INTRODUCTION

After the appearance of RUMPHIUS's *Herbarium Amboinense*, the result of lifelong research into the botanical treasures of the Malaysian Archipelago, the first comprehensive work on the flora of these islands was begun by C. L. BLUME, the second Director of the Botanic Gardens at Buitenzorg. His *Bijdragen tot de Flora van Nederlandsch Indië* (Contributions to the Flora of the Netherlands Indies) consisted of numerous brief botanical diagnoses mostly, however, of Javan species. Shortly after followed his *Flora Javae* and later *Rumphia*. None of these books represent a 'flora'; neither completeness was aimed at nor keys were given.

The first design for a flora of the whole of Malaysia seems to have been drafted by the Swiss botanists H. ZOLLINGER and his teacher, A. MORITZI.[1] I have not succeeded in tracing any further results of their plans.

Since the publication[2] of the *Flora van Nederlandsch Indië* or *Flora Indiae Batavae* by F. A. W. MIQUEL (5 vols, 1854–'60)—which was no 'flora' in the present meaning of the word, keys being almost absent—no work has been conceived with the object of covering the Malaysian region. MIQUEL's work[3] may be considered as a more or less critical compilation of descriptions, mostly copied or extracted.[4]

MIQUEL must have realized that by his Flora the proper work was only started. This may be concluded from the series of revisions which MIQUEL, together with some specialists, published in 4 volumes *Annales musei botanici lugduno batavi* (1863–'69),[5] *Choix des plantes rares ou nouvelles* (1863), to which was added his posthumous *Illustrations de la Flore de l'Archipel Indien* (1870–'71) by his successor at Leyden University, W. F. R. SURINGAR.

Unfortunately, MIQUEL had few pupils[6] which caused a serious shortage of well-trained systematists during half a century of botanical endeavour in the East Indies. The only Dutch scientists studying the Malaysian flora were:

P. DE BOER, who wrote his doctor's thesis on the subject *De Coniferis archipelagi indici* (1866), and later became a professor of Pharmacology at Groningen University, and

R. H. C. C. SCHEFFER, an extremely able botanist whose thesis was entitled *De Myrsinaceis archipelagi indici* (1867).

SCHEFFER was subsequently appointed as the (fourth) Director of the Botanic Gardens, Buitenzorg, and ardently promoted the study of the Malaysian Flora, notwithstanding his feeble health. In his term of office he published several important papers, most on *Annonaceae*[7] and *Palmae*.[8]

DE BOER had one pupil in systematic botany, TH. VALETON, who obtained his doctor's degree on a monographic study of the *Olacineae*.[9] He eventually was employed as a bacteriologist in the Sugar Experiment Station in Java but, soon after, joined the staff of the Botanic Gardens, Buitenzorg (1892).

After the appointment of Dr M. TREUB as the fifth Director of the Gardens in 1880, interest in the promotion of knowledge of the Malaysian flora revived, but TREUB was badly handicapped by the absence of trained Dutch systematists. TREUB—a contemporary of HOOKER, EICHLER, BENTHAM, and HARVEY & SONDER, the editors of respectively the *Flora of British India*, the *Flora Brasiliensis*, the *Flora Australiensis*, and the *Flora of tropical Africa*—was well aware that systematic botany in the Netherlands Empire was on the verge of falling behind that in other tropical countries. He judged the advancement of systematics of preeminent importance.

He engaged W. BURCK, a pupil of SURINGAR's at Leyden, later a teacher of botany at Buitenzorg, as a subdirector of the Gardens (1883) and charged him with critical research into *Sapotaceae* (getahpertja family),[10] *Mucuna*,[11] the *Erythroxylaceae* (cocafamily),[12] and *Dipterocarpaceae*,[13] mostly families of economic importance.

TREUB, who tried continuously to raise a worldwide interest in the Gardens and its botanical institutes, considered the compilation of a new Malaysian Flora to be premature. Collections were inadequate and of the vegetation of the surrounding regions little was known.

He advanced, therefore, the idea of composing a local flora of the surroundings of Buitenzorg, covering the region from the mangrove of Tandjong Priok to the summit of Mt Gedeh at 3000 m. All altitudinal zones would thus be represented.

This *Flore de Buitenzorg* would serve as a guide to botanically interested visitors of the Gardens and be equally acceptable to residents of Java. Dr J. G. BOERLAGE, then conservator of Leyden Herbarium, during a visit to Buitenzorg as a stipendiate of the Dutch Buitenzorg Fund, had already made collections for the new flora (1889) and published an article on the grasses.[14]

(1) ZOLLINGER, Observationes phytographicae *etc.* Natuur- & Geneesk. Arch. 1 (1845) 375; *cf.* also J. K. HASSKARL, Flora 30 (1847) 299.

(2) Made possible by a grant of the Ministry for the Colonies.

(3) Dates of publication of the several parts in Bull. Jard. Bot. Btzg III, 13 (1934) 284.

(4) Compare ZOLLINGER, Natuurk. Tijdschr. Ned. Ind. 13 (1857) 292–322; *id.* (in German), Vierteljahrschr. Naturf. Ges. Zürich 2 (1857) 318–349.

(5) Dates of publication of the several parts *cf.* NAKAI, Journ. Arn. Arbor. 6 (1925) 211–213.

(6) *Cf.* the article in honour of Dr A. A. PULLE, who resumed MIQUEL's work at Utrecht University, Bull. Jard. Bot. Btzg III, 16 (1939) 103–105.

(7) Ann. Jard. Bot. Btzg 2 (1885) 1–31.

(8) *Ibid.* vol. 1 (1876) 103–164; O. BECCARI, Reliq. SCHEFF. *ibid.* 2 (1885) 77–171.

(9) Critisch overzicht der *Olacineae* (1886).

(10) Ann. Jard. Bot. Btzg 5 (1886) 1–85.

(11) *Ibid.* 11 (1893) 183–190.

(12) *Ibid.* 11 (1893) 190–194.

(13) *Ibid.* 6 (1887) 145–249.

(14) Ann. Jard. Bot. Btzg 8 (1890) 47–78.

TREUB, however, found it difficult to rally workers to this local flora and so most of it was assigned to foreign visitors who sometimes were temporarily employed at the Gardens. Six volumes appeared, *viz* the *Myxomycetes* by O. PENZIG (1898), *Ferns* and *Fern Allies* by M. RACIBORSKI (1898), *Hepatics* by V. SCHIFFNER (1900), *Algae* by E. DE WILDEMAN (1900), and *Mosses* by M. FLEISCHER (1900–'22, 4 vols). The 6th and only volume on Phanerogams was written by J. J. SMITH (*Orchidaceae* 1905, atlas 1908–'14).

None of the volumes of the *Flore de Buitenzorg* bears the character of a local flora; the majority deal with the whole of Java. FLEISCHER's *Musci* even expanded to a standard work on the world's mosses.

Of the flowering plants apart from the *Orchidaceae*, much material was collected by BURCK and H. HALLIER who planned to elaborate a 7th volume of the *Flore de Buitenzorg*. A list of the species to be included is kept at Buitenzorg, but nothing ever appeared in print.

During this period important revisions of families were published abroad by O. BECCARI in his 3-volume *Malesia*. Several monographs appeared in the 4[0] tomes of the *Annals of the Royal Botanic Gardens, Calcutta*, on the genus *Ficus*, the *oaks* and *chestnuts*, the *bamboos*, *etc.*

Local floras of other parts of Malaysia were the 3rd edition of BLANCO's *Flora de Filipinas* (1877–'83)[1] by NAVES & F.-VILLAR, SCHUMANN & HOLLRUNG's *Flora von Kaiser Wilhelmsland* (1889), and SCHUMANN & LAUTERBACH's *Flora der Deutschen Schutzgebiete in der Südsee* (1901) with the *Nachträge* (1905). These eastern floras resembled enumerations and were mainly indices of materials collected on expeditions.

In 1890 BOERLAGE previously having published two critical studies of Malaysian plants, *viz* the genus *Achyranthes*[2] and the genera of *Araliaceae*,[3] started a work of quite another nature in the compilation *Handleiding tot de kennis der flora van Nederlandsch Indië*.[4] This comprised a description of the families and genera of Malaysian phanerogams. The species were—especially in the last parts—only briefly enumerated. He added to a few families keys to the genera. The generic descriptions were mostly critically copied from BENTHAM & HOOKER's *Genera Plantarum*, and occasionally emended. Phytographically BOERLAGE's *Handleiding* brought hardly anything new, but now a comprehensive review in the Dutch language of families and genera came within reach of interested persons in the colonies. However, as will be demonstrated later, this interest was and is still more directed towards *species* than *genera*.

(1) On the dates of publication see MERRILL, Philip. J. Sc. 12 (1917) Bot. 113–117.

(2) Ned. Kruidk. Archief II, 5 (1889) 420–430.

(3) Ann. Jard. Bot. Btzg 6 (1887) 97.

(4) In total 5 parts appeared, the last posthumously (1890–1903, 3 vols). The publication was made possible by a grant of the Ministry for the Colonies.

BOERLAGE's work was more intended as a prelude to a general flora than as a final work.

He accepted (1896) the post of subdirector of the Botanic Gardens and Head of its first Division (Herbarium and Botanical Museum), as a successor to BURCK and began a monograph of the *Annonaceae*[5]. Unfortunately he soon (1900) fell a victim to a tropical disease while on a tour in the Moluccas attempting to re-collect the plants mentioned by RUMPHIUS in his Herbarium Amboinense.

Another flora was started, at TREUB's instigation, of trees growing in the island of Java. This was to be based mainly on the collections made by Forest officer S. H. KOORDERS who gathered in the field notes on each species (occurrence, value, uses, etc.). Scientific descriptions and keys were by TH. VALETON. This work is *Bijdragen tot de kennis der Boomsoorten van Java* (*Additamenta ad cognitionem Florae Javanicae, pars* I, *Arbores*). Thirteen volmes compose this standard work, the 12th volume is by J. J. SMITH, the concluding 13th by SMITH and VALETON. The work was begun in 1894, and finished in 1913. Later illustrations were edited by KOORDERS in his unfinished *Atlas der Baumarten von Java* (4 vols, 1913–'18). The *Bijdragen* is an excellent work with critical descriptions and notes, and still very useful though, of course, now antiquated. The descriptions of the species and genera are both in Dutch and Latin.

During TREUB's directorate many collections, specially of the Outer Provinces,[6] were brought together. HALLIER made an important one in West Borneo, KOORDERS in Java and North Celebes, the SARASINS collected in Celebes, FORBES and KOORDERS in Sumatra, FORBES in Timor, while WARBURG's, SCHLECHTER's, and BECCARI's great collections equalled those of TEYSMANN's and extended over the whole archipelago. These collections were partly inaccessible though together they could have served to a large measure as a reliable basis for a Flora Malesiana.

Lack of trained taxonomists induced TREUB to engage J. J. SMITH, formerly an assistant curator of the Gardens, for taxonomic work. His revisions of Javan *Euphorbiaceae*, *Ulmaceae*, *Urticaceae*, and *Orchidaceae* proved his ability, and SMITH spent his life in describing Malaysian *Orchids*, *Ericaceae*, and *Epacridaceae*. Unfortunately, he did hardly any monographical work.

For the same reasons TREUB selected C. A. BACKER, a teacher in a primary school at Batavia who possessed already a thorough and critical knowledge of the local flora. BACKER intended to fill the still existing *lacunae* in the phanerogamic part of the Flore de Buitenzorg, which resulted in the publication of one volume of a *Flora van Batavia* (1907). This was followed by a preliminary schoolflora[7] and later by the *Schoolflora* (1911).

(5) Icon. Bogor. 1 (1899) 79–208, t. 26–75.

(6) That was: Netherlands Indian territory outside the islands of Java and Madoera.

(7) *Voorlooper eener Schoolflora van Java* (Precursory Schoolflora of Java). Batavia (1908).

The latter excellent work contained only ± 25 % of the Javan flora (*Choripetalae*). He later devoted all his time to the Javan flora, wrote (together with VAN SLOOTEN) a weed flora of tea plantations (1924), 3 instalments of a *Handboek voor de Flora van Java* (1924–'28), a weed flora of sugar plantations (1928–'34; vol. II (atlas) not yet completed), and is now engaged in completing the Flora of Java.[1]

An ill-advised enterprise was a flora of Java by S. H. KOORDERS who, when charged by the N.I. Government to write a flora of the Javan mountains, abandoned this concept and hurriedly compiled an *Exkursionsflora von Java* (Jena, 1911–'12, 3 vols) which did more harm than good and is scarcely of any value to a student of the Javan flora.

The flora of the Malay Peninsula was originally included in the Flora of British India, but as the account remained very incomplete KING & GAMBLE, and RIDLEY, started to work on it, publishing a true model of a critical local flora.[2] This was later followed by RIDLEY's decidedly uncritical *Flora of the Malay Peninsula* (5 vols, 1922–'25).

On the Flora of Borneo a most helpful *Bibliographic enumeration of Bornean plants* was prepared by Dr E. D. MERRILL.[3]

In the Philippines MERRILL, after 1902, energetically undertook the research of the Philippine flora, this first resulting in an excellent local *Flora of Manila* (1912), in a large number of papers dealing with several aspects of the Philippine flora, and crowned by his *Enumeration of Philippine flowering plants* (1923–'26).

The results of frequent expeditions into the Dutch and German territories of New Guinea were published by Dr A. A. PULLE and others in the serial *Nova Guinea* (vols, 8, 12, 14, and 18), and by C. LAUTERBACH and others,[4] and in recent years those of Dutch and British parts by MERRILL and other collaborators.[5]

The undesirability of compiling, at this stage, local floras in Malaysia. The studies of the materials of various separate regions persuaded some leading Dutch botanists in the first quarter of our century—for some reasons they doubted the feasibility of a Malaysian flora as a whole—to propose several local floras *e.g.* one of Java, of Borneo, Sumatra, Celebes, *etc.* This caused the appointment of HALLIER at Leyden to write a Flora of Borneo resulting in a small preliminary paper.[6]

It is clear that this was a wrong policy, born from either ignorance of the taxonomic position and the technique of writing revisions, or from the wish for dodging obstacles; the difficulties should be faced directly. Only temporary profit may be gained from making local floras, and both valuable time and money are wasted by the enormous duplication which is unavoidable when the goal of a flora of a plant-geographical unit is to be reached along this tortuous road.

The natural sequence is to start with the large flora, eventually followed later by local floras, a procedure followed in the great floras of South America, tropical Africa, India, and Australia. The unnatural sequence of starting with the local flora has led, both in North America and Europe, to a most regrettable state of affairs.

The absence of a general flora is also one of the causes that the flora of Java which BACKER has studied close on forty years is only now more or less to be completed. It contains several families which cannot be critically treated (*Lauraceae*, *Araceae*, *Zingiberaceae*, *etc.*) lacking revisions of these families in the whole Malaysian region.

General Flora. A general flora was and is needed and prospects at the end of the first World War seemed favourable. The Forest Research Institute and the Museum for Economic Botany[7] at Buitenzorg requested much service and urged the Herbarium of the Botanic Gardens to produce speedy results. This induced the Goverment to add to the staff of the Herbarium R. C. BAKHUIZEN VAN DEN BRINK (1917)—he was originally a plantation assistant—Dr D. F. VAN SLOOTEN and Dr H. J. LAM, the first pupils of PULLE at Utrecht (1919). In 1921 Dr H. C. CAMMERLOHER, a German biologist, was appointed, and a professional collector engaged, H. A. B. BÜNNEMEIJER.

At the same time a scheme was made for critical revisions. These were to be published in the Bulletin du Jardin Botanique, Buitenzorg[8] under the heading: *Contributions à l'étude de la Flore des Indes Néerlandaises.* Economically important families had priority. The method of treatment stood below that of KING & GAMBLE's *Materials* in so far that descriptions were only admitted if species were new or critical. This was believed to save time. On the other hand extensive lists of herbarium numbers had to be compiled. If the latter had been left out and instead a concise characteristic of the occurrence of the species given, besides a good diagnostic description of each species, the *Contributions* would have made a most satisfactory foundation. Though the later *Contributions* are far more complete than the earlier, the manner of treatment and publication is so laborious and slow that at this rate the Flora Malesiana will never be completed. Till the present 34 *Contributions* have appeared, comprising 2000 species.

Due to the post-war economic depression of 1921–'22 the Staff of the Buitenzorg Herbarium

(1) Seven parts of a mimeographed emergency edition were issued up till now through the care of the Rijksherbarium, Leiden (1940–'48), 9 vols.

(2) The contributions of the former appeared under the title *Materials towards a Flora of the Malay Peninsula* in various numbers of the Journ. Asiat. Soc. Bengal, vol. 58 onwards (18891–915).

(3) Journ. Str. Br. Roy. Asiat. Soc. Special number (1921).

(4) Under the title *Beiträge zur Flora Papuasiens* in many volumes of the Botanische Jahrbücher (1912 onwards).

(5) Journ. Arn. Arb. 9 (1928) *et seq.*

(6) Beih. Bot. Centralbl. 2. Abt. 34 (1916) 19–53.

(7) Head of this Museum was the late K. HEYNE, author of the standard work on useful plants of Indonesia (1927).

(8) Bull. Jard. Bot. Btzg III, 5 (1923) 294 *seq.*

were reduced, and though towards 1930 there were a few constructive moments, a protracted slump set in after that year and the Staff at Buitenzorg were reduced to the barest minimum. Shortly before the Pacific War the Staff again increased but the circumstances limited advancement of the Flora to planning.

I have always felt it as a shortcoming, and not in accordance with the standing of the great work at hand, that the contributions appeared in a periodical as scattered articles and not as a separate publication.

The work was undertaken on full official authority but being printed in an irregularly interrupted series of articles in many volumes of a technical journal, it was practically inaccessible to a wider non-professional public. A standard work of this scope and weight meant to be used by future generations and worthy of the wonders of nature in this great land ought to have commanded considerable interest in and beyond the tropics, specially so in neighbouring countries. It would not have made a difference in expenditure to issue this work as a separate publication thus materially augmenting its practical importance, its intrinsic value remaining, of course, the same.

This seemingly trivial technical-editorial point had very undesirable consequences. If the Government had once for all decided to order a standard work on the Malaysian flora to be written with all possible expediency and to be used many years afterwards, the halting and haphazard progress in the decade preceding the Pacific War would never have occurred.

It is a gratifying thought that the turbulent times of the present could not prevent the Government now to put the Flora Malesiana in an advantageous and satisfactory position both as regards effective publication, and national and international collaboration of systematists. Co-operation with foreign colleagues, whose help is invited and whose help is needed in order to finish the work within a reasonable time, will now, presumably, more easily be obtained. Evidently, it is far more attractive and stimulating to be entrusted with an individual part of a standard work than with writing an article in a journal.

Prospect and scope of the Flora Malesiana. A general flora of Malaysia must result from a careful study of all previous publications, blending them into a harmonious whole, and so founding Malaysian botany on a secure base of historical fact, observation, and accurate description. This is, however, the labour of a lifetime, and although I may be privileged in witnessing the laying of the foundations and the issue of a number of volumes, I cannot hope to bring it to a conclusion; progress, moreover, will depend entirely upon circumstances at present beyond control. I have no doubt that when I will be called to abandon this endeavour the historical necessity for the completion of this work will compel someone to continue this task and, eventually, to finish it.

It would, however, be wrong were I to convey the impression that this arduous undertaking had entirely originated with myself: on the contrary during many years the conviction has grown among plant taxonomists that the ample collections accumulating in this country warranted the preparation and publication of a Flora Malesiana. The collections are undeniably extensive having been gathered over a wide extent of country.[1]

As I am anxious to render each portion of the work in itself as complete as possible, and desirous of enlisting those of our fellow-botanists as may be willing to take care of those families or groups they are most familiar with, the Flora Malesiana, when terminated will probably consist of a series of local-monographs. For these reasons it seems inadvisable and most inconvenient to arrange the families in the mode of sequence usually adopted in systematic works.

I consider it important that the Flora Malesiana should embrace as wide an area as possible, being firmly convinced that no species can be properly defined, until it has been examined in all variations induced by the differences in climate, locality, and soil, which an extensive area affords. Also, the flora of an area cannot be worked out thoroughly without a knowledge of the botany of the surrounding countries (these have many plants in common), and so the greater the area encompassed, the better it will illustrate habits, forms, and variations of the species comprised within it. For this reason we have extended the limits of our Flora from Sumatra to New Guinea and from Luzon to Christmas Island, Timor and New Guinea.

The use of the Flora Malesiana. In the preceding pages I have mentioned several times the public and the government. Both have a right to a clear understanding of the use of a flora of the scope and character of that now contemplated.

Although it is difficult to explain theoretically the 'use', *i.e.* the material benefit of purely scientific standard works, many anecdotes and instances concerning scientists entirely possessed by their inventions, instruments, and desire for research, told in biographies and popular literature, exemplify the eminently practical results based on seemingly impractical and abstract study.

The same can be said about this Flora. Botany is not a cherished source of pleasure and interest to naturalists only; and I have but vague ideas of

(1) Collections have increased enormously. From 1917 on, the Forest Research Station at Buitenzorg accumulated materials of arboreous plants from the islands outside Java (more than 30.000 numbers): The Museum for Economic Botany furnished by its own collectors another 6000 numbers of those islands. The collectors of the Buitenzorg Herbarium in the past 30 years added to the collections more than 125,000 numbers. A similar increase of Malaysian collections in these last decades is due to the activities at Manila and Singapore; besides, private collectors substantially augmented the collections of New Guinea. A conservative estimate of the collections at Buitenzorg alone runs to about 400.000 numbers of Malaysian plants.

possible advantage and ultimate gain for the community and practice by means of this registration of the Malaysian flora.

I could refer, of course, to the fact that all other civilized nations have already made considerable progress in the task of making common knowledge of their vegetable resources.

Actually the disentangling of confused species, the description of new or the rehabilitation of obsolete genera, the dissection of dried flowers and, in general, the establishment of law and order in 'the hay loft', and the publication of the results have less appeal to the lay public than the segregation of a new promising variety of rice or sugarcane, or devising a method to suppress a pest of coffee or of coconut plantations.

The Flora of Malaysia contains besides highly interesting and even unique plant forms, instructive vegetation types, and peculiar ecological and phytogeographical problems, numerous important industrial plants and economic products which, in their manifold kinds, add to human comfort and social prosperity, while, in their ranks, many treasures still await discovery, the latest accessions being pectin and mannan producing plants. Their value has come as a surprise both to taxonomists and economists.

Nearly a century ago, one of the foremost of British botanists, Sir JOSEPH DALTON HOOKER[1] wrote an introductory essay to the Flora of British India, one of the most instructive general essays ever written on tropical botany. This nearly one century old exposition of facts and thought meets the present state of knowledge of the Malaysian flora admirably. Its excellence induced me to copy the following from it:—

"With regard to economic botany, it is obviously impossible to do more than briefly enumerate, under their respective species, the various products which have been used in the arts: for detailed accounts of their value, we must refer our readers to the many excellent works on those subjects, which have been published by Indian botanists."

"Our work is intended to facilitate the progress of economists, by supplying their great desideratum, a critical description of the plants which yield the products they seek. We have had a considerable experience both in medical and economic botany and we announce boldly our conviction, that, so far as India is concerned, these departments are at a standstill, for want of an accurate scientific guide to the flora of that country. Hundreds of valuable products are quite unknown to science, while of most of the others the plants are known only to the professed botanists. The mass must indeed always remain so: just as the refinements of the laboratory and the calculations of the mathematician must ever be mysteries to the majority of manufacturers and navigators, whose operations are based on the sciences in question. It is a mistake to suppose that it can be otherwise; or that those who are engaged in forwarding a science so extensive and abstruse as philosophical botany, can command the time to become so familiar with the details of the commercial value of vegetable products, as to be safe referees on these subjects. On the other hand, it is equally a mistake to suppose that those who devote themselves to the collection of economic products, can possess the experience and botanical knowledge necessary to render their identifications of tropical plants trustworthy in the eyes of men of science. It is therefore as a strictly scientific work that we offer this commencement of the Flora Indica to the public, but though the advancement of abstract science is indeed its primary object, yet as we yield to none in our estimate of the value of economic botany, we confidently trust that . . . our labours will be found of material service."

"Had it been possible to take up the economic plants of India by themselves, and to present a history of them to the English reader, we should at once have devoted ourselves to the task, with the certainty of obtaining an amount of encouragement which a so-called paying work is sure to command, but which one of a more scientific nature is not thought worthy of receiving. We should, however, only be deceiving the public, were we to propose a scheme which, in the present deplorably backward state of scientific Indian botany on the one hand, and the confusion of Indian economic botany on the other, is literally impracticable: the difficulties have increased fourfold, from scientific botany not having advanced *pari passu* with the economic branch; and so long as plants themselves remain undescribed, it is obviously impossible to recognize what are useful, or so to define them that they shall be known by characters that contrast with those of the useless. Our principal aim, however, being purely botanical, the most insignificant and useless weed is as much the object of our attention as the Teak, Sal, and tea: in the vegetable kingdom, and in the great scheme of nature, all have equal claims on our notice, and no one can predicate of any, its uselessness in an economic point of view."

"Every one who has studied Indian plants, whether for economic purposes or for those of abstract science, must have felt the want of a general work which should include the labours of all Indian botanists, to be a very serious inconvenience. Our own experience in India has convinced us of this; for we found it often impossible to determine the names of many of the most ordinary, and, in an economic point of view, often most valuable forms; and every day's additional experience in the preparation of this volume has served to show more and more clearly, that whilst such a work is wanting satisfactory progress is impossible. At present the student has to search in general systematic works, for the descriptions of species; and as all of these are imperfect, a multitude of scattered papers must be consulted for the additions which have from time to time been made. These too have unfortunately so often been published without reference to preceding works of a similar nature, that the same plant has been described as new by

(1) HOOKER & THOMSON, *Flora Indica* (1855) 1–280, specially p. 3 *et seq.*

many successive botanists, ignorant or neglectful of the labours of their predecessors." So far HOOKER.

To emphasize our inability to foresee practical results of taxonomic work I intend to mention a few recent instances in Malaysia showing that plants which seem useless at the present may stand in the focus of attention at a future date.

Twenty years ago it would have seemed the whim of a botanist to work on the species of a genus of foetid aroids, scientifically known as *Amorphophallus*. Few years later, however, the tubers of some species of this genus were found to be important commercially and industrially. The basic work on the distinction of the species, the notes on their distribution, their habit and structure proved to be most useful for agricultural purposes.

The same holds for a genus of leguminous plants, *Derris*. The roots were found to contain a very valuable resin-like substance, rotenon, poison to fish and numerous insects but harmless to larger animals, also to man. As soon as its commercial value was recognized a sudden large demand for *Derris* rose. It soon appeared that not every species was valuable and so the original studies of *Derris* offered hold for a first segregation of promising material whereas the systematist was questioned about the characters by which the species could be recognized.

The absence of any reliable taxonomic information of the genus *Metroxylon* prevents at present well-founded research on the economic possibilities of the sago-producing species which supply a basic food to the whole population of East Malaysia and Melanesia.

Invariably it is the duty of the taxonomic botanist to supply *basic data* to research in directed (= applied) botany.

In all cases the *name of the species*, and eventually its varieties, *is the alpha of knowledge*, as it represents the key to existing literature embodying earlier work on habits, life-history, on distribution geographical and altitudinal, ecology and growth habit, current native names if any, *etc.* and Flora Malesiana must serve for this purpose.

In the past *e.g.* tropical plant-breeding in some cases followed a wrong direction and might have achieved better results more rapidly when the aid of taxonomists had been available or requested.

From the discussion of some selected topics above it will be clear that the taxonomic botanist in composing the Flora Malesiana will be able to offer critical knowledge of numerous *forest products*, plants containing *vegetable oils*, *fats*, and *resins*, *rattan*, *timber*, *gums*, *fruits*, *spices*, *insecticides*, *fibres*, *dyes*, and *medicines*, or species which may serve for *afforestation*, for *ornamental use*, as new *green manures*, *fodder plants*, or possibly, *species withstanding drought* or being *resistant to fire or inundation*, suitable for *combating erosion*, and other economic aspects.

In addition to taxonomical information, the Flora Malesiana will contain ecological data. In anthropogenic areas and eroded lands biological control of necessity will seek guidance in its comprehensive survey of facts. Large amounts of money and energy have been wasted in the absence of professional planning, through negligence of fundamentals. I remember attempts, as expensive as they were fruitless, of planting mangroves to protect the coastal area of a tropical harbour, a waste which would have been avoided when the ecological potentialities of mangrove forest had been duly considered.[1]

In (re-)afforestation, the choice of trees has to rely partly on previous experience, but directions can be given by field-taxonomists and by means of general rules of tolerance capacities. Native trees occupy in our forest-types fitting ecological niches, but it should not be assumed that they grow always under optimal conditions. An example is probably found in swamp forest trees which have roots tolerant of a very low aeration of the soil, a virtue not practically utilized, as far as I know, when planting on very poorly aerated soils.

The ecological misunderstanding that all plants grow in nature under optimal conditions for their growth led to 'forest plantations' of quinine by JUNGHUHN. The *Cinchona*-crop was saved thanks to TEYSMANN who maintained that the plant should be grown in the open. Much trouble and still much more money could have been saved if this ecological principle had been better known.

The Flora Malesiana is, therefore, of first interest to practice and may direct new research: it must give data as to where the plant occurs, in what quantity, under what life-conditions, and with what life-cycle. It ought to contain ecological and biological data, and a critical extract of the notes made by the collectors. None of us can predict the industrial future of a neglected plant species, but we should be prepared for any coming rush on the botanical wealth of this vast archipelago, linking the Asiatic and Australian continents.

The aim of the Flora Malesiana is to compile a critical knowledge and a botanical standardization of the Malaysian flora of basic importance both to pure and to economic botany.

How much of the flora is known? Often it is assumed—the majority of botanists being acquainted with the state of knowledge in Europe or North America—that the flora of these islands is sufficiently known, and the actual facts cause astonishment.

For instance, not even the number of species is known otherwise than by very approximate calculation; 25.000 to 30.000 species of flowering plants is a conservative estimate. The *Orchidaceae* alone claim about 5000 species. Java possesses more than 500 species of ferns. The number of different species of trees in Malaysia is about 3000. The total number of genera is near 2400. The largest genera are found among the Orchids, *Dendrobium* with *ca* 1110 and *Bulbophyllum* with about 933 recognized species.

This is indeed astonishing if compared with the flora of Holland where the whole native flora

(1) Kustaanwas en mangrove (Natuurwet. Tijdschr. Ned. Ind. 101 (1941) 82–85).

amounts to little more than 1000 flowering plants.

Counting all trustworthy and up to date revisions together, about 5000 out of a total of 25.000–30.000 species are now more or less critically known. It appears that the bulk of the work remains still to be done.

The area covered by the Flora Malesiana will besides Indonesia also include the Malay Peninsula, Sarawak, Brunei & British North Borneo, the Philippines, Christmas Island, Portuguese Timor, and the whole of New Guinea (fig. 1).

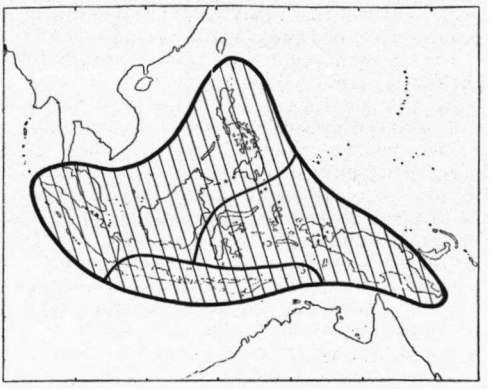

Fig. 1. Delimitation and main divisions of the flora of Malaysia.

It may be asked whether this is not an unnecessary extension of the task to include foreign border countries. To explain this it ought to be realized that the demarcation lines of natural units seldom coincide with political boundaries.

As much as possible, however, the demarcation of a Flora should be based on scientific, that is, plant geographical limits.

Plant geographically the natural demarcation lines of the Malaysian flora pass through the isthmus of Kra, between the Philippines and Formosa, and through Torres Straits, and include the Louisiades and the Bismarck Archipelago. An extensive geographical survey of the distribution of the Malaysian flora will be published in the 3rd volume of this work. The outcome[1] is wholly in confirmation with the suggested demarcation lines which were drawn first, as I have mentioned, about a century ago by ZOLLINGER.[2]

In the NW quite a number of typical Malaysian genera of forest plants fail to occur any further in the Indochinese Peninsula, *e.g. Rafflesia, Rhizanthes, camphorwood* (*Dryobalanops*), *benzoin* (*Styrax benzoin*), *kauri* or *copal* (*Agathis*), *true ironwood* (*Eusideroxylon*), *menggaris* (*Koompassia*), *etc.*

The Philippines possess an essentially Malaysian flora, in contrast to Formosa's Japano-Chinese floral character which was definitely demonstrated by MERRILL.[3]

The flora of New Guinea was formerly assumed to be essentially Australian in character. This interpretation was mostly based on zoological arguments and on the occurrence of few but very striking examples of plants which later appeared to be also spread westwards in the Moluccas and Celebes. O. WARBURG, in 1891,[4] on account of important statistics, already showed the essential Malaysian character of the Papuan flora.

Technically the botanist must in *each* case —whether the Flora Malesiana is limited to a political or to a natural demarcation—study and compare critically all species of the natural phytogeographical unit. Plants described hitherto only from East New Guinea almost certainly occur also in West New Guinea, numerous species originally described from the Philippines occur in Celebes, the Moluccas and New Guinea, and the same holds for the Malay Peninsula, where the flora is intimately allied to that of Sumatra and Borneo. In identifying plants of Malaysia in the narrow sense, that is, limited to the Netherlands Indian boundaries, the botanist is always obliged to revise or critically to take into consideration the species described from the border areas. This will cost him about the same time and labour as when admitting them into the final work.

If these species are omitted, the Flora Malesiana will doubtless be out of date early and unnecessarily.

Bibliographic advantage of the Flora Malesiana. The absence of any definitely indicated centre of publication for Malaysian plants has led to a rather chaotic taxonomic literature. At the present moment revisions of Malaysian plants are published more or less frequently in about 10 important periodicals scattered all over the world, and occasional publications are found in some 50 others. An annotated list of former revisions will be presented in this volume to facilitate future study. No single individual can be supposed to own these journals and it is thus more or less private knowledge to those, who have access to a well-stocked library. In Malaysia there are only two libraries where they are nearly all represented, *viz* at Buitenzorg and Singapore.

This is of course a rather unsatisfactory situation to naturalists, foresters, agriculturists, phytochemists, veterinarians, pharmacologists, and interested private persons desirous to study the flora according to the best available data. The Flora Malesiana will put students of systematic botany generally in possession of the essence of literature.

Sequence of publication. It is commonly understood that in a flora the sequence of publication ought to be in agreement with the 'natural system'. This has been—I feel sure—a serious obstacle mentally and practically to all those who, previously, have considered the project of this flora.

Arguments against this sequence are in the first

(1) Tijdschr. Kon. Ned. Aardr. Gen. 65 (1948) 193–207, 7 fig.

(2) Natuurk. Tijdschr. Ned. Ind. 13 (1857) 293–322.

(3) Bot. Jahrb. 58 (1923) 599–604.

(4) Bot. Jahrb. 13 (1891) 230–455.

place the existence of several 'natural systems'; it is tacitly agreed that the last word in 'the natural system' will probably never be spoken.

A system now adopted may be obsolete when this flora is finished.

A choice seems, therefore, difficult, as most of the systems are advanced by leading botanists who among themselves, may claim little priority of preference.

It would be possible that the editors of the Flora Malesiana advance a system of their own. However, this falls beyond the scope of this Flora which is solely intended as a practical work.

This technical difficulty, which was already mentioned on p. viii, in connection with the adoption of a system is a serious obstacle to the progress of the work.

Clearly not at every moment a specialist is available for every family of flowering plants. This is more or less a matter of chance. Rapid and regular publication is most desirable and so every opportunity should be made use of. A 'natural system' consequently involves the 'waiting' of some manuscripts for many years because it is not yet their turn to be printed, and several volumes will be set up in one part but can be continued only at a remote period because for the 'following' family no specialist was available. The real disadvantage can be observed in works like the *Flora of North America*, in course of publication, of which, in 1941, were published 2 complete volumes and 55 loose parts belonging to 17 of the remaining 32 planned volumes. The same has been the case with the *Flore Générale de l'Indo-Chine* where most volumes ranged over a period of about 30 years before they were completed and could be bound. In the meantime consultation was very difficult because the indexes appeared naturally in the final instalment. The handling of the loose parts is undesirable both from a bibliographical and a practical standpoint.

In the newly started *Flore de Madagascar* the families are numbered according to the natural system and are separately published and paged. The idea is that after completion the subscribers can arrange them into sequence and bind them accordingly. We must be aware, however, that this will hardly bring any advantage as the number of families in the Malaysian flora is 211, and that among them 70 families are represented by less than about 10 species, so that also in this case one has to handle a large amount of small unbound fascicles.

A long time is needed to complete the *Flora Malesiana*, about 25 years at least.[1] This is certainly not overestimated if compared with floras of similar magnitude as *Flora Brasiliensis* (1840–1906), *Flora of Tropical Africa* (1868–*hodie*), *Flora Capensis* (1894–1933), *Flora of British India* (1855–1897), *Flore générale de l'Indo-Chine* (1907–*hodie*), *Flora Australiensis* (1863–1878).

The exact duration cannot be calculated, this depends largely on opportunity and facilities, and the joining of forces. The editors are fortunate in having received the promise of much co-operation, and they hope to be able to extend their resources still more. Moreover a considerable amount of recent publications exists which may easily be adapted to the flora.

The here adopted scheme of 'opportunity sequence' in the production of family revisions will remove any delay caused by the 'natural system'. The addition of an up to date index to the contents of prior parts on the cover of each new appearing instalment will serve to verify in a moment if a desired group has already been revised.

The size of the families is of course widely different ranging from 1–5000 species.

At least one figure illustrating characteristics will be added to each family and large genus.

The volumes will not exceed 500–600 printed pages. They must be easy in the hand, agreeable to work with, and bound in covers which may not be attacked by tropical insects, as we hope that numerous subscribers will be found in the Old World tropics outside the official institutions.

Completeness of the Flora. No perfection can ever be attained in any tropical flora. Always novelties and new localities will have to be recorded. No squadron of botanists can ever comb a tropical area engirdling $^1/_7$ of the equator.

Although completeness is a first aim set for this work, its future value will depend mainly on the amount of critical original study which it contains. The Floras of British India[2] and Australia are now definitely incomplete, but they remain first class sources of information. BACKER's *Schoolflora voor Java*, of 1911, still meets present demands nearly as well as at the time of its appearance. If we can keep our flora to so high a standard it will become the keystone to future Malaysian systematic botany.

The Flora Malesiana will be started with the flowering plants (*Series I*).

Series II will comprise the ferns and fern allies and is estimated to occupy 3 volumes.

Series III will be devoted to mosses and hepatics. These will take about 5 volumes.

Series IV will treat the fungi and lichens. The number of volumes can as yet not be estimated.

Series V is intended for the algae and other groups of unicellular cryptogams.

For the series II–V special editors will be appointed. The general method of treatment may possibly deviate somewhat from the first and largest series but the needs of these can hardly be estimated at the moment.

C. G. G. J. VAN STEENIS

Buitenzorg/The Hague, Sept. '44/July '47.

(1) Under the most favourable conditions as regards funds, and co-operation.

(2) Dr K. BISWAS calculated that to the 'Flora of British India' consisting of *ca* 14000 species, *ca* 2000 have been added since its publication, a surprisingly low number in relation to its vast surface and variety of vegetation types (Proc. 30th I.S.C. pt II, sect. V, Bot., Pres. addr. p. 109).