Report of 69th Meeting of the British Association for the Advancement of Science, **1899**

SECTION K. — BOTANY

PRESIDENT OF THE SECTION – SIR GEORGE KING, K.C.I.E., Ll.D., M.B. F.R.S.

THRUSDAY, SEPTEMBER 14.

The President delivered the following Address:—

A Sketch of the History of Indian Botany.

THE earliest references in literature to Indian plants are, of course, those which occur in the Sanskrit classics. These are, however, for the most part vague and obscure. The interest which these references have, great as it may be, is not scientific, and they may therefore be omitted from consideration on the present occasion. The Portuguese, who were the first Europeans to appear in India as conquerors and settlers, did practically nothing in the way of describing the plants of their Eastern possessions. And the first contribution to the knowledge of the Botany of what is now British India was made by the Dutch in the shape of the 'Hortus Malabaricus,' which was undertaken at the instance of Van Rheede, governor of the territory of Malabar, which during the latter half of the seventeenth century had become a possession of Holland. This book, which is in twelve folio volumes and is illustrated by 794 plates, was published at Amsterdam between the years 1686 and 1703,under the editorship of the distinguished Botanist Commelyn. Van Rheede was himself only a Botanical amateur, but he had a great love of plants and most enlightened ideas as to the value of a correct and scientific knowledge of them. The 'Hortus Malabaricus' was based on specimens collected by Brahmins, on drawings of many of the species made by Mathaeus, a Carmelite missionary at Cochin,and on descriptions originally drawn up in the vernacular language of Malabar, which were afterwards translated into Portuguese by Corneiro, a Portuguese official in Cochin, and from that language finally done into Latin by Van Douet. The whole of these operations were carried on under the general superintendence of Casearius, a missionary at Cochin. Of this most interesting work the plates are the best part; in fact, some of these are so good that there is no difficulty in identifying them with the species which they are intended to represent. The next important contribution to the Botanical literature of Tropical Asia deals rather with the plants of Dutch than of British India. It was the work of George Everhard Rumph (a native of Hanover), a physician and merchant, who for some time was Dutch consul at Amboina. The materials for this book were collected mainly by Rumphius himself, and the Latin descriptions and drawings (of which there are over one thousand) were his own work. The book was completed in 1690, but it remained unpublished during the author's lifetme. Rumph died at Amboina in 1706, and his manuscript, after lying for thirty years in the hands of the Dutch East India Company, was rescued from

oblivion by Professor John Burman, of Amsterdam (commonly known as the elder Burman), and was published under the title of 'Herbarium Amboinense,' in seven folio volumes, between the years 1741 and 1755. The illustrations of this work cover over a thousand species, but they are printed on 696 plates. These illustrations are as much inferior to those of Van Rheede's book as the descriptions are superior to those of the latter. The works of Plukenet, published in London between 1696 and 1705, in quarto, contain figures of a number of Indian plants which, although small in size, are generally good portraits, and therefore deserve mention in an enumeration of botanical books connected with British India. An account of the plants of Ceylon, under the name 'Thesaurus Zeylanicus,' was published in 1737 by John Burman (the elder Burman), and in this work many of the plants which are common to that island and to Peninsular India are described. Burman's book was founded on the collections of Paul Heremann, who spent seven years (from 1670 to 1677) exploring the Flora of Ceylon at the expense of the Dutch East India Company. The nomenclature of the five books already mentioned is all uni-nominal.

Hermann's Cingalese collection fell, however, sixty years after the publication of Burman's account of it, into the hands of Linnaeus, and that great systematist published in 1747 an account of such of the species as were adequately represented by specimens, under the title 'Flora Zeylanica.' This Hermann Herbarium, consisting of 600 species, may still be consulted at the British Museum, by the trustees of which institution it was acquired, along with many of the other treasures possessed by Sir Joseph Banks. Linnaeus's 'Flora Zeylanica' was followed in 1768 by the 'Flora Indica' of Nicholas Burman (the younger Burman)–an inferior production, in which about 1,500 species are described. The Herbarium on which this 'Flora Indica' was founded now forms part of the great Herbarium Delessert at Geneva.

The active study of Botany on the binominal system of nomenclature invented by Linnaeus was initiated in India itself by Koenig, a pupil of that great reformer and systematist. It will be convenient to divide the subsequent history of Botanic science in India into two periods, the first extending from Koenig's arrival in India in 1768 to Sir Joseph Hooker's arrival in 1848; and the second from the latter date to the present day.

The pioneer John Gerard Koenig was a native of the Baltic province of Courland. He was a correspondent of Linnaeus, whose pupil he had formerly been. Koenig went out to the Danish Settlement at Tranquebar (150 miles south of Madras) in 1768, and at once began the study of Botany with all the fervour of an enthusiasm which he succeeded in imparting to various correspondents who were then settled near him in Southern India. These friends formed themselves into a society under the name of 'The United Brothers,' the chief object of their union being the promotion of Botanical study. Three of these brothers, viz. Heyne, Klein, and Rottler, were missionaries located near Tranquebar. Gradually the circle widened, and before the century closed, the enthusiasm for Botanic research had spread to the younger Presidency of Bengal, and the number of workers had increased to about twelve, among whom may be mentioned Fleming, Hunter, Anderson, Berry, John, Roxburgh, Buchanan (afterwards Buchanan-Hamilton), and Sir William Jones, so well known as an Oriental scholar. At first it was the custom of this brotherhood merely to exchange specimens, but gradually names began to be given, and specimens, both named and unnamed, began to be sent to Botanists of established reputation in Europe. Many plants of Indian origin came thus to be described by Retz, Roth, Schrader, Willdenow, Vahl, and Smith. Rottler was the only member of the band who himself published in Europe descriptions of any of the new species of his own collecting and these appeared in the 'Nova Acta Acad. Nat. Curio-sorum' of Berlin. A little later Sonnerat and other Botanists of the French Settlement at Pondichery sent large collections of plants to Paris, and these were followed at a considerably later date by the collections of Leschenhault. These French collections were described chiefly by Lamarck and Poiret. Hitherto Botanical work in India had been more or less desultory, and it was not until the establishment in 1787 of the Botanic Garden at Calcutta that a recognised centre of Botanical activity was

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established in British India. Robert Kyd, the founder of that Garden, was more of a gardener than a Botanist. He was, however, a man of much energy and shrewdness. The East India Company was still in 1787 a trading company, and a large part of their most profitable business was derived from the nutmegs and other spices exported from their settlements in Penang, Malacca, Amboina, Sumatra, and other islands of the Malayan Archipelago. The company were also in those days the owners of a fine fleet of sailing vessels, and the teak of which these ships were built had to be obtained from sources outside the Company's possessions. The proposal to found a Botanic Garden near Calcutta was thus recommended to the Governor of the Company's settlements in Bengal on the ground that, by its means, the cultivation of teak and of the Malayan spices might be introduced into a province near one of the Company's chief Indian centers. Kyd, as a Lieutenant Colonel of the Company's engineers and as Secretary to the Military Board at Calcutta, occupied a position of considerable influence, and his suggestion evidently fell on no unwilling ears; for the Government of Bengal, with the promptitude to accept and to act on good advice in scientific and semi-scientific matters which has characterized them from the day of Kyd until now, lost no time in taking steps to find a site for the proposed garden. Colonel Kyd's official proposal was dated June 1, 1786, and, in a dispatch dated August 2, the Calcutta Government recommended Kyd's proposal to the Court of Directors in London. Posts were slow and infrequent in those days, and the Calcutta Government were impatient. They did not wait for a reply from Leadenhall Street, but in the following July they boldly secured the site

recommended by Colonel Kyd. This site covered an area of 300 acres, and the whole of it, with the exception of thirty acres which were subsequently given up to a Bishop Middleton for an English college, still continues under cultivation as a Botanic Garden. Kyd died in 1793, and in the same year his place as Superintendent of the Garden was taken by Dr. William Roxburgh, a young Botanical enthusiast, and one of Koenig's United Brotherhood'. Roxburgh had studied Botany in Edinburgh, where he was a favourite pupil of Dr. Hope. Desirous of seeing something of foreign countries, he made several voyages to Madras in ships belonging to the Honourable East India Company. In 1776 he accepted an appointment in the Company's Medical Establishment, and was posted to the town of Madras, where he very soon made the acquaintance of Koenig. Roxburgh was shortly after transferred to a remote district, a good deal to the north of Madras, then named the Northern Circars. The station of Samulcotta, which formed Roxburgh's headquarters during his sojourn in the Circars, stands on the edge of a hilly region possessing a very interesting Flora, and this Flora he explored with the greatest ardour; and as part of the result of his labours an account of some of the most interesting of its plants was published in London, at the East India Company's expense, in three large folio volumes under the title 'The Plants of the Coast of Coromandel.' This was Roxburgh's earliest publication on a large scale. The first of this book appeared in 1795, and the last not until 1819, *i.e.* five years after the author's death. The increased facilities afforded to Roxburgh after his transfer to a comparatively well-equipped institution like that at Calcutta induced him at once to begin the preparation of descriptions of all the plants indigenous to British India of which he could procure specimens. And so diligently did he work that, when he was finally driven from India by ill-health in 1813, he left complete and ready for publication the manuscripts of his 'Flora Indica' and his 'Hortus Bengalensis' (the latter being an enumeration of the plants in cultivation in the Calcutta Garden). He also left admirable coloured drawings (mostly of natural size) of 2,533 species of plants indigenous to India. Seldom have twenty years yielded so rich a Botanical harvest Dr. Roxburgh was thus the first Botanist who attempted to draw up a systematic account of the plants of India, and his book, which is on the Linnaean system, is the basis of all subsequent works on Indian Botany; and until the publication of Sir Joseph Hooker's monumental 'Flora of British India' it remained the only single book through which a knowledge of Indian plants could be acquired. Roxburgh was immediately succeeded in the Calcutta Garden by Dr. Buchanan-Hamilton, a man of many accomplishments, who had traveled from Nepal in the North to Ava and

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Mysore in the South, accumulating materials for a Gazetteer of the Honourable Company's possessions. Dr. Buchanan was a Zoologist as well as a Botanist. He had published a valuable account of Mysore,Canara, and Malabar, and had collected materials for a work on the Fishes of India, besides having accumulated a large Herbarium, part of which may now be consulted at the University of Edinburgh. Prior to his death Buchanan-Hamilton had begun to write a learned commentary on Van Rheede's 'Hortus Malabaricus.' Many of his Nepalese collections were described in 1825 (a few years before his own death) by Don in his 'Prodromus Florae Nepalensis'. Buchanan-Hamilton remained only one year at Calcutta, and in 1815 he was succeeded by Nathaniel Wallich, a native of copenhagen, who, prior to his appointment to the Calcutta Garden, had been attached as surgeon to the Danish settlement at Serampore, twenty miles higher up the Hooghly, Wallich remained Superintendent of the Calcutta Garden for thirty years. In 1846 he went to England, and in 1854 he died. During his tenure of office in the Calcutta Garden, Wallich organised collecting expeditions to the then little-known regions of Kamaon and Nepal (in the Himalaya), to Oudh, Rohilcund, Sylhet, Tenasserim, Penang, and Singapore. He personally undertook in fact a botanical survey of a large part of the Company's possessions in India. The vast materials thus collected under his own immediate direction, and the various contributions made by others, were taken to London by him in 1828. With these were subsequently incorporated the collections of Russell, Klein, Heyne, Rottler, Buchanan-Hamilton, and Roxburgh. And by the help of a band of distinguished European Botanists, among whom may be named De Candolle, Kunth, Lindley, Meissner, Nees von Esenbeck, Von Martius, and Bentham (the latter in a very special manner), this vast mass of material was classified and named specifically. A catalogue of the collection was prepared by Wallich himself (largely aided by Bentham),and sets of the named specimens were distributed to the leading Botanical institutions in Europe, every example of each species bearing the same number. No description of the whole collection was ever

attempted, but many of the plants belonging to it were subsequently described in various places and at various times. So extensive was the Wallichian distribution that, amongst the names and synonyms of tropical Asiatic plants, no citation is more frequent in Botanical books than that of the contraction 'Wall Cat'. Besides the naming and distribution of this gigantic collection, Wallich prepared and published, at the expense of the same liberal and enlightened East India Company, his 'Plantae Asiaticae Rariores,' in three folio volumes with 300 coloured plates. He also contributed to an edition of Roxburgh's 'Flora Indica,' which was begun by the celebrated Dr. Carey of Serampore, descriptions of many plants of his own collecting. But the task of publishing his discoveries in this way proved beyond his powers, as it would have proved beyond those of any one who had only 365 days to his year, and less than a hundred years as his term of life!; Carey and Wallich's edition of Roxburgh's 'Flora Indica' was brought to an untimely conclusion at the end of the *Pentandria Monogynia* of Linnaeus. Wallich also began an illustrated account of the Flora of Nepal under the title 'Tentamen Florae Nepalensis.' But this also came to a premature end with the publication of its second part.

During much of the time that Wallich was labouring in Northern India, Robert Wight, a botanist of remarkable sagacity and of boundless energy, was labouring in Southern India, chiefly in parts of the Peninsula different from those in which Koenig and his band had worked. Wight was never liberally supported by the Government of Madras, and it was mostly by his own efforts and from his own resources that his collections were made, and that his Botanical works were published. The chief of the latter is his 'Icones Plantarum'. This book consists of figures with descriptions of more than two thousand Indian species. A good many of the plates are indeed copies from the suite of drawings already referred to as having been made at Calcutta by Dr. Roxburgh. The rest are from drawings made by native artists under his personal supervision. Ample evidence of the extraordinary energy of Dr. Wight is afforded by the facts that, although he had to teach the native artists whom he employed both to draw and to lithograph, the two thousand *Icones* which he published and described were

issued during the short period of thirteen years, and that during the whole of this time he performed his official duties.

Besides this *magnum opus* Wight published his *Spicilegium Nilghirense* in two vols, quarto, with 200 coloured plates. And between 1840 and 1850 he issued in two vols, quarto, with 200 plates, another book named 'Illustrations of Indian Botany,' the object of which was to give figures and fuller descriptions of some of the chief species described in a systematic book of the highest Botanical merit, which he prepared conjointly with Dr. G.A. Walker-Arnot, Professor of Botany in the University of Glasgow, and which was published under the title 'Prodromus Florae Peninsulae Indicae.' The 'Prodromus' was the first attempt at a Flora of any part of India in which the natural system of classification was followed. Owing to various causes, this work was never completed, and this splendid fragment of a Flora of Peninsular India ends with the natural order Dipsaceae.

The next great Indian botanist whose labours demand our attention is William Griffith. Born in 1810, sixteen years after Wight, and twenty-four years later than Wallich, Griffith died before either. But the labours even of such devotees to science as were these two are quite eclipsed by those of this most remarkable man. Griffith's Botanical career in India was begun in Tenasserim. From thence he made Botanical expeditions to the Assam valley, exploring the Mishmi, Khasia, and Naga ranges. From the latter he passed by a route never since traversed by a Botanist, through the Hookung valley down the Irrawadi to Rangoon. Having been appointed, soon after his arrival in Rangoon, surgeon to Pemberton's Embassy to Bhotan, he explored part of that country, and also sent collectors into the neighbouring one of Sikkim. At the conclusion of this exploration he was transferred to the opposite extremity of the Northern frontier, and was posted to the Army of the Indus. After the subjugation of Cabul, he penetrated to Khorassan. Subsequently he visited the portion of the Himalaya of which Simla is now the best-known spot. He then made a run down the Nerbudda valley in Central India, and finally appeared in Malacca as Civil Surgeon of that Settlement. At the latter place he soon died of an abscess of the liver brought on by the hardships he had undergone on his various travels, which were made under conditions most inimical to health, in countries then absolutely unvisited by Europeans. No Botanist ever made such extensive explorations, nor himself collected so many species (9,000), as Griffith did during the brief thirteen years of his Indian career; none ever made so many field notes or wrote so many descriptions of plants from living specimens. His Botanical predecessors and

contemporaries were men of ability and of devotion. Griffith was a man of genius. He did not confine himself to the study of flowering plants, nor to the study of them from the point of view of their place in any system of classification. He also studied their morphology. The difficult problems in the latter naturally had most attraction for him, and we find him publishing, in the 'Linnaean Transactions,' the results of his researches on the ovule in *Santalum, Loranthus, Viscum*, and *Cycas*. Griffith was also a cryptogamist. He collected, studied, and wrote much on Mosses, Liverworts, Marsiliaceae, and *Lycopods*, and he made hundreds of drawings to illustrate his microscopic observations. Wherever he traveled he made sketches of the most striking features in the scenery. His habit of making notes was inveterate; and his itinerary diaries are full of information not only on the Botany, but also on the zoology, physical geography, geology, meteorology, archaeology, and agriculture of the countries through which he passed. His manuscripts and drawings, although left in rather a chaotic state, were published after his death under the editorship of Dr. McClelland, at the expense of the enlightened and ever-liberal East India Company. They occupy six volumes in octavo, four in quarto, and one (a 'Monograph of Palms') in folio.

Another Botanist of much fame, who died prematurely in 1822, after an Indian career of only nine years,was Dr. William Jack. In 1814-15 Jack accompanied Ochterlony's army to the Nepal terai. He was transferred in 1818 to the Company's Settlement in Sumatra under Sir Stamford Raffles, and during the four years of his residence in Sumatra he contributed to Botanical literature descriptions of

many new genera and species which were published in his 'Malayan Miscellanies.' His collections, unfortunately, were for the most part lost by an accident, but those which were saved are now in the Herbarium Delessert in Geneva.

Somewhat similar to Griffith in temperament and versatility was the brilliant Victor Jacquemont, a French Botanist who, at the instance of the Paris Natural History Museum, travelled in India for three years from 1829 to 1832. During this period Jacquemont collected largely in the Gangetic plain. He then entered the North-West Himalaya at Mussourie, explored Gharwal and Sirmur, ascended the Sutlej to Kanawer and Piti (at that time unexplored), visited Cashmir, and returning to the plains, crossed Northern Rajputana to Malwa and the Deccan. He finally reached Bombay with the intention of returning to France. But at Bombay he succumbed to disease of the liver, brought on by hard work and exposure. His remains, after having lain in the cemetery there for fifty years, were, with that tender regard for the personality of her famous sons which France has always shown, exhumed in 1881, and conveyed in a French frigate to find a permanent resting-place in the place of Jacquemont's birth. Jacquemont's collections were transmitted to Paris, and his plants were decribed by Cambessedes and Decaisne, while his non-botanical collections were elaborated by workers in the branches of science to which they respectively appertained, the whole being published in four volumes quarto, at the expense of the French Government.

The roll of eminent Botanists who worked in India during the first half of the century closes with the name of Thomas Thomson, who collected plants extensively between 1842 and 1847 in Rohilkund and the Punjab, and again still more extensively during a Government mission to the North-West Himalaya and Tibet which was continued from 1847 to 1849. During this period Dr. Thomson explored Simla, Kanawar, Piti Cashmir, Ladak, and part of the Karakoram. His collections, which were large and important, were transmitted to the Botanic Garden at Calcutta, and thence in part to Kew. They formed no insignificant part of the materials on which the 'Flora India' and 'Flora of British India' were founded. Dr. Thomson also published an account of his travels–an admirable book, though now jostled out of memory by the quantities of subsequently issued books of Himalayan travel and adventure.

About the year 1820 a second center of Botanical enterprise was established at Seharunpore, in the North-West Provinces. A large old garden near that important town, which had been originally founded by some Mohammedan nobles of the Delhi Court, was taken over the Honourable Company, and was gradually put upon a scientific basis by Dr. George Govan, who was appointed its first superintendent. Dr. Govan was in 1823 succeeded by Dr. J. Forbes Royle, and he in 1832 by Dr. Hugh Falconer. Dr. Royle made collections in the Jumno-Gangetic plain, in the Lower Gharwal Himalaya, and in Cashmir. He was distinguished in the field of Economic rather than in that of Systematic Botany, his chief contribution to the latter having been a folio volume entitled 'Illustrations of the Botany of the Himalaya Mountains'. His valuable labours as an Economic

Botanist will be noticed later on. Hugh Falconer was an accomplished palaeontologist who devoted but little of his splendid talents to Botany. His great contribution to palaeontology, the value of which it is almost impossible to over-estimate, consisted of his exploration and classification of the tertiary fossils of the Sewalik range. Falconer was transferred to the Calcutta Garden in 1842. He was succeeded at Seharunpore by Dr. W. Jameson, who explored the Botany of Gharwal, Kamaon, and Cashmir, but who published nothing Botanical, his chief energies having been devoted to the useful work of introducing the cultivation of the China tea plant into British India, and this he did (as will afterwards be mentioned) with triumphant success.

During the first half of the century, a considerable amount of excellent Botanic work was done in Western India by Graham, Law, Nimmo, Gibson, Stocks, and Dalzell, the results of whose labours culminated in the preparation by Graham of a List of the Plants of Bombay, which was not, however, published until 1839 (after his death); in the publication by Stocks of various papers on the Botany of Scinde; and in the publication by Dalzell and Gibson in 1861 of his 'Flora of Bombay.' It is

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impossible in a brief review like the present to mention the names of all the workers who, in various parts of the gradually extending Indian Empire, added to our knowledge of its Botanical wealth. It must suffice to mention the names of a few of the chief, such as Hardwicke, Madden, Munro, Edgeworth, Lance and Vicary, who collected and observed in Northern India, and who all, except the two last mentioned, also published Botanical papers and pamphlets of more or less importance; Jenkins, Masters, Mack, Simons, and Oldham, who all collected extensively in Assam; Hofmeister, who accompanied Prince Waldemar of Prussia, and whose collections form the basis of the fine work by Klotzsch and Garcke (*Reis. Pr. Wald.*); Norris, Prince, Lobb, and Cuming, whose labours were in Penang and Malacca; and last, but not least, strachey and Winterbottom, whose large and valuable collections, amounting to about 2,000 species, were made during 1848 to 1850 in the higher ranges of the Kamaon and Gharwal Himalaya, and in the adjacent parts of Tibet. In referring to the latter classic Herbarium, Sir Joseph Hooker remarks that it is 'the most valuable for its size that has ever been distributed from India.' General Strachey is the only one who survives of the splendid band of collectors whom I have mentioned. I cannot conclude this brief account of the Botanical labours of our first period without mentioning one more book, and that is the 'Hortus Calcuttensis' of Voigt. Under the form of a list, this excellent work, published in 1845, contains a great deal of information about the plants growing near Calcutta, either wild or in fields and gardens. It is strong in vernacular names and vegetable economics.

The second period of our history begins with the arrival in India in 1848 of Sir (then Dr.) Joseph Hooker. This distinguished Botanist came out in the suite of Lord Dalhousie, who had been appointed Governor-General of India. The province to the exploration of which Sir Joseph directed his chief attention was that of Sikkim in the Eastern Himalaya, the higher and inner ranges of which had never previously been visited by a Botanist, for Griffith's explorations had been confined to the lower and outer spurs. The results of Sir Joseph's labours in Sikkim were enormous. Towards the end of his exploration of Sikkim he was joined by Dr. Thomas Thomson, and the two friends subsequently explored the Khasia Hills (one of the richest collecting grounds in the world), and also to some extent the districts of Sylhet, Cachar, and Chittagong. Dr. Thomson subsequently amalgamated the collections made by himself in the Western Himalaya with those made in Sikkim by Sir Joseph individually, and by them both conjointly in Eastern India; and a distribution of the duplicates after the fashion of the Wallichian issue, and second only to it in importance,was subsequently made from Kew. The number of species thus issued amounted to from 6,000 to 7,000, and the individuals were much more numerous than those of the Wallichian collection. The immediate literary results of Sir Joseph Hooker's visit to Sikkim were, (1) his superbly illustrated monograph of the new and magnificent species of *Rhododendron* which he had discovered; (2) a similar splendid volume illustrated by plates founded on drawings of certain other prominent plants of the Eastern Himalaya which had been made for Mr. Cathcart, a member of the Civil Services of India, and (3) his Classic 'Himalaya Journals'–a book which remains until this day the richest repertory of information concerning the botany, geography and anthropology of the Eastern Himalaya. A remoter result was the appearance in 1855 of the first volume of a 'Flora Indica,' projected by himself and his friend Dr. Thomson. The first half of this volume is occupied by a masterly introductory essay on Indian Botany, of which it is hardly possible to overrate the importance. This remarkable essay contains by far the

most important contribution to the Physico-Geographical Botany of India that has ever been made, and it abounds in sagacious observations on the limitation of species and on hybridisation, besides containing much information on the history of Indian Botanical collections and collectors. The taxonomic part of the book was cast in a large mould, and the descriptions were written in Latin. Unfortunately the condition of Dr. Thomson's health and the pressure of Sir Joseph's official duties at Kew made it impossible that the book should be contined on the magnificent scale on which it had been conceived. After a period of about twelve years Sir Joseph, however, returned to the task of preparing, with

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the aid of other Botanists, a Flora of the Indian Empire, conceived on a smaller scale and written in the English language. His proposals for this work were accepted and officially sanctioned by the Duke of Argyll while he was Secretary of State for India. The first part of this great work was published in 1872 and the last in 1897. In the execution of this great undertaking Sir Joseph had the assistance of Mr. C.B. Clarke, who elaborated various natural orders; of Mrs. J.G. Baker, who worked out *Leguminosa* and *Scitaminea,* and of Sir W. Thiselton Dyer, Messrs. A.W. Bennett, Anderson, Edgeworth, Hiern, Lawson, Maxwell Masters, Stapf, and Gamble. The greater proportion, however, of the book is Sir Joseph's own work, and noble monument it forms of his devotion and genius.

Since the date of Sir Joseph Hooker's visit to India, by far the most important Botanical work done in India has been that of Mr. C.B. Clarke. Rather than attempt to give any appreciation of my own of Mr. Clarke's labours (which would be more or less of an impertinence), I may be allowed to quote from the preface to the concluding volume of the 'Flora of British India,' Sir Joseph Hooker's estimate of them. Referring to all the collections received at Kew since the preparation of the 'Flora' was begun, Sir Joseph writes: 'The first in importance amongst them are Mr. C.B. Clarke's, whether for their extent, the knowledge and judgment with which the specimens were selected, ticketed, and preserved, and for the valuable observations which accompany them'. Mr. Clarke, has published numerous papers on Indian Botanical subjects in the Journals of the Linnaean and other societies. He has issued as independent books monographs of Indian *Compositae* and *Cyrtandracea*, the former in octavo, the latter in folio, and illustrated by many plates; and he is now engaged on his *opus maximum*, viz. a monograph of the *Cyperaccae*, not only of India, but of the whole world; and to the completion and publication of this every systematic Botanist is looking forward with eager anxiety.

During this second half of the century Dr. Thomas Anderson, who was for ten years superintendent of the Calcutta Garden, collected much; and he had just entered on what promised to be a brilliant, career of Botanical authorship when his life was cut short by disease of the liver, contracted during the labours to establish the cultivation in British India of the quinine-yielding species of cinchona. Dr. Anderson was also the earliest Conservator of Forests in Bengal. Sulpiz Kurz, for many years Curator of the Calcutta, Herbarium, also collected largely in Burma, and besides many excellent papers which he contributed to the 'Journal of the Asiatic Society of Bengal,' he prepared for Government an excellent manual entitled ' The Forest Flora of Burma.' This was published in two volumes in 1877. Other collectors in Burma were Colonel Eyre (in Pegu), Mr. Burness (at Ava), and the Rev. Mr. Parish, to whom horticulturists are indebted for the introduction to Europe of the beautiful orchids of this rich province. And in this connection must be mentioned Mr. E.H. Man, C.I.E., who, although not himself a Botanist, has given for many years past the greatest possible help in the Botanical exploration of the Andaman and Nicobar groups of islands, our first knowledge of which was, by the way, derived from the collections made by the naturalists of the Austrian and Danish exploring expeditions. A large book on Burma, which contains a good deal of Botany, was published by an American missionary named Mason, who resided for the greater part of his working life in that country. General Sir Henry Collett, who commanded a brigade during the last Burmese war, also made most interesting collections in that country, the novelties of which were described by himself in collaboration with Mr. W. Botting Hemsley, of the Kew Herbarium, in the Linnaean Society's 'Journal' some years ago. Sir Henry Collett also collected much in the Khasia and Naga hills, and in the portion of the North-Western Himalaya of which Simla, is the capital, and on these latter collections, together with the materials in Kew Herbarium, Sir Henry is now elaborating a local Flora of Simla. The preparation of local Flora for an Indian district is an entirely new departure, and the publication of Sir Henry's book, which

is to be well illustrated, is looked forward to with much interest. At rather an earlier period, Dr. Aitchieson, C.I.E., was a diligent collector of the plants of the

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Punjab and of the North-Western Frontier. Some results of his work are to be found in his 'List of Punjab Plants,' which was published in 1867, and in various papers which he contributed (some of them in conjunction with Mr. Hemsley) to the Linnaean Society and to the Botanical Society of Edinburgh. In Dr. G. Henderson's book on Yarkand there are also descriptions of some plants of the extreme North-Western Himalaya and of Western Tibet. Mr. (now Sir George) Birdwood also made some contributions to the Botany of the Bombay Presidency.

Five officers of the Indian Forest Department, viz. Dr. Lindsay Stewart, Colonel Beddome, Sir D. Brandis, and Messrs. Talbot and Gamble, C.I.E., have within the past thirty years made important contributions to the Systematic Botany of India. Dr. Stewart collected largely, and published in 1869 his 'Punjab Plants,' a book which gives a very imperfect impression of his acquirements as a Botanist. Sir Dietrich Brandis issued in 1874 his admirably accurate 'Forest Flora of the North-West Provinces of India,' illustrated by seventy excellent plates. Between the years 1869 and 1873, Colonel Beddome issued his 'Flora Sylvatica of the Madras Presidency,' illustrated by numerous plates. He also published, between 1869 and 1874, a volume of descriptions and figures of new Indian plants, under the title 'Icones Plantarum Indiae Orientalis.' Colonel Beddome is the only Indian Botanist of note, except Griffith, Mr. C.B. Clarke, and Mr. C.W. Hope, who has written much on Indian Ferns. His two works, the 'Ferns of Southern India' and the 'Ferns of British India,' published, the former in 1863 and the latter between 1865 and 1870, practically give a systematic account, together with excellent figures, of the whole Fern Flora of India. Of these excellent books a condensation in a popular and abridged form has also been issued. The fourth Forest officer who has published contributions to Systematic Botany is Mr. W.A. Talbot, whose 'List of the Trees, Shrubs, and Woody Climbers of the Bombay Presidency' gives evidence of much careful research. And the fifth is Mr. J.S. Gamble, who, besides amassing at his own expense probably the largest private collection of plants ever owned in India, has published a systematic account of the Indian *Bambusea*, a tribe of grasses which, from the peculiarity of many of the species in the matter of flowering, had so long been the bane of the Indian agrostologist. Mr. Gamble, in his monograph, gives a description and a life-sized figure of every one of the Indian species. Of this monograph (which forms a volume of the 'Annals of the Botanic Garden, Calcutta') Sir Joseph Hooker writes (at p.375, vol. vii. of his 'Flora of British India'): 'It is indispendable to the student of the tribe by reason of its descriptions and admirable plates and analyses.' Mr. Gamble has also published a Manual of Indian Timbers. A Forest officer who was ever ready to help in Botanical work, but who never himself published, was Mr. Gustav Mann, for many years Conservator of Forests in Assam, but now lost to India by his premature retirement. Other Forest officers, who have done, and are still doing, good botanical work in their various spheres, are Messrs. Lace, Heinig, Haines, McDonell, Ellis, Oliver, and Upendra Nath Kanjilal. Mr. Bourdillon,0 Conservator of Forests in the Travacore State, is also an enthusiastic Botanist and collector.

In the Madras Presidency Botanical work has been carried on during this second half of the country by Noton, Perrottet, Metz, Hohenacher, Schmidt (on the Nilgiris), Bidie, and Lawson. By the efforts of the latter two a second public Herbarium was established in Madras (the first having been broken up many years ago), and in this second Madras Herbarium are to be found many of the collections of Wight, besides those of the other Madras Botanists just named.

In the Bombay Presidency the only public Herbarium is at Poona. This is of recent origin, and owes its existence to be devotion of four men, viz. Dr. Theodore Cooke (late Principal of the College of Science at Poona), Mr. Marshall Woodrow (until recently Superintendent of the Garden at Guneshkind and Lecturer in Botany in the Poona College), the late Mr. Ranade (a native gentleman), and Dr. Lisboa (a medical practitioner in the Deccan)—all four enthusiastic Botanists. The amount of Government support given to the Herbarium at Poona has hitherto been very inadequate. It is to be hoped that greater liberality may be extended to it now that a stranger to the Bombay Presidency has just

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been appointed to its charge in the person of Mr. George Gammie, hitherto employed in the Cinchona Department of Bengal.

Reference has already been made to the Botanic Gardens at Seharunpore and Calcutta. But to complete

this sketch, and especially in order to give a clear idea of the apparatus at present existing in India for carrying on the study and practice of Systematic Botany, it is necessary again to refer to them. On the retirement of Dr. Jameson in 1872, Mr., J.F. Duthie was selected by the Secretary of State for India as Superintendent of the Seharunpore Garden. Mr. Duthie is still at Seharunpore. During his tenure of office he has added to the Herbarium previously existing there (which consisted chiefly of the collections of Royle, Falconer, and Jameson) a magnificent collection of his own. Mr. Duthie has published a valuable book on the 'Field and Garden Crops of the North-Western Provinces,' and another on the Grasses of the same area. He is now engaged on the preparation of local Floras of the North-West Provinces and of the Punjab.

The Calcutta Garden at the date of Sir J.D. Hooker's arrival in India in 1848 was under the temporary charge of Dr. McClelland, who soon made way for Dr. Falconer, who, in 1855, was succeeded by Dr. J. Thomson, and he in turn by Dr. T. Anderson in 1861. Mr. C.B. Clarke acted as Superintendent during the interregnum between Dr. Anderson's lamented death in 1870 and my own appointment in 1871. The Garden and Herbarium at Calcutta have been most liberally supported by Government of Bengal. By funds thus supplied the Garden has been remodelled and improved; the Herbarium has been housed in an excellent fire-proof building (erected in 1883), and the collections of which it consists have been greatly increased. The chief items of these later acquisitions have been the large contributions of Mr. C.B. Clarke; of Dr. D. Prain, for many years Curator of the Herbarium, and now Superintendent of the Garden and of the cinchona plantation and factory; of Mr. G.A. Gammie, formerly one of the staff of the cinchona plantation, and now Lecturer on Botany in the College of Science at Poona; of Mr. R. Pantling, Deputy-Superintendent of the Cinchona plantation, who, in addition to dried specimens of the orchids of Sikkim, contributed nearly five hundred drawings, most of which have been lithographed as the illustrations to a book published in the 'Annals' of the Garden, as the 'Orchid Flora of Sikkim;' of Mr. Kunstler, a collector in the Malay Peninsula; and last, but by no means least, of a trained band of aborigines of Sikkim named Lepchas who possess keener powers of observation of natural objects, more patience, sweeter tempers, and, I am bound in fairness to add, dirtier clothes than any race I have ever met–black, yellow, or white! In addition to their liberal grants to the Garden and Herbarium, the Bengal Government, twelve years ago, sanctioned the publication, at their expense, as occasion might offer, of monographs of important families or genera of Indian plants. These monographs are printed in quarto, and they are, with one exception, profusely illustrated by plates drawn and lithographed by Bengali Bengal draughtsman. The series is known as 'The Annals of the Royal Botanic Garden, Calcutta,' and it has now reached its eighth volume, the ninth being in active preparation. These 'Annals' have been contributed to by Dr. Prain (my successor at the Calcutta Garden), by Dr. D. Douglas Cunningham, Mr. J.S. Gamble, Mr. R. Pantling, and myself.

About ten years ago, it occurred to the Supreme Government of India that it might be to the interest of Science if the four Botanical establishments at Calcutta, Seharunpore, Madras, and Poona were to be formed into a kind of hierarchy under the designation of The Botanical Survey of India, without removing either officers or the four institutions to which they were attached from the financial or general control of the local administrations within which they are respectively situated, the Supreme Government making a small contribution of money for the purpose of exploring little-known districts and making itself responsible for the cost of a publication called 'The Records of the Botanical Survey'. The four institutions just mentioned continue, therefore, to be paid for and controlled by the Governments of Bengal, the North-West Provinces, Madras, and Bombay, but their Superintendents are placed on the cadre of the Botanical Survey. The published Records of this Survey now extend to twelve numbers, each of which is devoted to an account of the Botany of some part of the enormous and continually expanding area to be explored.

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Such, then, is the machinery by which Systematic and Geographical, as distinguished from Economic and Physiological, Botany is carried on within the Indian Empire. But the work done in India itself by no means represents all that is being carried on in connection with the elucidation of the Flora of the Empire of India. On the contrary the bulk of the work of elaborating the materials sent from India in the shape of dried specimens has always been, and must always be, done in a large Herbarium; and until lately no Herbarium in Asia has been sufficiently extensive. The last word on every difficult taxonomic question must still lie in Europe. A

very large number of Herbarium, specimens collected in India have found their way to the various centers of Botanical activity in Europe, and have been described by Botanists of many nationalities. The lion's share of these specimens has naturally come to the two great national Herbaria in the British Museum and at Kew, but especially to the latter. It was in the Kew Herbarium that Sir Joseph Hooker and his collaborateurs prepared the Flora of British India. And it is in the Kew Herbarium that are to be found the types of an overwhelming proportion of the new species described for the first time in that monumental work. The Kew Herbarium is therefore to the Indian Botanist the most important that exists. I must apologies for diverging for a moment to remind you what a type specimen is. It is the very one on which an author has founded any species to which he has given a name. And in order to determine absolutely what is the specific form to which the author meant his name to apply, it is often necessary to examine his type. This necessity increases in urgency with the extension of our knowledge of the Flora of the world.

The preservation in good condition of a type specimen is therefore, from the point of view of a Systematic Botanist, as important as is the preservation to the British merchant of the standard pound weight and the standard yard measure on which the operations of British commerce depend. 'Types' also stand to the Systematic Botanist much in the same relation as the national records do to the national historian. The latter are guarded in the Record Office, I understand, with all the skill which the makers of fire-proof, damp-proof, and burglar-proof depositories can suggest. If, however, the type of a species happens to be deposited at Kew, what are the probabilities of its preservation? Such a type at Kew is incorporated in what is admitted to be in every sense the largest and, for its size, the most accurately named, the most easily consulted, and therefore the most valuable Herbarium in the world, the destruction of which would be a calamity commensurate in extent with that of the burning of the Library at Alexandria. One might therefore reasonably expect that a people who rather resent being called a 'nation of shopkeepers' would feel pride in providing for this priceless national collection a home which, although perhaps somewhat inferior to that provided for the National Historical Records, might at least be safe from fire. This expectation is not fulfilled. The infinitely valuable Kew Herbarium and library have no safer home than an old dwelling-house on Kew Green, to which a cheap additional wing has been built. The floor, galleries, and open inner roof of this additional wing are constructed of pine coated with an inflammable varnish, and on the floor and galleries are arranged cabinets (also made of pine-wood), in which the specimens (which are mounted on paper) are lodged. The provision of a fireproof building, capable of expansion as the collections extend, is surely not beyond the means an exchequer which last year netted over one hundred and six millions sterling of revenue. On behalf of the Flora of India, I venture to express the hope that the provision of a proper home for its types may receive early and favourable consideration by the holders of the national purse-strings. But India is by no means the only portion of the Empire interested in this matter, for the types of the Australasian Floras, those of a large part of the North American Flora, and those of many species inhabiting countries outside British rule or influence, find their resting-place at Kew. The safe custody of the Kew Herbarium is, therefore, not merely a national, but a cosmopolitan responsibility.

In this Address I have hitherto made little reference to Cryptogamic and Economic Botany. As regards Cryptogamic Botany there is little to relate. Except Griffith, no Indian Botanist of the earlier of the two periods into which

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I have divided my sketch ever did any serious work amongst non-vascular Cryptogams. During the second period two men have done gallant work under difficulties which no one who has not lived in a tropical country can thoroughly appreciate. I refer to Drs. Arthur Barclay and D.D. Cunningham. The former made some progress in the study of Uredinous fungi, which was cut short by his untimely death, while the latter, in addition to his bacterial and other researches connected with the causation of human disease, conducted protracted investigations into some diseases of plants of fungal or algal origin. Some of the results of Dr. Cunningham's labours were published in the 'Transactions' of the Linnean Society, and in a series entitled the 'Scientific Memoirs, by Medical Officers of the Indian Army.' To the 'Annals of the Botanic Garden, Calcutta,' Dr, Cunningham also contributed elaborate memoirs on the phenomena of Nyctitropism, and on the mode of fertilisation in an Indian species of *Ficus (F. Roxburghii)*. There is no doubt that in the past Cryptogamic Botany has not been studied in India as it ought to have been and might have been. This discredit will, I hope, be soon

removed; and I trust that, by the time the twentieth century opens, a Cryptogamist may have been appointed to the staff of the Calcutta Botanic Garden. The collecting of Cryptogams was not, however, altogether neglected in India in times past. For, from materials sent to England, Mitten was able to elaborate a Moss Flora of India, while Berkeley and Browne were enabled to prepare their account of the *Fungi* of Ceylon. Dr. George Wallich, in whom the Botanical genius of his father burnt with a clear though flickering flame, did some excellent work amongst Desmids, and was among the earliest of deep-sea dredgers.

Economic Botany has, on the other hand, by no means been neglected. It was chiefly on economic grounds that the establishment of a Botanic Garden at Calcutta was pressed upon the Court of Directors of the East India Company. And almost every one of the workers whose labours I have alluded to has incidentally devoted some attention to the economic aspect of Botany. Roxburgh's Flora Indica' contains all that was known up to his day of the uses of the plants described in it. Much of Wight's time was spent in improving the races of cotton grown in India. The Botanists of the Seharunpore Garden during the middle of the century were especially prominent in this branch of Botanical activity. Royle wrote largely on cotton and on other fibres, on drugs, and on various vegetable products used, or likely to be use, in the arts. These Botanists introduced into the Himalayas more than fifty years ago the best European fruits. From gardens which owe their origin to Royle, Falconer, and Jameson, excellent apples grown in Gharwal and Kamaon are today purchasable in Calcutta. Peaches, nectarines, grapes, strawberries, of European origin, are plentiful and cheap all over the North – West Himalaya, and are obtainable also in the submontane districts. Potatoes, and all the best European vegetables were introduced long ago; and at Seharunpore there is still kept up a large vegetable garden from which seeds of most European vegetables are issued for cultivation during the cold season in the gardens of the various regiments of Queen's troops quartered in Upper India. More or less attention has been given in the past by Government Botanists in India generally to the improvement of the cultivation of flax, hemp, rheea, tobacco, henbane, dandelion, vanilla, sarsaparilla, coffee (Arabian and Liberian), cocoa, ipecacuanha, aloes, jalap, indiarubber, Japanese paper-mulberry, cardamoms, tapioca, coca, tea, and cinchona. Only to three economic enterprises, however, have I time to allude in any detail. These are (1) the cultivation of tea, (2) the introduction of cinchona, and (3) the formation of the Forest Department. But before proceeding to the consideration of these I wish to give a short account of the inauguration of the office of Reporter on Economic Products. Up to the year 1883 there had been no special Government department in India for dealing with questions connected with the natural products of the Empire. Whatever had been done prior to that date (and the amount was by no means unimportant) was the result of isolated and uncoordinated effort. In 1883 the Government of India founded a department for dealing with the Economic Products of the Indian Empire, and under the title of Reporter on these products they were fortunate enough to secure Dr. George Watt, a member of the Bengal Educational Services.

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Dr. Watt is an accomplished and able Botanist. He has collected Indian plants largely, and has made numerous notes both in the field and in the bazaar. The great work which, on the initiative of Sir Edward Buck, Secretary to the Department of Revenue and Agriculture, and of Sir W. Thiselton Dyer, of Kew, Dr. Watt began and carried to a successful termination was the compilation of his 'Dictionary of Economic Products,' in which valuable book is collected all that is known of almost every Indian product, whether vegetable, animal, or mineral. The study of Economic Botany is now pursued in India as part of a highly specialised system of inquiry and experiment. Dr Watt has a competent staff under him in Calcutta, one of whom is Mr. D. Hooper, well known for his original researches into the properties of various Indian drugs. Dr. Watt has arranged in Calcutta a magnificent museum of economic products, and there is no doubt the economic resources of the Empire are now being studied with as much energy as intelligence.

Tea cultivation is one of the enterprises in the introduction and development of which Botanists took a very leading part. The advisability of introducing the industry was first pressed on the attention of the East India Company by Dr. Govan (of Seharunpore), and in this he was seconded by Sir Joseph Banks as President of the Royal Society. Royal in 1827, and Falconer slightly later, again urged it as regards the North-West Himalaya. In 1826 David Scott demonstrated to rather unwilling eyes in Calcutta the fact that real tea grows wild in Assam. In 1835 Wallich, Griffth, and McClelland were deputed by Government to visit Assam, to report on the indigenous tea. In the year 1838 the first consignment of

the Indian-grown tea was offered for sale in London. The consignment consisted of twelve chests containing 20 lbs. each. This first sample of 240 lbs. was favourably reported upon. Last year the exports of tea from India to all countries reached 157 millions of pounds, besides 120 millions of pounds exported from Ceylon!

The introduction of cinchona into India originated purely with the Government Botanists. As everybody knows, quinine, and to a less extent the other alkaloids present in cinchona bark, are practically the only remedies for the commonest, and in some of its forms one of the most fatal, of all Indian diseases, viz. *malarious fever.* The sources of supply of the cinchona barks in their native countries in South America were known to be gradually failing, and the price of quinine had for long been increasing. The advisability of growing cinchona in the mountains of British India was therefore pressed upon Government by Dr. Royle in 1835, and he repeated his suggestions in 1847, 1853, and 1856. Dr. Falconer, in his capacity of Superintendent of the Botanic Garden, Calcutta, made a similar suggestion in 1852; and his successors at Calcutta, Dr. T. Thomson and Dr. T. Anderson, in turn advocated the proposal. In 1858 Government at last took action, and, as the result of the labours of Sir Clements Markham and Sir W. J. Hooker, of Kew, the medicinal cinchonas were finally, in the period between 1861 and 1865, successfully introduced into British India—on the Nilgiris under Mr. McIvor, and on the Sikkim-Himalaya under Dr. T. Anderson. Various experiments on the best mode of utilising the alkaloids contained in red cinchona bark resulted in the production in 1870 by Mr. Broughton, Quinologist on the Nilgiri plantation, of an amorphous preparation containing all the alkaloids of that bark. This preparation was named *Amorphous Quinine.* Somewhat later (1875) a similar preparation, under the name of *Cinchona Febrifuge*, was produced at the Sikkim plantation by Mr. C.H. Wood, the Quinologist there; and of these drugs about fifty-one tons had been distributed from the Sikkim plantation up to the end of last year. The preparation of pure quinine from the yellow cinchona barks, so successfully grown in the Sikkim plantation, long remained a serious problem. The manufacture of quinine had hitherto been practically a trade secret. And when the Indian Government had succeeded in providing the raw material from which a cheap quinine might be made for distribution amongst its fever-stricken subjects, the knowledge of the means of extracting this quinine was wanting. Philanthropic platitudes were freely bandied about as to the immensity of the boon which cheap quinine would be to a fever-Stricken population numbering so many millions. But there

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was a singular absence of any practical help in the shape of proposals, or even hints, as to how quinine was to be extracted from the rapidly increasing stock of crown and yellow bark. The officers in charge of the cinchona plantations in India had therefore to do their best to solve the problem for themselves. And it was ultimately solved by Mr. C.H. Wood, at one time Government Quinologist in Sikkim, who suggested, and Mr. J.A. Gammie, Deputy-Superintendent of the plantation there, who carried into practice a method of extraction by the use, as solvents of the cinchona alkaloids, of a mixture of fusel-oil and petroleum. The details of this process were published in the 'Calcutta Official Gazette,' for the benefit of all whom it might concern. Very soon after the introduction of this method of manufacture, the Government factories in Sikkim and Nilgiris were able to supply the whole of the Government hospitals and dispensaries in India with all the quinine required in them (some 5,000 or 6,000 pounds annually), besides providing an almost equal quantity for the supply of Government officers for charitable purposes. The latest development of the quinine enterprise in India has been the organisation of a scheme for the sale at all the post-offices in the province of Bengal, and in some of those of Madras, of packets each containing five grains of pure quinine, that being a sufficient dose for an ordinary case of fever in a native of India. These packets (of which some are on the table for distribution) are sold at one pice each, the pice being a coin which is equal, at the current rate of exchange, to one farthing sterling!

In conclusion, I wish to make a few remarks on the third great economic enterprise connected with Botany in India, viz. the Forest Department. The necessity for taking some steps to preserve a continuity of supply of timber, bamboos, and other products from the jungles which had for generations been exploited in the most reckless fashion, was first recognised by the Government of Bombay, who in 1807 appointed commissioners to fix the boundaries of and to guard the forests in the Presidency. This scheme was abandoned in 1822, but was resumed in a modified form during 1839-40. Seven years later a regular forest service was established in Bombay, and Dr. Gibson was its first head. Dr. Gibson in turn was succeeded by Mr. Dalzell—and both were Botanists. In

the Madras Presidency the first man to recognise the necessity of perpetuating the supply of teak for ship-building was Mr. Connolly, collector of Malabar, who in 1843 established a teak plantation at Nelûmbur, which has been carried on, and annually added to, down to the present time. In 1847 Dr. Cleghorn (a Botanist) was appointed to report on the conservation of the forests of Mysore (which contain the well-known sandal-wood), and the following year Lieutenant Michael (still with us as General Michael, a hale and hearty veteran) was appointed to organise and conserve the public forests in Coimbatore and Cochin. The crowning merit of General Michael's administration was the establishment, for the first time in India, of a system of protection against the fires which annually used to work such deadly havoc. In 1850 the British Association, at their Edinburgh Meeting, appointed a Committee to consider and report upon the probable effects, from an economic and physical point of view, of the destruction of tropical forests. This Committee's Report was submitted to the Association at the Meeting at Ipswich in 1851. The weighty evidence collected in this Report so impressed the Court of Directors of the East India Company that, within a few years, regular forest establishments were sanctioned for Madras and British Burma, the two main sources of the supply of teak.

In 1856 Mr. (now Sir Dietrich) Brandis was appointed to the care of the forests of the latter province. These forests had been the object of spasmodic efforts in conservancy for many years previously. In 1827 Dr. Wallich reported on the teak forests, and five years later a small conservancy establishment was organised, officered by natives. This however, was kept up for only three or four years. In 1837 and 1838 Dr. Helfer reported on these forests, and an English conservator was appointed. In 1842 and 1847 Codes of Forests Laws were drawn up, but do not appear to have been enforced to any extent. In 1853 Dr. McClelland was appointed superintendent, but he continued to hold the office for only a short time. A few years after Sir Dietrich Brandis's assumption of the charge of the

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Burmese Forests, he was appointed Inspector-General of all the Government Forests in British India; and it is to him that we owe for the most part the organisation of the Indian Forest Department as it now exists. That organisation includes two Schools of Forestry (in both of which Botany is taught), one in connection with Cooper's Hill and the other at Dehra Dun in Upper India. The latter has for many years been under the direction of a gentleman who is distinguished both as a Forester and as a Botanist. In the Cooper's Hill School, the higher grades of Forest officers receive their training; at Dehra Dun those of the lower grades receive theirs. The officers of the department on the Imperial list, according to the latest official returns, now number 208, divided into the grades of conservator, deputy- and assistant-conservator, with a single inspector-general as chief. In addition to these, there are 566 provincial officers, ranking from rangers upwards to extra deputy-conservators.

Botanists took a leading part in moulding the department in its earlier years; for, as already states, its pioneers—Gibson, Dalzell, Cleghorn, Anderson, Stewart, and Brandis—were all Botanists. And to most people, who give even casual attention to the matter, it appears fitting that the possession of a knowledge and liking for Botany should form a strong characteristic of officers whose main duties are to be in the forest. And this belief did for some time exercise considerable influence in the selection of recruits for the department. But, except in the Dehra Dun School, it does not appear to guide the department any longer. For example, at the Entrance Examination to the Forest School at Cooper's Hill, only three subjects are obligatory for a candidate, viz. mathematics, to which 3,000 marks are allowed; German, to which 2,000 are allowed; and English, for which 1,000 are given. Botany is one of the nine optional subjects of which a candidate may take up two, and in each of which 2,000 marks may be made.

Botany is taught at Cooper's Hill, and (according to the Calendar of the College) it forms one of the 'special auxiliary subjects' for the Forest student. I do not wish to say a single word in depreciation of the Botanical teaching at this College, which is probably excellent of its sort. I do not know what value, as part of their professional equipment, students are accustomed or encouraged to attach to the possession of the means of acquiring a knowledge of the trees and shrubs in the midst of which they are to pass their lives in India. But this I do know, that the ordinary Forest officer educated in England now arrives in India without sufficient knowledge to enable him to recognize from their Botanical characters the most well-marked Indian trees. To tell such an officer the name of the natural family to which a plant belongs coveys no information to him whatever, for he knows nothing of Botanical affinities. Moreover, the Forest officer after he has arrived in India

is not encouraged to familiarise himself with the contents of the forests under his charge. This will be better appreciated by giving an example than by any number of remarks. Some three years ago, Mr. J.S. Gamble (a Forest officer) published a monograph of the Bamboos of British India. From bamboos, as you may possibly be aware, a very large amount of Forest revenue is annually derived. The sales of bamboos for the year 1896-97 amounted to no less than 110 millions of stems. A great number of the species of bamboos have the curious habit of flowering gregariously at remote intervals of thirty or forty years, and the flowering is followed by death. The absence from the forests for years in succession of flowers of a number of the species, and the similarity of many of them in leaves, had hitherto made members of the group most difficult of identification. Mr. Gamble had devoted himself to their study for many years. He had carefully examined all the previously collected materials stored in the Herbaria at Kew, the British Museum, Calcutta, and elsewhere; and large special collections had been made for him by Mr. Gustav Mann and other officers of Government. Moreover, he had General Munro's great paper in the 'Linnean Transactions' as a basis. Mr. Gamble's work was undertaken with the full approval of Sir Joseph Hooker, who indeed accepted Mr. Gamble's account of the bamboos for his 'Flora of British India.' Mr. Gamble's monograph is illustrated by a life-sized drawing of each species, with analyses of the flowers on a larger scale. When completed, the book was published as one of the volumes of the

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'Annals of the Calcutta Botanic Garden.' In consideration of the supposed great importance of the book to the forester, and in the belief that the copies would be eagerly taken by the Forest Department, an extra hundred copies were printed, and these hundred copies were put into stout canvas binding suitable for camp use. These copies, or as many of them as he cared to take, were offered to the Head of the Forest Department in India at the reduced price of fifteen rupees per copy. The result was an official refusal to buy a single one, although the purchase of the whole hundred (which was not asked for) would have cost only fifteen hundred rupees—a sum which would have reduced the revenue of the year by about one twelve-thousandth part! An appeal against this ruling having been made to a still higher authority, a modified order was subsequently issued permitting such Forest officers as desired to possess the book to buy copies and charge the cost in their office expenditure. I may state that the book was not a private venture. It was produced at the expense of the Government of Bengal.

It is not because I like to play the censor that I have made these remarks about the Forest Department. Having myself served in it from 1869 to 1871, I can speak from my own experience as to the value, from the utilitarian point of view, of a knowledge of the names, affinities, and properties of the trees, shrubs, and herbs which compose an Indian jungle, and of a knowledge of these as individual members of the vegetable kingdom rather than as masses of tissue to be studied through a microscope. The appointment which I help in India for twenty-six years after leaving the Forest Department gave me full opportunity of getting into touch with all who interest themselves in a knowledge of plants, and of discovering how few of these at the present day are Forest officers. The majority of the latter, if they love their trees, are content to do so without knowing their names or relationships! There are, of course, splendid exceptions who know as well as love. The general decadence of the teaching of Systematic Botany in England during the past twenty years is, perhaps, to some extent the cause of the low estimation in which the science is held by the authorities of the Indian Forest Department. Twenty-five years ago Systematic and Morphological Botany, no doubt, had too great prominence given to them in the teaching at universities and colleges of this country, and the other branches of Botanical science were too much neglected, although I do not think they were despised. Now it appears to me that Systematic Botany is too much neglected. I hope it is not also despised! Few of the systematists who survive in England are now to be found attached to the universities. They are mostly clustered round the two great Herbaria in London; and such of them as have to look to Systematic Botany for the means of livelihood are not in the receipt of salaries such as one might reasonably expect in one of the richest countries in the world!