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THE FLORA OF KODAIKANAL

K. M. MATTHEW, S. J.*

St. Xavier's College, Bombay

ABSTRACT

Kodaikanal is of special botanical interest for its temperate flora, rare in Peninsular India, on account of high altitude and consequent moderate temperature. The climate is characterized by moderate temperature with low annual range, and moderate and well-distributed rainfall. Its flora is relatively rich, but not yet studied exhaustively and critically.

The flora of Kodaikanal has been subjected to excessive human interference, as first by noted by Beddome already in 1858, and this has been true ever since, especially of late. A disastrous form of interference is the putting of fire during summer to ensure good growth of grass with the first showers. Recently many places have been completely cleared for cultivation. The more ornamental species like orchids and lilies, and the rarer pteridophytes have been removed by visiting botanists. Thus the flora of Kodaikanal, as it is today, is but a relic of a rich flora in the past.

The present paper restricts itself to the plants above alt. 1675 m. The flora of this area may be classified at first into the *Indigenous* and the *Exotic*, treated separately below.

I. THE INDIGENOUS FLORA

The plateau consists of undulating hills over three-quarters of which are covered with *grasslands*, whose continuity is interrupted by patches of evergreen forests locally called *sholas*.

Grasslands : For an enumeration of species, see Matthew (1959). The most abundant species are (?) *Strobilanthes kunthianus* Anders., *Pteridium lanuginosum* Wall., *Rhododendron nilagiricum* Zenk., *Cymbopogon polyneuros* (Steud.) Stapf, *Themeda cymbaria* Hack., *Tripogon bromodies* Roth., *Andropogon lividus* Thw., *Heteropogon contortus* (Linn.) Beauv., *Arundinella purpurea* Hochst. ex Steud., *Chrysopogon orientalis* (Desv.) A. Cam. and *Eulalia phaeothrix* (Hack.) O. Kze.

Sholas : These are closed evergreen forests composed of tropical and temperate species, occurring as isolated patches in sheltered valleys, often associated with streams. Trees are characteristically stunted, rarely exceeding 20 m. tall, well-branched, attaining considerable girth and supporting numerous epiphytes. Among the most abundant species are *Syzigium arnottianum* Walp., *Michelia nilagirica* Zenk., *Gordonia obtusa* Wall., *Eurya japonica* Wt., *Phoebe wightii* Meissn., *Vaccinium leschenaultii* Wt., *Meliosma arnottiana* (Wt.) Walp., *M. wightii* Planch., *Daphniphyllum glaucescens* Bl., *Elaeocarpus serratus* Linn., *E. ferrugineus* Wt., *Turpinia nepalensis* Wall. and *Schefflera racemosa* Harms.

The co-existence in close juxtaposition of these two mutually exclusive plant communities has been the subject of numerous ecological discussions. See Champion (1935), Ranganathan (1938), Bor (1938), Shankaranarayanan (1958) and Gupta (1960).

II. THE EXOTIC FLORA

At present the exotic or introduced plants form the dominant part of the vegetation of Kodaikanal, and their abundance and distribution are steadily on the increase. These plants began to appear about 1830 with the coming of the European Government Officials and Missionaries for summer rest or settled down after retirement. On account of a climate similar to that of their home countries, they successfully introduced ornamental, fruit-bearing or commercially important species. This flora has been exhaustively studied for the first time by the author during 1960-62 ; the work confined to the woody plants and the naturalized weeds treats of 344 species from 223 genera belonging to 85 Families.

The history and present abundance of Acacias, Conifers, Eucalypts, Cinchona, Fruit Trees, Pyrethrum, Geranium, Nepalese Alder, Fodder Grasses, Weeds and Orchids are discussed in detail.

Conclusion : Outlook for the future : (1) Further destruction of the indigenous flora should be prevented as far as in us lies, and this flora to be studied carefully and exhaustively, revising Fyson's work completely. (2) The excessive spread of the more aggressive exotic species to be checked. (3) A Flora of the Flower Garden to be prepared, which will be common for many of the hil stations of India.

Kodaikanal, famous as a hill station, on the Palni (Pulney) Hills in the District of Madurai in the State of Madras in South India, is situated at an altitude of about 2100 m., between 10°.12′ and 10°.15′ N and 77°.26′ and 77°.33′ E. It has a quasi-temperate climate, in spite of low latitude, on account of high altitude. Moderate temperature with low annual range is characteristic. The annual rainfall of about 170 cm. is not too impressive, but its even distribution almost throughout the year keeps the vegetation fresh without the drastic fluctuations of monsoon and dry seasons, so striking for most parts of Peninsular India. The soil largely consists of a special kind of gneiss called charnockite.

Kodaikanal has always been a favourite spot with botanists, on account of its rich and characteristic flora, very different from that of the surrounding districts. R. Wight, in 1837, published the first botanical paper on Kodaikanal, a report of the collections of plants which he made. In 1858, R. H.

* Present Address : St. Mary's College, Kurseong, Darjeeling Dt., West Bengal.

Beddome published a report on the Vegetable Products of the area and a list of over 700 plants collected there. His book "The Ferns of Southern India" (1873) includes many species from the area.

However, it was only by the turn of this century that intensive botanical exploration was carried out there. Some of the inmates of Sacred Heart College, Shembaganur, made extensive collections from Kodaikanal since 1909, but they did not achieve any publication except for a list of plants by A. Saulière in 1914; however, their collections and drawings are preserved in the Museum of the College. G. Foreau made collections of Algae, Lichens and Mosses which were examined and described by Fremy, Moreau & Moreau, and Dixon & Potier de la Varde respectively, and included numerous new taxa. Mosses, however, remained his speciality, a complete enumeration of which has been published in 1961.

P. F. Fyson, of the Presidency College, Madras, first published (1915-1921) a Flora of Kodaikanal (and Nilgiris) with the help of collections, besides his own, made by a team of European Officials, who visited the area during summer. Gamble's Flora of Madras (1916-1935) includes many species from Kodaikanal. Fyson revised his work in 1932, which book remains even today the only Flora of Kodaikanal, though it is far from exhaustive or critical, chiefly for want of sufficient intensive exploration and field observations.

Since 1932, there has been little addition to the knowledge of the botany of Kodaikanal except for occasional short publications, all of which are cited in the Bibliography. The present author has had the occasion to know the flora in some detail during his permanent residence in the area (1950-1957) and by means of an intensive exploration (1960-1962) of the introduced plants of the area.

Speaking of the flora of Kodaikanal, it is essential to specify the area covered and the particular type of vegetation intended, as carelessness in this matter has caused confusion even in published works. Only regions above 1675 m. are included here, which have a vegetation quite different from that of lower elevations. This flora has been indiscriminately tampered with, either by felling of trees or by setting fire to the grasslands. The latter happens during summer when many of the annuals are dry, and results in the destruction of vegetation in extensive tracts of land. Of late, large areas have been cleared for cultivation of species of food or commercial value. The more botanically interesting species like orchids and the rarer pteridophytes have suffered at the hands of thoughtless botanists visiting the area periodically.

The flora is best studied under two headings: the *Indigenous* and the *Exotic*.

MAP OF KODAIKANAL TALUK

Places indicated by Numbers on the Map

1.	Vandaravu	Alt.	2554 m.
2.	Marian Shola	„	2390 m.
3.	Mannavanur	„	1908 m.
4.	Kukkal	„	1892 m.
5.	Berijam	„	2134 m.
6.	Pumbarai	„	1917 m.
7.	Pallanghi	„	1693 m.
8.	Villakevi	„	1219 m.
9.	Kodaikanal	„	2100 m.
10.	Lake	„	2089 m.
11.	Reservoir	„	2265 m.
12.	Villuppatty	„	1932 m.
13.	Shembaganur	„	1830 m.
14.	Perumalmalai	„	1550 m.
15.	Palamalai	„	1240 m.
16.	Panncikkadu	„	1372 m.
17.	Machur	„	1347 m.
18.	Adukkam	„	1200 m.
19.	Tandikkudi	„	1409 m.
20.	Pachalur	„	1219 m.
21.	Periyur	„	1219 m.
22.	Pulatur	„	1263 m.
23.	Neutral Saddle	„	1569 m.

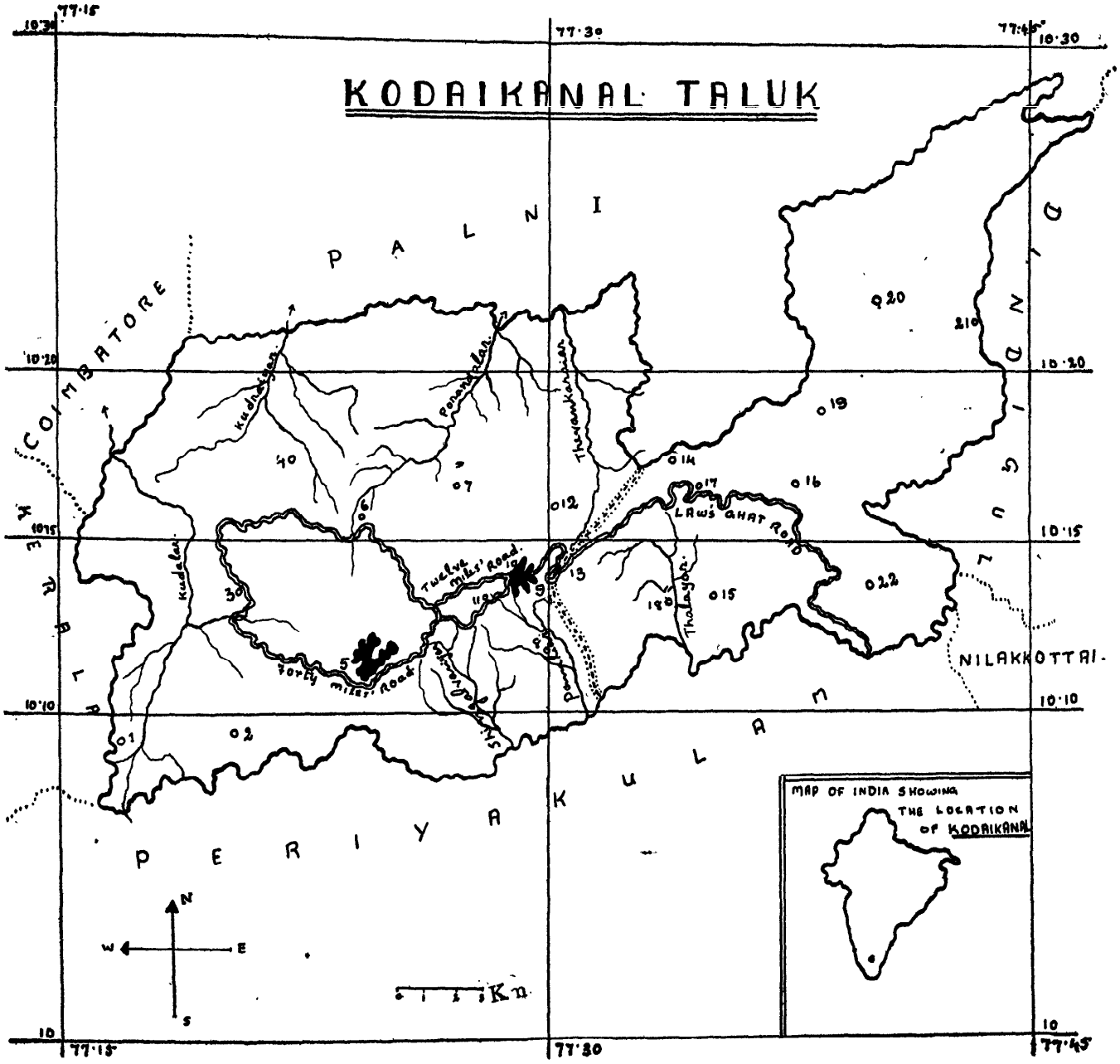
THE INDIGENOUS FLORA

The plateau of Kodaikanal consists of undulating hills mostly covered with *grasslands* whose continuity is interrupted by dense patches of evergreen woods locally called *sholas*. These two types of vegetation, distinct in themselves, are discussed separately.

Grasslands: These occupy more than three-quarters of the area. An enumeration of the species of this type of vegetation has been published by the author in 1959 after an intensive exploration of three localities every fortnight for a whole year. It should be noted that under 'grasslands' all the types of vegetation excluding the sholas are included. Though the grasses outnumber other species, the Bracken (*Pteridium lanuginosum* Wall.) and (?) *Strobilanthes kunthianus* T. And. are the most conspicuous in many places. Other characteristic shrubs are *Berberis tinctoria* Lesch., *Hypericum mysorense* Heyne, *Oldenlandia stylosa* O. Kze., *Gaultheria fragrantissima* Wall., *Uraria rufescens* (DC.) Schindl., *Rubus fairholmianus* Gardn. and *Osbeckia wightiana* Wall.

The most abundant species of grasses are *Cymbopogon polyneuros* (Steud.) Stapf, *Themeda cyambaria* Hack., *Tripogon bromoides* Roth, *Andropogon lividus* Thw., *Heteropogon contortus* (Linn.) Beauv., *Chrysopogon orientalis* (Desv.) A. Cam., *Arundinella purpurea* Hochst. ex Steud., *Eulalia phaeothrix* (Hack.) O. Kze., and *Themeda triandra* Forsk.

A considerable number of species of low herbs grow among the grasses. *Anaphalis beddomei* Hook. f., *A. lawii* (Hook. f.) Gamble, *A. travancorica* Sm., *Andrographis neesiana* Wt., *Campanula fulgens* Wall., *Cassia leschenaultiana* DC., *Centella asiatica* (Linn.) Urb., *Commelina clavata* Cl., *Conyza stricta* Willd; *Cyanotis arachnoidea* Cl., *Justicia simplex* Don, *Lilium neilgherrense* Wt., *Micromeria biflora* Benth., *Prunella vulgaris* Linn., *Striga*



asiatica (Linn.) O. Kze., and *Wahlenbergia gracilis* DC. The most abundant species of orchids are *Habenaria travancorica* Hook. f., *Phyllomphax obcordata* Sch., and *P. obcordata* var. *janitha* Hook. f. and *Satyrium nepalense* Don. Marshy places have the following species associated with them. *Burmannia pusilla* (Wall. ex Miers) Thw., *Drosera burmannii* Vahl, *Gentiana pedicellata* Wall. var. *wightii* Kurz, *Hypericum japonicum* Thunb., *H. wightianum* Wall., *Impatiens goughii* Wt., *Laurembergia brevipes* (Wt. & Arn.) Schindl., *Rotala rotundifolia* (Roxb.) Koch, *Utricularia graminifolia* Vahl and *Xyris schoenoides* Mart.

Sholas: These are patches of dense isolated woods composed of evergreen trees occurring in sheltered valleys or along folds in the undulating plateau, often associated with streams. Trees are characteristically stunted and seldom exceed 20 m. tall, are considerably branched and support a large number of epiphytes. The most abundant species are *Daphniphyllum glaucescens* Bl., *Elaeocarpus ferrugineus* Wt., *E. glandulosus* Wall. ex Miers, *E. serratus* Linn., *Eurya japonica* Thunb., *Gordonia obtusa* Wall., *Litsea ligustrina* Nees, *Meliosma arnottiana* (Wt.) Walp., *M. wightii* Planch., *Michelia nilagirica* Zenk., *Phoebe wightii* Meissn., *Rhododendron nilagiricum* Zenk., *Syzigium arnottianum* Walp., *Turpinia nepalensis* Wall. and *Vaccinium leschenaultii* Wt.

The grasslands and the sholas are distinct in their

composition. The co-existence in close juxtaposition of two such mutually exclusive plant communities has been the subject of numerous ecological discussions since 1935, as to which of the two is the climatic climax, or both. The main points will be mentioned, but a discussion on the matter is outside the scope of the present subject. Champion (1935) does not consider the grasslands as climaxes anywhere, but accounts for their origin from the destruction of the sholas. Ranganathan (1938) thinks that both the sholas and the grasslands are climaxes. Bor (1938) points out that the sholas alone are the true climax, while the grasslands are only a biotic climax. Shankaranarayanan (1958) subsumes the views of Champion and Bor that the grasslands are not a true climax, but a 'sub-climax' governed by "a set of biotic factors which do not admit easy passage towards the final climax".

THE EXOTIC FLORA

At present the exotic or introduced flora forms the more dominant portion of the vegetation of Kodaikanal. Within recent years their abundance and distribution have been considerably increasing. These plants began to appear since 1830 with the coming of European Officers or Missionaries who came up here for a summer rest or settled down after retirement from service. Some of them, realizing similarity in climate of the place with that of their home countries, introduced ornamental, fruit-bearing and commercially important species of plants from nearly all over the world, though till recently when determined large scale plantation of certain commercially important species has been taken up, the cultivation of exotics was mostly random. However, over the years these plants have come to dominate the entire area.

To a student of botany such species are very interesting but on the other hand, they offer great difficulties with their identification. Fyson and Gamble together mention about 120 species by name, but this seldom helps in the work of identification, while many more species have not even been mentioned by them. Students visiting the place have been forced to give up the identification of many of the species as impossible, or what is worse, have given uncritical names to plants. Besides, as these plants are now growing in a new habitat, their phenology and degree of acclimatization should be compared against similar data from their native countries. Queries used to be made time and again by botanists, horticulturists and Forest Officers regarding the identity, phenology and possibility of commercial exploitation of many of the introduced plants. Thus the need for an exhaustive study of the exotic flora was pressing, and hence the author made a study of it from 1960 to 1962, and includes 344 species from 223 genera belonging to 85 Families.

Sir Vere Levinge (1819-1885), Collector of Madura, some of the Officers of the Forest Department, especially H. B. Bryant, and the Fathers of Sacred Heart College, Shembaganur, are among the more noteworthy agencies in the introduction of these plants. As for places where a large number of species occur together, the campus of the Astrophysical Observatory, the Bryant Park and the Sacred Heart College are the more outstanding.

Though at present the exotic flora forms the more conspicuous portion of the vegetation, not all the species tried here were successful to the same degree. Some failed completely; others just live on without producing flowers; others flower but do not produce fruits; others produce fruits without fertile seeds; and still others produce fertile seeds but unable to produce vigorous plants. Even in the so-called naturalized or successful species a number of phenological variations from plants in their native habitats are noted. As a rule, plants are smaller at Kodaikanal, though in the floral parts the difference in size is not appreciable. Flowers are seldom scented here. The term 'flowering season' can be applied only in a broad sense, as many of the plants flower nearly throughout the year. In the dioecious plants, the staminate and pistillate phases often do not synchronize. The pistils, or stamens, or both, are at times seen to be ill-developed, which accounts for the non-production of seeds. Even within Kodaikanal itself it has been possible to elucidate a fairly clear relation between altitude and the time of flowering: often it has been noted that for the same species occurring at various altitudes, flowering occurred first at the lowest altitude and latest at the highest. In the timber species, the grain of the timber is almost always seen to be inferior to that in the native country. It is also known that many of the species previously recorded here are absent now, which could either be owing to large scale denudation of the vegetation or insufficient acclimatization. The disappearance of some of the weeds of cultivation is accounted for by the cessation of the import of vegetable seeds.

It will be possible to treat here only about some of the more successful of the introduced plants, regarding the history of their introduction, degree of success, present distribution and abundance.

ACACIA

Some species of this genus are extensively cultivated, and have become perfectly naturalized at Kodaikanal. Economically these are the most important group of exotic plants here realizing lakhs of rupees of income to the State.

The most important of these are the Wattle which comprise three closely related plants: *A. decurrens* (Wendl.) Willd. (Green or Common or Tan Wattle), *A. dealbata* Link (Silver Wattle), and *A. mearnsii* De Wild., more commonly but erroneously known as *A. mollissima* Willd. (Black Wattle).

The Wattle assumed commercial importance here only since 1940, and more so since 1948, with the

cessation of import of South African Bark. At present the Madras State alone consumes 20320000 Kgms. of bark annually. Besides the bark, large quantities of fuel also are made available on a short rotation.

The first to introduce Wattle in Kodaikanal was Sir Vere Levinge (1819-1885), after his retirement to Kodaikanal in 1867, but large scale introduction was begun only in 1883 (on the Nilgiris in 1832 by Capt. Dunn) when a plantation of about 7 hectares was raised at Poombarai by the Forest Department. Under the initiative of A.W. Lushington, about 40 hectares of land were brought under cultivation in 1919 but was completely destroyed by the disastrous fire of February, 1920, which burnt down hundreds of hectares of plantations. H. B. Bryant further extended Wattle Plantations, but it was only since 1940 that the idea that the bark and wood could become items of considerable national wealth.

With the realization of the tannin value of Wattle bark, cultivation of Wattle received a great impetus since 1948. A Wattle Plantation Circle was organized by the Forest Department which was to work in seven felling series: Vandaravu, Marianshola, Gundar, Berijam, Paricombai, Ayakudi, and the firebelt series, in a rotation of 10 years. In 1958 there were 2513 hectares of land under Wattle cultivation, and another 2242 hectares are expected to be brought under cultivation by 1965, making a total of 4755 hectares on the Palnis. At present Wattle is being planted between 1250 m. and 2200 m. Among the various species the Green or Tan or Common Wattle [*A. decurrens* (Wendl.) Willd.] was first preferred for large scale cultivation, and continued in the lead till 1955 when the Black Wattle (*A. mearnsii* De Wild.) was recommended as a higher yielder of tannin of superior quality.

The Silver Wattle (*A. dealbata* Link) is definitely a poor yielder of tannin; even the fuel is of inferior quality, and the plant is often easily broken by the wind. It is nowhere cultivated commercially but owing to the remarkable power of regeneration by rootsuckers, it is liable to invade neglected areas. This species is frequently seen along roadsides, where it is noted for its straggling, almost recumbent, habit. Despite its many less desirable qualities, the Silver Wattle is known to enrich the soil by nitrogenizing it. As the plant prevents soil erosion, it is suited to clothe unstable hill slopes. Lime-free soil as that of the Nilgiris and Palnis, seems to favour the growth of the plant.

Wattle in Kodaikanal have been observed to hybridize freely, as plants with intermediate characters are often seen. A few of them have been identified in the field by J. D. Matthews, Forest Geneticist, British Forestry Commission Research Station, Alice Holt, England, and S. Kedharnath, Forest Geneticist, Forest Research Institute, Dehra Dun, in November 1960. The potentialities of hybridization in commerce have not yet been studied. Fear has been expressed that the quality of tannin might become inferior, and orders have been issued to the officials of the Wattle Planting Circle to destroy all hybrid seedlings in the nursery itself. However, as the flowerings of the Black, Green and Silver Wattles overlap at Kodaikanal, the possibility exists of evolving a race with the superior tannin quality of the Black Wattle, the vigour and tenacity of the Silver Wattle and the resistence to frost and insect enemies and the initial rapid growth of the Green Wattle.

AUSTRALIAN BLACKWOOD
(*A. melanoxylon* R. Br.)

This is an evergreen tree with an erect bole, up to 20 m. tall and a girth of 1.5 m., frequently less. The dense crown of characteristic shape makes it a handsome exotic; in Tamil, it is called Ther Chavukku (=Chariot Acacia) as the crown is imagined to resemble a chariot. The tree was first introduced at Kodaikanal in 1870 (in the Nilgiris in 1832) by Sir Vere Levinge. It is very well acclimatized but suffers much from plant parasites; of these the most frequent is *Dendrophthoe neelgherrensis* (W. & A.) van Tiegh. The quality of the timber does not compare with the Australian samples, but still it is largely used in construction.

CONIFERS

Though the Forest Department was responsible for large scale introduction of Conifers from the turn of this century, many species had already been introduced earlier under private initiative. Between 14th October and 23rd December 1892, there are five entries in the diary of P. Labarthère (1831-1914), as having planted *Cedrus deodara* (Roxb.) Loud., *Cryptorulosa* D. Don, *C. macrocarpa* Hartw., *C. goveniana* Gord., and *Chamaecyparis lawsoniana* (A. Murr.) Parl., at La Providence, La Salette and Mt. St. Mary, Kodaikanal. As many of these trees are still alive it is possible to estimate the rate of growth of the various species.

In 1906 the Forest Department launched a scheme for the introduction of Conifers on a plantation scale and by 1915 about 33 species were tried with varying degrees of success. Among the best distributed and best acclimatized species at Kodaikanal at present are *Cupressus torulosa* D. Don., *Cryptomeria japonica* (Linn. f.) D. Don, and *Callitris rhomboidea* R. Br. The last mentioned species, though not mentioned in any of the records examined, has become so common and abundant as to become a permanent feature of any tract of vegetation here, but only above 2000 m.

Among the extensively cultivated plants, the genus *Pinus* held pride of place. Between 1906 and 1915, over 370 hectares of land were planted with Pines, under the initiative of H. B. Bryant. This plantation was situated to the South West of Kodai-

kanal, in the Gundar Valley Extension Reserve at 2200 m.

In 1906, seeds of *Pinus attenuata* Lemm., *P. torreyana* Parr., *P. cembroides* Zucc. var. *monophylla* (Torr. & Frem.) Voss, and *Pseudotsuga macrocarpa* Mayr. were obtained from California, and seedlings raised in nurseries in April-May, and planted out in October 1907. *Pinus radiata* D. Don which succeeded best and formed 80% of the plantations, was planted nearly every year from 1906-1915. Other species tried were *P. attenuata* Lemm., *P. torreyana* Parr., *P. coulteri* D. Don, *P. ponderosa* Doug., *P. pinaster* Ait., *P. sabiniana* Doug., *P. lambertiana* Doug., *Sequoia washingtonia* Sudw., and among the Himalayan conifers, *P. roxburghii* Sarg., *Cupressus torulosa* D. Don, *Taxus baccata* Linn., *Picea morinda* Link, *P. parryana* Sarg. and *P. sitchensis* Carr. Among these *Pinus pinaster* Ait., *P. ponderosa* Doug., *P. sabiniana* Doug., *P. coulteri* D. Don and *Sequoia washingtonia* Sudw. seem to have failed completely. By 1915 it was realized that the timber of *Pinus radiata* D. Don, which was by far the most abundant species, was of no commercial value and all further planting was stopped.

Three major disasters mar the history of the Pine Plantations of Kodaikanal: the first, in February, 1920, was a fire which burnt for 3 days and wiped out an area of 217 hectares, killing over 95,000 trees; the cyclone of 6th May, 1930, blew down over 30,000 of the remaining trees; another fire in 1940 wiped out trees in another 14 hectares of land. Incidentally, the present author has been told by eye-witnesses that the fire of 1920 was started intentionally by angry shepherds, whose pasture lands were being converted into plantations!

Since 1952 vigorous attempts were made by the Forest Department to dispose of the trees, perhaps on account of the progressive deterioration of the plantation and perhaps also with the idea of replacing them with better paying trees. The entire Pine Plantation of Kodaikanal was sold out in 1955 for its timber. Considerable resentment was expressed in the Press and even in the Legislature against such extermination of a valued asset, and in response to it, it was decided to leave 4 hectares of the old plantation as "Pine Preservation Plot" near the Pillar Rocks, and to replant at least a part of the old Pine Plantation. It was proposed to replant 90 hectares with Pines in 3 years from 1957. Till the end of 1960, about 40 hectares were planted with *Pinus radiata* D. Don, *P. insularis* Endl. and a few of *P. taeda* Linn. and *P. caribaea* More. *P. radiata* D. Don was chosen on account of its remarkable success in the past, and *P. insularis* Royle because it was recommended by J. A. Masters, Retired Chief Conservator of Forests.

EUCALYPTUS

Major Partridge of the Bombay Army first introduced the Australian Bluegum (*E. globulus* Labill. in 1852. A. Arockiam (1864-1961), who arrived in Kodaikanal already in 1887, told the present author that he saw on arrival just four big trees here. Sir Vere Levinge, after 1860, seems to have introduced some more. However the first attempt at large scale introduction was under the initiative of the Fathers of Sacred Heart College, Shembaganur. They had acquired a large tract of land at Shembaganur in 1877 with the intention of establishing a College. Eucalypts were planted on a large scale as a preliminary measure to drain the marsh and to keep off insects and thus to make the place inhabitable. Seeds were brought from Australia, probably via Ootacamund, by F. Barbier 1887; the plantation extended over 40 hectares. Eucalyptus oil was first extracted in Kodaikanal from this plantation.

Though the Forest Department, too, had begun introducing Eucalypts in 1870, appreciable introduction took place only since 1887. Between 1887 and 1902 over 98 hectares were planted in the Gundar Shola, chiefly with a view of providing fuel for the growing demands of the town, and Mr. H. B. Bryant, the Forest Officer, seems to have taken a lively interest and a leading part. Thereafter no departmental planting was done till 1953, when under a fresh scheme 180 hectares more were brought under cultivation in various localities in and around Kodaikanal. At present there is no impetus to continue this, as all the attention is concentrated on Wattle.

Besides the Bluegum, many other species were tried, both for timber and as ornamental trees, chiefly at Shembaganur and at the Astrophysical Observatory, Kodaikanal. A. Anglade (1873-1953) recorded over 40 species in Kodaikanal around 1925. Since that time, there has been large scale destruction of these trees, and during the recent investigation only half the number of species were collected in spite of exhaustive collections.

There has been a fair amount of success in the case of some species though many others fared badly. Among those which gave the most constant results are *E. globulus* Labill., and *E. diversicolor* F. v. Muell., but even in these cases the timber cannot compare with Australian samples; it is unfit for use as railway sleepers or for polished work. Preservatives do not penetrate well; however for rough work and as fuel there is much demand.

Though not comparable with Australian samples, these are among the more successful exotics of Kodaikanal, unrivalled in height, girth and coppicing power. There are trees over 60 m. high, and coppices reach a height of 3 m. in 6 months! These trees have adapted themselves remarkably well to their new surroundings, as is clear from the fact that some of the species are easily raised in the nursery and transplanted with a fair amount of success. If certain preliminary cultural conditions are observed, growth is rapid from the beginning. However, it

has been noticed in the case of less naturalized species, and most species fall in this category, that though many seeds germinate, few seedlings survive.

CINCHONA

Cinchona, said to have been first introduced into Europe between 1840 and 1846, already found its way to Kodaikanal in 1864. Though J. F. Royle, in 1840, first tried to introduce it into India, the first actual attempt occurred only in 1852, and failed. Markham in 1860 made the first successful attempt at introducing it. Sir Vere Levinge (1819-1885), Collector of Madura, first introduced it to Kodaikanal with 12 seedlings which he brought from Ootacamund in March 1864. The plants did well so that by December 1865, they had reached 1.2—1.5 m. tall. Large scale introduction was begun at Shembaganur by L. St. Cyr. (1813-1887) since 1867. The plantation extended to the present limits of the Shembaganur Eucalyptus forest. King in 1876 noted that in October 1872 there were 700 healthy trees in this plantation.

Gradually the plantation was given up. The trees were on exposed slopes, and seem to have fared badly in course of time; besides, Kodaikanal samples of bark were poor in alkaloids. Though the bark had a market even in the Continent then, the profits seem to have been negligible, but the exploitation was carried on as late as 1903. Later, realizing that the bark of the root was richer in alkaloids, trees were uprooted and thus the Cinchona plantation largely disappeared. By this time the planting of Eucalyptus was in full swing and even the remaining Cinchonas were neglected. Though in the shade of the Eucalyptus, the Cinchona trees improved, they no more received sufficient attention, but even today there are many of them in the Eucalyptus forest.

FRUIT TREES

The lead in the introduction of fruit trees was given by Sacred Heart College, Shembaganur; its farms at Kodaikanal and Shembaganur yielded the typical hill fruits like Pears, Apples, Peaches, and Plums while those at Perumalmalai at a lower elevation with a warmer climate, yielded the more tropical fruits like Oranges, Loquat and Avocado Pear. Later, more orchards sprung up under private initiative, and recently the State Agricultural Department also has come into the field.

Among the Fruit trees of Kodaikanal, the "Bhutan Pear" or the "Country Pear" (*Pyrus communis* Linn.) is by far the most extensively cultivated (320 hectares). The name "Country Pear" should not be taken to mean that this species is indigenous but that it has long been extensively cultivated and is now perfectly naturalized. The name "Bhutan Pear" probably refers to the country of origin. This species is preferred to the other hill fruits for the cheapness and the better keeping quality. The plant was first introduced here by J. Ciceron (1813-1872) at La Providence. Sometimes the yield is so great that it has to be controlled to prevent the branches from breaking.

Nowadays the grafted varieties are displacing the "Country Pear" with the encouragement and facilities provided by the State Agricultural Department, especially in supplying new grafts from Pomological Station, Coonoor. Among the recent introductions from Coonoor, are:

(1) **"The New Pear"**: This has given yield in the fourth year after grafting. The fruit is bigger and more tasty than that of the "Country Pear" and the long fruit-stalk makes it wind-resistent.

(2) **"Kieffer Pear"**: This does well, but it is the last to ripen. It is said to be a hybrid between the European *P. communis* Linn. and the Japanese *P. serotina* Ehrh.

(3) **"Jargonelle"**: The percentage of success is low and the rate of growth notably slow.

(4) **"Pear William"**: This has not yet begun to yield.

(5) **"Poire d'Angleterre"** (English Pear): The fruit is distinctly tailed, and the tree has been a success now for many years.

(6) **"Poire mouille-bouche"**: Fruits are very tasty.

(7) **"Poire de Beurré"**: Fruits not seen as yet.

(8) **"Poire d'Arenberg"**: From grafts supplied in 1955 by Mrs. Schmidt of the Kodaikanal Golf-Club.

Still more recently (1959) new grafts from Spain have been tried by P. Irigary at La Providence and Mt. Saint Mary. They are "Manteca de la Asuncion", "Manteca Hardy", "Manteca", "Lebrum", "Decana de Julion" and "Decana del Comicio", and are growing well, but have not yet come to fruit.

The Apple (*Malus sylvestris* Mill) has not been cultivated to any considerable extent probably because of the poor returns. The plant lacks the vigour and longevity that it enjoys in more congenial surroundings, especially with a colder winter. Till now only private individuals undertook its cultivation, but in 1961 the State Agricultural Department has started an orchard cum nursery.

Grafting has been to a certain extent successful. Some trees grafted at La Providence in 1951 gave yield in 1956. More recently (1956) grafts of "Rome Beauty" were introduced from Coonoor, and of the Spanish varieties (1959) "Reineta-Transplante Amarillo", "Reineta de Crux", "Reineta-Sans Pareille", "San Juan", "Emperador Alejandro", "Manzana de Regil", "Bismark" "Santiago Roja", "Manzana superfina", and "Level Alma" have been tried.

Though the Peach [*Prunus persica* (Linn.) Batsch] was recorded for the Palnis already in 1858 by Beddome, it was never cultivated on an orchard scale. An annual yield of 6-9 Kgms. of fruits per tree is considered good, and is to be had from May to July.

The Japanese Plum (*Prunus salicina* Lindl.) is the heaviest yielder, second, if at all, to the "Country Pear". The European Plum (*Prunus domestica* Linn.) in spite of bearing flowers regularly, seldom fructifies. The Japanese Plum is never popular, for it can hardly be eaten raw and is easily perishable.

Among the recent trials in grafts, the "Hale" is the most popular, being the most productive and serving both for dessert and culinary purposes. The yield is said to be up to 32 Kgms. per tree. Other trials are "Shiro", "King of Plums", and "Kelsey", which yield in June-July.

PYRETHRUM

The flowers of the Pyrethrum [*Chrysanthemum cinerariifolium* (Trev.) Vis.] were in great demand during World War II, when its value as an insecticide was realized. The plant flowers in 6-9 months and yields annually 40-109-218 and 36 Kgms. of flower respectively in the first four years, realizing a total of 403 Kgms. of flower per hectare of land in one rotation.

The Government of India urged the Madras State Government, during World War II, to undertake large scale planting of this and agreed to compensate any loss incurred. The scheme was already started in the Nilgiris in 1942 with seeds bought from Kenya. About the same time Major Willis introduced the plant from Africa and successfully cultivated it at "Restalrig", at Kodaikanal. The Forest Department planted Pyrethrum in 225 hectares of land near Berijam (Fort Hamilton) and 2 hectares at Kodaikanal between 1943-1944, but the scheme was dropped with the Central Government revoking their agreement to make good the losses incurred since 31.12.1946, the Madras State Government ordering the cessation of Pyrethrum cultivation on 13.8.1947. Now this plant occurs here either in gardens or an escape.

GERANIUM

The Geranium (*Pelargonium graveolens* L'Her.) often cultivated as a garden plant, was raised on a commercial scale at Shembaganur since 1954 and its oil extracted by steam-distillation. The oil called "Mawah" oil or, locally, "Geranium" oil, is an excellent perfume, but the yield is very small. Besides private enterprises, the Forest Department began cultivation at Perumal since 1957, extending the area by 2 hectares annually.

ALDER

The Nepalese Alder (*Alnus nepalensis* D. Don) which was earlier cultivated on the Kunnun Devan Hills for its wood is of late being introduced on the Palnis by the Forest Department. The tree matures in 8 years and gives a good yield: a tree in Bryant Park (probably the first in Kodaikanal) has attained a height of 25 m. and a girth of 3m. in 35 years (1922-1957). The Forest Department propose to cultivate 40 hectares of land at the rate of 4 hectares annually from 1958 onwards. However to date attempts to germinate locally collected seeds have not been very successful.

FODDER

Among fodder grasses, by far the first place goes to the Kikiyu Grass (*Pennisetum clandestinum* Hochst. ex Chiov.) native in Tropical Africa. Details of its first introduction in Kodaikanal are wanting. In 1932 the Forest Department planted the species in two small plots of land at Perumalmalai Reserve Area as an experimental measure, with cuttings supplied by Mr. Clayton of Kodaikanal. The scheme failed, but somehow the grass has by now simply overgrown the roadsides, bunds, and neglected areas in Kodaikanal.

It is a prolific yielder of fodder: at Central Farm, in the Nilgiris an annual crop of 3565 Kgms. per hectare has been realized. The plant suits better for pasturages rather than for periodic cuttings as its tendency is to spread on the ground than to grow tall. The pasturage value is high on the hills and is an excellent soil binder and can stand both frost and water-logging. It can be grown with advantage in forest slopes subject to soil erosion.

It grows well at Kodaikanal (2200 m.), and at Shembaganur (1830 m.) but does badly at lower elevations. It is being realized, probably too late, that on account of too rapid a rate of growth on the hills it invades cultivated lands becoming a pest whose eradication is next to impossible on account of the numerous roots which are not easily dug out.

Another species that has come into prominence of late is Napier or Elephant Grass (*Pennisetum purpureum* Schumach.), and at the Diary Farm at Perumalmalai, this species has completely displaced the Guinea Grass, *Panicum maximum* Jacq.

More recently Prairie Grass (*Bromus unioloides* H.B.K.), Weeping Love Grass [*Eragrostis curvula* (Schrad.) Nees], Perennial Ryegrass (*Lolium perenne* Linn.), Cockstfoot (*Dactylis glomerata* Linn.), and *Phalaris tuberosa* Linn. have been introduced from Sheep Farm, Ootacamund. An attempt by the Forest Department to raise fodder grass in 100 hectares of land at Ampthill Downs Reserve Area has largely failed, but further attempts are still being carried on.

WEEDS

As exotic weeds are many, only some of the more conspicuous ones will be mentioned here. These have been introduced either consciously as ornamental plants or unconsciously, along with seeds of other plants.

By far the first place goes to the Lantana [*Lantana camara* var. *aculeata* (Linn.) Mold.]. It is not known when actually the plant came to inhabit Kodaikanal. Beddome, (1858) mentions *Lantana*

indica as "very common" here and it is likely that he is referring to this plant, as the true *L. indica* Roxb. is scarce even now. Anyway A. Arokiam (1864-1961) who came to Kodaikanal in 1887 told the present author that it was already then a pest. Native in tropical America, introduced into India as an ornamental and hedge plant in the first half of the 19th century, it has spread with alarming results over extensive tracts of the country. This truly ubiquitous plant thrives equally well in the plains as on the hills, in poor as well as on lateritic soils and bears flowers and fruits almost throughout the year.

The plant shows certain variations apparently connected with altitude. The following data were gathered by examining the plants at various altitudes. Along Law's Ghat Road, it was found that up to milestone 19.0 (1200 m.) *all* the plants bore orange flowers, the peripheral ones of each spike being deep orange and the interior ones ligher. At milestone 19.1 a *few* plants with pink flowers were seen for the first time. A few metres higher, the two forms of the plants occurred side by side, though still the pink-flowered variety were fewer. By milestone 20.3 (1220 m.) the latter took the lead. These two forms are easily distinguished, apart from the colour of their flower, by their prickles. The orange-flowered form is definitely a more rugose plant, with many, closely placed, sharp, strong, and recurved prickles while the pink-flowered one has far fewer and much slender prickles. Higher up the road, the orange-flowered form continued to decrease until about Shembaganur (1850 m.) it almost disappeared. However it should be remarked that at Ootacamund, on the Nilgiris, at about the same altitude, the orange-flowered form is fairly common, though not abundant.

The plant is difficult to eradicate; it spreads rapidly along roadsides and on neglected slopes, changing tracts of bare land into impenetrable jungles, in a few years. In favourable places it can grow up to 12 m. tall along trees. Though *Lantana* is an unwelcome weed, it is said to enrich the soil.

The Mexican Blue Floss Flower (*Ageratum houstonianum* Mill.) conspicuous by its blue flowers, too, is an abundant and common weed. Mr. Charles E. Brown, a resident of Coonoor, mentioned that this plant was first introduced at Ootacamund by Mr. Jameison, Curator, Government Botanical Gardens, Ootacamund, about 1890. The information was passed on to Mr. Brown by Mr. Charles Grey, who had known Mr. Jameison. Though the plant is common and abundant in open ground, its abundance is unsurpassed in gardens where the soil has been loosened and left unweeded. This plant is often confused with *A. conyzoides* Linn., a somewhat similar plant, occurring at lower elevations.

As in the case of *Lantana* just mentioned, the two species of *Ageratum* were studied up along Law's Ghat Road. At milestone 11.6 (920 m.) both plants were seen side by side. *A. conyzoides* Linn. had smaller, white flowers, at most with a bluish tinge, and with the leaves scented when crushed, while *A. houstonianum* Mill. had larger and blue flowers, and the leaves not scented. By about milestone 14.2 (1050 m.), *A. houstonianum* Mill. became the mere dominant species. Milestone 15.6 (1140 m.) was about the highest altitude where *A. conyzoides* Linn. was last collected.

The Mexican White Floss Flower (*Eupatorium glandulosum* H.B.K.) also is reported to have been introduced by Mr. Jameison along with *A. houstonianum* Mill. Though this is widely spread and established on the Nilgiris, it is still comparatively rare on the Palnis, except in a few places. At Shembaganur, where there were just a few plants in 1957, now there is a whole jungle of it.

The Yellow Broom [*Sarothamnus scoparius* (Linn.) W.D.J. Koch], native in W. Europe, in copious yellow bloom for most part of the year, doubtless, reached here as a garden plant. Fortunately only a few plants are allowed to grow in Kodaikanal proper; at Panayarapparai, at milestone 10.2 of the Goschen's Forty Miles' Road, there is a tract of land overgrown with this plant showing what danger this plant can present if left uncontrolled.

The Gorse (*Ulex europeus* Linn.), too, is common but not abundant anywhere.

Probably one of the most abundant, firmly established and perfectly naturalized weeds is *Erigeron karvinskianus* DC. This plant is usually known under the name of *E. mucronatus* DC., once erroneously confused in S. India, with *Vittadenia australis* A. Rich. Sir Vere Levinge (1819-1885), Collector of Madura, is said to have introduced it to Kodaikanal. It has been locally and wrongly called "Swan River Daisy".

ORCHIDS

Though confined to gardens, they should be mentioned here as they are popular with visiting naturalists. A large number of species grow at Shembaganur, many of which have been introduced from Sikkim Himalayas. *Dendrobium* spp., *Cymbidium* spp., *Cyperorchis* spp., *Cypripedium* spp. are the most popular among the introduced orchids.

CONCLUSION

The vegetation of Kodaikanal has, of late, been undergoing considerable destruction, so that a number of species recorded earlier are absent now. Representations should be made, if necessary under the auspices of the B.S.I., to the Government of India to see to the preservation of this flora. There is a great need of preparing an exhaustive Flora for the area. Fyson's work is good as far as it goes; but needs careful revision. Besides the book is long out of print now.

The exotic species have to be carefully watched as some of them are likely to invade the entire

country. *Acacia dealbata* Link, *Eupatorium glandulosum* H.B.K., and *Ageratum houstonianum* Mill. are some such species.

The plants of the flower garden have always remained an enigma to botanists as to their correct botanical names. True, there are numerous hybrids, but a basic Flora dealing with the commoner species and varieties will fill a long-felt need, and will be useful for all the hill stations of India.

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