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THE FLORA OF KHANDALA ON THE
WESTERN GHATS OF INDIA

BY

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2nd Edition



सत्यमेव जयते

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FOREWORD

It is my pleasure and privilege to get the Flora of Khandala on the Western Ghats of India published in Volume XVI, No. 1. Due to war and consequent financial and other difficulties issue of the Records of the Botanical Survey of India had to be kept in abeyance for about 8 years. Immediately after the war and as soon as the conditions improved, publications of the Records of the Botanical Survey of India were renewed under the orders of the Govt. of India, and Vol. XV, Pt. I and Pt. II—Common Fresh and Brackish Water Algal Flora of India and Burma, 1949 by K. Biswas was published. Soon after materials for the 'Flora of Khandala' were received from Father H. Santapau and 'Studies in Indian Berberidaceae' from Dr. R. Chatterjee. Govt. sanctions for the publication of both these works were obtained as soon as possible and the Govt. of India Press are good enough to take up printing work of these almost immediately on receipt of these manuscripts.

Although the Flora of Khandala on the Western Ghats of India occupy a small space, it is none-the-less an important and interesting spot in the Bombay Presidency. My esteemed friend late Father E. Blatter with whom I had the good fortune to travel together to Poona mentioned to me years ago while passing through the then denser vegetation of Khandala by train about the need for thorough exploration and study of this spot and also of the flora of the Mahabaleswar hills in Panchgani district where he lived in his Parish house. Father Santapau by taking up this floristic work has thus contributed much to our knowledge of the flora of this part of the country. His work is extremely valuable as it contains more or less complete record of his detailed observations made actually in the field during his many visits to the Khandala Valley. The data contained in his monograph 'The Flora of Khandala on the Western Ghats of India' are therefore of greatest value to science in the preparation on modern lines of future floras of other parts of India. He has left no stone unturned to collect and record briefly all possible information which a systematist can possibly expect in a work of this kind. Then again his work has been brought to perfection by comparison and examination of his own specimens with those in the Herbaria

at Calcutta, Kew, British Museum Natural History London and Linnean Society. He has also made a very good attempt to clarify the systematic position and complicated question of nomenclature of many species mentioned in his Treatise. His notes under each species are valuable additions.

Moreover, this work is of considerable value in throwing light on the nature of different elements in the flora of Khandala and also distribution and migration of some of the cosmopolitan and Malayan species which curiously enough seem to be predominant in this locality. Many species are allied to Bengal species. During my review of the Systematic and Taxonomic studies on the Flora of India and Burma I pointed out, to quote H. N. Ridley's words "If we examine the flora of India from the Himalayan region to Ceylon and Burma, we notice that it is composed of a series of elements common to other regions of the surrounding areas ; of these we may eliminate for study purposes the weeds or plants intentionally or accidentally introduced by man and confine our attention to those which are indigenous, and we must make a distinction also between plants which have migrated overland and the sea-borne or maritime species which have arrived by quite a different path. Hooker (Flora Indica, 1855 gave a division of the flora as then known into sections according to geographical affinity. More recent investigations have much modified his sections."

No definite conclusion, therefore, can be drawn from our meagre knowledge of the flora, unless like Father Santapau, detailed botanical survey of the different parts of India is carried out and data and observations are recorded as a result of field study in season and out of season for the study of each and every species. Autecological investigation is, therefore, gaining more and more importance in solving many an intricate floristic problem of this vast sub-continent of ours with which the floras of the neighbouring countries are intimately linked.

Fr. Santapau's work will undoubtedly prove useful to all Systematists, Taxonomists and students of Botany. I have no hesitation to recommend this valuable work to all interested in the flora of this country.

THE HERBARIUM,
INDIAN BOTANIC GARDEN,
CALCUTTA.

K. BISWAS,
Superintendent,

The 22nd February, 1952. Indian Botanic Garden, Calcutta.

PREFACE

The present Flora is the result of twelve happy years spent in the exploration of Khandala. For a long time I had been keenly interested in the plants of the Western Ghats of India, but it was almost an accident that this work was undertaken. The late Rev. Fr. J. F. Caius, S. J., shortly after my return to India in 1940, once remarked to me that many botanists, who had worked on the botany of India, seemed to have gone for extensive rather than intensive exploration. This casual remark was the inspiration that urged me to concentrate on Khandala.

My work has been made easier by the help and assistance that I have received from many people. The Rev. A. M. Coyne, for many years Principal of St. Xavier's College, gave me every facility, not only by granting me leave of absence from the college, but also by putting St. Xavier's Villa in Khandala at my disposal. Throughout the earlier part of the work, I was fortunate to have the advice and constant company of C. McCann, F.L.S., the then Asst. Curator, Bombay Natural History Society; he accompanied me in many of my field outings and helped in the identification of some of the more difficult families of plants; by his departure from India in 1946 I have been deprived of the company of a very charming friend, and India has lost one of the best field workers in Natural History.

I owe sincere thanks to Sir Edward Salisbury, F. R. S., the Director, and to Dr. N. L. Bor, the Assistant Director, Royal Botanic Gardens, Kew, for many kindnesses received from them during my two years' stay at Kew during the preparation of this book; to Dr. K. Biswas, the Superintendent, Indian Botanic Garden, Calcutta, and to Dr. S. K. Mukerjee, the Curator of the Herbarium, for their help in the identification of some of my plants; Mr. M. B. Raizada of Dehra Dun has also helped me; it is with sincere gratitude that I acknowledge my indebtedness to them all. Part of the work connected with this Flora was submitted to London University towards the degree of Ph.D. and is here presented with the kind permission of the authorities of London University.

The Flora of Khandala is dedicated to the legion of Indian botanists working throughout the new and independent India, with the sincere hope that other local floras may in time be published and so help gradually to make our very rich flora better known to the scientific world.

ST. XAVIER'S COLLEGE, BOMBAY

Easter Sunday, 25th March 1951. H. SANTAPAU, S. J.

PREFACE TO THE SECOND EDITION

When the first edition of this Flora was published in 1953, the number of printed copies was so small that many libraries and institutions were unable to complete their series of the *Records*. To satisfy their needs and to help Systematic Botanists in their troublesome quest for the correct botanical name of many of the plants included in this Flora, this second edition has been prepared.

In general there have been but a few changes from the first edition. The most noticeable change is the suppression of the herbarium references after the description of the species or varieties; the occurrence of any particular species in Khandala is given on the findings of the author in the field or in the herbarium; where he has not been able to see any herbarium specimen, he mentions the name of the author on whose authority the plant has been included in the book. From the time the book went to press for the first edition up to the present the author has discovered a large number of plants in the district; many of them form new records for the district, and some are records even for Bombay State; all these new findings have been included in this edition. Further some of the plants have had some extra details added, the details being the result of constant exploration in the Khandala area until the end of 1954. In several cases references have been added to important publications that have come out after the first edition went to press.

References to Cooke's and Gamble's floras throughout this book are always to the *first* edition.

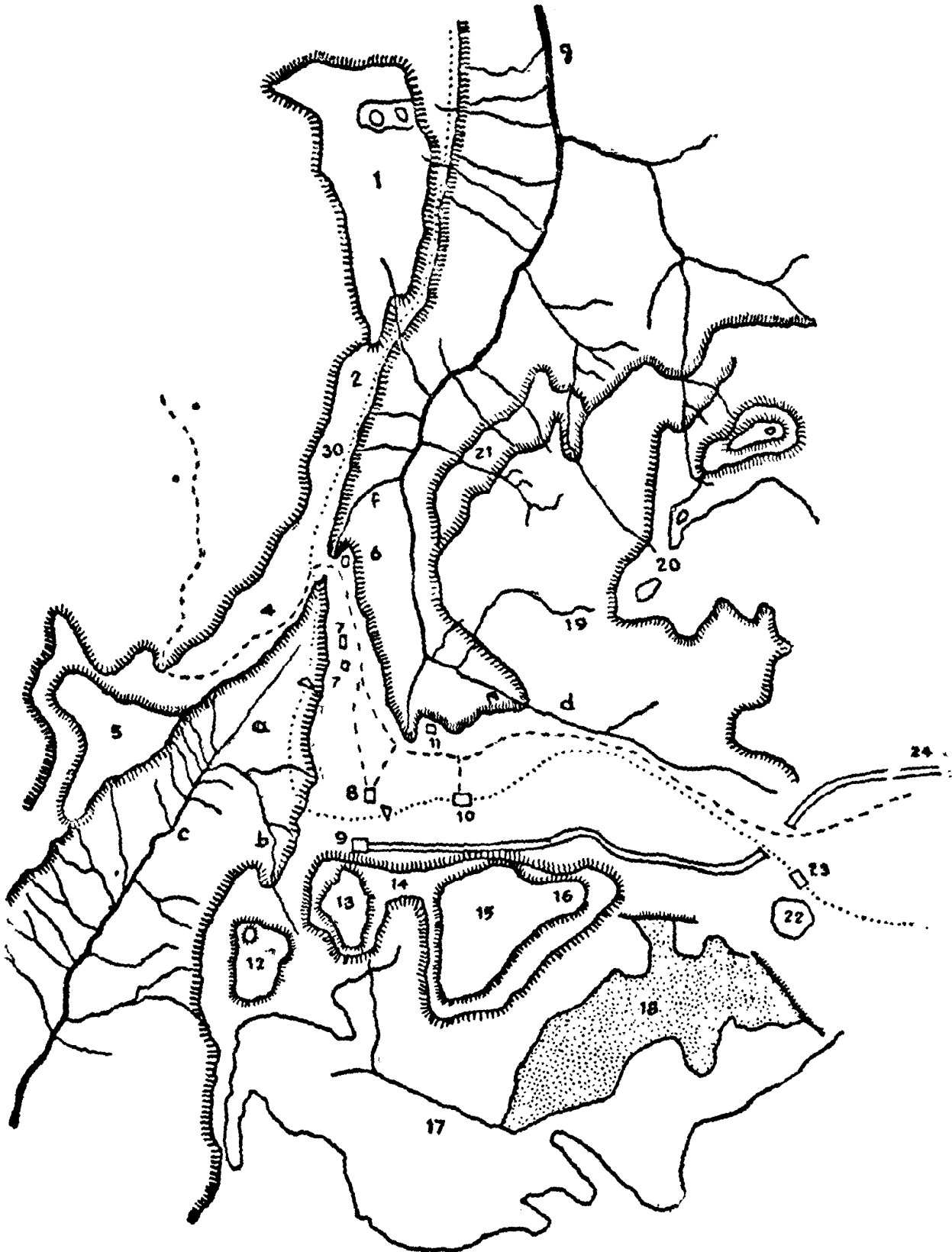
Bombay, 6th April, 1958.

H. SANTAPAU.

Explanation of Map of Khandala.

-----	Main Road.
.....	Railway Line.
====	Canal.
=====	Streams.
-----	Steep Slopes.

- | | |
|--|--------------------------------|
| 1. Behran's Plateau. | 13. Echo Point. |
| 2. Monkey Hill Plateau. | 14. Saddle. |
| 3. Monkey Hill. | 15. Bhoma Hill. |
| 4. Battery Hill Plateau & Reversing Station. | 16. Barometer Hill. |
| | 17. Korinda Valley. |
| 5. Patanmal Plateau. | 18. Lanavla Lake. |
| 6. Elphinstone Point. | 19. Kune Plateau. |
| 7. St. Xavier's Villa. | 20. Ghira Hill. |
| 8. Khandala Hotel. | 21. Meroli Plateau. |
| 9. Forbay. | 22. Lanavla Grove. |
| 10. Khandala Station. | 23. Lanavla Station. |
| 11. St. Mary's Villa. | 24. Tata Canal. |
| 12. Duke's Nose. | |
| <i>a.</i> St. Xavier's Ravine. | <i>d.</i> Kune Stream. |
| <i>b.</i> Echo Point Ravine. | <i>e.</i> Dhobi Falls. |
| <i>a.</i> Duke's Nose Ravine. | <i>f-g.</i> St. Mary's Ravine. |



MAP OF KHANDALA
(Scale approx. 1 : 63,000)

INTRODUCTION

THE DISTRICT OF KHANDALA

Geographical position.—Khandala is a small Maratha village and a railway station on the main C. Ry. South East Line, situated at the western edge of the Deccan Plateau, 116 Km. by road from Bombay and 66 Km. from Poona. The position of the railway station, the centre of the present village, is $73^{\circ} 23' E.$ and $18^{\circ} 0' N.$ (See No. 10 on the map). The highway from Bombay to Poona passes through the middle of the village, and from the Konkan plains to Khandala itself follows, at least in some stretches, the very old Bhore Ghat road of the Maratha days. The original village of Khandala lies about 300 m. to the south of the station, on one of the many spurs or "Sausages" of Bhoma Hill. The elevation of the railway station is about 677 m. above sea level, and about 630 m. above the Konkan plains to the West.

Main features of the district.—The district covered in the present flora and referred to in these pages as "Khandala District" consists of a level plateau about 25 km. sq. made up of three semi-independent plateaus. Karvanda or Korinda Valley is the southernmost part or plateau (Nos. 17 & 18 on the map), and is separated from Khandala proper by Bhoma Hill and Echo Point; it is, however, united to Khandala through the eastern part where Bhoma Hill comes suddenly to an end. The northern portion is the larger plateau, known as Kune Plateau (no. 19 on map), and is separated from the central portion by the Kune stream and ravine, the latter often referred to in these pages as "St. Mary's Ravine" (d—f on map). The western boundaries of the district are formed by the long ravine that runs from a spot roughly between the old Reversing Station and St. Xavier's Villa southwards to the base of Duke's Nose (a—c on map); the eastern boundaries are rather arbitrary, and for convenience sake were fixed as the line passing through the top of Ghira Hill (no. 20 on map) to the eastern side of Barometer Hill (no. 16 on map), as the eastern portion of Bhoma Hill is often called. Somewhat cut off from the main part of Khandala are Behran's Plateau, 4-5 km. north of Khandala station (no. 1 on map), and Patanmal Plateau (no. 5 on map) about 5 kms. SW. of the station; both these plateaus and the intervening country have been included as part of the district, mainly because they are of easy access from St. Xavier's Villa and the elevation of the plateaus above sea level is about the same as that of the main or central Khandala plateau.

The highest spot in the district is Bhoma Hill (No. 15); the highest part being marked on the Survey maps as 2,782 ft. (about 848 m.) above sea level; to the west of Bhoma Hill is Echo Point (No. 13), which is but a little lower than Bhoma Hill itself; the spur joining these two hills is known locally as the "Saddle" and is about 722 m. above sea level (No. 14); through the Saddle passes the path that connects Khandala with Korinda village through Khandala Hotel (No. 8) and the Forbay terminus of the Tata Hydroelectric Canal (No. 9). Slightly to the south-west of Echo Point and rising in isolated majesty is the massive hill

known as "Duke's Nose", so called after the Duke of Wellington on account of the remarkable similarity between the western edge of the hill and the profile of the human face (No. 12).

To the north of Khandala rises a massive plateau, known locally as "Behran" and to English-speaking visitors as "Rama's Bed and Pillow"; the latter name graphically describes the shape of the plateau: it consists of a level stretch about 1.5 km. long and 900 — 1,400 m. broad, and is bounded on the north by two hills which are joined by a neck slightly lower than the hills themselves; from some distance away the two hills with their connective link do look like a pillow on which a head has rested. The plateau ends very abruptly on all sides, more especially so on the eastern and north sides. In geological times Behran's Plateau, Patanmal Plateau and Matheran (about 18 kms. away to the NNW) were obviously connected to the main Deccan Plateau, from which they have been cut off in the course of time through the intense erosive action of winds and rains; this explains the fact that all these plateaus have about the same elevation over sea level and that their vegetation is typically the same as that of Khandala.

St. Mary's or Kune Ravine is a deep chasm with very steep, almost vertical sides, running in a north westerly direction between Khandala and Kune for about 1.5 km.; then it turns north and runs in this new direction for several kilometers (c—g on map); the ravine may be said to start at the foot of Dhobie Falls (83 m. high, a magnificent sight during the monsoon) just behind St. Mary's Villa, hence the name of "St. Mary's Ravine" given to it by school boys and visitors. Occasionally the slopes of this Ravine open out into a ledge-like plateau, as *e.g.*, at Meroli.

St. Xavier's Ravine runs in a S. or SSW. direction for about 3 kms. and passing through the village of Chavni goes to swell the waters of the river Ambar. About 1.5 km. from the upper end of this ravine it is joined by a stream that runs between Echo Point and Duke's Nose (b on map); for the sake of convenience in the following pages I refer to this stream and ravine as "Echo Point Ravine", whilst the lower part of the main stream and ravine I have called "Duke's Nose Ravine". Locally there is no name for these ravines; I have given them arbitrary names for the sake of brevity in my field books and in the pages of this flora.

CLIMATIC CONDITIONS

Reference has already been made to the intense erosive action of winds and rains. In order to get a clear idea of the climatic conditions prevailing in the district, I had a meteorological observation post set up in Khandala, and for three whole years was thus able to obtain a fairly complete set of records. Through the kindness of the Director General of Observatories, Poona, I also obtained rainfall data for a number of years previous to those during which I explored the district. During my absences from Khandala most of the instruments were left in charge of the Rev. O. More, the missionary in charge of Kune Katkari Settlement, to whom I gladly acknowledge my indebtedness.

Rainfall.—Owing to its position on the edge of the Ghats, Khandala is exposed to the full blast of the monsoon ; an occasional shower of rain may fall towards the end of May or beginning of June ; the monsoon proper sets in some time in the first half of June and continues with unabated force until the beginning of September ; there is then generally a break of a few days with only occasional showers ; the winds and rains then change to a NW.—SE. direction and this constitutes what is termed the “second monsoon”. About the beginning of October or occasionally a little earlier the rains come to a stop, and until the middle of May of the following year there is either no rain at all or only in such small quantities that they can scarcely be measured with the ordinary rain gauge. During the rainy months, the amount of rainfall in 24 hours may go from a few mm. to well over 335 mm. ; it is clear that under such conditions, botanizing may be rather trying.

The following table gives the total rainfall from June 1st to September 30th, for the years 1931 to 1946. The highest total is that for 1942 (230·90 in. = 585·5 cms.), the lowest that for 1941 (128·6 in. = 326·6 cms.); the average for the 16 years is 192·9 in. = 489·9 cms.

TABLE 1.
Total Rainfall June—September.

Year.	Total in In.	Total in Cms. (Approx.)	REMARKS.
1931	213·6	542·5	
1932	154·8	593	
1933	224·9	571·3	
1934	172·5	437·3	
1935	168·1	427·3	
1936	165·6	420·6	
1937	180·3	457·7	
1938	226·6	573	
1939	173·2	439·5	
1940	218·7	555·8	
1941	128·6	326·4	The lowest in 16 years.
1942	230·9	586·5	The highest in 16 years.
1943	215·5	547·6	
1944	163·6	431·5	
1945	223·1	566·1	
1946	226·1	574·3	

To make my data comparable with those given by Champion in his book "Preliminary Survey of the Forest Types of India and Burma" (Ind. For. Rec. 1(1), 1936) Table 2 has been added to show the distribution of the annual rainfall throughout the months of the year.

TABLE 2.

Rainfall in cms. for 1944-45.

Months.	1944.	1945.	1946.
January . . . . .	..	..	..
February . . . . .	..	..	..
March . . . . .	..	..	..
April . . . . .	..	..	..
May	Traces.	Traces.	Traces.
June	52.8	80.3	80.5
July	213.1	234.9	203.4
August	137.9	183.9	212.3
September	27.7	67.1	78.2
October	13.9	3.5	Traces.
November . . . . .	..	..	..
December	Traces.	..	..
Total for Year	445.4	569.7	574.4
Rainy days	96	112	112
Months with less than 5 cms.	7	8	8

The erosive action of such torrential rains can best be seen in parts of the district where the forest has been cut down in recent years. Extensive deforestation was carried out on the spurs of Echo Point behind Khandala Hotel from 1939 to 1945; for the first few years the soil could support a fair crop of *Nachni* (*Eleusine coracana* Gaertn.) and other cereals; but gradually the upper soil is being washed away and the rocks begin to appear; at the present rate in the course of a few years all the soil will have been washed away and there will be another bare and rocky spot added to the many that so considerably disfigure the district.

Winds.—During the first half of the monsoon winds blow in a S.W. — N.E. direction and often reach the speed of 60 kms. and more per hour; when the wind force is coupled with heavy rains it often results in bringing

down some of the tallest trees of the forest, a frequent occurrence in Khandala during the first half of the monsoon. During the second half of the rainy season winds are more moderate. Outside the monsoon months there are fairly strong winds blowing from the N. or N.E., and during the months of December and January such winds may attain the velocity of gales, but their duration is only from the early hours of the morning to about 10 a.m. or at most till noon. For the rest of the year there is but a gentle breeze from the sea that springs up in the evening and lasts throughout the night and considerably freshens the atmosphere.

Temperature.—The hottest months of the year are March and April, with noon temperatures in the shade often reaching 37.8°C (=100°F); the hottest hours of the day are between 1.30 and 3 p.m. The lowest temperatures recorded during 1945 were only 8.9°C (=48°F) on January 7th, and 11.1°C (=52°F) on December 27th. In the course of the day even in January or December temperatures often rise to 26.6°C (=70°F). The range for any particular day in the year between the maximum and minimum for that single day may be over 17°C; during the rains the range may be as low as 0.5°C and is seldom above 5.5°C. Table 3, built after the fashion of those in Champion, *loc. cit.*, gives the temperature data for 1945.

TABLE 3.

Temperature in °C for Khandala for the Year 1945.

—	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean	20.2	22.5	28	28.9	29.2	25.7	22.9	23.1	23.6	27	25.1	22.3
Mean Maxim.	25.0	28.2	35.3	34.6	34.6	27.8	24.4	24.8	26.7	32.2	32.7	30.4
Mean Minim.	14.5	16.8	20.6	21.9	23.9	23.6	21.6	21.5	20.5	19.8	17.6	14.2
Max. Highest	29.4	34.4	39.4	37.8	37.8	37.8	27.2	28.9	30.3	35	34.4	32.8
Lowest Minim.	8.9	12.8	17.8	20.0	22.2	21.1	20.5	20.0	19.4	17.8	14.4	11.1
Mean Rel. Hm. at 9 a.m.	67.7	65.2	78.4	87.2	88.2	91.2	96.7	94.0	85.4	91.8	80.6	79.6

Mean Yearly temperature . . .	25.2°C.
Mean Maxim. temperature . . .	29.7 „
Mean Minim. temperature . . .	19.0 „
Highest Maximum	39.4 „
Lowest Minim.	8.9 „
Mean Rel. Humidity 9 a.m. . . .	54.7 per cent.

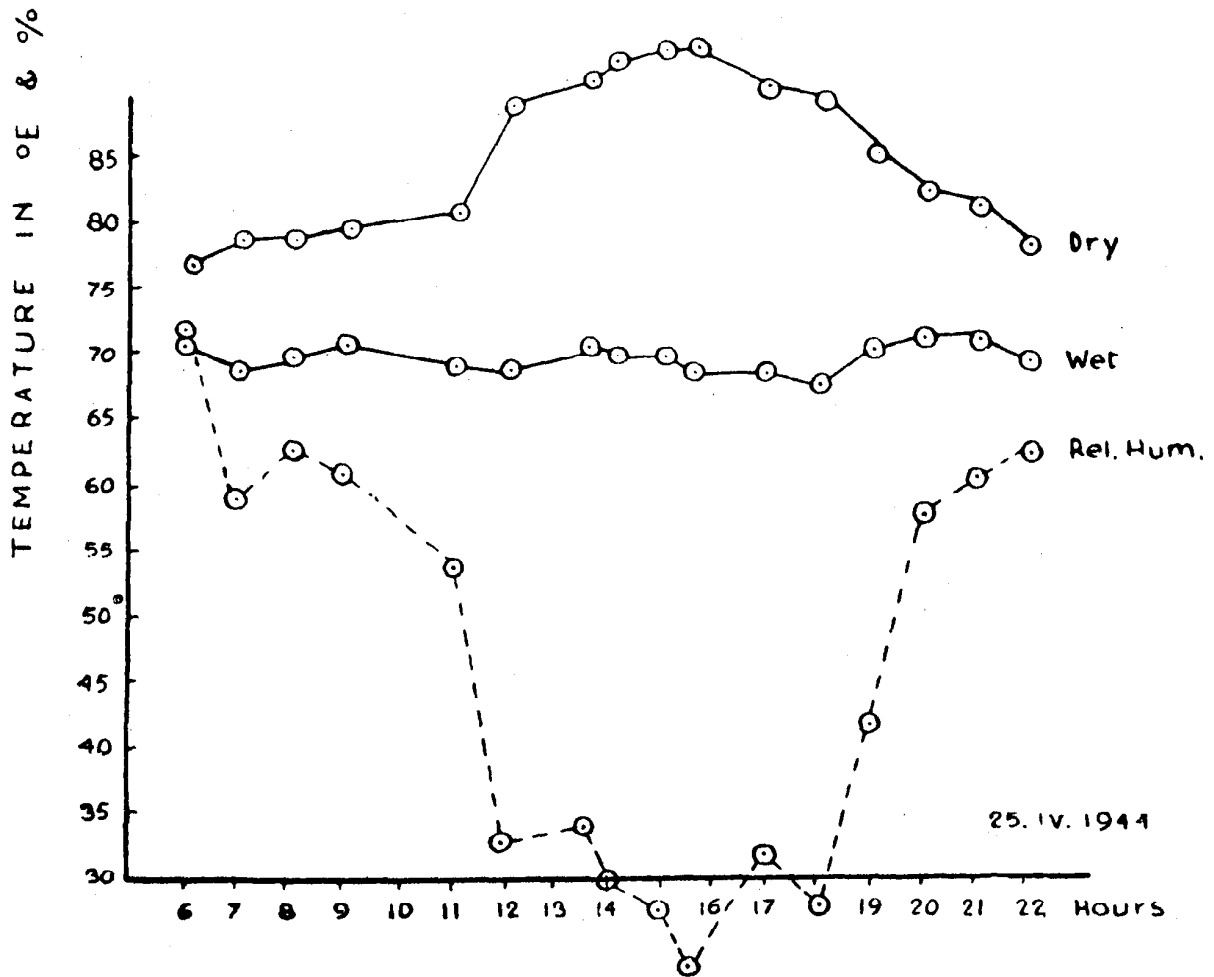
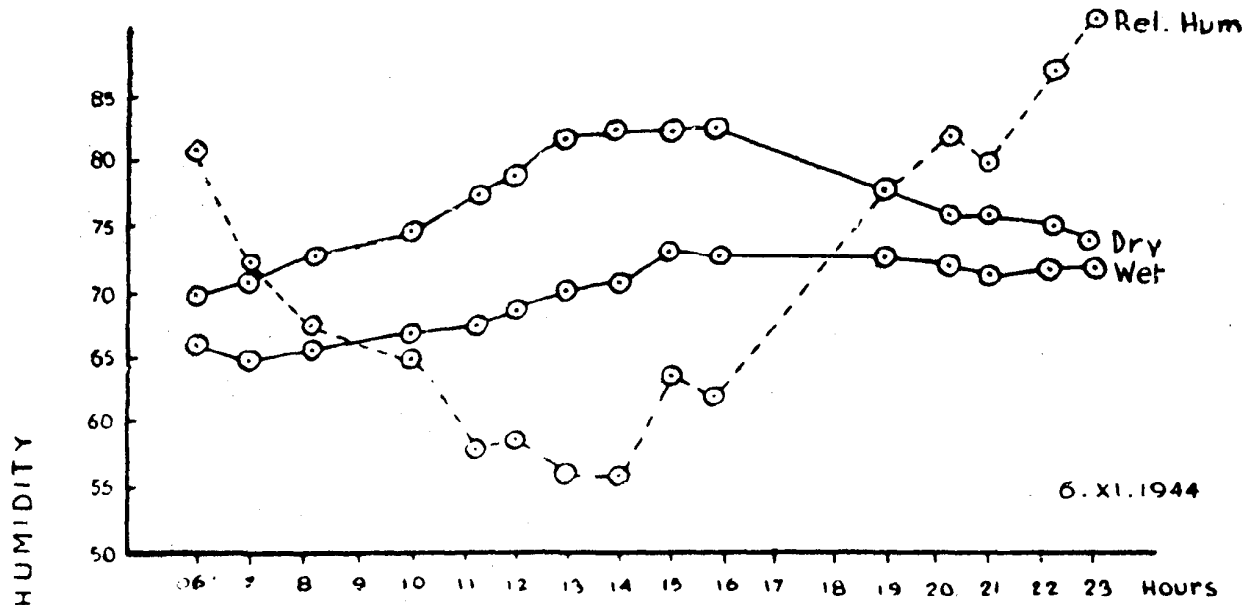
Relative Humidity.—Owing to its position on the western edge of the Ghats, Khandala receives the breezes from the sea which is only about 60 km. away, and in consequence the atmosphere never gets as dry as e.g., in Poona and other places further inland. Even during the hottest and driest months of the year, the relative humidity during the night and in the early hours of the morning is fairly high, often about 90 per cent. ; during April the relative humidity is generally above 70 per cent. in the morning, during the course of the day the air dries up and the moisture content may come down to 25 per cent. at about 3 p.m. ; thereafter it rises again so that by 10 p.m. it is again over 60 per cent. During the rainy season the moisture content of the air is seldom below 90 per cent. and often is near 100 per cent. Table no. 3 gives the mean monthly relative humidity for 1945 ; all the readings have been calculated from the Dry and Wet Bulb Thermometer readings, the official Hygrometric Tables of the Meteorological Dept., Govt. of India, being used for the calculations.

The two diagrams, Nos. 1 and 2, give the Dry and Wet Bulb Thermometer readings for April 25 and November 6, 1944, and the percentage relative humidity as calculated from the thermometer readings.

During the summer months of 1946, April to June, I had a thermograph set up in St. Xavier's Villa, in the shade, about 1.5 m. from the ground. The records obtained show a very regular daily curve with a maximum of about 100°F (=37.8°C) in the early afternoon and a fairly gradual descent lasting until 7—8 a.m. of the following day ; after 8 a.m. there was a steep rise to the afternoon maximum. Occasional showers of rain during May and the first half of June were recorded as a sharp, almost vertical drop ; when the rains set in, the record became an almost straight line at about 70°F (=21.1°C).

SOIL AND GEOLOGY.

Khandala forms the western edge of the Deccan Plateau, and its rocks are mostly, like those of the rest of the plateau, of very dark basalt. The northern wall of St. Mary's Ravine shows the rocks laid down in very regular horizontal strata of varying thicknesses, separated by rather thin, snow-white quartz layers. In such localities the upper strata may be missing, and this gives rise to horizontal ledges varying in width from a few cms. to several hundred meters ; thus for instance, Meroli Plateau is formed by one of these ledges about 300 m. wide and 1.5-2 km. long. Generally all over Khandala the amount of loose soil is very scanty except in places where the silt brought down by the rains from the higher ground has been retained by some natural or artificial barrier, as is the case in the cultivated fields on either side of the railway station. Where the vegetation is dense, as in most of the ravines and their slopes, there is always plenty of humus on the ground ; but where the vegetation has been cut down, the upper soil is easily washed away, as on many of the slopes of either side of Bhoma Hill, Echo Point and the "Bed" or flat tableland of Behran's Plateau.



Wet & Dry Thermometer Readings for 24 April & 6 November, 1944

THE BOTANICAL EXPLORATION OF KHANDALA.

John Graham (1805-1839), was the first of the "modern" botanists to explore Khandala ; in his Catalogue Graham mentions Khandala 101 times, "Lanovlee Grove near Khandala" 14 times, the Ghats about Khandala or the Ghats generally over 90 times. Whilst reading the Catalogue one may notice that when Graham mentions, e.g. Belgaum, S. Concan and other places, he generally gives Law, Gibson, and others as his authorities ; as regards Khandala, except on very rare occasions he mentions the place and various points in the district directly, and, it would seem, from his own observations. Graham spent considerable time in Khandala, but from the plants listed in his Catalogue it appears that he was there only during the dry season of the year or at most from October onwards ; as regards monsoon plants, he merely cites them as "common" without any reference to Khandala. He died in Khandala on May 28, 1839, and was buried in a small cemetery which is at present enclosed within the grounds of St. Mary's Villa. The funeral inscription on the well-preserved tomb records that Graham was "an active originator, warm supporter and accomplished member of the Agricultural Society of Western India" and that the tomb was "erected by his numerous friends...in commemoration of...his disinterested labours and valuable contributions in the cause of Botanical Science".

Hooker f. and Thomson in the introductory essay to their *Flora Indica* (p. 52) have a few very hard expressions on Graham and his Catalogue ; "the Catalogue ... has unfortunately been of little use to us ... ; internal evidence occasionally enables us to recognize with certainty the plant named ; but more frequently it shows that the identification is erroneous...". In spite of the many obvious deficiencies of Graham's Catalogue, it has been quoted by practically every subsequent writer on the flora of Western India, including several of the authors who helped Hooker f. in his *Flora of British India*. For my part, I have been able to trace, with but few exceptions, all the plants that Graham mentioned as occurring in Khandala in his time. In general I may say that Graham's Catalogue has been of real service to me in the exploration of the district.

Blatter, Hallberg and McCann.—These botanists with Blatter as the leader, carried out extensive work in the district and made large collections during the years 1917—1919 ; as a matter of fact their collections form the main nucleus of the Blatter Herbarium. McCann, working on his own, made a special collection of the Gramineae, Cyperaceae and Orchidaceae from 1919 to 1931. Many of the plants of the earlier collections of these workers are not too well preserved and often not too carefully pressed ; moreover, these collections were made mainly during October and March to May, so that monsoon plants are rather poorly represented. Blatter seems to have planned writing the *Flora of Khandala* and for this purpose recorded his findings in a card index, which is at present in the Blatter Herbarium, and will be quoted in this flora as "Blatter in MS. catalogue". Similarly, Hallberg kept a record of the plants he collected in Khandala ; his catalogue consists of a series of marginal notes to his own copy of Nairne's *Flowering Plants of Western India* ; this series of annotations is mentioned in this flora as "Hallberg, in MSI catalogue". Shortly before C. McCann left India for New Zealand.

had occasion to examine his private herbarium, which consisted of several thousand well preserved specimens ; his collection at the time of writing this flora is in Wellington, New Zealand.

Occasional Visitors.—Among the many botanists who have paid occasional visits to Khandala the following deserve special mention : Dr. *A. Gibson*, the Superintendent of the Botanic Garden at Dapuri ; *J. S. Law* of the Bombay Civil Service ; Dr. *J.E. Stocks*, Bombay Medical Staff ; *G. M. Woodrow*, Professor of Botany, College of Science, Poona ; Dr. *Th. Cooke*, Principal of the College of Science, Poona and Director of the Botanical Survey of Western India ; the Rt. Rev. *R. D. Acland*, Bishop of Bombay ; *J. L. Sedgwick*, of the Bombay Civil Service, and others such as *Gammie*, *Meebold*, *Bhide*, *Bhiva*, *Kanitkar*, etc. Their collections are scattered through several herbaria in India and Europe ; for the purpose of this Flora, I have examined the collections of Blatter, Hallberg, and McCann, Sedgwick and Bell, Acland, Woodrow, Cooke in Poona and in Kew, etc. The bulk of the collections from Khandala of Stocks, Law, Gibson, Dalzell and a few sheets of Meebold are kept in Kew Herbarium ; a large number of sheets of Cooke, Gammie, Bhide, Bhiva, etc. are preserved in the Herbarium of the Economic Botanist, Bombay Government, in the Agricultural College, Poona, where recently I have had occasion to examine them at leisure.

MY EXPLORATION OF KHANDALA.

Methods.—The present flora is based on the results of ten years of study in Khandala. Almost from the very beginning of my work I was fortunate in having the company and assistance of C. McCann, the only survivor of the trio Blatter, Hallberg and McCann, who until 1946 was my almost constant companion in many of my visits through the district. With McCann's help, the following method was evolved for the exploration of Khandala :

1. For the purposes of obtaining a record not only of the vegetation of Khandala, but also of the seasonal changes, excursions were made regularly at least once, often twice or more times every month in the year, including the monsoon and winter months ; this has been kept up for 1940-1946 and 1948-1949.

2. St. Xavier's Villa was made the centre or base camp for the work. In a large room in the villa I set up a laboratory where scientific instruments and chemicals could be kept permanently and where all dissection and other work could be carried out in comfort. Radiating from St. Xavier's Villa, the district was so divided into sections that each of these could be explored in little more than half a day ; parts of the district which on account of distance could not be visited in this regular fashion have been left out of this flora entirely.

3. In the course of the day's excursion, plenty of observations were entered in a rough log book and specimens were collected. On the return to St. Xavier's Villa, all the specimens were carefully checked, rough notes studied and entered into the proper field books ; the specimens were then poisoned, labelled and pressed. When a plant had been repeatedly collected and pressed, new specimens were again collected and

examined, and, should they add nothing further to the previous collections, an entry was made in the field book merely to record the presence of the plant and its condition, and the specimens were discarded. An attempt was made in every case at the identification of the plant before pressing or discarding ; any specimen that could not be identified on the spot, was preserved for future study. The laboratory work at times was very heavy, especially during the monsoon ; but the general plan was to finish the study of one set of plants before attempting another collection. This, on occasion, meant staying up in the laboratory till nearly midnight, but generally speaking the plan was carried out smoothly and without undue fatigue.

4. On numerous occasions plants were found in the vegetative condition and their identity could not be ascertained ; then the exact position of the plant in question was determined by reference to several points in the district, this was done with a prismatic compass ; in the course of ten years I have never failed to find again a plant that had been so marked.

5. Special attention was paid to the sizes of trees, etc., as it appeared that the measurements given by Cooke often seemed to disagree with my findings in Khandala. For the purposes of accurate measurements, I made use of an Abney level or of a pocket sextant ; the trigonometrical method of measuring trees has been found to be the most accurate and at the same time the easiest, for trees over 4m. in height.

6. The colour of the flowers, often so vaguely and inaccurately described in some of the Indian floras, was determined whilst the flowers were still fresh by reference to the tables in Ridgway's Standard Colours and Nomenclature ; references are given in the body of this book as " Ridg. 1, b", etc.

Results.—Practically every plant found in Khandala by previous collectors has been recorded again in this flora ; the relative abundance of most plants and their life cycles have been determined ; moreover, a fairly good number of plants not previously recorded for the district has been added ; several new species, varieties and forms have been described. The flowering and fruiting seasons for most plants have been accurately recorded, and these have been found to vary considerably from the data given by Cooke. The colours of most flowers have been noted down, and where they did not agree with published descriptions, reference was made to Ridgway's book, which has always been part of my equipment in my excursions.

Plants which in Cooke's Flora are given as " rare " or " very rare " have been repeatedly found in Khandala ; from my findings, I would rather say that they are restricted in their occurrence or in the length of time during which they are conspicuous for their flowers ; thus, e.g., Cooke writes of *Phaseolus khandalensis* Santapau (*Ph. grandis* Cooke) : " A very rare plant, found only on the Konkan and Deccan hills " ; similarly of *Dolichos bracteatus* Baker Cooke writes : " A very rare plant, the only specimens seen being those in Herb. Kew marked 'Konkan, Stocks' " ; both plants are abundant in Khandala and Purandhar ; unfortunately their flowering times coincide with the worst part of the monsoon, and so specimens in herbaria are rather scanty. Some of the typical monsoon plants passing as rare in the literature are not rare at all,

but "unfortunately they flower in July, at which time the whole of the hill-sides are streaming with water, rendering plant-collecting-a task of no ordinary difficulty" (Cooke, 2 : 734) ; some of these rare plants have proved to be about the commonest and most abundant ones in Khandala during the heavier part of the monsoon.

In the course of my excursions, I have paid special attention to plants of the families Liliaceae, Amaryllidaceae and other tuberous or bulbous plants ; in the past they have often been missed by previous collectors, because their flowers are of very short duration and come out immediately after the very first monsoon showers. Such is the case, for instance, with several species of *Pancratium*, *Crinum* and with the vernal form of *Curcuma pseudomontana* Grah. ; residence in Khandala throughout the month of June has afforded me a good opportunity to collect interesting data heretofore not recorded on these early monsoon plants.

THE VEGETATION OF KHANDALA.

On several occasions, both in the field and in the laboratory, I have tried to fit the various types of vegetation found in Khandala into one of the groupings described by Champion in his book " Preliminary Survey of the Forest Types of India and Burma " ; but I have found great difficulty in this, the reason being that the species mentioned by Champion are quite different from those of my district. For this reason I have finally decided to omit all reference to Champion's types, and to give my own description.

One of the remarkable features of the vegetation of the district taken as a whole, is the almost complete absence of deciduous trees ; it is only on the " Bed " or flat tableland on Behran's Plateau that deciduous trees are sufficiently numerous to affect the general character of the place. In other parts of Khandala there are deciduous trees, but their leaves are shed at different times or seasons for different trees, so that the district as a whole must be classed among the evergreen parts of the country. Some trees shed their leaves at the beginning of the cold season, others during the hot summer months, most trees, however, are evergreen. One tree has often attracted my attention, *Heterophragma quadriloculare* Schum. (*H. roxburghii* DC. in Cooke's Flora) ; it is one of the few trees that are generally leafless during the first part of the monsoon.

1. *Meroli Plateau*. As indicated above, Meroli consists of a practically flat ledge varying in width between 200 and 300m. and about 1.5-2km. in length. Its altitude is about 275-310m. Botanically it is one of the most interesting spots in the district, as its forest on account of its inaccessibility has not been cut down to any considerable extent and the spot is in consequence about the only piece of virgin forest left in Khandala. The forest at Meroli seems to be made up of several clear layers. Total measurements of the tallest trees show that the upper layer

reaches an average of 30m. (about 100 ft.) ; the most common trees in the top layer are the following :

<i>Caryota urens</i> Linn.	<i>Ficus glomerata</i> Roxb.
<i>Ficus nervosa</i> Heyne	<i>Tetrameles nudiflora</i> R. Br.
<i>Schleichera oleosa</i> Merr.	<i>Dysoxylon binectariferum</i> Hook. f.
<i>Chukrasia tabularis</i> Juss.	<i>Holoptelea integrifolia</i> Planch.
<i>Mangifera indica</i> Linn.	<i>Alstonia scholaris</i> R. Br.
<i>Pongamia pinnata</i> Pierre	<i>Albizzia procera</i> Benth.
<i>Albizzia odoratissima</i> Benth.	<i>Holigarna grahamii</i> Hook. f.

Climbing over the tops of these trees are the most powerful climbers in the district, among which are the following :

<i>Entada phaseoloides</i> Merr.	<i>Calycopteris floribunda</i> Lamk.
<i>Diploclisia glaucescens</i> Diels.	<i>Combretum ovalifolium</i> Roxb.

Towards the edges of Meroli away from the ravine, on rising ground are some large specimens of

<i>Cleidion spiciflorum</i> Merr.	<i>Bridelia squamosa</i> Gehrm.
<i>Garcinia malabarica</i> Talb.	<i>Garcinia indica</i> Choiss.
<i>Lepisanthes tetraphylla</i> Radlk.	<i>Lagerstroemia lanceolata</i> Wall.

with *Cylista scariosa* Wt. & Arn., *Symphorema involucratum* Roxb. and *Mezoneuron cucullatum* Wt. & Arn. and other climbers.

The second layer of the forest at Meroli is constituted by much smaller trees, which reach but 12—18 m. high, among which the following deserve special mention as being the commonest :

<i>Hymenodictyon obovatum</i> Wall.	<i>Ochrocarpus longifolius</i> Bth. & Hk.
<i>Gmelina arborea</i> Roxb.	<i>Syzygium cumini</i> Skeels.
<i>Pouteria tomentosa</i> Baehni	<i>Ixora brachiata</i> Roxb.
<i>Sterculia guttata</i> Roxb.	<i>Embllica officinalis</i> Gaertn.
<i>Meyna laxiflora</i> Robyns	<i>Knema attenuata</i> Warb.
<i>Grewia tiliaefolia</i> Vahl	<i>Miliusa tomentosa</i> Sincl.
<i>Erinocarpus nimmonii</i> Grah.	<i>Murraya paniculata</i> Jacq.
<i>Murraya koenigii</i> Spreng.	

when these flowers disappear or become rare, *Neuracanthus sphaerostachyus* becomes the dominant plant ; towards the end of the rainy season large patches are occupied by *Dysophylla stellata* Benth., *Cyathocline lutea* Law, *Hygrophila serpyllum* Anders. with its attendant parasite, *Striga gesneroides* var. *minor* Sant., several species of *Utricularia*, etc., each of these plants growing in almost pure formations in large patches. Among the undergrowth towards the western edge of the plateau, several Amaryllidaceae are about the only plants in flower with the exception of a few grasses. Towards December, the most common herb is *Blumea oxyodonta* DC., a highly scented but otherwise scarcely noticeable plant. With the coming of the hot season grasses and most other herbaceous plants die out and at the time the ground becomes entirely bare but for a few specimens of *Lepidagathis trinervis* Wall. and *Vernonia cinerea* Less. Shortly before the coming of the rains, the slopes and the plateau itself are set on fire by shepherds with the idea that better crops of grass are obtained from burnt ground ; much damage is caused to trees by this burning, as generally herbaceous plants tend to accumulate under the shade of trees.

Another feature of the plateau is the great abundance of orchids (*Dendrobium*, *Aerides*, *Eria*, etc.) supported by various trees, especially by the scraggy-looking *Terminalia crenulata* Roth, and the evergreen *Memecylon umbellatum* Burm.

At the foot of the plateau there is a large flat portion of land that extends up to Monkey Hill and has been under cultivation for a long time ; this flat land deserves mention on account of the numerous specimens of *Dolicandrone falcata* Seem. var. *lawii* Haines, *Lansea grandis* Engl., *Erythropsis colorata* Burk., and *Anogeissus latifolia* Wall. scattered through it ; some of these trees are nowhere else to be seen in the whole district.

5. *Khandala and Kune Plateaus.* The village of Khandala and its immediate neighbourhood is distinguished from the rest of the district by the large number of showy plants that have been successfully introduced. Among trees and shrubs, the following are outstanding for their flowers :

<i>Delonix regia</i> Raf.	<i>Peltophorum roxburghii</i> Deg.
<i>Duranta repens</i> Linn.	<i>Bougainvillea spectabilis</i> Willd.
<i>Thunbergia grandiflora</i> Roxb.	<i>Plumeria acuminata</i> Ait.
<i>Antigonon leptopus</i> Hk. & Arn.	<i>Thespesia populnea</i> Soland.
<i>Artocarpus integra</i> Merr.	<i>Anacardium occidentale</i> Linn.
<i>Carica papaya</i> Linn.	<i>Syzygium jambos</i> Alst.

Of trees that are native of the district, *Cassia fistula* Linn., *Erythropsis colorata* Burk., and *Olea dioica* Roxb. have been introduced into gardens, the first two for their flowers, the last one for its shade. *Ficus retusa* Linn., *Bambusa bambos* Voss., *Adhatoda vasica* Nees, *Duranta repens* Linn., *Vitex negundo* Linn. etc. are often used as garden plants especially

as hedge plants. *Casuarina equisetifolia* Linn. and *Eucalyptus* sp. are also found in some gardens, and both make fine trees. Among the introductions, mention must also be made of *Lantana camara* var. *aculeata* Mold. of relatively recent introduction, which is spreading very widely and causes much damage; *Pedilanthus tithymaloides* Poir. has escaped from gardens and may be found in flower, but it is not an attractive plant. Of the genus *Opuntia* only one plant has been observed in the district (*O. elatior* Mill.); it flowers readily throughout the year, but does not seem inclined to spread. *Ricinus communis* Linn. is also found in some gardens, and is occasionally found as an escape.

These two plateaus are fairly intensely cultivated, at least during the monsoon and post-monsoon periods; there are no forests on either plateau, and the trees to be mentioned occur scattered singly or in small clumps.

<i>Mangifera indica</i> Linn.	<i>Syzygium cumini</i> Skeels.
<i>Randia brandisii</i> Gamble.	<i>Ixora brachiata</i> Roxb.
<i>Grewia tiliaefolia</i> Vahl.	<i>Bridelia squamosa</i> Gehrm.
<i>G. disperma</i> Rottl.	<i>Pongamia pinnata</i> Pierre.
<i>Garcinia indica</i> Choiss.	<i>Meyna laxiflora</i> Robyns.
<i>Flacourtia latifolia</i> Cooke.	<i>Salmalia malabarica</i> Sch. & Endl.
<i>Erythrina stricta</i> Roxb.	<i>Ficus glomerata</i> Roxb.
<i>Caryota urens</i> Linn.	<i>Butea monosperma</i> Taub.
<i>Sterculia guttata</i> Roxb.	<i>Sapium insigne</i> var. <i>malabaricum</i> Hk. f.

Scattered through the two plateaus and rather localised are a number of trees, that are native of the district, but are far from common :

<i>Albizia chinensis</i> Merr.	<i>Madhuca latifolia</i> Macbr.
<i>Phoenix sylvestris</i> Roxb.	<i>Macaranga peltata</i> Muell. Arg.
<i>Migusops elengi</i> Linn.	<i>Vitex leucoxylon</i> Linn.
<i>Linociera malabarica</i> Wall.	<i>Holoptelea intergrifolia</i> Planch.
<i>Gmelina arborea</i> Roxb.	<i>Toona ciliata</i> Roem.
<i>Carallia brachiata</i> Merr.	<i>Acacia arabica</i> Willd.
<i>Zizyphus mauritiana</i> Lamk.	<i>Garuga pinnata</i> Roxb.
<i>Stereospermum personatum</i> Chatt.	

Among the commoner shrubby, suberect or climbing plants, are :

<i>Hiptage benghalensis</i> Kurz.	<i>Jasminum malabaricum</i> Wt.
<i>Combretum ovalifolium</i> Roxb.	<i>Clematis hedysarifolia</i> DC.
<i>Anodendron paniculatum</i> DC.	<i>Elaeagnus conferta</i> Roxb.
<i>Stephania hernandifolia</i> Walp.	<i>Capparis moonii</i> Wt.
<i>Cynanchum callialata</i> Buch. Ham.	<i>Smilax zeylanica</i> Linn.
<i>Thunbergia laevis</i> Nees.	<i>Acacia torta</i> Craib.
<i>Dalbergia volubilis</i> Roxb.	<i>Carissa congesta</i> Wt.

Among the commoner shrubs are :

- Calotropis gigantea* R. Br. *Colebrookea oppositifolia* Sm.
Holarrhena antidysenterica Wall. *Pavetta indica* Linn.
Casearia graveolens Dalz. *Vitex negundo* Linn.
Lantana camara var. *aculeata* Mold.

Among herbaceous plants flowering during the dry part of the year, the following stand out as more common and noticeable :

- Argemone mexicana* Linn. *Salvia plebeia* R. Br.
Leucas stelligera Wall. *Pogostemon plectranthoides* Desf.
Solanum xanthocarpum Schr. *Polygonum glabrum* Willd.
 & Wendl.
Datura innoxia Mill. *Eclipta prostrata* Linn.

In and around the village tank

- Nymphaea pubescens* Willd. *Limnanthemum indicum* Thw.
Bacopa monnieri Pennell. *L. cristatum* Griseb.
Centella asiatica Urb.

In general these two plateaus are the parts of the district most affected by man's interference. Among the cultivated plants commonly seen in Khandala are *Oryza sativa* Linn., which is cultivated in fields which have a tolerably good soil and abundant water supply ; Natchi (*Eleusine coracana* Gaertn.) is grown in fields which are too poor either on account of the stony nature or of the steep slope of the ground ; occasionally during the after-monsoon period *Cicer arietinum* Linn., *Solanum tuberosum* Linn., *Lycopersicon esculentum* Mill., *Solanum melongena* Linn., several vars. of *Capsicum annuum* and a few of the commoner varieties of *Phaseolus* are also cultivated. Much damage, however, is caused to these cultivated plants either by wild animals or insects ; in the case of the potato and tomato plants there is another serious cause of trouble, and that is that very few insects are attracted to their flowers, and in consequence fertilisation has to be carried out by artificial means.

6. *Elphinstone slopes*. This is an interesting corner just below Elphinstone Point, and near mile stone No. 70 along the main road from Bombay ; the forest here extends from about 780 to 300 m. ; by far the most abundant tree in this part of the forest is *Atalantia racemosa* Wt. & Arn., a pleasant sight when in flower ; the following are also common :

- Putranjiva roxburghii* Wall. *Tetrameles nudiflora* R. Br.
Dysoxylon binectariferum Hk. f. *Pristimera grahamii* Smith.
Ventilago bombaiensis Dalz.

For the rest this part of the forest both in composition and in the sizes of the larger trees is very similar to Meroli Plateau, but the division of the forest into layers is not so clearly marked here. At certain times of the year, particularly in the early morning and towards sunset, this

place is considered dangerous on account of panthers and other wild animals which have made it their home.

7. *Changes induced by the rainy season.* Soon after the first isolated showers towards the end of May or beginning of June, bulbous plants of the families Amaryllidaceae, Zingiberaceae and others come into flower very suddenly, often long before the leaves appear above ground. Among such plants are :

<i>Pancratium</i> sp.	<i>Crinum latifolium</i> Linn.
<i>Curcuma pseudomontana</i> Grah.	<i>Curculigo orchioides</i> Gaertn.
<i>Arisaema murrayi</i> Hook.	

Soon after the beginning of the monsoon the following plants are conspicuous :

<i>Asparagus racemosus</i> var.	<i>Tylophora fasciculata</i> Ham.
<i>javanica</i> Baker.	<i>Ensete superbum</i> Cheesm.
<i>Impatiens kleinii</i> Wt. & Arn.	<i>Zingiber</i> sp.
<i>Cissus elongata</i> Roxb.	<i>Fimbristylis digitata</i> Boeck.
<i>Hypoxis aurea</i> Lour.	

and several of the Cucurbitaceae, among which *Dicoelospermum ritchiei* Clke. is common. After about a week of steady rains, new grasses cover the whole ground with a beautiful light green. Throughout the monsoon, the most conspicuous plants, excluding grasses which on account of their abundance form the outstanding feature of open places, are the following :

<i>Curcuma pseudomontana</i> Grah.	<i>Zingiber macrostachyum</i> Dalz.
<i>Impatiens balsamina</i> L.	<i>Swertia minor</i> Knoblauch.
var. <i>rosea</i> Hook.	<i>Exacum pumilum</i> Griseb.
<i>Ceropegia attenuata</i> Hook.	<i>Chlorophytum tuberosum</i> Baker.
<i>Thespesia lampas</i> Dalz. & Gibs.	<i>C. glaucum</i> Dalz.
<i>Thunbergia laevis</i> Nees.	<i>Begonia crenata</i> Dryand.
<i>Asystasia dalzelliana</i> Sant.	<i>Barleria prattensis</i> Sant.

Orchids are also common and showy, among the ground ones the genus *Habenaria* being the commonest and most conspicuous :

<i>H. rariflora</i> Rich.	<i>H. grandiflora</i> Lindl.
<i>H. digita</i> Lindl.	<i>H. longecalcarata</i> Rich.
<i>H. heyneana</i> Lindl.	<i>H. marginata</i> Coleb. etc.

On Bhoma Hill and its slopes the "Queen" of Khandala orchids, *Platanthera susannae* Lindl. is found in fairly large numbers. *Utricularias* cover large spaces on rocks and tree trunks, whilst *Hygrophila serpyllum* Anders. covers much of the rocky ground. About the middle of the rainy season, the commonest plants in flower are :

<i>Senecio grahamii</i> Hook.	<i>Neuracanthus sphaerostachyus</i> Dalz.
<i>Adelocaryum coelestinum</i> Brand.	<i>Heracleum concanense</i> Dalz.

<i>Plectranthus mollis</i> Spr.	<i>Smithia setulosa</i> Dalz.
<i>Tricholepis amplexicaulis</i> Clke.	<i>Elephantopus scaber</i> Linn.
<i>Anotis foetida</i> Bth. & Hk.	<i>Dioscorea</i> several species.
<i>Linum mysorense</i> Heyne.	<i>Clerodendrum serratum</i> Moon.
<i>Commelina obliqua</i> Buch.-Ham.	<i>Cyanotis tuberosa</i> Schult.
<i>Fleurya interrupta</i> Gaud.	<i>Geissaspis cristata</i> Wt. & Arn.
<i>Drosera indica</i> Linn.	<i>Melanthesa turbinata</i> Wt.
<i>Striga gesneroides</i> Vatke.	<i>Rhamphicarpa longiflora</i> Bth.
<i>Sopubia delphinifolia</i> Don.	<i>Lindernia</i> several species.

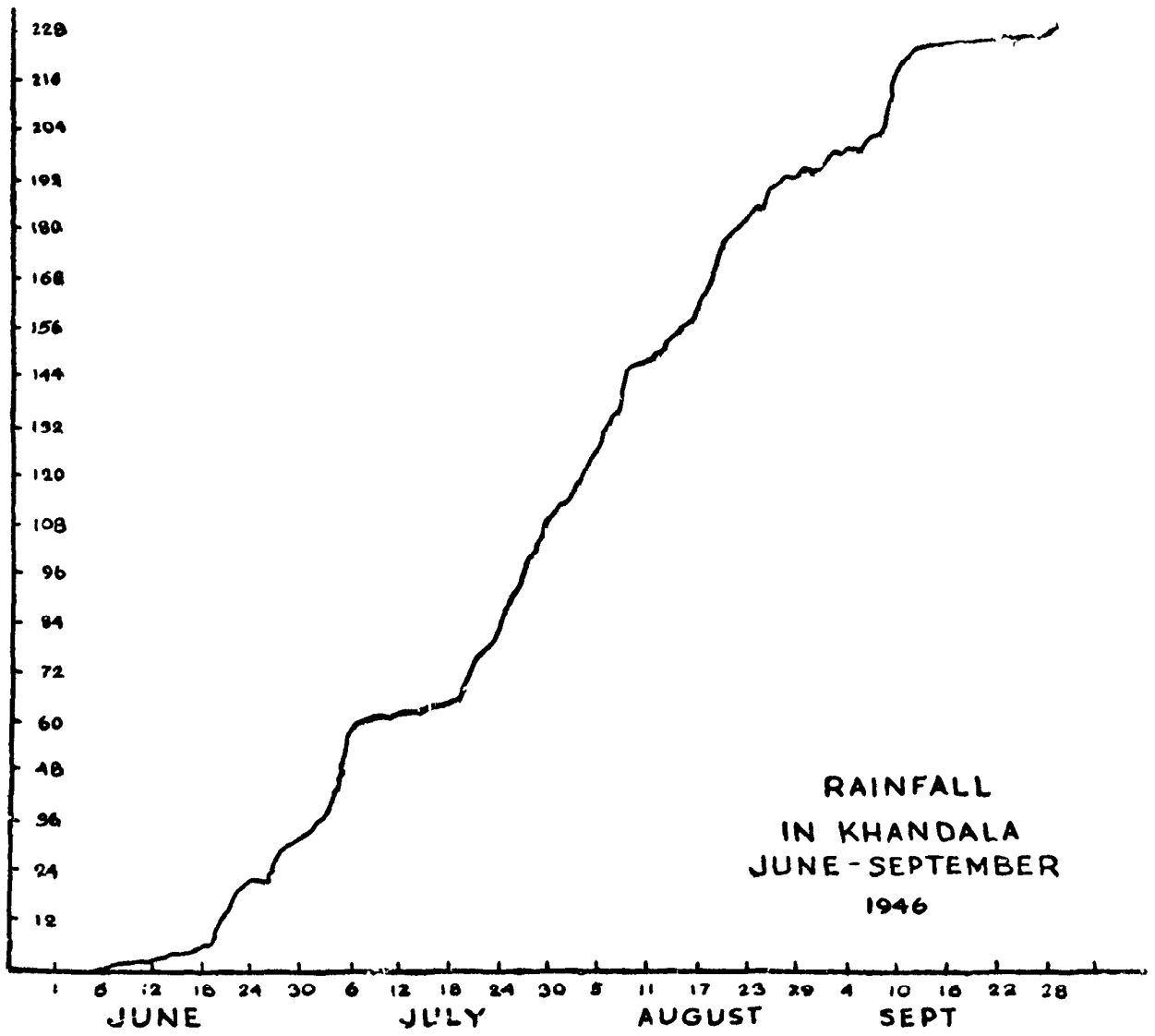
Restricted in their habitat but rather showy are these plants :

<i>Oroxylum indicum</i> Vent.	<i>Exacum bicolor</i> Roxb.
<i>Dolichos bracteatus</i> Baker.	<i>Phaseolus khandalensis</i> Sant.
<i>Begonia concanensis</i> DC.	<i>Kaempferia scaposa</i> Bth.
<i>Mussaenda glabrata</i> Hutch.	<i>Trichosanthes bracteata</i> Voigt.
<i>Rhynchoglossum obliquum</i> Bl.	<i>Sonerila scapigera</i> Hook.
var. <i>parviflora</i> Clke.	<i>Impatiens acaulis</i> Arn.
<i>Barleria strigosa</i> var.	<i>Ceropegia evansii</i> McC.
<i>terminalis</i> Clke.	<i>Leea robusta</i> Roxb.
<i>B. lawii</i> Anders.	<i>L. setuligera</i> Clarke.

During the years 1943-1945 the most noticeable monsoon plants were the large clumps of *Carvia callosa* Bremek., which covered the slopes above and around Khandala and added a vivid touch of colour to the hillsides.

As may be seen from the accompanying rainfall chart, at the beginning of September there is generally a lull in the rains lasting for a few days ; at such a time, when the ground is covered with dense vegetation and high waterfalls plunge into the ravines and the weather is cool and not too wet, Khandala is one of the most attractive spots in Western India. The only snag in the otherwise perfect picture is that deadly snakes (Cobras, Russel's Vipers, etc.) and other dangerous animals are common not only among grasses, but even or perhaps more so in the neighbourhood of human dwellings. The differences in general appearance among the various parts of the district described above, seem to disappear during the monsoon ; many of the plants just mentioned as belonging to the monsoon, are common everywhere, except in dense forests where want of light prevents many of the herbaceous plants from growing. One of the main difficulties encountered in the exploration of the district during the rains is the fact that the ground is covered with liverworts (*Funaria*, *Anthoceros*, etc.) and is thereby rendered very slippery ; in my experience of nearly ten years this has been a greater difficulty even than a heavy monsoon day with a rainfall of 10 or more inches and with the stormiest winds of the season.

RAINFALL IN INCHES.



RAINFALL
IN KHANDALA
JUNE - SEPTEMBER
1946

PLAN FOLLOWED IN THIS FLORA.

The present work is primarily a record of ten years of exploration of Khandala. The data given in these pages are all first-hand, and have been carefully recorded on the spot on the day itself of the collection. As for the collections of specimens, I made them myself, since the study of the literature convinced me that generally collectors seem to gather the most obvious specimens and easily avoid difficult parts of the country. Often in my excursions I had two or three local men, but as a rule they only collected what was pointed out to them, so that even when they saw the plants before I did, I insisted on examining every specimen on the spot before it was disturbed ; this has entailed much labour and to some extent has reduced the number of specimens ; but on the other hand, I have been able to obtain direct evidence concerning all the specimens gathered in the district.

The more immediate work connected with this flora was carried out mainly in London during my stay lasting just over two years. Most of my time was spent in such institutions as Kew Gardens, British Museum of Natural History, London, and Linnean Society. All my Khandala specimens were checked against the actual types, when these were available in London, or with the best specimens in those institutions. Another important part of the work done in London was the adjusting of the nomenclature of Khandala plants and bringing it up to date. In Hooker's *Flora of British India* there are many plant names which, to say the least, were rather arbitrarily chosen ; Cooke himself did little in this respect except follow almost blindly the lead of Hooker. For my work I made use of every recent available monograph, so that any change in the names of plants in this book has been introduced on the authority of the latest monographers. As a result many of the names given by Cooke in his *Flora* have been relegated to the synonymy, and new names or new combinations have been adopted ; this, however, has only been done where such changes have proved strictly necessary in accordance with the Rules.

In the preparation of this *Flora*, I have consulted, in addition to my own ample field notes and numerous specimens (over 16,000 plants were collected in Khandala between 1940 and 1949), the few notes and ample herbarium materials in Blatter Herbarium, Sedgwick and Bell's Herbarium, Acland's collections, McCann's private and very interesting herbarium, Dr. Lisboa's collections, and the three London Herbaria mentioned above ; I have lately examined a large number of specimens of Cooke, Woodrow, Gammie, Bhide, Bhiva, etc. in the herbarium of the Agricultural College, Poona.

Of the vernacular or local names, only those are given here which I have ascertained to be in use locally ; vernacular names vary greatly from place to place, and often the same name is used to indicate several plants. In general I have noticed in Khandala that only those plants which are economically useful have local names ; small herbs which are not used either medicinally or as an article of food have no names.

The order followed in this book is the same as that of Cooke in his *Flora*. The remarks given against individual plants are not meant to be a full description of the plant ; only such data as correct or complete

Cooke's description are entered here. Throughout this work the decimal system is used, occasionally the common English system is added as for instance in the case of rainfall or temperature measurements ; such data were first obtained with instruments marked with English units, the conversion to decimal units being done with the help of the Handbook of Chemistry and Physics, 31st edition.

ABBREVIATIONS.

For economy of space, titles of journals and names of the more commonly occurring authors have been cut down from the conventional abbreviations to shorter or even mere initials, as follows :

ABGC	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 <i>et al.</i>
F.	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>i. e.</i> , 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 and Prantl, Die natürlichen Pflanzenfamilien.
Pfreich.	Engler, Das Pflanzenreich.
RBSI	Records of the Botanical Survey of India.
Talb.	Talbot, W. A. : Forest Flora.
TLS	Transactions of the Linnean Society of London.
WI	The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. Vol. 1.

RANUNCULACEAE

CLEMATIS Linn.

Clematis gouriana Roxb. ex DC. Syst. 1 : 138, 1818 ; FBI 1 : 4 ; Gr. 1 ; D. & G. 1 ; C. 1 : 2 ; N. 5. *Cl. vitalba* Linn. subsp. *gouriana* O. Kuntze in Verh. Bot. Ver. Prov. Brandenb. 26 : 100, 1885.

According to Cooke this plant is common in thickets on the Ghauts ; the authority for the inclusion of this plant in this book are two manuscript catalogues left by Blatter and Hallberg. I have not seen this plant in Khandala, there are no specimens from that locality in any of the Herbaria I have consulted.⁽¹⁾

Clematis hedysarifolia DC. Syst. 1 : 148, 1818 ; FBI 1 : 4 ; O. Kuntze, loc. cit. 151 ; C. 3.

Very common about Khandala ; these plants may be seen almost throughout the year, especially along the railway line embankment at the foot of Behran's Plateau. Flowers are not showy in themselves, but as they grow in dense masses, they render the plant an attractive one. The plant is especially attractive in fruit.

Flowers.—October to November. *Fruits.*—November to May.

Clematis naravelioides O. Kuntze, loc. cit. 119, 1885.

Some of my specimens of this species have been identified by Dr. I. Eichler of Adelaide, Australia, who examined all my *Clematis* from Western India. Some of the Khandala plants have a reddish stem, their leaflets up to 14×10 cm.

Flowers.—October 1942 ; on the slopes below Behran's Plateau. This is a new record for Bombay State.

DELPHINIUM Linn.

Delphinium dasycaulon Fres. Mus. Senckenb. 2 : 272, 1837 ; FBI 1 : 25 ; D. & G. 2 ; Huth in Engl. Bot. Jahrb. 20 : 435 ; C. 1 : 5 ; N. 6.

Fairly abundant in Khandala along the edge of the ravine from Khandala Cemetery to the foot of Echo Point ; not seen elsewhere in the district. This plant is said to be rare by Cooke. At Purandhar, Poona Dt., this is one of the commonest and most abundant flowering plants ; in every case this plant seems to thrive in well-watered and well-drained soil, it does not grow except on steep slopes. A very fine plant when in flower.

⁽¹⁾ On Nov. 29th, 1951 for the first time I collected this plant in flower (*Santapau* 13962—13969) and on Dec. 27th, 1951 in fruit (*Santapau* 13990—13993) on the slopes below Forbay.

Flowers and Fruits.—In Khandala during October only. At Purandhar this plant is very common, and can be seen in flower and fruit from October to December.

DILLENACEAE.

DILLENIA Linn.

Dillenia pentagyna Roxb. Pl. Corom. 1 : 21, t. 20, 1795 ; FBI 1 : 38 ; Gr. 2 ; C. 1 : 6 ; N. 7.

A fairly common tree scattered through the ravines or slopes of the various hills about Khandala. In the seedling state leaves may reach and even exceed 90 × 30 cms. On 26th November, 1945, I found a tree about half way down St. Xavier's Ravine with buds and leaves on ; I have not seen this irregularity about flowering time on any other occasion. The wood is soft, and is only used for fuel.

Local name : Karumbel.

Flowers.—March to June. *Fruits.*—April to September.

MAGNOLIACEAE

MICHELIA Linn.

Michelia champaca Linn. Sp. Pl. 536, 1753 ; FBI 1 : 42 ; C. 1 : 7 ; N. 7.

Rare in the district ; only seen in some of the gardens in Khandala.

Flowers.—29 May 1931. *Fruits.*—29 May 1931, 15 August 1950.

ANNONACEAE

MILIOSA Lesch.

Miliosia tomentosa (Roxb.) Sinclair in Gardn. Bull. 14 : 378, 1955. *Uvaria tomentosa* Roxb. Pl. Cor. 1 : 31, t. 35, 1795. *Saccopetalum tomentosum* Hook. f. & Thom. Fl. Ind. 152, 1855 ; FBI 1 : 88 ; C. 1 : 16 ; King in ABGC 4(1) : 159, t. 207 ; Blatter in JBNHS 34 : 293.

“ The genus *Saccopetalum* was reduced by Baillon... to *Miliosia*, and this view is followed by Ast in Fl. Gen. Indo-Chine. I cannot see any usefulness therefore in retaining *Saccopetalum* as distinct from *Miliosia*.” (Sinclair loc. cit.)

Not a very common tree about Khandala ; I have found it on Meroli Plateau, at the base of the slopes below Elphinstone Point and on Monkey Hill Plateau.

Flowers.—March 1943, *Fruits.*—March to June.

SAGERAEA Dalz.

Sageraea laurifolia (Grah.) Blatter, loc. cit. 294, 1930 ; Chatterjee in PLS 154 : 266. *Guatteria laurifolia* Graham, Cat. 4, 1839. *Sageraea laurina* Dalz. in Kew Journ. Bot. 3 : 207, 1851 ; D. & G. 2 ; FBI 1 : 93 ; Beddome, Icon. t. 9 ; King, loc. cit. 7, t. 35 B *pro parte*; Talb. 1 : 33 *pro parte*. *Bocagea Dalzellii* Hook. f. & Thoms. in FBI 1 : 92, 1872 ; C. 1 : 17 *pro parte*.

Not common about Khandala ; occasional specimens are found scattered on ravine slopes.

King, loc. cit., has separated *Sageraea* from *Bocagea* St. Hil. ; Hook. f. and Thoms. (in FBI.), Benth. and Hook. (in Gen. Plant.) and Baillon (in Hist. Plant.) retain *Sageraea* as distinct from *Bocagea*. But in FBI., loc. cit., Hook. f. and Thoms. unite the two genera into one with the name of *Bocagea*. Among the more recent authors, Talbot (For. Fl. 1 : 33, 1909), Brandis (Ind. Tr. 13, 1911), Gamble (Ind. Timb. 15, 1902), and Blatter, loc. cit., follow King in separating the two genera ; King does not think it possible to combine the extreme imbrication of the sepals and petals in *Sageraea* with the valvate calyx and corolla of *Bocagea*.

Local names : Sajeri and Undi.

Flowers.—November. *Fruits*.—December to March.

MENISPERMACEAE

TINOSPORA Miers.

Tinospora cordifolia (Willd.) Miers. in Ann. Hist. Nat. (Ser. 3). 7 : 38, 1851 ; Hook. f. & Thoms. Fl. Ind. 184, 1855 ; FBI 1 : 97 ; D. & G. 8 ; C. 1 : 18 ; Diels in Pfreich. 46 : 139 ; Blatter 31 : 549 ; N. 10. *Menispermum cordifolium* Willd. Sp. Pl. 4 : 826, 1806. *Cocculus cordifolius* DC. Syst. 1 : 513, 1818 & Prodr. 1 : 97 ; Gr. 4 ; Wight, Icon. tt. 285, 486.

Fairly common about Khandala ; very common on Behran's Plateau. Unfortunately this plant flowers when there are no leaves on it, and in consequence it is often confused with other species of *Tinospora*. In Khandala, however, I have not seen any but *T. cordifolia* growing.

Flowers.—January to March. *Fruits*.—April to June.

DIPLOCLISIA Miers.

Diploclisia glaucescens (Blume) Diels in Engl. Pfreich. l. c. 225, t. 77, 1910 ; G. 28 ; Blatter, loc. cit. 551. *Cocculus glaucescens* Blume, Bijdr. 25, 1825. *Cocculus macrocarpus* Wight & Arn. Prodr. 13, 1834 ; Gr. 5 ; Wight, Ill. 1 : 22, t. 7 ; FBI 1 : 101 ; C. 1 : 20 ; N. 11.

This plant, both in flower and in fruit, is one of the finest sights in the jungle around Khandala. During the flowering season numerous insects, particularly the small Indian bee, *Apis indica*, can be seen and heard hovering about the plant.

The leaves are used locally for cigarette wrappers.

Local name : Vatoli.

Flowers.—March to June. *Fruits*.—April to September.

STEPHANIA LOUR.

Stephania hernandifolia (Willd.) Walp. Repert. 1 : 96, 1842 ; FBI 1 : 103 *pro parte* ; C. 1 : 22 *pro parte* ; Diels, l. c. 279 ; Blatter, loc. cit. 35. *Cissampelos hernandifolia* Willd. Sp. Pl. 4 : 861, 1805 ; DC Prodr. 1 : 100. *Clypea hernandifolia* Wight & Arn. Prodr. 14, 1834 ; Wight, Ic. t. 939.

The description found in FBI and followed by Cooke is based on mixed material consisting of *S. hernandifolia* proper and *S. japonica*. On the whole question of *Stephania*, see Blatter loc. cit.

The following details have to be added to Blatter's description. The general colour of the inflorescence is green or greenish yellow. The fruit at first is green, at maturity is generally white or creamy white, occasionally one finds fruits with a tinge of orange colour on them ; I cannot tell whether this colour is a transition from the green to the white or is final and definite.

A common climber widely spread about Khandala ; it seems to grow best on open plateaus and exposed situations ; the whole plant looks somewhat pale in colour.

I have examined all the specimens of *Stephania* in Blatter Herb. and have found that all the fruits have a perforated condyle ; *St. hernandifolia* must, then, be considered by far the commoner of the two species in Khandala.

Local name : Tan.

Flowers.—June to November. *Fruits*.—August to January.

Stephania japonica (Thunb.) Miers in Ann. Nat. Hist. (Ser. 3) 18 : 14, 1866 ; Blatter loc. cit. *Menispermum japonicum* Thunb. Fl. Jap. 195, 1784. *Stephania hernandifolia* Miq. Prol. Fl. Jap. in Ann. Mus. Lugd. Bat. 1 : 103, 1867 ; FBI 1 : 103. *pro parte* ; C. 1 : 22 *pro parte*.

The identification of this species is a difficult one ; Diels loc. cit. 377, gives the following characteristics glabrous shrubby plant, leaves glabrous, inflorescence glabrous ; condyle not perforated. I have examined all the specimens in Blatt. Herb. where mature fruits are present, and in all cases without exception I find the condyle perforated. *S. japonica*, therefore, must be considered a rare species in Khandala. The specimen mentioned below was identified by Blatter ; but in the absence of mature fruits I cannot confirm the identification.

Blatt & McC. 17475.

COCCULUS DC.

Cocculus hirsutus (Linn.) Diels in Pfreich. 46 : 236, 1910 ; Blatter 552.

C. villosus DC. Syst. 1 : 525, 1818 ; FBI 1 : 101 ; C. 1 : 21 ; N. 11.

Menispermum hirsutum Linn. Sp. Pl. 341, 1753.

The occurrence of this plant in Khandala is given on the authority of Chibber, who found the plant in the district in June 1909 ; I have seen the specimen in the Herb. Econ. Bot., Poona, and found it too defective for satisfactory identification.

CISSAMPELOS Linn.

Cissampelos pareira Linn. Sp. Pl. 1031, 1753 ; FBI 1 : 103 ; Diels 286, f. 91 A-K ; Blatter 555 ; C. 1 : 22 ; N. 11.

A climber on hedges, etc. The long pendulous female bracteate racemes make this an elegant plant.

Flowers.—June to September. *Fruits*.—August to September.

CYCLEA Arn.

Cyclea burmanni (DC.) Hk. f. & Thoms. Fl. Ind. 201, 1855 ; FBI 1 : 104 ; C. 1 : 23. *Cocculus burmanni* DC. Prodr. 1 : 96, 1824, *Menispermum peltatum* Lam. Encycl. 4 : 96, 1797. *Cyclea peltata* Diels loc. cit. 312, 1910 ; G. 31 ; Blatter 556 (non *C. peltata* Hook. f. & Thoms. nec Miers).

Diels in his monographic treatment of the genus *Cyclea* adopted the name *C. peltata* for the present species. The specific name *peltata* is not available, it being preoccupied by two older homonyms. In the circumstances, the oldest available name for the present species is that of Hook. f. and Thoms.

The identification of this plant is not easy ; male flowers are quite distinct, and if present render identification easy. The female flowers and fruits of this species and those of *C. fissicalyx* Dunn are practically identical. I have based my identification of the female flowers on the following character, which is given by Cooke, and accepted as correct by Blatter in his Revision :

Sepal hairy.....*C. burmanni* Hook. f. &
Th.

Sepal glabrous.....*C. fissicalyx* Dunn.

All my specimens showing female flowers have a sepal that is densely hairy outside.

A common plant in Khandala ; when young it is glaucous in colour and often densely hairy ; when old it is more or less pubescent on the stem and either glaucous or green in the rest of the plant. Male flowers

are very characteristic in their structure, but they are also very easily caducous.

Flowers and Fruits.—Throughout the whole year.

Cyclea fissicalyx Dunn in Gamble, Fl. Madr. 31, 1915 & in Kew Bull. 1916 : 60 ; Blatter 557. *C. peltata* Miers, Contr. Bot. 3 : 236, 1874 ; C. 1 : 44 (non Hook. f. & Thoms. nec Diels).

There is but one specimen of this species in Blatt. Herb., and unfortunately it is without flowers or fruits ; the sheet bears the identification of Blatter. According to this author, the plant is "apparently rare" ; in Khandala I have not seen any specimen which may be taken as belonging undoubtedly to this species.

NYMPHAEACEAE

NYMPHAEA Linn.

Nymphaea pubescens Willd. Sp. Pl. 2 : 1154, 1799 ; G. 34 ; Blatter 34 : 294 *pro parte*. *N. rubra* Roxb. ex Salisb. Parad. Lond. 1, sub t. 14, 1805 ; Wight, Illustr. t. 10 ; Gr. 5. *N. Lotus* Hk. f. & Thoms. FBI 1 : 114. 1872 ; C. 1 : 25 ; N. 12 (non Linn.). *N. Lotus* var. *pubescens* Hk. f. & Thoms. loc. cit. ; C. loc. cit.

Conard (Rhodora 18 : 161-164, 1916) does not identify any of the Indian species of *Nymphaea* with the *N. Lotus* of the Linnean Herb. Following Wight and Arn. (Prodr. 17), Conard distinguishes two different species on the strength of the colour of the flowers : *N. rubra* Roxb., and *N. pubescens* Willd. Blatter, loc. cit., follows Conard ; Gamble, disregarding the colour of the flowers, distinguishes two species on the pubescence or glabrousness and the structure of the margin of the leaves.

In my opinion, colour cannot be made into the basis of classification. For a number of years I have been observing these plants in Khandala and have come to the conclusion that there is a very wide variation in colour from deep red to pure white, with an extensive range of pinks, etc. in between. Moreover, on one and the same flower one can see variation in the intensity of the colour from the outer perianth segments inwards. In every case, the structure of the anthers and stigmatic rays and of the leaf margins place these Khandala plants among *N. Lotus* or *N. Lotus* var. *pubescens* of Cooke, and *N. pubescens* of Gamble. For this reason I have followed Gamble and S. T. Dunn (Kew Bull. 1916 : 60-61) in the classification of Khandala *Nymphaeas*.

The plant is commonly in flower in Khandala village tank almost throughout the year, with the exception of the first months of the monsoon. Just before the monsoon the tank is generally cleaned and all *Nymphaea* plants removed ; leaves and flowers only begin to reappear towards the end of September.

Roots, petioles and peduncles are collected and eaten locally ; Cooke states that the seeds are also eaten, and this may account for the rarity of fruits in Khandala.

NELUMBO Adans.

Nelumbo nucifera Gaertn. Fruct. 1 : 73, t. 19, f. 2, 1788 ; Blatter 294. *Nelumbium speciosum* Willd. Sp. Pl. 2 : 1258, 1800 ; Gr. 5 ; FBI 1 : 116 ; C. 1 : 26.

The occurrence of this plant in Khandala is given on the authority of Hallberg ; I have not seen the plant growing in Khandala, there are no specimens from this locality in Blatt. Herb.

PAPAVERACEAE

ARGEMONE Linn.

Argemone mexicana Linn. Sp. Pl. 508, 1753 ; Bot. Mag. t. 243, Gr. 6 ; FBI 1 : 117 ; Wight, Illustr. t. 11 ; C. 1 : 27 ; Fedde in Pfreich 40 : 273, t. 36 B ; N. 13 ; WI 116.

The colour of the flowers in Khandala is always yellow ; I have not seen white flowers, as mentioned by Cooke for the genus.

Very common all over Khandala in waste lands ; in the ravines it generally occurs along stream beds, showing the course or method of distribution of the plant. It is not found in dense jungle, nor on Bhoma Hill. During the rainy season the plant seems to be washed away from the district, and is very rare or altogether absent ; immediately after the rains, the seeds germinate and seedlings and plants once more become very common and remain so till the next rainy season.

The sap of the plant is yellow or greenish yellow.

Local name : Piula Dhotara.

Flowers and Fruits.—Throughout the year, rare during the rains.

PAPAVER Linn.

Papaver somniferum Linn. Sp. Pl. 508, 1753 ; FBI 1 : 117 ; Gr. 6 ; Blatter 295 ; Fedde, 338, t. 37 A ; N. 13.

Blatter listed this plant in his MS. catalogue as having seen it in Khandala ; there are no specimens in Blatt. Herb. I have often seen it cultivated in gardens in Bombay and elsewhere, but not in Khandala.

CRUCIFERAE

RORIPPA Scop.

Rorippa indica (Linn.) Hochreut. in Candollea 2 : 370, 1925. *Sisymbrium indicum* Linn. Mant. 1 : 93, 1767. *Nasturtium indicum* DC. Prodr. 1 : 139, 1824 ; FBI 1 : 134 ; C. 1 : 30.

Common particularly on the old railway line—from below Elphinstone Point to the Railway station ; especially abundant on the waste ground near the village tank.

Flowers and Fruits.—January to June.

CARDAMINE Linn.

Cardamine trichocarpa Hochst. ex Rich. Tent. Fl. Abyss. 1 : 18, 1847 ; Schulz in Bot. Jahrb. 22 : 462, 1903 ; Dunn in Kew Bull. 1916 : 61 ; Blatter 295, *Cardamine hirsuta* Linn. var. *subumbellata* Dalz. in Hook. Journ. Bot. 4 : 294, 1852. *Cardamine subumbellata* Hk. f. FBI 1 : 138, 1872 ; C. 1 : 30.

Common in moist waste places, especially on the old railway line near the village tank ; common also in stream beds. Everywhere gregarious in habit.

Flowers and Fruits.—March to October.

SISYMBRIUM Linn.

Sisymbrium brassicaeforme C. A. Mey. in Ledeb. Fl. Alt. 3 : 129, 1831.

An erect herb, up to 1 m. high ; leaves lyrate, the apical segment hastate to sagittate ; flowers small, yellow ; pods linear, nearly cylindrical, long.

This plant has only been observed on one occasion ; it was growing in a ditch near the railway station.

Flowers and Fruits.—24 March 1949.

VIOLACEAE

VIOLA Linn.

Viola odorata Linn. Sp. Pl. 934, 1753.

The cultivated violet, seen in some of the gardens in Khandala ; the scent of the flowers does not seem to be remarkable for its sweetness or strength. Rare in Khandala.

CAPPARIDACEAE

CLEOME Linn.

Cleome viscosa Linn. Sp. Pl. 672, 1753 ; FBI 1 : 170 ; Wight, Icon. t. 2 ; C. 1 : 39 ; Blatter 31 ; Pax & Hoffm. in Pfam. (2) 17 B : 213 ; N. 16. *Cleome icosandra* Linn. loc. cit. 1753. *Polanisia viscosa* DC. Prodr. 1 : 22, 1824. *Polanisia icosandra* Wight & Arn. Prodr. 22, 1834 ; Gr. 8 ; Merr. Enum. 2 : 209.

This is a very common plant in Bombay and Salsette islands, but relatively rare in Khandala. Its flowers are yellow and the whole plant is densely clothed with glandular hairs which make the plant very

“sticky” to touch. In Khandala I have only seen it in a ditch near running water on sandy soil, near the Railway station.

Flowers and Fruits.—May 1946.

Cleome chelidonii Linn. f. Suppl. 300, 1781 ; FBI 1 : 170 ; C. 1 : 39 ; Blatter 900. *Polanisia chelidonii* DC. Prodr. 1 : 242, 1824 ; Gr. 7 ; Wight & Arn. Prodr. 22 ; Wight, Icon. t. 319.

The only specimens collected in Khandala have a strongly developed stem and a large number of radical leaves ; stem at ground level up to 20 mm. thick, gradually tapering upwards. Radical leaves usually 7-foliolate, petioles up to 15 cm. long ; leaflets up to 5×2 cm., obovate, tapering into the petiole.

Stems, petioles and leaflets covered with short, stout hairs from broad bases, which render the whole plant very hispid. The pubescence mentioned by Cooke is absent from my Khandala specimens.

GYNANDROPSIS DC.

Gynandropsis gynandra (Linn.) Briq. in Ann. Cons. Jard. Bot. Geneve 17 : 382, 1914 ; Merrill, loc. cit. 209 ; Pax & Hoffm. 218. *Cleome gynandra* Linn. Sp. Pl. 671, 1753. *Cleome pentaphylla* Linn. Sp. Pl. (ed. 2) 938, 1762. *Gynandropsis pentaphylla* DC. Prodr. 1 : 238, 1824 ; FBI 1 : 171 ; Gr. 7 ; C. 1 : 40 ; N. 16.

Cooke gives June as the flowering time of this plant. Blatter gives December. Examination of the specimens in Blatt. Herb. shows that the plant is in flower practically throughout the year.

A rare plant in Khandala, only found near habitations, possibly an escape from cultivation.

CAPPARIS Linn.

Capparis moonij Wight, Illustr. 1 : 35, 1840 ; FBI 1 : 175 ; C. 1 : 46 ; Blatter 905 ; Pax & Hoffm. 176.

This is a common plant in Khandala, especially about St. Xavier's Villa and along the road to the Reversing Station. Flowers are very conspicuous ; the fruit remains on the parent plant for a long time, on a stout gynophore. But the presence of short, stout and hooked thorns makes collection and preservation of specimens a task of no mean danger

Flowers.—October to April. *Fruits.*—March to August.

Capparis sepiaria Linn. Syst. (ed. 10) 1071, 1759 ; FBI 1 : 177 ; Gr. 9 ; C. 1 : 48 ; N. 18. *Capparis incanescens* DC. Prodr. 1 : 247, 1824 ; Hook. Icon. t. 123.

There is in my collection from Khandala but one specimen of this plant, and that specimen has neither flowers nor fruits ; the general character of the leaves, however, seems to place my specimen under this species. Until further material be collected from the same locality, the occurrence of this plant in Khandala is uncertain.

Capparis zeylanica Linn. Sp. Pl. (ed. 2) 720, 1762 ; Dunn in Kew Bull. 1916 : 62 ; Blatter 903 (sub *C. brevispina*) & 906 (non *C. zeylanica*)

Hk. f. & Thoms. in FBI 1 : 174). *Capparis horrida* Linn. f. Suppl. 264, 1781 ; Wight & Arn. Prodr. 26 ; Wight, Icon. t. 173 ; FBI 1 : 178 ; C. 1 : 48 ; N. 18.

This is an interesting plant, mainly on account of the complications in nomenclature ; see Dunn, loc. cit. and further notes by Blatter loc. cit.

Not a common plant in Khandala ; I have only seen it three times in six years.

BIXACEAE

BIXA Linn.

Bixa orellana Linn. Sp. Pl. 512, 1753 ; FBI 1 : 190 ; Gr. 10 ; Wight, Illustr. 17 ; D. & G. Suppl. 5 ; C. 1 : 53 ; Talb. 1 : 72, t. 46 ; Blatter 909 ; Pilger in Pfam. (ed. 2) 21 : 315, t. 139 ; WI. 196, t. 31.

The only authority for the inclusion of this plant is Blatter, who states, in his MS. catalogue, that he has seen the tree in Khandala, growing in gardens. I have not seen the tree in the district, there are no specimens from Khandala in Blatt. Herb.

FLACOURTIACEAE

FLACOURTIA Commers.

Flacourtia montana Graham, Cat. Bomb. Pl. 10, 1839 ; C. 1 : 55 ; Talb. 1 : 76, t. 48 ; Blatter 912 ; Pilger in Pfam. (ed. 2) 21 : 440 ; N. 19.

Both Cooke and Blatter speak of rather long spines on the trunk and branches of this tree. My specimens from Khandala have no spines of any sort. Among the specimens in Kew Herb. originating from Bombay and Madras, I have searched for such spines in vain.

The ripe fruit is eaten by the Katkaris ; it has a pleasantly acid taste. The red fruits stand out very conspicuously on the deep green background of the foliage. The tree is middle-sized to very large, at times one of the largest in the district. The size of the tree, the absence of spines and the size of the fruit for a long time prevented me from identifying this species ; I must thank Dr. S. K. Mukerjee of the Indian Botanical Garden, Calcutta, for his help in identifying it.

Not common in Khandala ; the best specimens are to be found on the steep slopes below Elphinstone Point.

Local name : Tara Bor.

Flowers.—December 1943. *Fruits*.—December to April.

Flacourtia occidentalis (Hook. f. & Thoms.) Blatter in JBNHS 31 : 914. 1927. *F. ramontchi* L'Herit. var. *occidentalis* Hook. f. & Thoms. in FBI 1 : 193, 1872 ; C. 1 : 56 ; Talb. 1 : 77, t. 51.

The following is Blatter's description (loc. cit.) : " A small tree ; whole plant more or less covered with permanent grey velvety tomentum ; bark grey, scaly, thin. Spines slender, straight. Leaves 3-8 by 2-5 cms, broadly oblong, oblong-elliptic, orbicular or obovate or lanceolate,

rarely elliptic or ovate, crenate or serrate, base rounded, cuneate or cordate, rounded or acute at the apex, more or less tomentose ; petioles tomentose or velvety. Racemes tomentose. Sepals ovate, ciliate. Styles about 5, distinct, reflexed, and 2-divided at the apex ”.

According to Blatter this species differs from *F. ramontchi* in having its branchlets, leaves, petioles and inflorescence permanently more or less velvety or tomentose, and spines being slender.

A rare plant in Khandala ; I have seen no other specimens but the one mentioned by Blatter in his Revision, which is kept in Blatt. Herb.

Flowers.—According to Blatter, November to March.

Flacourtia latifolia (Hook. f. & Thoms.) Cooke in Fl. Pres. Bomb. 1 : 56, 1901 ; Blatter 913. *F. ramontchi* L’Her. var. *latifolia* Hk. f. et Thoms. FBI 1 : 193, 1872. *F. inermis* (?) Graham 10, 1839 (non Roxb.).

This is one of the commonest, not only of *Flacourtias*, but also trees in Khandala. Generally a small tree with fairly large leaves. Spines may be present or absent on young branches, but they are practically always present on older stems and branches. Spines on older stems compound, massed, up to 25 cms. long, very sharp and hard ; on younger stems or branches simple, and at the beginning very soft and reddish in colour. The whole stem is at times a solid mass of dangerous-looking spines.

For the identification of this tree and its separation from *F. ramontchi* I have followed Cooke :

Stigmas 3-4 *F. latifolia*.

Stigmas 5-11 *F. ramontchi*.

I have examined all the specimens in Blatt. Herb. from Khandala and in every case have found 3-4 stigmas, occasionally 5 on a few flowers, but the majority of flowers or fruits on a particular branch has only 3-4 stigmas.

The fruit is strongly astringent when immature ; when ripe it attains a size of 9 mm. in diam. and is very dark purple, almost black in colour ; the ripe fruit has an agreeable taste.

Local name : Tambat.

Flowers.—January to June. *Fruits.*—January to October.

Flacourtia indica (Burm. f.) Merrill, Interp. Rumph. Herb. Amb. 377, 1917 ; Sleumer in Fl. Males. I, 5 (1) : 76, f. 30 h-i, 1954. *Gmelina indica* Burm. f. Fl. Ind. 132, t. 39, f. 5, 1768. *Flacourtia sepiaria* Roxb. Pl. Cor. 1 : 48, t. 68, 1795 ; FBI 1 : 194 ; Gr. 10 ; C. 1 : 56 ; Blatter 914 ; Gilg in Pfam. (ed. 2) 21 : 440.

A small shrub with rigid branches, and spines bearing flowers and leaves. In his Revision, Blatter mentions No. 18127 as a specimen of this species from Khandala. On examination, the specimen turns out to be not *Flacourtia* but *Elueggea*.

PITTOSPORACEAE

PITTOSPORUM Banks.

Pittosporum floribundum Wight & Arn. Prodr. 154, 1834 ; FBI 1 : 199 pro parte : Gr. 38 ; C. 1 : 58 ; Talb. 1 : 81. *P. nepaulense* Blatter in JBNHS 34 : 302, 1930 (non Rehder & Wils.)

Blatter, loc. cit., gives the name of this tree as *P. nepaulense* Rehder and Wils., and adds the synonyms *Senacia nepaulensis* Wall. and *Celastrus verticillata* Roxb. Rehder and Wils. in Sargent. Pl. Wils. 3 : 326, 1916 distinguish between *P. nepaulense* and *P. floribundum* Wight : the former seems to have flowers in an elongated umbelliferous panicle, whilst the latter has them in a much branched paniculate corymb ; in Hook. f., FBI, the description is based on mixed material of the two species. *P. nepaulense* is the typical plant of the Eastern Himalayas, Sikkim and Khasia Hills ; *P. floribundum* belongs to the South and Western parts of India. After the monograph of M. Gowda in JAA 32 : 263-343, 1951, it is clear that my Khandala sheets are *P. floribundum*.

A fairly common tree on Bhoma Hill from Forbay upwards. The most typical part of the plant is the fruit, which at maturity turns jet black and retains its apiculation. Valves of capsule transversely striated inside.

Local name : Pisara.

Flowers.—July to August. *Fruits*.—August to May.

POLYGALACEAE

POLYGALA Linn.

Polygala erioptera DC. Prodr. 1 : 326, 1824 ; FBI 1 : 203 ; Chodat, Mon. Polygal. 2 : 324, t. 28, f. 1-4 ; idem in Pfam. 3 (4) : 336 ; C. 1 : 60 ; Blatter 34 : 302 ; N. 21.

Rare in Khandala ; I have not seen it growing in the district, there are no specimens from Khandala in any of the herbaria I have examined.

Blatter in Revision, loc. cit.

CARYOPHYLLACEAE

POLYCARPON Linn.

Polycarpon prostratum (Forsk.) Aschers. & Schweinf. in Oster. Bot. Zeitschr. 39 : 128, 1889 in observ. *Alsine prostrata* Forsk. Fl. Aeg.-Ar. 207, 1775. *Polycarpon indicum* Merrill in Phil. Journ. Sci. Bot. 10 : 30, 1905 ; Blatter 34 : 304. *Loeflingia indica* Retz. Observ. 4 : 38, 1785. *Polycarpon depressum* Rohrb. in Mart. Fl. Bras. 14 (2) : 257, 1872 (non Nutt. 1838). *Pharnaceum depressum* Linn. Mant. 2 : 562, 1771. *Hapalosia loeflingiae* Wall. ex Wt. & Arn. Prodr. 358, 1834. *Polycarpon loeflingiae* Benth. & Hook. Gen. Pl. 1 : 153, 1862 ; C. 1 : 65.

Cooke lists this plant as one of the rare plants in the Presidency. In Khandala far from being rare, it is one of the commonest herbs found in rice fields after the harvest and in other moist places where grasses are not the dominant feature of the vegetation. It is particularly abundant

during the dry season in dried or drying up pools. In a corner of the Soldier's Playing Fields they form a very dense mat in an almost pure formation and cover a space of about 7 × 10m. It is often associated with *Polygonum plebeium* Br., which it much resembles in habit and appearance ; it can easily be distinguished from the latter by the fact that *Polygonum* has alternate leaves and bright red or pink flowers.

Flowers and fruits.—Throughout the dry season.

SAPONARIA L.

Saponaria vaccaria Linn. Sp. Pl. 409, 1753 ; FBI 1 : 217 ; C. 1 : 62 ; G 61 ; N. 22.

An erect, glabrous herb, up to 35 cm. high. Flowers of about the same colour as those of *Canscora diffusa* R. Br., ; calyx deep green along the midrib, white at the edges.

Found as a weed in gardens in Khandala and elsewhere in Western India ; it is not common.

Flowers.—December to February. *Fruits.*—March.

PORTULACACEAE

PORTULACA Linn.

Portulaca oleracea Linn. Sp. Pl. 445, 1753 ; FBI 1 : 246 ; C. 1 : 68 ; Pax & Hofm. in Pfam. (ed. 2) 16 C : 247, f. 108B ; N. 23.

Common all over Khandala, especially along the village streets, near the village tank and in stream beds, or in general in moist ground. It is common but scarcely abundant. Locally the plant is not mentioned as being used as a vegetable.

Flowers and fruits.—Throughout the dry season.

Portulaca quadrifida Linn. Mant. 1 : 73, 1767 ; FBI 1 : 247 ; C. 1 : 68 ; Wight, Ill. 2 : 109 ; Pax & Hoffm. 247 ; N. 23.

A rare plant in Khandala ; I have not found it there. In Blatt. Herb. there are no specimens from Khandala. Hallberg is the only authority for the inclusion of this plant in this flora .

ELATINACEAE

BERGIA Linn.

Bergia ammannioides Heyne ex Roth, Nov. Pl. Sp. 219, 1821 ; FBI 1 : 251 ; Wight, Ill. 1 : t. 25 ; C. 1 : 73 ; Blatter 34 : 623 ; Niedenzu. in Pfam. (ed. 2) 21 : 274, t. 119 K-R ; N. 24. *Elatine ammannioides* Wight & Arn. Prodr. 41, 1834 ; Gr. 12.

A fairly common herb in Khandala, especially about the village tank or in moist places ; in habit it is very similar to *Ammannia* and *Rotala* from both of which it is easy to distinguish on account of the shape of the capsule.

Flowers and Fruits — October to April.

GUTTIFERAE

GARCINIA Linn.

Garcinia indica (Du Petit-Thou.) Choiss. in DC. Prodr. 1 : 561, 1824; FBI 1 : 261 ; C. 1 : 76 ; Blatter 34 : 623 ; Engler in Pfam. (ed. 2) 21 : 219, t. 87H-J ; N. 25. *Brindonia indica* Du Petit-Thouars in Dict. Sc. Nat. 5 : 339, 1804. *Garcinia purpurea* Roxb. Fl. Ind. 2 : 624, 1832 ; Gr. 25 ; D. & G. 31.

The rind of the fruit is used locally for pickling ; the pulp is eaten and has a delicate flavour. A small tree, common on the Khandala Plateau ; in the ravines it attains a fairly large size.

Local names : Kokam or Kokambi ; by Anglo-Indians or Europeans this tree is sometimes called " The Tomato Tree ".

Flowers.—November to March. *Fruits*.—January to August.

Garcinia xanthochymus Hk. f. FBI 1 : 269, 1874 ; C. 1 : 78 ; N. 25 ; Blatter 624. *Xanthochymus pictorius* Roxb. Pl. Cor. 2 : 51, t. 196, 1798 (non *Garcinia pictoria* Roxb.). *X. tinctorius* DC. Prodr. 1 : 562, 1824 (sphalm. pro *X. pictorius* Roxb.). *Garcinia tinctoria* Dunn in Kew Bull. 1916 : 64 ; G. 74.

The occurrence of this plant is given on the authority of Blatter ; I have not seen any specimens from the district. It is very easy to confuse this species with *G. malabarica* Talbot, as will be explained below ; from the leaves alone it is not possible to distinguish these two trees ; in every doubtful case I have based my identifications on the flowers or fruits and I have found that all my Khandala plants belonged to *G. malabarica* Talbot.

Garcinia spicata (Wight & Arn.) Hook. f. in JLS 14 : 486, 1875 ; C. 1 : 78 ; G. 74 ; Blatter 624. *Xanthochymus spicatus* Wight & Arn. Prodr. 102, 1834. *X. ovalifolius* Roxb. Fl. Ind. 2 : 632, 1832. *Garcinia ovalifolia* (Roxb.) Hk. f. FBI 1 : 269, 1874 (non Oliver).

A rare plant in Khandala ; Blatter mentions the tree from Khandala in his MS. catalogue, and in the Revision he further states that he has seen the specimens from Khandala.

Garcinia talboti Raizada in Ind. For. 84 : 485, 1958. *G. malabarica* Talb. in JBNHS 11 : 234, t. 1, 1897 (non Desr. 1789) ; Santapau in RBSI ed. 1, 16 (1) : 17, 1953. *G. ovalifolia* var. *macrantha* Anders. in FBI 1 : 269, 1874. *G. spicata* var. *macrantha* Cooke, Fl. Pres. Bomb. 1 : 79, 1901. *Xanthochymus ovalifolius* Graham, Cat. 26, 1839 (non Wt. & Arn. 1834).

The description of *Xanthochymus ovalifolius* given by Graham, the time of flowering and fruiting and the type of fruit seem to indicate that he was dealing with this species ; moreover, the present species is about the commonest in the ravines at Khandala.

A small tree, easily confused with *G. xanthochymus*, from which it can be distinguished by the number of stigmatic lobes, *G. malabarica* having 3, *C. xanthochymus* 5-6.

A fine small tree with very typical leaves and fruits. Common on ravine slopes.

Local name : Pansara.

Flowers.—November to January. *Fruits*.—February to May.

OCHROCARPOS Du Petit-Thou.

Ochrocarpos longifolius (Wight) Benth. & Hook. f. ex Anders. in FBI 1 : 270 ; C. 1 : 79 ; Blatter 624 ; Engler in Pfam. (ed. 2) 21 : 192. *Calysacion longifolium* Wight, Ill. 1 : 150, 1840.

Occasionally found on steep slopes or in the ravines ; flowers remain on the tree for a fairly long time ; the fruit persists until the beginning of the rains. The wood is red and hard, but no use is made of it locally except for fuel.

Local name : Undi.

Flowers.—February to April. *Fruits*.—April to June.

ANCISTROCLADACEAE

ANCISTROCLADUS Wall.

Ancistrocladus heyneanus Wall. Cat. 7262, 1832 ; Gr. 28, 2839 ; Wight, Icon. tt. 1987-1988 ; FBI 1 : 299 ; C. 1 : 87 ; N. 26 ; Talb. 1 : 116, t. 69 ; Gilg in Pfam. (ed. 2) 21 : 592, t. 270 A.

A dimorphic shrub with hooked branches. In the young stages, or even later when support is not available, it is an erect shrub with very large, strap-shaped leaves, which are scattered all over the stem or branches. At later stages, when near support, it is a climber with much smaller leaves, which are gathered at the ends of branches.

Fairly common in the ravine just below St. Xavier's Villa. This is a very typical plant on account of the following characteristics : (a) The hooks which are especially noticeable on young branches ; (b) The size and shape of the fruits, with the large winged calyx ; (c) The particular revolving movement, propeller-like, of the fruits in falling.

Flowers.—February to May. *Fruits*.—February to June.

MALVACEAE

SIDA Linn.

Sida acuta Burm. Fl. Ind. 147, 1768 ; C. 1 : 93 ; Blatter 34 : 628. *S. carpinifolia* Linn. f. Suppl. 307, 1781 ; FBI 1 : 323. *Althaea coromandeliana angustis, praelongis foliis, semine bicornio* Plukenet in Herb. vol. 1, fol. 53 (in Brit. Mus. Nat. Hist.).

Burmah cites Plukenet's plant as the type of this species ; Plukenet's specimens are preserved in the British Museum, Natural History, London, and have been examined in connection with the present work.

The leaves of Plukenet's specimens are all glabrous, the petioles hairy ; after studying Plukenet's specimens, I went through all the sheets of *Sida acuta* in Kew Herb. ; all agree with Plukenet's specimen, except one from Tinnivelly, collected by Beddome (No. 519). From the specimens of this plant in the Brit. Mus. and Kew Herb., the distribution of this plant is quite clear : it extends through India, Ceylon, Malaya, the Philippine Islands, Timor and other Pacific Islands, Formosa and China.

Blatter, loc. cit., mentions the occurrence of this plant in Khandala. In the Blatt. Herb. there are several specimens of *Sida* labelled by Blatter "*Sida acuta* Burm."; on careful examination, all such sheets have turned out to belong to *S. rhombifolia* var. *rhomboidea*. Until further evidence is obtained, I consider the occurrence of this plant in Khandala very doubtful.

Sida rhombifolia Linn. var. *rhomboidea* Masters in FBI 1 : 324, 1874. *S. rhombifolia* forma *rhomboidea* Blatter 34 : 629, 1930.

Not in Cooke. A number of sheets from Bombay at present in Kew Herb. have been identified as *S. acuta* Burm. but belong to the present species. Blatter has reduced Master's variety to a form, on account of the extreme variability of the plant.

Externally this plant is very similar to *S. acuta* Burm., for which it is often mistaken ; *S. acuta* Burm. has glabrous leaves and very long awns, whilst the present species has hairy leaves and very short or O awns.

Fairly common and abundant in Khandala. Local woodmen use the stems as ropes for their grass or firewood bundles.

Local name : Chikankara.

Flowers.—September to December. *Fruits*.—October to January.

Sida rhombifolia Linn. var. *retusa* Masters in FBI 1 : 324, 1874 ; C. 1 : 93. *Sida retusa* Linn. Sp. Pl. (ed. 2) 961, 1762 ; Gr. 16 ; D. & G. 17. *S. rhombifolia* Linn. forma *retusa* Blatter 629, 1930.

A common plant in Khandala in open places and by the road sides. Local people use the stems as ropes for grass or firewood bundles.

Merrill (Enum. Phil. Fl. Pl. 2 : 35) has restored Linne's *S. retusa* to specific rank ; Blatter on the other hand finds the different varieties of *S. rhombifolia* so variable that he has made them all forms of the same species. My findings in Khandala agree with those of Blatter ; I have, however, retained the plants as varieties (and not merely as forms) in deference to authority.

Local name : Chikankara.

KYDIA Roxb.

Kydia calycina Roxb. Hort. Beng. 51, 1814 & Pl. Cor. 3 : 12, t. 215, 1819 ; FBI 1 : 348 ; Gr. 20 ; C. 1 : 94 ; N. 33 ; Talb. 1 : 127, t. 78 ; Blatter 629.

A common tree all over the district ; when in bloom, its white masses of flowers and the many insects around it, make this tree a showy one in Khandala. Leaves fall off during the hot season ; fruits or their remains persist to the beginning of the monsoon.

Local name : Warang or Warengi.

Flowers.—October to January. *Fruits*.—November to May.

ABUTILON Linn.

Abutilon polyandrum (Roxb.) Wight & Arn. Prodr. 55, 1834 ; Gr. 15 ; FBI 1 : 325 ; C. 1 : 95 ; Blatter 629 ; N. 28. *Sida polyandra* Roxb. Hort. Beng. 50, 1814, & Fl. Ind. 3 : 173, 1832.

Fairly common and often gregarious ; one of the brightest flowers in Khandala. The plant would be worth cultivating in gardens, except for the spreading habit of its branches.

Flowers.—November to March. *Fruits.*—December to March.

URENA Linn.

Urena lobata Linn. Sp. Pl. 692, 1753 ; FBI 1 : 329 (excl. *U. palmata*) ; C. 1 : 100 ; Hochreut. in Ann. Cons. Jard. Bot. Genève 5 : 134 ; Merrill Enum. 3 : 36 ; N. 29. *U. sinuata* Linn. Sp. Pl. 692, 1753 ; FBI & C. 11. cc. ; Gr. 13 ; Blatter 34 : 631.

I have followed Hochreutiner and Merrill in uniting Linne's two species under *U. lobata*. The distinction between the two species on the ground of the leaf structure cannot be maintained. Some plants have all their leaves deeply lobed, others have them more or less shallowly lobed, and yet others have their upper leaves not lobed at all whilst the lower ones are more or less deeply lobed, with a gradual passing from the unlobed upper to the deeply lobed lower leaves. The structure and colour of flowers, fruits, etc., is uniform and indistinguishable in the two species. In Khandala the lobing of the leaves seems to be a matter of age or position of the leaves on the stem.

Common after the rains, and in moist places even during part of the hot season. A poor looking plant. Local people make use of the stem fibres as ropes for grass or firewood bundles.

Flowers and Fruits.—October to March.

HIBISCUS Linn.

Hibiscus hirtus Linn. Sp. Pl. 694, 1753 ; FBI 1 : 335 ; Gr. 14 ; Wight, Icon. t. 41 ; D. & G. 20 ; Hochreutin. in Ann. Cons. Jard. Bot. Geneve 1 : 86 ; C. 1 : 106 ; Talb. 4 : 122, t. 73 ; Blatter 632 ; N. 30.

Common in flower or in fruit throughout the year except during the rainy season ; generally it occurs on the edges of the forest or in clearings or by paths in dense forest ; but it is not a gregarious plant.

The flowers look beautiful but the plant as a whole is a poor sight. A very fibrous plant, but on account of its relative scarcity no use is made of the fibres by local people.

Local name: Nareri.

Flowers and Fruits.—October to June.

Hibiscus micranthus Linn. f. Suppl. 308, 1781 ; FBI 1 : 335 ; D. & G. 20 ; C. 1 : 107 ; Blatter 632 ; N. 30.

A rare plant in Khandala ; in Blatt. Herb. there is only one specimen from Khandala ; I have not seen the plant growing in the district.

Hibiscus rosa-sinensis Linn. Sp. Pl. 694, 1753 ; FBI 1 : 344 ; Bot. Mag. t. 158 ; Gr. 13 ; C. 1 : 113 ; Blatter 634.

Introduced probably from China and cultivated in Indian gardens, where it flowers most of the year. According to Blatter, no fruits are produced in India ; I have seen no fruits, although I have kept several

of these plants under observation for a number of years. Generally the colour of the flowers is red ; other colours, pink, yellow or pale creamy yellow, occur, but have not been seen in Khandala.

Hibiscus schizopetalus Hook. f. in Bot. Mag. t. 6524. *H. mutabilis* Blatt. loc. cit. 34 : 634, 1930 (non Linn.).

In Khandala I have seen the plant cultivated in gardens for the last eight years. There are several good plants in St. Mary's Villa, and in the gardens near the Hindu temple on the South side of the village tank. The flowers are either pure red or more often red streaked with white or creamy lines. The plant does not seem to fruit in India.

ABELMOSCHUS Medik.

Abelmoschus manihot (Linn.) Medik. Malv. Fam. 46, 1787 ; Hochreut. in Candollea 2 : 87, 1924. *Hibiscus manihot* Linn. Sp. Pl. 696, 1753 ; Hochreut. in Ann. Cons. Jard. Bot. Genève 4 : 153, 1900 ; Blatter 633. *H. tetraphyllus* Roxb. Hort. Beng. 52, 1814, & Fl. Ind. 3 : 211, 1832 ; FBI 1 : 341 ; C. 1 : 111 ; Talb. 1 : 123, t. 74 ; N. 31. *Abelmoschus tetraphyllus* Graham, Cat. 14, 1839 ; D. & G. 19.

Shrubby, erect, up to 1m. high, sometimes higher.

Involucral bracts generally longer than the calyx. Roxburgh named his plant *H. tetraphyllus* on account of the four bracts of the epicalyx ; for a few years I have been searching in Khandala and elsewhere for a plant with only four bracts, but only on very rare occasions did I see any flower with four bracts, their number being generally 5, occasionally 3 or 6, and very rarely 4.

Hochreutiner distinguishes three varieties of *H. manihot* : *genuinus tetraphyllus* and *pungens* ; I cannot assign my Khandala plants to any of these varieties, as my plants seem to be intermediate between the first two varieties.

Tolerably common in Khandala, but not gregarious.

Local name: Ran Bhendi.

Flowers and Fruits.—October to December.

Abelmoschus esculentus (Linn.) Moench. Meth. 617, 1794 ; Gr. 14 ; Schumann in Pfam. 3(6) : 48, t. 20K. *Hibiscus esculentus* Linn. Sp. Pl. 696, 1753 ; FBI 1 : 343 ; C. 1 : 112 ; Blatter loc. cit.

Blatter mentions the occurrence of this plant in his MS. catalogue. I have not seen it growing in the district, although the fruits are sold in the local market as a vegetable. The plant is obviously cultivated in the district, but in what particular part I am unable to say.

Local name: Bhendi.

Blatter in MS. catalogue : " Cultivated as a vegetable. "

THESPESIA Soland.

Thespesia populnea (Linn.) Soland. ex Corr. in Ann. Mus. Par. 9 : 290, 1807 ; FBI 1 : 345 ; Gr. 15 ; C. 1 : 114 ; Blatter 635 ; Blatter & Millard, Beautif. Ind. Tr. 106 ; Kerr in KB. 1941 : 18. *Hibiscus populneus*

Linn. Sp. Pl. 694, 1753. *Ipomoea campanulata* Linn. Sp. Pl. 160, 1753 (non FBI. nec Cooke nec alior. auct. ante Kerr, 1941).

A fairly large tree planted along the main road from Khandala to St. Xavier's Villa. I have not seen it anywhere in the jungle.

Flowers, when young are pale yellow or sulphur yellow with a large deep-purple spot inside the corolla near its base ; when the flowers begin to fade, they turn pinkish red, the purple spot inside becoming almost black.

Local name : Bhendi.

Thespesia lampas (Cav.) Dalz. & Gibs. Bomb. Fl. 19, 1861 ; FBI 1 : 345 ; Talb. 1 : 124, t. 75 ; Hutch. Sil. & Steph. Evol. Gossyp. 6 ; N. 32. *Hibiscus lampas* Cav. Diss. 3 : 154, t. 56, f. 2, 1787 ; Gr. 13 ; Wight, Icon. t. 5 ; Hochreut. in Ann. Cons. Jard. Bot Genève 4 : 57 ; Blatter 634.

Shrubby, erect, up to 3 m. high, generally about 1.5-2 m. The whole plant when young is densely covered with simple and compound hairs which, however, fall off in the mature plant ; branching sparse, occasionally profuse, the branches spreading and long.

This is a very common plant all over the district ; it is especially common on the slopes of Monkey Hill or of Battery Hill, among grasses. The size and colour of the flowers render the plant very conspicuous. The bark is used by hill people to make rough cordage to tie bundles of firewood for the market.

Local name : Ran Bhendi.

Flowers.—September to November. *Fruits*.—September to January and occasionally till May.

BOMBACACEAE

SALMALIA Schott. & Endl.

Salmalia malabarica (DC.) Schott. & Endl. Melet. 35, 1832. *Bombax malabaricum* DC. Prodr. 1 : 479, 1824 ; FBI 1 : 349 ; Gr. 16 ; C. 1 : 120 ; Talb. 1 : 130, tt. 79-80 ; Blatter & Millard, Beaut. Ind. Tr. 9 ; N. 33.

Fairly common in Khandala, but scarcely as common as the following species. Locally the wood is used for firewood ; commercially the cotton of the fruit is collected for stuffing pillows and mattresses ; the wood is used in the manufacture of matchsticks. Of late years there has been extensive cutting of these trees for the match industry ; in time this may lead to the total extermination of the tree from Khandala.

When the tree is in full bloom, it is visited by a number of birds in search of the abundant nectar produced by the flowers.

Local name : Saur.

Flowers.—February to March. *Fruits*.—March to April.

Salmalia insignis (Wall.) Schott. & Endl. Melet. 35, 1832. *Bombax insigne* Wall. Pl. As. Rar. 1 : 71, 1830 ; FBI 1 : 349 ; C. 1 : 120 ; Blatter 637 ; Blatter & Millard 13

Corolla very prominent, petals up to 16.5×3.5 cms. tomentose outside. The colour varies between very pale pink to deep red, but generally is much paler than in the preceding species.

Stamens between 450 and 500. Filaments at first pale, almost white, becoming brick red on drying up ; in length up to 10 cms. Anthers small, at first yellow, at length purplish. Style about the same colour as the filaments, but tinged reddish pink in the upper third, 2 cms. longer than the massed filaments. Stigma 5-lobed, inconspicuous.

This is much more common than *S. malabarica* ; at the time of the dehiscence of the fruit, masses of cotton covering the seeds are common on the floor of the forest. It is impossible or nearly so to distinguish this species from *S. malabarica* when both trees are in leaf ; *S. insignis* comes into flower and fruit several months earlier, the size of its flowers is much larger and the colour much paler, the number of stamens about 8 times larger, the size of the fruit is also much bigger. When in flower or fruit, the identity of the *Salmalias* of Khandala is quite clear.

Locally the tree is only used for fuel ; commercially it is used for matchsticks.

Local name : Saur.

Flowers.—November to January. *Fruits*.—December to April.

STERCULIACEAE

STERCULIA Linn.

Sterculia urens Roxb. Pl. Cor. 1 : 25, t. 24, 1795 ; FBI 1 : 355 ; C. 1 : 123 ; Talb. 1 : 137, t. 83 ; Blatter 878 ; N. 34.

After leaf fall the trunk and branches appear white, the bark peeling off in large irregular patches ; this gives the tree a patchy appearance. The wood is mucilaginous and when an incision is made on the wood the mucilage comes out and solidifies into a colourless gum, which is used locally as an article of food ; in the rainy season this gum easily decomposes with an unpleasant odour. For the rest this tree is only used for fuel.

Not a common tree in Khandala, except at the foot of Behran's plateau, on the narrow ledge between the railway line and St. Mary's Ravine, and on the slopes below Elphinstone Point.

Local name : Kaundal.

Flowers.—November to March. *Fruits*.—January to May.

Sterculia villosa Roxb. Hort. Beng. 50 & Fl. Ind. 3 : 153, 1832 ; Gr. 19 ; FBI 1 : 355 ; C. 1 : 124 ; Blatter 878.

Leaves on young seedlings of very large proportions, up to 69 cms. diam. with a petiole 75 cms. long. A rare tree in Khandala.

Flowers.—December 1942. *Fruits*.—Not seen.

Sterculia guttata Roxb. Hort. Beng. 50, 1814, & Fl. Ind. 3 : 148, 1832 ; FBI 1 : 355 ; Gr. 17 ; Wight, Icon. t. 487 ; C. 1 : 124 ; Talb. 1 : 139 t. 84 ; G. 106 ; N. 34.

The seeds of this tree are eaten by monkeys, but until dehiscence they are difficult to get at on account of the thick, fibrous pericarp.

A common tree in Khandala, flowering and fruiting abundantly. A short branch collected on Battery Hill on 21 December 1943 had 21 follicles with a total weight of 5 kilograms (follicles only). The seeds are occasionally eaten raw or roasted by local people.

Local name : Kukrul or Kukar.

Flowers.—November to March. *Fruits*.—December onwards, persisting for a year or more on the tree.

FIRMIANA Marsig.

Firmiana colorata R. Br. in Bennett, Pl. Jav. Rar. 235, 1844 ; GI 107 ; Blatter 79. *Sterculia colorata* Roxb. Pl. Cor. 1 : 26, t. 25, 1795 ; FBI 1 : 359 ; Gr. 17 ; C. 1 : 125 ; Talb. 1 : 140, tt. 85-86 ; N. 35. *Erythropsis colorata* Burkill in Gardn. Bull. Straits Settl. 5 : 231, 1931 ; Santapau in RBSI. (ed. 1) 16(1) : 26.

During the flowering and fruiting season, and when the leaves first appear, this is one of the more colourful trees in Khandala ; the wood is soft, and is only used for fuel. Common, though not abundant, in the district ; the best specimens are to be found on Monkey Hill Plateau.

Local name : Kausi.

Flowers and Fruits.—March to May.

PTERYGOTA Schott. & Endl.

Pterygota alata (Roxb.) R. Br. in Benn. Pl. Jav. Rar. 234, 1844 ; G. 104 ; Blatter 879. *Sterculia alata* Roxb. Hort. Beng. 50, 1814 & Pl. Cor. 3 : 84, t. 287, 1819 ; FBI 1 : 360 ; C. 1 : 125.

Cooke seems to be the only author to mention the occurrence of this plant in Khandala ; Blatter in his Revision follows Cooke, but adds no further details. I have not seen the plant in Khandala ; there are no specimens from this place in any of the Herbaria I have consulted.

Cooke ; Blatter "Planted at Khandala and Poona".

PTEROCYMBIUM R. Br.

Pterocymbium tinctorium (Blanco) Merrill in Gov. Lab. Publ. (Philip.) 27 : 24, 1905. *Heritiera tinctoria* Blanco, Fl. Filip. 653, 1837. *Sterculia campanulata* Wall. ex Masters in FBI 1 : 362, 1874 ; C. 1 : 126 ; Blatter 878.

A large tree cultivated in the grounds of Khandala Hotel, the only specimen in the district. In March 1942 the ground beneath the tree was covered with flowers. In May 1944 Mr. Nanaboy, the owner of the Hotel, kindly presented me with some of the fruits which he had collected some time previously ; the seeds seem to remain alive for a very short period once they are separated from the parent tree. It is not a particularly fine tree.

Flowers.—March 1942. *Fruits*.—May 1944.

HELICTERES Linn.

Helicteres isora Linn. Sp. Pl. 963, 1753 ; FBI 1 : 365 ; Gr. 16 ; Wight, Icon. t. 180 ; D. & G. 22 ; C. 1 : 138 ; Talb. 1 : 146, t. 89 ; G. 197 ; Blatter 879 ; N. 35.

The colour of the flowers and the structure of the fruit render this a conspicuous plant. Common in Khandala in the undergrowth on the slopes below Duke's Nose. No practical use is made of the stem or fruits.

Local name : Murdi.

Flowers.—August to November. *Fruits*.—September to June.

ERIOLOAENA DC.

Eriolaena quinquelocularis Wight, Icon. 3 : 7, 1847 ; FBI 1 : 371 ; C. 1 : 132 ; Talb. 1 : 115, tt. 92-93 ; G. 110 ; Blatter 881.

Common and somewhat gregarious on the higher parts of the district ; especially common on the upper plateau of Bhoma and Ghira Hills ; lower down it is not common. Except perhaps when the new leaves are on, the tree is a poor sight even when in flower ; at the best of times it looks bare and rugged.

Local name : Buti.

Flowers.—May to June. *Fruits*.—June to August, but persisting for a year or more before dehiscence.

PTEROSPERMUM Schreb.

Pterospermum acerifolium Willd. Sp. Pl. 3 : 729, 1801 ; FBI 1 : 468 ; C. 1 : 129 ; Talb. 1 : 149 ; Blatter 880.

There is but one tree in a garden near St. Mary's Villa ; I have kept the tree under observation for a number of years. It is a small tree with large leaves and large white flowers. Flowers and fruits : from November onwards till the beginning of the monsoon.

MELOCHIA Linn.

Melochia umbellata (Houtt.) Stapf in Kew Bull. 1913 : 317 ; G. 110 ; Blatter 883. *Visenia umbellata* Houtt. Handl. 8 : 309, t. 46, f. 3, 1777 ; Wight, Icon. t. 509. *Melochia velutina* Wall. ex Bedd. For. Man. in Fl. Sylv. xxxv, t. 5, f. 3, 1871 ; FBI 1 : 374 ; C. 1 : 135 ; N. 36. *Riedleia tiliaefolia* DC. Prodr. 1 : 491, 1824 ; Gr. 19 ; D. & G. 24.

Blatter mentions in his MS. catalogue that this plant flowers in November. I have not seen the plant in Khandala. Graham, loc. cit., adds that it grows on "the hill above Sir Herbert Compton's Bungalow at Kandalla" ; there is no record of such a bungalow even in the Collector's Office, Poona ; but from information gathered from Mr. Nanaboy, it seems probable that the bungalow occupied the present site of the Khandala Hotel, and that the slopes mentioned by Graham are the lower slopes below Forbay.

WALTHERIA Linn.

Waltheria indica Linn. Sp. Pl. 673, 1753 ; FBI 1 : 374 ; Gr. 246 ; C. 1 : 135 ; G. 111 ; N. 36. *W. americana* Linn. Sp. Pl. 673, 1753 ; Merrill, Enum. 3 : 47 & Pl. Life Pac. World 140

A rare plant in Khandala ; I have not seen it in the district. There is but one specimen in Blatter Herbarium.