length from North to South with a width of 6.4 km. (4 miles).

The unworkable area as declared by the forest department is 2,811 acres. This is left to " Nature " and hence the luxuriant growth of the vegetation. The hill is isolated. Direct access to the hill can only be had from the N. E. corner, the other sides being much too steep to climb, but a few attempts were made with the help of the local guides to explore the various parts of the foot and the lower half of the hill. (Plate No. 1)

## Environmental factors and Climatic data

The plant communities are affected by the environmental factors. Thus the environmental conditions such as climate, altitude and soil have a considerable influence on the growth of the vegetation of a particular area.

No meteorological data of rainfall, temperature and humidity, etc. are kept at Pavagadh. But all the data on rainfall, temperature, etc. given here were available in detailed daily series for all the years, from the Medical Officer, I/C Dispensary and Rain Gauge Station, Halol and Mamalatdar Office, Halol - situated at about 4.8 km. (3 miles) away from Pavagadh. The climatic conditions differ little between Pavagadh and Halol, except perhaps at the higher parts of the Hill; hence it appears that the climatic difference is small and may be neglected; at any rate these are the data of the nearest meteorological station.

It may be said in general that the weather is dry and hot in summer - March to June, the hottest months being April to May. The rainy season sets in by the latter half of June and ends by October. The wettest months are July and August. The cold season commences in November and ends in February.

Breeze is from S. or S. W. N. or N. E. in the monsoon; and N. or N. E. S. or S. W. in winter.

Soil is black cotton soil.

## A. Rainfall (1)

Table I. Total monthly Rainfall for 1957 & 1958

| Month | 1957 In mm. | 1958 In mm. |
|---|---|---|
| January | - | - |
| February | - | - |
| March | - | - |
| April | - | - |
| May | 24 | - |
| June | 265 | 110 |
| July | 333 | 317 |
| August | 258 | 309 |
| September | 9 | 364 |
| October | 16 | 21 |
| November | 5 | 2 |
| December | - | - |
| | 910 | 1123 |

( The maximum amount of rainfall for a single day was 113 mm. on 26-8-1958).

(1) The data given in tables I-V were first recorded in British units; they have been converted to metric units to comply with the Recommendation No. 83 D of the International Code of Botanical Nomenclature, Stockloholm 1952.

Table II. Total Annual Rainfall for 1946 to 1958:

| Year | In mm. |
|---|---|
| 1946 | 1117 |
| 1947 | 1034 |
| 1948 | 606 |
| 1949 | 952 |
| 1950 | 1457 |
| 1951 | 618 |
| 1952 | 1008 |
| 1953 | 1289 |
| 1954 | 1379 |
| 1955 | 1256 |
| 1956 | 1267 |
| 1957 | 910 |
| 1958 | 1123 |

Average for 1946 to 1958: 1078 mm.

During these 13 years, the maximum rainfall was 1457 mm. (57.36 in.) in the year 1950, and the minimum rainfall was 606 mm. (23.89 in.) in the year 1948.

Table III. Maximum Amounts of Rainfall for a single day for 1946 to 1957

The maximum amounts of rainfall for a single day together with their respective dates here given are during the months of June to October. The rainfall is given in mm.. The original was measured in inches.

| Year | June | | July | | August | | September | | October | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date | mm. | Date | mm. | Date | mm. | Date | mm. | Date | mm. |
| 1946 | 30 | 114 | 23 | 43 | 3 | 84 | 13 | 43 | - | - |
| 1947 | - | - | 16 | 167 | 23 | 81 | 4 | 135 | 3 | 13 |
| 1948 | 22 | 55 | 26 | 61 | 17 | 34 | 6 | 116 | 10 | 9 |
| 1949 | 4 | 10 | 20 | 84 | 4 | 54 | 17 | 64 | 1 | 12 |
| 1950 | 11 | 5 | 8 | 114 | 2 | 25 | 18 | 72 | - | - |
| 1951 | 26 | 50 | 27 | 60 | 18 | 60 | 27 | 8 | - | - |
| 1952 | 26 | 53 | 7 | 5 | 18 | 4 | - | - | - | - |
| 1953 | 16 | 29 | 12 | 20 | 17 | 176 | 4 | 72 | - | - |
| 1954 | 13 | 61 | 12 | 67 | 9 | 95 | 6 | 99 | 1 | 88 |
| 1955 | 26 | 49 | 9 | 188 | 31 | 93 | 10 | 52 | 4 | 24 |
| 1956 | 25 | 25 | 11 | 121 | 3 | 87 | 3 | 19 | 10 | 41 |
| 1957 | 30 | 146 | 10 | 79 | 16 | 78 | 27 | 5 | 22 | 16 |

## B. Temperature

Of all climatic factors, temperature is the one which has greater influence on the vegetation of a particular place. The maximum and minimum temperatures for every month of the year for 1955-1958 and upto April 1959, in degrees Centigrade, are given in the following tables. The original observations were made in degrees Fahrenheit.

Table IV. Maximum Monthly Temperature

| | 1955 | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|
| January | 28.1 | 33.0 | 27.4 | 34.6 | 36.1 |
| February | 27.9 | 35.6 | 32.4 | 35.6 | 40.0 |
| March | 37.4 | 39.9 | 37.1 | 39.9 | 45.0 |
| April | 42.7 | 42.5 | 42.5 | 42.2 | 45.5 |
| May | 41.9 | 40.1 | 41.3 | 45.5 | - |
| June | 35.9 | 34.9 | 37.0 | 43.3 | |
| July | 34.0 | 33.5 | 29.8 | 36.6 | |
| August | 29.9 | 29.0 | 31.8 | 35.0 | |
| September | 32.5 | 28.4 | 34.1 | 35.0 | |
| October | 35.5 | 33.4 | 39.3 | 38.8 | |
| November | 36.0 | 36.0 | 37.7 | 38.3 | |
| December | 32.9 | 33.5 | 33.3 | 37.2 | |

Table V. Minimum Monthly Temperature

| | 1955 | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|
| January | 17.1 | 15.6 | 16.7 | 19.4 | 14.4 |
| February | 18.7 | 17.4 | 15.4 | 19.2 | 14.4 |
| March | 26.4 | 23.0 | 21.8 | 23.8 | 19.4 |
| April | 24.7 | 25.6 | 26.4 | 27.1 | 24.4 |
| May | 32.3 | 27.9 | 27.6 | 26.6 | |
| June | 26.5 | 27.1 | 27.1 | 24.4 | |
| July | 25.8 | 24.3 | 25.6 | 24.4 | |
| August | 24.0 | 24.7 | 25.3 | 23.3 | |
| September | 28.0 | 25.7 | 25.0 | 23.3 | |
| October | 22.5 | 23.3 | 25.1 | 20.5 | |
| November | 18.0 | 20.6 | 21.4 | 17.7 | |
| December | 17.3 | 18.0 | 19.4 | 14.4 | |

During these 4 years, the maximum temperature reached was 45.5°C in the years 1958 & 1959, and the minimum temperature was 14.4°C in the years 1958 & 1959. The average annual temperatures from May 1957 to April 1958 and May 1958 to April 1959 are as follows:

| | May 1957 to April 1958 | | May 1958 to April 1959 | |
|---|---|---|---|---|
| | Maximum | Minimum | Maximum | Minimum |
| Average Hot season | 40.1°C | 26.4°C | 44.8°C | 23.7°C |
| Average Rainy season | 33.7°C | 25.2°C | 36.4°C | 22.9°C |
| Average Cold season | 35.3°C | 19.9°C | 37.9°C | 15.2°C |
| Average Annual Temp. | 36.4°C | 23.8°C | 39.7°C | 20.6°C |

Relative Humidity: No data are available on this subject.

## GEOLOGY

The hill has a terraced appearance and is very much like that of many other hills in the western parts of India. It consists of lava flows the " Deccan Trap ", clearly visible from a distance. The arrangement of the rock formations that make up the Pavagadh Hill is: rhyolite, green bedded tuffs, porphyritic basalt, olivine dolerite and nonporphyritic alkaline basalt. The details on the geology of the hill are based on ' A note on the Geology of Pavagadh Hill ' by S. S. Merh (1955).

Biotic Factor: The area of this isolated hill has been declared as ' unworkable area ' - ' forest reserve ' by the forest department. This is left to Nature, and hence the luxuriant growth of the vegetation, which, in consequence, is not disturbed by fire, ploughing, grazing by sheep and other animals.

## THE BOTANICAL EXPLORATION OF PAVAGADH

In the past there had never been a systematic exploration of the hill. In the literature, especially in the Cooke's Flora of the Presidency of Bombay, no reference has been given to Pavagadh. The previous knowledge on the subject is next to nil; but for one or two papers, little has been published on the subject. There is no comprehensive flora of the area, at least there is none based on a careful exploration of the district.

To my knowledge, Shri. V. L. Devkar was the first visitor who published an abstract on the Survey of the Flora of Pavagadh in the Proceedings of 29th Indian Science Congress, Baroda, 1942, which consists of a mere list of plants based on a visit or two. But I doubt about the author's collection as the specimens if at all collected on that occasion, have not been available to the writer in the preparation of this flora.

The nearest approach to systematic exploration was sometime about 1955. In the first instance Shri. B. B. Joshi was working on the flora of Pavagadh hill, which he soon gave up. With Dr. V. G. Phatak as the co-author, he however published a list of plant species of Pavagadh as a result of a short survey of the hill from July 1954

to January 1955. Next visitor is Rev. Father H. Santapau. In his paper on " Excursion of the Indian Botanical Society to Pavagadh Hill near Baroda, on January 7th, 1955 ", he enumerated the Plants of Pavagadh and Baroda, the best reference on the subject. A. R. Chavan and A. R. Mehta (1959) published a paper on " Grasses of Pavagadh ", a detailed study of 69 species from the area.

## MY OWN EXPLORATION OF PAVAGADH

The work on this project was started in May 1957. Methods followed in the collection of Data: For the details to be recorded, the author has followed the technique from " Botanical Collector's Manual " by Rev. Father H. Santapau. General Methods employed in this work: Extensive, but above all intensive collection in every season of the year, recording of distribution and relative abundance of the plants, particularly of those of medicinal or economic use, etc.

Outline of the experiments: Visits to the place in the monsoon at least once a week, during the dry season about twice in the month over a period of three years; careful collection and examination of plants, etc.. This did help us to get the record not only of the vegetation of Pavagadh, but also of the seasonal changes. The area though extensive was easily covered up for the survey by paying frequent visits to the different spots. Observations were made from time to time during the different trips in different seasons. While carrying on the detailed study of the flowering plants in their natural habitats, care was taken to record plants of economic and medicinal importance and also the rare plants of the district.

Work in the field: At the time of every visit to the hill as many plants as possible were collected so that duplicates may be available, and ample notes were taken in rough diaries during the actual collection of plants. Every specimen we saw in leaf, flower and fruit was collected so as to note the various stages in the life cycle of a plant. Herbaceous plants were collected with their entire root-systems and in some cases (Curcumas) the underground parts such as tubers etc. were also collected, which helped us in the identification of the plant. Among the useful notes taken on the spot and entered in the field diaries are:

(a) Actual state of the plant, in flower, fruit or leaf, fresh or completely dry, etc.

(b) Habit of the plant (tree, shrub, herb, climber, parasite or epiphyte with its host, etc.).

(c) Average size of the plant.

(d) Relative abundance of the plant wherever it occurs.

(e) Distribution of the plant (whether it be abundant or otherwise).

For economy of space, we used the following abbreviations in our field books:

(i) Distribution of the plant: (D1 to D5)

D1 - The distribution of the plant is rare.

D3 - Fairly common.

D5 - Common everywhere.

(ii) Relative abundance of the plant: (A1 to A5)

A1 - The plant is scaree.

A3 - Fairly abundant.

A5 - So abundant as to form the dominant feature of the vegetation of an area.

( " Distribution of the plant - This means, (1) how often has a particular plant been seen in the field. (2) It does not imply abundance or scarcity. (3) But merely extent of the distribution of a species in a particular area or district ".)

( " Relative abundance of the plant - The term abundant is not synonymous with common. Abundant applies to the actual number of a particular plant, whatever be its distribution ".)

(f) Colour of the flowers when fresh and scent, if any. Among the ecological notes, following points were noted:

(g) The type of ground (rocky, sandy, or loamy, dry, wet, or marshy, etc.) on which a plant grows.

(h) Clear localisation of plant species &

(i) Any clear association.

(j) Local names and uses of the plants.

The plants were collected personally by the author.

Work in the Laboratory: Specimens were brought to the laboratory on return from the field. All the plants were carefully checked and identified by reference to Hooker's Flora and other provincial floras. Cooke's Flora was specially referred to, for it is the standard work among students in the Bombay State ( now reorganised as Gujarat and Maharastra States) and for practical purposes the most complete work on the flora of these areas. Some of the specimens which could not be identified were sent to the Indian Botanic Gardens, Calcutta, Forest Research Institute, Dehra Dun

and the Blatter Herbarium, Bombay. Immediately after the identification of the plants the specimens were pressed, poisoned and labelled. Saturated solution of mercuric chloride in ethyl alcohol or in methylated spirit was used for poisoning all the specimens. After studying the rough field notes, the author did concentrate on the writing of proper field books, the filing of the plants in the proper index cards, etc. and in general in looking after the scientific work. Mounting was done after poisoning and pressing.

Work in the Herbarium: The specimens identified by reference to various floras were checked and compared with the specimens in the herbarium. With regard to the arrangement of families, genera and species, I followed the system of Blatter Herbarium.

## GENERAL ASPECT OF THE VEGETATION OF PAVAGADH HILL

The following prominent points are worth noting in the vegetation of Pavagadh.

### (1) Forest at Pavagadh

The forest at Pavagadh can be differentiated into three layers:

(a) The Upper Layer:

The hilly slopes are covered with a dense dry Deciduous Forest. The trees noted below are common and are given roughly in order of abundance.

*Tectona grandis* Linn. f.

*Terminalia crenulata* Roth.

Morinda tinctoria var. tomentosa Hook. f.

Anogeissus latifolia Wall.

Dalbergia latifolia Roxb.

Mitragyna parvifolia (Roxb.) Korth.

Wrightia tinctoria R. Br.

Cassia fistula Linn.

Lannea coromandelica (Houtt.) Merrill.

Anona squamosa Linn.

Acacia leucophlaea Willd.

Randia brandisii Gamble.

Alangium salvifolium (Linn. f. ) Wanger.

Bridelia squamosa (Muell. - Arg.) Gehrm.

The forest is economically valuable because of the presence of valuable timbers. Tectona grandis Linn. f. is dominant, growing 10-20 m. (30ft. - 60ft.) high. Next to teak trees are Terminalia crenulata Roth. and Dalbergia latifolia Roxb.

(b) The Middle Layer:

The vegetation at about half-way up the hill is abundant. The composition of these parts of the forest is given below in order of their relative abundance.

Tectona grandis Linn. f.

Anogeissus latifolia Wall.

Feronia limonia (Linn.) Swingle.

Cordia dichotoma Forst. f.

Grewia tiliaefolia Vahl.

followed by shrubby plants Carissa congesta Wight. and Holarrhena antidysenterica (Linn.) Wall. ex A. DC.

(c) The Lowest Layer:

The vegetation noted at the base of the hill is from the areas near the Bus Station, in open lands and the surrounding forests. It also covers the sides of a stream. The species of this area are strikingly common. These are given approximately in order of abundance.

Tephrosia purpurea (Linn.) Pers.
Euphorbia thymifolia Linn.
Euphorbia hirta Linn.
Euphorbia bombaiensis Santapau.
Convolvulus microphyllus Sieb. ex Spreng.
Acanthospermum hispidum DC.
Pergularia daemia (Forsk.) Chiov.
Acacia pennata (Linn.) Willd.
Maerua arenaria (DC.) Hook. f. et Thoms.
Cynodon dactylon (Linn.) Pers.
Chloris virgata Sw.
Urochloa panicoides Beauv.
Eragrostis japonica (Thunb.) Trin.

(2) Vegetation on the higher parts and the top of the hill

Above the forest limit - 523 m. (1,700 ft. and above) the

vegetation is characterised by the plants mentioned below, which are common and abundant. They are arranged alphabetically, the order followed being that of the scientific names of the plants.

Argemone mexicana Linn.

Blumea glomerata DC.

Carvia callosa (Wall.) Bremek.

Cassia occidentalis Linn.

Cassia tora Linn.

Celosia argentea Linn.

Commelina obliqua Buch. - Ham.

Cyathocline purpurea (Don) O. Kuntze

Cymbopogon citratus (DC.) Stapf.

Ficus arnottiana Miq.

Garuga pinnata Roxb.

Girardinia zeylanica Decne.

Hemigraphis latebrosa Nees. var. heyneana Bremek.

Justicia prostrata (Clarke) Gamble

Lepidagathis cuspidata (Wall.) Nees.

Lepidagathis trinervis Wall. ex Nees.

Linum mysorense Heyne.

Melanocenchris jacquemontii Jaub. & Spach.

Rungia pectinata (Linn.) Nees.

Trachyspermum stictocarpum (Clarke) Wolff var. stictocarpum.

Tripogon spec.

(3) V e g e t a t i o n a t M a c h i 461 m.(1,500ft.)

This small plateau is surrounded by dense forests. The

plants commonly met with are given in order of abundance.

Baliospermum montanum Muell. - Arg.

Plectranthus stocksii Hook. f.

Sida spinosa Linn.

Blumea membranacea DC.

Bergia odorata Edgew.

Indigofera enneaphylla Linn.

Cyperus rotundus Linn.

Cenchrus ciliaris Linn.

### (4) Vegetation in the lower parts of the Hill

(a) Vegetation on the sides of the main paths of the hill and its surrounding forest areas is of the following composition. Plants are arranged alphabetically, the order followed is that of the scientific names of the plants.

Barleria prattensis Santapau

Bryonopsis laciniosa (Linn.) Naud.

Cardiospermum halicacabum Linn.

Cassia auriculata Linn.

Cassia tora Linn.

Cocculus hirsutus (Linn.) Diels.

Combretum ovalifolium Roxb.

Garuga pinnata Roxb.

Holarrhena antidysenterica (Linn.) Wall. ex A. DC.

Salmalia malabarica (DC.) Sch. et Endl.

Sida spinosa Linn.

Sida veronicaefolia Lamk.

Zizyphus mauritiana Lamk.

(b) The undergrowth of forest

The following plants are about the most common and abundant in the undergrowth of the forests. The arrangement in the listing of plants is the same as given above.

Apluda mutica Linn. var. aristata (Linn.) Pilger

Baliospermum montanum Muell. - Arg.

Barleria prionitis Linn.

Cryptolepis buchanani Roem. et Schult.

Haplanthus verticillatus (Roxb.) Nees.

Helicteres isora Linn.

Heylandia latebrosa DC.

Neuracanthus sphaerostachyus (Nees.) Dalz.

Peristrophe bicalyculata (Retz.) Nees.

Plumbago zeylanica Linn.

Pupalia lappacea (Linn.) Juss.

Teramnus labialis (Linn. f. ) Spreng.

Urochloa panicoides Beauv.

## (5) Vegetation near Ponds

Two ponds are situated on the slopes of the hill, and a third one is also situated at 769 m. (about 2,500') above sea level where the vegetation is not luxuriant. In view of their location at different altitudes the ponds on the slopes are differentiated here as the upper and the lower ones. The plants observed on the

banks are fairly common and typical.

(a) Upper Pond:

This is the Telia talao and lies just near the upper forest limit - 461 m. (about 1,500') above sea level. The plants occurring are more or less equally common and abundant. The list of plants given here is arranged according to families in a natural sequence.

Polycarpon prostratum (Forsk.) Aschers. & Schweinf.

Portulaca oleracea Linn.

Glinus lotoides Linn.

Caesulia axillaris Roxb.

Eclipta prostrata Linn.

Gnaphalium indicum Linn.

Sphaeranthus indicus Linn.

Heliotropium supinum Linn.

Asteracantha longifolia (Linn.) Nees.

Polygonum plebeium R. Br.

(b) Lower Pond:

Known as the Mendhi talao it is situated at 369 m. (about 1,200') above sea level. Practically, all the plants listed below are in abundance. The arrangement in the listing of plants is the same as given above.

Feronia limonia (Linn.) Swingle

Glinus oppositifolius (Linn.) A. DC.

Acanthospermum hispidum DC.

Ageratum conyzoides Linn.

Gnaphalium indicum Linn.

Asteracantha longifolia (Linn.) Nees.

Nothosaerva brachiata (Linn.) Wt.

Streblus asper Lour.

Cyperus difformis Linn.

(6) The Flora of Old Walls

The hill has several lines of defence of the Hill fortress. Of all the gates, the Sadan Shah gate is elaborately planned with a temple and subsidiary cells. A few stiff rocks on the slopes together with the old walls of the fort have conspicuous signs of moisture and are protected from full solar radiation. Moisture-loving vegetation is mostly met with and hence these lithophytes are worthy of remarks and special study. The plants are arranged according to families.

Woodfordia fruticosa (Linn.) Kurz.

Trachyspermum stictocarpum (Clarke) Wolff var. stictocarpum.

Canscora diffusa R. Br.

Canscora decurrens Dalz.

Trichodesma amplexicaule Roth.

Kickxia incana (Wall.) Pennell.

Lindenbergia indica (Linn.) O. Kuntze

Didymocarpus pygymea Clarke

Rungia pectinata (Linn.) Nees.

Leucas biflora R. Br.

Nepeta hindostana (Roth.) Haines.

Fleurya interrupta (Linn.) Gaud.

Ficus arnottiana Miq.

Melanocenchris jacquemontii Jaub. & Spach.

Tripogon spec.

(7) C l i m b e r s

The climbers are noted on trees, on shrubs and on hedges. Some are slender and others are fairly large and stout. The distribution of these climbers is fairly common and abundant with the exception of a few. The list of climbers given here is arranged according to families.

Cocculus hirsutus (Linn.) Diels.

Maerua arenaria (DC.) Hook. f. et Thoms.

Ventilago calyculata Tul.

Cardiospermum halicacabum Linn.

Abrus precatorius Linn.

Canavalia gladiata (Jacq.) DC.

Dolichos biflorus Linn.

Mucuna prurita Hook.

Teramnus labialis (Linn. f.) Spreng.

Caesalpinia crista Linn.

Acacia pennata (Linn.) Willd.

Combretum ovalifolium Roxb.

Bryonopsis laciniosa (Linn.) Naud.

Coccinia cordifolia (Linn.) Cogn.

Luffa acutangula (Linn.) Roxb. var. amara (Roxb.) Clarke.

Cryptolepis buchanani Roem. et Schult.

Leptadenia reticulata (Retz.) Wt. et Arn.

Pergularia daemia (Forsk.) Chiov.

Cuscuta reflexa Roxb.

Ipomaea maxima (Linn. f. ) Don

Ipomaea cairica (Linn.) Sweet

Ipomaea nil (Linn.) Roth.

Rivea hypocrateriformis Choisy

(8) Parasites and Epiphytes

Parasites are rare for this type of forest. Dendrophthoe falcata (Linn. f.) Etting., is the only plant observed on the following hosts which are not much affected:

Salmalia malabarica (DC.) Sch. et Endl.

Grewia tiliaefolia Vahl.

Mangifera indica Linn.

Cassia fistula Linn.

Acacia leucophlaea Willd.

Alangium salvifolium (Linn. f.) Wanger

Cordia dichotoma Forst. f.

Tectona grandis Linn. f.

Lately, we have on several occasions noticed Dendrophthoe falcata on different host plants. And our note in the Journal of the Bombay Natural History Society, reports the attack of this parasite on 5 new host plants, recorded for the first time in India. The host plants noticed are: Cadaba fruticosa (Linn.) Druce., Firmiana colorata R. Br., Ailanthus excelsa Roxb., Butea monosperma (Lamk.) Taub., Tecoma stans (Linn.) H.B.K.

Among the other parasites are the species of Cuscuta and Viscum. Cuscuta is very common on Streblus asper Lour., Clitoria

ternatea Linn., and several spec. of Euphorbia. The hosts for Viscum are Terminalia crenulata Roth., and Randia brandisii Gamble.

Still another Root parasite, Striga euphrasioides (Vahl.) Benth. is found in the undergrowth of the forest among the grasses.

The environmental conditions are rather unfavourable for the growth of Orchids. The branches of Manilkara hexandra (Roxb.) Dub. are laden with orchid Aerides maculosum Lindl. at about 738 m. (2,400') on the upper parts of the hill.

## (9) The Vegetation of the surrounding Plains

The plains considered here are those parts which just surround the foot of the hill. The surrounding plains of the hill include ditches, ponds, hedges, drying pools, cultivated lands, waste lands and road sides, etc. In many places the vegetation is very abundant and of a common occurrence. The plants are arranged in an alphabetical order.

Acacia arabica (Lamk.) Willd.

Anisomeles indica (Linn.) O. Kuntze.

Argemone mexicana Linn.

Asteracantha longifolia (Linn.) Nees.

Borassus flabellifer Linn.

Butea monosperma (Lamk.) Taub.

Caesulia axillaris Roxb.

Calotropis gigantea (Linn.) R. Br.

Capparis decidua (Forsk.) Pax.

Cassia absus Linn.

Cassia occidentalis Linn.

Cassia tora Linn.

Cenchrus ciliaris Linn.

Chloris virgata Sw.

Convolvulus microphyllus Sieb. ex Spreng.

Cuscuta reflexa Roxb.

Cynodon dactylon (Linn.) Pers.

Cyperus rotundus Linn.

Eragrostis ciliaris (Linn.) Link.

Euphorbia neriifolia Linn.

Glinus lotoides Linn.

Heliotropium supinum Linn.

Ipomaea aquatica Forsk.

Leonotis nepetaefolia (Linn.) R. Br.

Mangifera indica Linn.

Phoenix sylvestris (Linn.) Roxb.

Pithecellobium dulce (Roxb.) Benth.

Tephrosia purpurea (Linn.) Pers.

Xanthium strumarium Linn.

## (10) The plants under cultivation in the district

The commoner crops of Gujarat, such as cotton, tobacco, paddy, and pulses are under cultivation.

## (11) The Flora of Cultivated Fields

Our country is an Agricultural land. Gujarat abounds in cultivation. The surrounding plains of the area under observation are cultivated. The Flora of these cultivated fields includes herbaceous or even shrubby plants, rather weeds which are abundant and common everywhere and sometimes a dominant feature of the vegetation. The losses caused by these weeds are very well known. At present, India is in want of and claims complete harvest from each acre of land. The conclusion for the same is the effective suppression of weeds. Hence, special attention should be paid to control and eradication of weeds by research workers, so that the yield would materially increase. The commoner plants given here are listed in an alphabetical order.

Amaranthus polygamous Linn.

Anagallis arvensis Linn. var. coerulea (Schreb) Gren. et Godr.

Bergia odorata Edgew.

Blumea lacera DC.

Caesulia axillaris Roxb.

Calotropis gigantea (Linn.) R.Br.

Chenopodium album Linn.

Chrozophora prostrata Dalz.

Chrozophora rottleri (Geis.) Juss. ex Spr.

Crotalaria medicaginea Lamk.

Cyperus rotundus Linn.

Digera muricata (Linn.) Mart.

Eclipta prostrata Linn.

Emilia sonchifolia (Linn.) DC.

Euphorbia bombaiensis Santapau

Euphorbia hirta Linn.

Gnaphalium indicum Linn.

Grangea maderaspatana (Linn.) Poir.

Gynandropsis gynandra (Linn.) Briq.

Heliotropium scabrum Retz.

Heliotropium supinum Linn.

Merremia emarginata (Burm.f.) Hall. f.

Orobanche cernua Loefl.

Phyllanthus niruri auct. non Linn.

Polygonum plebeium R. Br.

Portulaca oleracea Linn.

Rungia pectinata (Linn.) Nees.

Solanum nigrum Linn.

Solanum xanthocarpum Schr. et Wendl.

Sphaeranthus indicus Linn.

Stemodia viscosa Roxb.

Striga euphrasioides (Vahl.) Benth.

Tephrosia purpurea (Linn.) Pers.

Trianthema portulacastrum Linn.

Vernonia cinerea (Linn.) Less.

Withania somnifera (Linn.) Dunal.

## (12) Introduced Plants

Lantana camara Linn., var. aculeata (Linn.) Moldenke, a weed of the plains, has a strong hold on some slopes. Several plants

of Agave ingens Berg.? are fairly abundant on the plains in hedges, where the plant appears to have become naturalised.

(13) Palms

Borassus flabellifer Linn. and Phoenix sylvestris (Linn.) Roxb. are fairly common and abundant in the plains near the village Jarod of this district. At many places these tall trees form the dominant feature of the vegetation, but disappear after about 3.2 km. (two miles) behind Halol. Azadirachta indica A. Juss. and several species of Ficus - (F. bengalensis Linn., and F. religiosa Linn.) are observed growing in association with these palms.

(14) Rare plants

The plants noted below are not common in the area under observation. The list of plants given here is arranged alphabetically, the order followed is that of the scientific names of the plants:

Acalypha ciliata Forsk.

Ammania multiflora Roxb.

Amorphophallus commutatus (Schott.) Engler

Anagallis arvensis Linn. var. coerulea (Schreb) Gren.et Godr.

Anisomeles indica (Linn.) O. Kuntze.

Argemone mexicana Linn.

Arisaema neglectum Schott.

Blepharis maderaspatensis (Linn.) Roth.

Cadaba fruticosa (Linn.) Druce

Calotropis gigantea (Linn.) R. Br.

Celastrus paniculata Willd.

Coccinia cordifolia (Linn.) Cogn.

Convolvulus pluricaulis Choisy

Corchorus aestuans Linn.

Crataeva nurvala Buch. - Ham.

Cucumis setosus Cogn.

Curcuma inodora Blatter

Dendrophthoe falcata (Linn. f.) Etting.

Dipcadi montanum Dalz.

Diploclisia glaucescens (Blume) Diels.

Dolichos biflorus Linn.

Echinops echinatus Roxb.

Emblica officinalis Gaertn.

Euphorbia tirucalli Linn.

Firmiana colorata R. Br.

Melochia corchorifolia Linn.

Pulicaria wightiana (DC.) Benth. ex Clarke.

Rivea hypocrateriformis Choisy

Solanum xanthocarpum Schr. et Wendl.

Triumfetta annua Linn.

Vicoa indica (Willd.) DC.

Volutarella ramosa (Roxb.) Santapau

Xanthium strumarium Linn.

Zizyphus oenoplia Mill.

## (15) Plants not mentioned in the Cooke's Flora of the Presidency of Bombay

The following plants found in this area are not mentioned in

Cooke's Flora; some of them may be introduced into India after the publication of the flora; others have been described as new species or new plant records for Bombay State.

Triumfetta annua Linn.

Cucumis setosus Cogn.

Momordica denudata (Thwait.) Clarke

Acanthospermum hispidum DC.

Bidens bipinnata Linn.

Convolvulus pluricaulis Choisy

Merremia quinquefolia (Linn.) Hall. f.

Didymocarpus pygmea Clarke.

Gomphrena celosioides Mart.

Euphorbia prostrata Ait.

Trema politoria Planch.

Curcuma inodora Blatter.

### (16) Characteristic plants during the rainy season

The plants observed in various parts of the hill have been collected in various parts of the year; it has been possible, therefore, to note that there is a distinct vegetation during the rainy season. The view of the hill during the rains is pleasing as the plants begin to sprout up. Even the old walls of the fort together with a few rocks on the slopes of the hill are covered with various plant species. In the rainy season, the vegetation on the slopes of the hill and in the forest consists of Impatiens Balsamina Linn. var. rosea Hook. f., Chlorophytum tuberosum (Roxb.) Baker,

Plectranthus stocksii Hook. f., Lepidagathis cuspidata (Wall.) Nees., Celosia argentea Linn., Pupalia lappacea (Linn.) Juss., Linum mysorense Heyne., Curcuma inodora Blatter, Amorphophallus commutatus (Schott.) Engler, Eranthemum roseum (Vahl) R. Br., Barleria prattensis Santapau, Dioscorea bulbifera Linn., Corchorus aestuans Linn., Dipcadi montanum Dalz., Cynodon dactylon (Linn.) Pers., Dichanthium annulatum (Forsk.) Stapf., Aristida depressa Retz., Urochloa panicoides Beauv., Coccinia cordifolia (Linn.) Cogn., Peristrophe bicalyculata (Retz.) Nees., Heteropogon contortus (Linn.) Beauv., Cyperus rotundus Linn., and several species of Arisaema, Crotalaria, Euphorbia and Eragrostis. Aerides maculosum Lindl. is the only orchid. Most of these are annuals growing luxuriantly in the rainy season.

Soon after I started working in the exploration of Pavagadh, I was indeed fortunate enough to observe and record a rare general flowering of Carvia callosa (Wall.) Bremek., on the slopes of the hill (upto about 523 m.) in September - November 1957.

## (17) Zonal distribution of the plants according to the soil on which they grow

We give below the formations that make up the hill. The plants growing in different types of soils are also noted under such formations. This, however, does not mean that these plants do not occur in other types of ground, but the plants noted are commonly met with in such soils. The details on the geology of the hill are based on ' A note on the Geology of Pavagadh Hill ' by S. S. Merh (1955). (Plate No. 2)

(a) Rhyolites: This is the highest part of the hill and is acidic. Plants occurring here are Tripogon spec., Euphorbia neriifolia Linn., Chrozophora rottleri (Geis.) Juss. ex Spr.

(b) Green bedded tuffs: Just below the highest part of the hill, the vegetation noted below is common on this plateau which is acidic (ash beds) eg. Echinops echinatus Roxb., Chrozophora prostrata Dalz., Xanthium strumarium Linn., Leucas aspera Spr., Lycopersicon esculentum Mill., Gomphrena celosioides Mart., Glinus oppositifolius (Linn.) A. DC.

(c) Porphyritic basalt: This is less basic. Among a few plants noted are Polygonum plebeium R. Br., Trichodesma amplexicaule Roth. and Leucas biflora R. Br.

(d) Olivine dolerite: Vegetation noted here is in between 523 m. (1700') to 677 m. (2200'). This part of the hill is more basic and is characterised by the occurrence of Carvia callosa (Wall.) Bremek., Melanocenchris jacquemontii Jaub. & Spach., Garuga pinnata Roxb., Celosia argentea Linn., Girardinia zeylanica Decne., Lepidagathis cuspidata (Wall.) Nees., Linum mysorense Heyne, Cymbopogon citratus (DC.) Stapf, Rungia pectinata (Linn.) Nees., Lepidagathis trinervis Wall. ex Nees., Asteracantha longifolia (Linn.) Nees.

(e) Non-porphyritic alkaline basalt: This is basic, - silica % less.

Just from the foot of the hill upto the forest limit (523 m.),

the parts all over the hill are composed of the black cotton soil and this forms the major portion of the area under observation. Acacia arabica (Lamk.) Willd., Anogeissus latifolia Wall., Baliospermum montanum Muell. - Arg., Barleria prattensis Santapau, B. prionitis Linn., Bryonopsis laciniosa (Linn.) Naud., Cardiospermum halicacabum Linn., Chloris virgata Sw., Cocculus hirsutus (Linn.) Diels., Cyperus rotundus Linn., Eranthemum roseum (Vahl) R. Br., Lannea coromandelica (Houtt.) Merrill, Neuracanthus sphaerostachyus (Nees.) Dalz., Cenchrus ciliaris Linn., Salmalia malabarica (DC.) Sch. et Endl., Tectona grandis Linn. f., Teramnus labialis (Linn. f.) Spreng., Terminalia crenulata Roth., Zizyphus mauritiana Lamk., and several species of Eragrostis and Euphorbia are a few examples.

### (18) Localisation of plant species

Under this heading we give only such plants as are observed in particular places remaining absent from other parts of the hill. Such plants are abundant and sometimes form a dominant feature of the vegetation of the spot. No reference is given to the directions in which such localities are situated; instead, the more commonly known parts are mentioned.

Abutilon glaucum (Cav.) Sweet.

At the foot of the hill near the bus station, on open ground exposed to Sun.

Amorphophallus commutatus (Schott.) Engler

On the slopes of the hill near Budhia gate, exposed to Sun.

Arisaema neglectum Schott.

Abundant on the slopes just above Machi under the shade of trees.

Carvia callosa (Wall.) Bremek.

Fairly abundant in almost pure stands on the upper half of the slopes of the hill (above Machi); seen only occasionally in the lower half.

Curcuma inodora Blatter

Abundant on the plateau near Machi; growing in rocky grounds in dense forest, protected from the Sun.

Didymocarpus pygymea Clarke

Very common on old walls of the fort just below Machi, protected from the Sun.

Chlorophytum tuberosum (Roxb.) Baker and

Dipcadi montanum Dalz.

On the plateau near the Temple of Bhadrakali; abundant in open rocky grounds, exposed to the Sun.

Echinops echinatus Roxb.

On the highest part of the hill near Dudhia talao; in large clumps in open places exposed to the Sun. Rev. Fr. Santapau (1955) enumerating the plants of Pavagadh and Baroda writes in his paper " in one spot along the main road noticed a large clump of these plants, otherwise it is rather rare in the district; did not notice it on the hill ". In the year 1958, one or two plants were noted in the locality

of the preceding species. Since then, this plant is found in a locality, just in the opposite direction; firmly settled, upto 804 m. (2,600') on the hill. Rare.

## (19) Plant Associations

We list below such plants as are seen to grow together in the area under observation. Plant species observed to grow together only occasionally, are classed under the ' chance association '. These associations are:

(a) Heliotropium supinum Linn. and
Grangea maderaspatana (Linn.) Poir.

(b) Evolvulus alsinoides Linn.,
Heylandia latebrosa DC. and
Convolvulus microphyllus Sieb. ex Spreng.

(c) Cleome viscosa Linn.,
Crotalaria medicaginea Lamk.,
Cassia tora Linn. and
Achyranthes aspera Linn. var. porphyristachya Hook. f.;

are but a few examples.

Plants with possibility of intimate relationship and noted to grow together on most occasions are mentioned here:

(a) Tricholepis glaberrima DC. and
Trichodesma amplexicaule Roth.

(b) Cassia occidentalis Linn. and
Cassia absus Linn.

(c) Lepidagathis cuspidata (Wall.) Nees. and
Carissa congesta Wight.

(d) Coldenia procumbens Linn. and
Glinus lotoides Linn.

(e) Datura metel Linn. and
Calotropis gigantea (Linn.) R. Br.

(f) Digera muricata (Linn.) Mart. and
Tephrosia purpurea (Linn.) Pers.

(g) Zizyphus mauritiana Lamk. and
Capparis decidua (Forsk.) Pax.

Occurring in bare grounds in the plains at the foot of the hill, Zizyphus mauritiana is somewhat shrubby in appearance. On most occasions, we have observed isolated clumps of Capparis decidua growing with it. The vegetation of this type can be noted as a ' thorn scrub '. Several species of Zizyphus occur in the forest proper at the foot of the hill or on the slopes; among these Z. nummularia (Burm.) Wt. et Arn. and Z. xylopyra (Retz.) Willd. are common, while Z. oenoplia Mill. is rare.

(h) Solanum xanthocarpum Schr. et Wendl., Argemone mexicana Linn. and Sphaeranthus indicus Linn.

(i) Abutilon indicum Sweet., Polygala erioptera DC. and Commelina nudiflora Linn.

(j) Trianthema portulacastrum Linn., Boerhavia diffusa Linn., and several species of Euphorbia, - especially E. hirta Linn.

(k) Leucas biflora R. Br., Kickxia incana (Wall.) Pennell. and Lindenbergia indica (Linn.) O. Kuntze - ( on the old walls of the fort.)

(l) Tectona grandis Linn. f. and
Terminalia crenulata Roth.

The upper layer of the forest (upto 523 m. altitude) at Pavagadh is covered with a dense dry ' Deciduous Forest '; Tectona grandis is the dominating tree and is ordinarily met with in association with Terminalia crenulata which is fairly common in the forest. Economically, both are valuable timbers; and are noted growing in round about the same type of habitat.

(m) Palms and the strangling figs.

The distribution of the palms - Borassus flabellifer Linn. and Phoenix sylvestris (Linn.) Roxb. is fairly common and abundant in the plains near the village Jarod of this district. At many places these tall trees form the dominant feature of the vegetation. The strangling figs - Ficus bengalensis Linn. and F. religiosa Linn. are observed growing in association with these palms. These stranglers manage to send down their roots into the soil. It seems evident that an intimate relationship exists between these trees; and there exists still a doubt about their nature of growth. Are these stranglers epiphytic? The palms are certainly deprived of their lives. The formation of this community is not at all the result of old and new plantings. Our findings show that first of all the plants have to send down their roots into the soil; ultimately appearing as independent trees. Azadirachta indica A. Juss. is also observed growing in association with these palms.

(20) Gregarious plant species

Plant species showing gregariousness are Ageratum conyzoides Linn., Cassia occidentalis Linn., Cassia tora Linn.,

Cyperus difformis Linn., Lepidagathis cuspidata (Wall.) Nees., Peristrophe bicalyculata (Retz.) Nees., Trichodesma amplexicaule Roth., Tephrosia purpurea (Linn.) Pers. The following plants are gregarious but not common: Argemone mexicana Linn., Calotropis gigantea (Linn.) R. Br., Solanum xanthocarpum Schr. et Wendl.

## (21) Pure formations

In the area under observation, the nature of growth of the plants mentioned here is either (i) in isolated or dense clumps (clumps varying according to the plant species; may be large or small), (ii) or in fairly dense patches, (iii) or almost in pure stands.

Acanthospermum hispidum DC., Aerva lanata (Linn.) Juss., Alternanthera sessilis (Linn.) R. Br., Anisomeles indica (Linn.) O. Kuntze, Asteracantha longifolia (Linn.) Nees., Blumea membranacea DC., Caesulia axillaris Roxb., Capparis decidua (Forsk.) Pax., Carvia callosa (Wall.) Bremek., Cymbopogon citratus (DC.) Stapf., Cyperus bulbosus Vahl., Echinops echinatus Roxb., Glinus lotoides Linn., Grangea maderaspatana (Linn.) Poir., Haplanthus verticillatus (Roxb.) Nees., Heliotropium supinum Linn., Hemigraphis latebrosa Nees. var. heyneana Bremek., Hygrophila polysperma (Roxb.) T. Anders., Indigofera cordifolia Heyne. ex Roth., Kickxia incana (Wall.) Pennell., Leonotis nepetaefolia (Linn.) R. Br. Leucas biflora R. Br., Lindenbergia indica (Linn.) O. Kuntze, Melanocenchris jacquemontii Jaub. & Spach., Phyla nodiflora (Linn.) Greene, Polygonum plebeium R. Br., Sphaeranthus indicus Linn., Spodiopogon rhizophorus (Steud.) Pilger, Tridax procumbens Linn., Tripogon spec., Xanthium strumarium Linn.

## (22) Aquatic and Semi-aquatic formations

A characteristic feature in the Flora of the area under study includes such aquatic formations as are commonly met with in a few ponds, and ditches occurring in the surrounding plains. The aquatic formation consists of: Nymphaea pubescens Willd. and Ipomoea aquatica Forsk. A few plant species of ' semi-aquatic ' formation are: Phyla nodiflora (Linn.) Greene, Cyperus bulbosus Vahl., Hygrophila polysperma (Roxb.) T. Anders., Gnaphalium indicum Linn. and Cressa cretica Linn.

The soils of the drying pools have enough moisture and as such are the best habitats for a few hygrophytic plants noted below:

Coldenia procumbens Linn., Glinus lotoides Linn., Gnaphalium indicum Linn., Grangea maderaspatana (Linn.) Poir., Sphaeranthus indicus Linn.

Pavagadh vegetation, based on my own observations in the field, has been narrated in the introductory remarks under the heading 'General Aspect of the Vegetation of Pavagadh Hill.' It could not be fitted into any of the types of Champion (1936), since the species of the area under observation have very little in common with those named by the author in his book - "Preliminary Survey of the Forest Types of India and Burma."

The area of this nicely isolated hill comes under the then Bombay Presidency. And the different elements in the Pavagadh

flora have a parallel with those of the 3 distinct elements of the Bombay flora - one from the Malayan region, another from north-eastern and C. India and one more from N. Africa through Asia Minor.

In addition to the distribution of Pavagadh plants in World Phytogeography, I have given the regional distribution of almost all the species enumerated with the hope that it may turn out to be of some use to a plant geographer in tracing the origin of the component elements of the regional flora.

It has been observed that the following indigenous species are apparently endemic in our parts of India - Bombay State, and up to the present time have not spread to other parts. I wish to draw attention to such plants which are preserved on this hill: Alysicarpus beddomei Schindler, Alysicarpus belgaumensis Wight, Amorphophallus commutatus (Schott) Engler, Anotis foetida (Dalz.) Benth. & Hook., Blumea malcolmii (Clarke) Hook. f., Capillipedium filiculme (Hook. f.) Stapf, Carvia callosa (Nees) Bremek., Clitoria biflora Dalz., Curcuma inodora Blatter, Curcuma pseudomontana Grah., Ischaemum diplopogon Hook. f., Nepeta bombaiensis Dalz., Neuracanthus sphaerostachyus (Nees) Dalz., Senecio dalzellii Clarke.

Certain families discussed in this flora constitute a dominant feature of the vegetation. C. E. C. Fischer in the Flora of the Presidency of Madras, following Hooker f., does list the 10 most abundant families for Madras. I have drawn a similar list for the families of Pavagadh, and the results are given here in the tabular form:

| Order | Family | No. of spec. in Pavagadh | Hooker's Order for India | Fischer's Order for Madras |
|---|---|---|---|---|
| 1 | Leguminosae | 74 | 2 | 1 |
| 2 | Gramineae | 73 | 3 | 2 |
| 3 | Compositae | 30 | 7 | 7 |
| 4 | Acanthaceae | 25 | 6 | 4 |
| 5 | Euphorbiaceae | 24 | 5 | 5 |
| 6 | Convolvulaceae | 21 | - | - |
| 7 | Malvaceae | 18 | - | - |
| 8 | Cucurbitaceae | 15 | - | - |
| 9 & | Labiatae | 14 | 9 | 9 |
| 10 | Amaranthaceae | 14 | - | - |
| 11 | Scrophulariaceae | 12 | - | - |

## PLAN FOLLOWED IN THIS FLORA

The order followed in the Enumeration of the Families of Pavagadh in this thesis is the same as that of Cooke in his Flora of the Presidency of Bombay. However, we have followed the latest monographic works of some of the modern systematists on the subject, in splitting certain families. We do not give a full description of the plant; the remarks given against individual plants, based on our field notes carefully recorded on the spot, will help to correct or complete Cooke's description.

Nomenclature: (i) The nomenclature of the plants of Pavagadh has been brought up-to-date as far as possible, to conform with the articles of the latest edition of the International Code of Botanical Nomenclature (1956). In the references given after the name or synonyms of plants, we have followed the instructions of Appendix V of the code.

(ii) Article 32, paragraph No. 2 of the International Code of Botanical Nomenclature (1956). The names of authors as given in the list are correct except those that come under the above article. With the means at our disposal, it is impossible to find who the real author of a particular name is in such cases; Index Kewensis and other references available to the writer do not give such names. Ofcourse, in all dubious cases of the application of certain names one should see the original type-material. Owing to the circumstance we could not consult all books and types necessary for such a work, we realise that some of our names may not be correct. Santapau (1953) has treated the subject in detail in the Indian Forester 79: 611-13.

The names of plants in this thesis vary to a certain degree from the names given by Cooke in his Flora. To give the reasons for the changes made, we have, after the correct name, put the list of necessary synonyms. The adjusting of the nomenclature of Pavagadh plants and bringing it up-to-date did prove to be difficult but we are confident of changes in the names of the plants since the changes adopted in the text are quite essential to keep harmony with the Rules.

To comply with Recommendation No. 83 D of the International Code of Botanical Nomenclature, Stockloholm 1952, all data are given in metric units even when such data were first recorded in British units.

With a view to help in the identification of the plant or to make it easier, we give keys to the families, genera, species and varieties, based on as many characters as possible.

As regards the local or vernacular names, our public is familiar with only those plants which are medicinally or economically useful, no local names being available for herbs or shrubs which are unsuitable from their point of view. Often, local names vary from place to place; we therefore, after careful recording, list only such names as are used locally for the plants.

Our data on the usefulness of the plants are of interest as being first-hand and authoritative. With the help of the local people and in most of the cases from local Ayurvedic practitioners, we have come to know the medicinal properties and economic uses of Pavagadh plants. The present work records such plants as we have found to be used medicinally in the district under study.

In accordance with the Recommendation 45E of the Int. Code of Bot. Nom. (1956 edition), we have drawn our figures to scale. Moreover, we give references to other published illustrations. Our illustrations are based on fresh specimens from Pavagadh. The habit, details of structure, etc., it is hoped, will help in the identification of the plant.

Before concluding these remarks, I have pleasure to put down a word about my visits paid to the Blatter Herbarium, St. Xavier's College, Bombay, in the course of this study. After my Pavagadh specimens were carefully identified by reference to various floras,

they were checked against the best specimens in Blatter Herbarium, many of which had been previously checked against the actual types or against authentic specimens in Kew Herbarium. The most important part of the work connected with this flora - the adjusting of the nomenclature of Pavagadh plants and bringing it up-to-date in accordance with the Rules, was carried out chiefly in Bombay. I had an access to the library equipped with nice literature on the subject and hence the change in names of plants are on the authority of the latest available monographs. As regards the distribution of Pavagadh plants in World Phytogeography, we have added extensive notes prepared after a careful study of various floras available to us.

In the preparation of this flora, in addition to my own specimens, I have cited other available Herbarium sheets of Pavagadh plants in charge of earlier explorers. I have made reference to these specimens only after a careful checking of the determinations.

## ABBREVIATIONS

We give below the more common abbreviations adopted and mentioned in the nomenclature of the plants. The titles of books, journals and names of the more commonly occurring authors have been abbreviated from the customary abbreviations to a single word or even mere initials for economy of space.

ARBGC. - Annals of the Royal Botanic Garden, Calcutta.

*C. - Cooke, Th.: The Flora of the Presidency of Bombay.

D. - Dalzell, N.

D. & G. - Dalzell; N. & A. Gibson. The Bombay Flora.

FBI. - Flora of British India by Sir J.D.Hooker et al.

*Fischer - Fischer, C.E.C., joint author with Gamble of the Flora of the Presidency of Madras.

*G. - Gamble, J.S.: The Flora of the Presidency of Madras.

Gr. - Graham, J.: A Catalogue of the Plants growing in Bombay.

HK. f. - Hooker, filius, i.e., Sir J.D.Hooker, the editor of Flora of British India.

JAA. - Journal of the Arnold Arboretum.

JASB. - Journal of the Asiatic Society of Bengal.

JBNHS. - Journal of the Bombay Natural History Society.

JIB. - Journal of Indian Botany or the Journal of the Indian Botanical Society.

JLS. - Journal of the Linnean Society of London.

Merr.,Enum.- E.D.Merrill: An Enumeration of Philippine Flowering Plants.

N. - Nairne, A.K.: The Flowering Plants of Western India.

PLS. - Proceedings of the Linnean Society of London.

Pfam. - Engler, A. & K. Prantl, Die naturlichen Pflanzenfamilien.

Pfreich. - Engler, A., Das Pflanzenreich.

RBSI. - Records of the Botanical Survey of India.

*Sant. - Santapau, H.: The Flora of Khandala in RBSI. 16(1).

Talb. - Talbot, W.A.: Forest Flora of the Bombay Presidency and Sind.

TLS. - Transactions of the Linnean Society of London.

Wall. - Wallich, N. Numerical List (usually cited as 'Wallich Catalogue').

WI. - The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. Vols. I - V.

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* References given here are to the first editions and not to the reprinted or second edition.

# R E S U L T S

(1) During three and a half years of intensive study in the field and herbarium on the Flora of Pavagadh, we have been able to publish several notes and papers in the leading journals of India; reference to such publications is made in the text in the proper places; reprints are attached to this thesis.

(2) Frequent visits to the place did help us to record most of the plant species of Pavagadh recorded by previous visitors. About an equal number of plants not previously recorded for the district including a fairly good number of families missed by our predecessors have been also added. We have been able to determine the distribution and relative abundance of plants and their life cycles and have added extensive notes to show their distribution in World Phytogeography.

(3) Very little attention has been paid to the colour of the flowers of many plants in our Indian floras; the colours of most of the flowers, determined when in fresh state in the fields, have been noted here. The data on flowering and fruiting periods for almost all the plants have been recorded precisely and are often found to vary from the data given by Cooke in his Flora.

(4) Due care was taken to collect plants in the rains, and as a result we have come across plants which were not recorded from the area under observation. In fact, Dipcadi montanum Dalz., Chlorophytum tuberosum (Roxb.) Baker, several species of Arisaema, and Curcuma inodora Blatter, etc. are among our collection because of particular care paid to these plant species. And our field notes

on the systematics of Curcuma are indeed a distinct contribution in the revision of the genus Curcuma in India.

(5) Several plants reported to be " rare " or " very rare " by Cooke in his Flora of Bombay have been noted as fairly abundant and common in Pavagadh. It is probable that these plants have restricted distribution in other parts of the region studied by Cooke. Also we find from our field experience that some of these species are often confused with other species in their general appearance. Here is an example: for Polycarpon prostratum (Forsk.) Aschers. & Schweinf., Cooke mentions that the plant is rare; our findings are that the plant is fairly common in Pavagadh and all over the district.

(6) The preparation of this thesis gave us training in botanical field exploration, in the laboratory and in the Herbarium, which will enable us to carry on research on similar problems in the study on modern lines of the future Floras of other parts of our Country.

(7) In the end, it is our humble claim that the data contained in this work are of value as being first hand and reliable; we claim that this thesis is a distinct contribution to our knowledge of the Flora of Western India in general and of Gujarat in particular.

For all these reasons, this thesis, is respectfully submitted to the Maharaja Sayajirao University of Baroda towards the degree of Doctor of Philosophy in Systematic Botany.