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THE RIJKSHERBARIUM AND ITS CONTRIBUTION TO THE KNOWLEDGE OF THE TROPICAL ASIATIC FLORA

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The role played by the Rijksherbarium in the progress of Asian botany is of course closely interwoven with the history of exploration and phytography, and its evaluation needs, therefore, a background setting in the development of scientific botany in the East.

The Rijksherbarium was founded after a decade in which, for the second time, the knowledge of the Malesian flora made a big jump forward, this time on a large scale, and on a professional level, by many persons, in a definite and successful way.

The first attempt to expose its botanical treasures was in pre-Linnean times by the outstanding amateur naturalist, Rumphius, who lived from 1653–1702 on the island of Amboyna in the Moluccas. His voluminous MSS on the botany of the Moluccas and other islands were published posthumously through the sponsorship of J. Burman in 'Herbarium Amboinense' (6 vols, 1741–1750, 7th 1755). In this standard work he described more than 1300 plant forms, many of which were illustrated.

Linnaeus got this work too late to evaluate it in his 'Species Plantarum' (1753). Through this (strange) mischance its scientific contribution did not come to be fully appreciated and it was for a very long period neglected.

The main sources of Linnaeus' knowledge of Asian plants stemmed from continental SE. Asia, viz. those which he had earlier published in his 'Flora Zeylanica' (1747) which were largely based on the Hermann collection made in Ceylon (1672–1679) and the 'Hortus Malabaricus' by Van Rheede tot Draakestein (12 vols, 1678–1703), apart from occasional odd records from collections or descriptions by Breyne, Osbeck, Kaempfer, etc.

1753–1817

The 'Flora Indica' (1768) by N. L. Burman, professor at Amsterdam, was a bad and haphazard compilation which did not add clarification to the fragmentary picture of Malesian botany.

Neither did Lamarck's 'Encyclopédie méthodique' (13 vols, 1783–1817) and his 'Tableau Encyclopédique' (4 vols, 1791–1823), which incorporated the Malesian collections by early French explorers (Commerson, 1768, Sonnerat, 1771–1772, De la Billardière, 1792–1794).

Botanical exploration in the last quarter of the 18th century in Java had been extremely promising, but its outcome met with singular misfortune through quite unrelated mishappenings.

The first was by Solander who assisted Banks during Cook's first voyage. He

collected in West Java in 1770 for three months, resulting in a MS, 'Plantae Javanensis' in which he described 338 species. Due to Banks' notorious aversion to publishing, this MS was shelved till the present day in the British Museum. His collections were available to Gaertner for his famous book on seeds and fruits (1788 – 1792).

In 1775 and 1777 Thunberg made a fairly large collection in coastal West Java, but it was not methodically documented until a mere name list appeared in his 'Florula Javanica' (1825).

In 1783 – 1784 the Swede Hornstedt made a fair collection in the coastal districts of North Java, the results of which remained unpublished until 1949.

A major effort was made in 1786 when Fernando de Noroña explored the interior of West Java gaining the first botanical glimpses of the Javanese mountain flora. Unfortunately his collection was lost and he died soon afterwards in Mauritius (1788), his large MSS and plates at Paris giving testimony to his singular zeal and talent.

A still greater, prolonged exploration of Java was made by the Frenchman, Louis Deschamps, who travelled all over the island (1793 – 1798). Unfortunately his collections were lost too, his plates and diary (no MS) being the only fragments of his work to be left to posterity.

Leschenault de la Tour collected during a French expedition in Timor (1801, 1803) and East Java (1803 – 1806). His large collections were stored in Paris without being recorded in a tangible publication; his Timor collections were much later integrated into Decaisne's 'Herbarii Timorensis Descriptio' (1834).

One of the largest collections made (and preserved) in Java was that by Horsfield (1802 – 1818). It was only written up much later, and then only in small part, by Bennett & Brown, in their much delayed 'Plantae Javanicae Rariores' (1838 – 1852).

It is a singular coincidence of Fate that all the major efforts of this period had such poor results in terms of their publication.

In addition it should be emphasized that around 1820 the major part of the Malesian provinces were almost entirely unexplored, viz. Borneo, the Philippines, Celebes and New Guinea. Herbarium collections were almost absent, even from the Moluccas on which Rumphius had composed his Herbarium Amboinense.

This stood in sharp contrast to the successful progress in India where the able members of the Society of Botanists, 'The United Brothers' (Koenig, Heyne, Klein, Rottler, Roxburgh) and later Buchanan Hamilton and Wallich put Indian botany on its feet, in which the foundation of the Botanic Garden at Calcutta was a cornerstone (1791). In 1800 another important botanic garden was founded in Penang I. Indian botany would retain its superiority over that in Malesia all through the 19th century with the able and productive successors, Wight, Griffith, Jenkins, Hooker, Thomson, Clarke, Kurz, ruling the waves of Asiatic botany. They had the good fortune to receive the backing of the Hookerian centre at Kew, the joint effort finally culminating in the standard work, 'Flora of British India' (1872 – 1897), which incorporated also the flora of Malaya.

British botanists also filled other parts of the Malesian vacuum by sending out, from Calcutta, collectors to Malesia, e.g. Chr. Smith, whose collections from the Moluccas, Sumatra and Malaya were incorporated in Roxburgh's works, 'Hortus Bengalensis' (1814), 'Flora Indica' (2 vols, 1820, 1824) and its Carey edition (3 vols, 1832). British collecting in Sumatra, then a British colony, included that by Miller

(1770–1772), Campbell (1800), Marsden (1770–1776), Roxburgh Jr. (1802–1804), and especially that by Jack (1818–1822) whose precious work, 'Descriptions of Malayan Plants', covered both Malaya and Sumatra.

1817–1827

The brief sketch given above illustrates the fragmentary knowledge of the Malesian flora at the time when Reinwardt was in 1817 commissioned within a big scheme to explore the natural conditions of the Dutch East Indies in the fields of botany, zoology, geology, etc. He was charged to explore the resources of the country for agriculture, forestry, horticulture, etc. This resulted, in the same year, in the founding of the Botanic Garden at Buitenzorg (Bogor). His botanical staff was small, consisting merely of the garden curators Hooper and Kent, the latter in 1823 replaced by Zip(p)elius, and the draughtsmen A. J. and J. Th. Bik. Apart from them two young, eager, professional botanists were charged with botanical exploration, Kuhl and Van Hasselt; they were members of the 'Natuurkundige Commissie' (Natural Science Commission) installed in 1820 for scientific research; they had also a draughtsman, Keultjes, and a taxidermist/draughtsman, Van Raalten.

Reinwardt himself made a large exploration trip through the eastern parts of Malesia; Kuhl and Van Hasselt eagerly explored West Java. Unfortunately they soon fell victim to tropical disease, Kuhl and Keultjes after nine months, and Van Hasselt two years later. Reinwardt repatriated in 1822.

In 1822, his adjunct, Blume, medical doctor and Inspector of Vaccine, became Director of the Garden and took charge of the assembled materials, adding to them himself by exploring West and Central Java. In a fantastically short time he mastered the situation, published the first Catalogue of the Garden (1823) and set himself to the publication of the 'Bijdragen (Contributions) tot de Flora van Nederlandsch Indië' (1825–1826) in which he described over 1100 new species with brief Latin descriptions and many new genera, viz. 150, of which 84 are still in use while several dozen others are still used as infrageneric taxa. The species were arranged by families, each of which was accompanied by a commentary in appendices on their use. The 'Bijdragen' were continued in his 'Enumeratio plantarum Javae' (1827–1828, printed in Leiden), containing treatment of additional families, among them the Pteridophyta. The two works together, though fully centred on Java, laid a firm basis for further studies in other parts of Malesia. They were based on his own collections from West and Central Java, those of Reinwardt from Java and his tour in East Malesia (at least in part), and odd collections by garden personnel, amongst them Zip(p)elius in West Java.

He had no access to the collections of Kuhl and Van Hasselt, who were members of the 'Natuurkundige Commissie' and whose material was sent to the Museum of Natural History at Leiden. Their herbarium came only at Blume's disposal in 1828 except for part of it which had been entrusted to J. G. S. van Breda, professor of natural history at Ghent. Except for 57 plants this consisted of the *Orchidaceae* and *Asclepiadaceae* which Van Breda had agreed to study or at least prepare for the press on the basis of the preliminary descriptions of Kuhl and Van Hasselt as a posthumous honour. Of this sumptuous folio work 'Genera et species Orchidearum et Asclepiadearum quas in itinere per insulam Java ... collegerunt Dr. H. Kuhl et Dr. J. C. van Hasselt, editionem et descriptiones curavit J. G. S. van Breda' three parts appeared, each with 5 plates (1828–1829); it was discontinued because of the outbreak of the war and Van Breda's sudden escape to Leiden. Obviously he took

the herbarium with him, as this was transferred to the Rijksherbarium in 1844. In how far he succeeded in saving other plates and MSS is not clarified; in Bibliotheca Bogoriensis there is a book filed containing the detailed analyses of Kuhl and Van Hasselt on *Asclepiadaceae* and *Orchidaceae*. This could possibly contain the drawings of 181 plant species sent in 1825 by G. van Raalten to the Minister of General Affairs of which, on advice of Reinwardt, those of the *Orchidaceae* and *Asclepiadaceae* were entrusted to Van Breda for his work (Dr. P. Smit, in litt.).

Blume has later been accused of having harvested honour at the expense of his prematurely deceased colleagues Kuhl, Van Hasselt, Zipelius, and of Reinwardt, whose collections were all at Blume's disposal for his works; unjustly it appears to me. He fully acknowledged his debt to them in the title pages of his works in which he made use of their material. In fact the Kuhl & Van Hasselt sheets carry excellent field notes and flower analyses made in the field, but there are no indications that Kuhl in the 8 months, and Van Hasselt in the c. 3 years of their field work, went much beyond this preliminary stage. Whatever his other merits, Reinwardt was a poor systematist, as appears from his short 'Sylloge Plantarum'.

Taking into consideration his isolated position, the paucity of literature available to him, and the overwhelming abundance of unknown plant forms surrounding him, Blume proved himself a brilliant systematist, equal to the best of the 19th century; a man also who had the vision to frame the harvest later into solid works, to which his early works were clearly precursors. The reason for the explosive publication of the precursors is not quite certain, but the pending deterioration of the economy of the colony was a major reason for it. Another reason may have been the uncertainty of the times in the colony, many people dying young and shipments of MSS and material often being lost by shipwreck, as happened to many of Reinwardt's dispatches; competition with the British botanists in India may have been another incentive. Blume left Java in 1826, and after his departure the Government let the Bogor garden almost fall into decay. The large set of duplicates Blume meticulously left at the Garden were carelessly stored in an attic of the Palace, where they were later plundered by a German surgeon, Kollmann.

1829—1862

With the founding of the Rijksherbarium in 1829, which was very soon transferred from Brussels to Leiden, Blume, as its first director, could develop his master plan of composing a sumptuous folio work publishing in detail the flora of Java, in 'Flora Javae'. His single assistant was a young zoologist, Fischer (1804 – 1832), helping in the redaction of 'Flora Javae'.

The contributions of the Rijksherbarium to the flora of Malesia became Blume's one-man-show. Initially publication of 'Flora Javae' ran smoothly: in rapid succession treatments appeared of several families among which some interesting or large ones included *Rafflesiaceae*, *Fagaceae*, *Magnoliaceae*, *Annonaceae*, *Dipterocarpaceae*, and certain ferns (1828 – 1830), but publication was then abruptly stopped. A few years later it gave way to another work in the same sumptuous format and scale, 'Rumphia', which covered the botany of the whole of Malesia. Blume must have had more MSS and plates of 'Flora Javae' in portfolio, as others were published in 1847 (Pteridophyta), 1851 (*Loranthaceae*), and 1858 (*Orchidaceae*).

The publication of 'Rumphia' of which 4 volumes appeared (1836 – 1849), and which was of the same high quality as 'Flora Javae', was also discontinued for reasons unknown to me.

Blume must by this stage have realized that his ambition of producing a 'Flora of the Netherlands Indies' could not be realized within this scope. He set himself therefore the seemingly more modest task of an inventarisation of the complete Rijksherbarium collections, in accordance with one of the directives contained in the official instructions. These collections were, since 1829, enriched with the gatherings of the members of the 'Natuurkundige Commissie', Korthals (Sumatra, Borneo, Java), Spanoghe (Timor), Forsten (N. Celebes, Moluccas). In addition Blume had exchanged specimens on a small scale and by his contacts with numerous foreign botanists obtained material from Berlin, Geneva, Paris, Petersburg, etc., and from Asa Gray, Bunge, Lindley, Wallich, etc. He particularly wanted 'authentics', what we would now call isotypes. Besides, he had over the years tried to stimulate Dutch officials abroad, pharmacists, physicians and consuls living outside the country, to add to the collections.

The new work emerging was 'Museum Botanicum Lugduno-Batavum' (2 vols, 1849–1857). The purpose of it was to enumerate in a concise critical way, the Leiden collection, more or less arranged by families. In the 1st volume 972 species were treated, in the 2nd, 608. Some new genera and many new species were described; occasionally a complete census was made of a group beyond the Rijksherbarium collections. Why the work was so untimely discontinued is again unclear. Possibly Blume was at that time too heavily engaged in bringing out his most important treatment of the *Orchidaceae* of Java in 'Flora Javae' nova series, vol. 1, also published with a preface translated into French as 'Collection des Orchidées les plus remarquables de l'Archipel Indien et du Japon' (1858–1859).

Blume's contributions to the progress of Asian tropical botany were brilliant, but restricted. Though we do not know details, Blume must have been aware that in the forty years of his directorship, with few other duties to divert his attention, and obviously little correspondence, he had only accomplished unfinished works. One of the reasons for this was that he had cultivated from the beginning a monopolistic habit, by claiming that all important or original private collections should be deposited in the Rijksherbarium. Though one can sympathize with this standpoint seen from his position, one must be aware that at that period very many collections were private; the period of centralisation in a few big centres had hardly started. He should have considered that monopolizing would mean intruding on privacy, hence irritation, and could only succeed well by counterbalancing claims through liberal exchange, sympathetic help and collaboration in other people's efforts. In this he failed by reserving all Malesian collections for his own research. In the early thirties he lost the sympathy of Reinwardt, but other than this little harm was done, as he had no competitors.

However this soon changed and several works were published on Malesian plants by others, e.g. Blanco, 'Flora de Filipinas' (1837, ed. 2, 1845), Spanoghe, 'Prodromus Florae Timorensis' (1841), Korthals, 'Kruidkunde' (1840–1844), and later De Vriese, 'Plantae Indiae Batavae Orientalis ... exploravit Reinwardt' (1856–1857). Also many large collections were made to which he had no access, e.g. those by Von Siebold and his collaborators, Bürger, Textor and others in Japan (1823–1830), Junghuhn in Java & Sumatra (1835–1848), Cuming in the Philippines and Malaya (1836–1840), Hasskarl in Java (1837–1845), Zollinger in Java (1845), while Reinwardt also had a large private herbarium. Blume also tried to monopolize the collections made by Teysmann, the curator of the Bogor Botanical Garden since 1830, but (in a letter of Dec. 1844) the latter convinced the Govern-

ment that this was undesirable. The estrangement led Teysmann to collaborate with Miquel. For the same reason Blume managed to be on non- or ill-speaking terms with the botanists mentioned above, especially with Junghuhn.

This was a great pity, and a drawback for the promotion of botanical research, especially with respect to Korthals. This excellent botanist had been a member of the 'Natuurkundige Commissie' from 1830 – 1837 in the Netherlands Indies and was one of the happy few who had returned to Holland in safety, with his very large and ample collections made in Java, Sumatra and S.E. Borneo. He continued his work for the 'Commissie' by writing up the results until his pension in 1843. Between 1837 – 1839 he wrote a number of meticulous revisions on various groups, but they were for unknown reasons only published much later (1846 – 1854). He was then also engaged in his magnificent work, 'Kruidkunde' (1840 – 1844), which was of equal standing with Blume's works. He paid great attention to microscopical features in taxonomic research, as initiated by R. Brown and followed by Griffith. His excellent work had the promise of a successful career in botany. However, even while he was composing these works, he withdrew his interest in botanical study, as appears from an unpublished diary of Zollinger in 1841. He became absorbed in philosophical considerations, preferring, as De Wit puts it, 'serene, impersonal reflection to the strife and disagreements clouding relations among the Dutch botanists of his day.' Working in the same institute as Blume probably contributed to his growing aversion to botanical science. Apparently Blume did nothing to gain his sympathy and collaboration and maybe felt him to be a rival. It is much to be deplored that he spent the rest of his life remote from the science he had furthered so considerably; in 1892 he died, 84 years old.

Another aspect of Blume's policy which irritated many fellow-botanists, and stemmed from his monopolistic view of the Malesian material in the Rijksherbarium, was the fact that he refused to lend material to colleagues and to distribute duplicate specimens, unless for his own needs or profit. On the strength of complaints, the Premier Thorbecke officially ordered new regulations for the Rijksherbarium in 1850, opening its treasures to scientific botanists, which Blume grudgingly and incompletely submitted to.

Though it is true that, according to his annual reports, Blume had ample correspondence and personal contacts with many foreign botanists, these contacts were probably mostly intended to seek information and obtain material, rather than to gain scientific collaboration.

The splendid isolation from Dutch botanical circles in which he surrounded himself and the Rijksherbarium, created a vacuum which was filled by the creative attempts of others, notably by Miquel, then professor at Amsterdam. Miquel published, in collaboration with others, 'Plantae Junghuhnianae' (1851 – 1856), soon followed by his 'Flora Indiae Batavae' (1855 – 1859), a four-volume, more or less critical, comprehensive enumeration of all species found in, recorded from, or expected to occur in the Malesian area which he more or less delimited as we do today. From general sources, Miquel, who never set foot in the tropics, managed to compose a short introduction to the plant-geography and vegetation. Though in critical style the work could not compete with contemporary Floras of tropical Asia by British botanists, his work meant a landmark in the progress of Malesian botany.

1862–1871

After Blume died (1862), he was replaced as director by Miquel in the same year. Though Miquel remained professor at Utrecht (since 1859), then connected with Leiden by one of the first railways in Holland, and hence could not spend all his time with the management of the Rijksherbarium, he inaugurated for it a new explosive, open, internationally cooperative era in its function as the focus of Malesian and Japanese botany.

After composing the 5th volume of his Flora, the 'Supplement' (1860–1861), a rather uncritical 'Flora of Sumatra', he set about a more thorough treatment of Indo-Malesian plants in his monumental folio work, 'Annales Musei Botanici Lugduno-Batavi' (4 vols, 1863–1870). It also incorporated the important 'Prolusio Florae Japonicae'; in addition he completed the 2nd volume of Siebold & Zuccarini's 'Flora Japonica' (1870) at the request of Von Siebold's widow. It is almost unbelievable that he is responsible for most of the text of the 'Annales'; only for a few groups, Algae, Conifers, Pteridophytes, and a few groups of flowering plants he called on a dozen specialists in Holland and abroad for their collaboration. These he could easily find as Miquel was a congenial person who had the sympathy of the whole botanical world. He had very many ties then, or he renewed them, with fellow-botanists abroad, amongst them, Kew, the Calcutta Botanic Gardens, F. von Mueller at Melbourne, and with Teysmann at Bogor. With the latter it became a rule that a duplicate of all Bogor collections was sent to Leiden, a custom prevailing until the present day. All private herbaria mentioned above which had been refused to Blume were now incorporated in the Rijksherbarium, either obtained by gift or purchase. Liberal exchange of duplicates was organized on a large scale. Thus he succeeded in his period of directorship, 1862–1871, in restoring the name and fame of the Rijksherbarium, and through his fantastic activity, in making a fundamental contribution to the progress of the floras of Malesia, Asia and Japan.

1871–1933

Miquel's rather untimely death in 1871 meant a serious setback, especially as the former Leiden professors, Reinwardt and De Vriese, both of whom had had great interest in the flora of the East, had died before him, in 1854 and 1862 respectively, without leaving promising pupils in taxonomy. He himself had managed only two such pupils at Utrecht. Actually he complained that he could not attract more graduate students, which he ascribed to their lack of interest in pure science. A major factor in this may have been his desperate devotion to his own research to which he gave priority, and it is his feverish scientific activity which led to his amazing productivity. Stafleu mentioned that Miquel seldom prepared his lectures, and that he worked until a few minutes before the appointed hour, to resume his writing again immediately after.

His two 'taxonomic' pupils at Utrecht were De Boer who wrote a thesis on Malesian conifers and became professor at Groningen University, and the only real, all-round taxonomist, Scheffer, who sailed to Java in November 1867, to take up the directorship of the Botanic Gardens at Bogor.

To overcome the lack of a prominent, suitable Dutch taxonomist as a successor to Miquel, it would have been realistic to attempt to attract one from abroad. But lack of interest by the authorities and lack of support from scientific circles resulted in the adding of the task to that of the professor of general botany, Suringar.

Miquel had continued the 'Annales' under a new title, 'Illustrations de la Flore de

l'Archipel Indien', of which two fascicles had appeared. Suringar published his MS of the third fascicle (1871), but otherwise he did not stimulate or work himself on Indo-Malesian botany.

This was the beginning of an era of six decades during which the Rijksherbarium was a mere museum, a period of reception rather than emission. Suringar's own interest was the Algae, floristic botany of the Netherlands, and specific delimitation in *Melocactus*. He was not interested in 'big botany' and did not feel inclined to launch or to participate in large taxonomic projects such as were being undertaken in the leading centres of taxonomy, in Berlin, Kew, Paris and Geneva.

This provincial outlook on the function of a large herbarium for taxonomy was perpetuated when, after his death in 1898, the directorship was held by the professor of plant physiology, Janse, during the directorship of Lotsy (1906 – 1909), and that of Goethart (1910 – 1932). All of them regarded the Herbarium as a mere depot of specimens, a museum, not a tool, a working collection to disentangle the riches of the plant kingdom, especially that of the tropics. Lotsy's interest was mainly focussed on evolution and origin of species through hybridisation and Goethart shared the latter's interest and launched (with Jongmans) a project on the cartography of the Netherlands flora. Among the staff were two exceptions, notably Boerlage (see below) and Hallier f.

Hans Hallier was the son of the German professor E. Hallier. He had received an excellent education by some famous tutors and acquired a great knowledge of anatomical and vegetative characters. He had joined, as botanist, a large expedition to West Borneo (1893 – 1894) and was there confronted with an exceptionally rich tropical flora, completely different from the European one with which he was acquainted. The challenge to master this and sort it out heralded his lifelong interest in taxonomic affinity at the higher levels, which meant phylogeny. Following the expedition he was appointed in the Bogor Herbarium from 1893 to 1895 to participate in the 'Flore de Buitenzorg' project and to compose the volume on the flowering plants. For this purpose he collected in West Java, but the attempt never went beyond the making of MS lists of species which should be entered. A difficulty thereby was that the area to be covered by this Flora was never precisely defined other than by the vague notion that it went from coastal Priok to the summits of Mts Salak and Gedeh. To judge from his publications he spent this period more on working on his Borneo collections which, of course, were scientifically of far more interest than the well-known ones of the 'Flore de Buitenzorg'. For reasons unknown he left Bogor to accept a post at Hamburg, returning once to the Malesian scene during a world trip in 1903 – 1904 when he collected in the Philippines and Micronesia.

By his coming to Leiden in 1908, as a scientific assistant, the Rijksherbarium gained a prime taxonomist with great vision and knowledge, and an unparalleled form-knowledge, not only of Old World families and genera. His ideals were to frame a new phylogenetic plant system. For this purpose he dug into all sorts of families and genera to trace their affinities, reviving amongst methodologies, e.g., Greshoff's ideas, developed at Bogor, on the use of phytochemistry for taxonomical use: chemotaxonomy. His phylogenetical conclusions often differed from those of the Engler centre at Berlin, which sometimes led to acid controversy. His uncanny insight has often later proved to be correct, and not uncommonly anticipated opinions which are nowadays currently accepted. However, he frequently changed or recalled opinions on the speculative structure of the 'genealogical tree', while his

papers are often very difficult to consult. This frequently frustrated general recognition of his work at the time. At Leiden he rather worked in isolation as a 'Privatgelehrter'. His main works, on the elaboration of the large Elbert collections of Java and the Lesser Sunda Is., and Winkler's and his own in Borneo, are extremely important for the botany of Asia and Malesia, as they were interspersed by partial revisions and the straightening out of affinities and identification of many neglected generic concepts. As a person he seems to have been rather difficult and to possess fanatical idiosyncrasies; he refused, for example, permanent appointment and had no pension rights when he left in 1922. He then pursued linguistic studies, on the phylogeny of languages and derivation and change of words, a hobby earlier acquired by comparing vernacular names of Indonesian plants.

Although the period 1871–1933 was, apart from Hallier's and Boerlage's contributions to Malesian taxonomy, not a fertile one by way of contributions to research, it should be mentioned that in this period there were important acquisitions to the collections, amongst others from the Philippines and Malaya, and the herbaria of Hasskarl, Reinwardt, Forbes, Elbert, Hallier f., etc. It should also be mentioned that the availability of the specimens became established. Until 1909 they were shelved in largely unmounted condition in portfolios and many collections were kept separate. They were unified in one file and arranged alphabetically in the families especially thanks to Goethart who must take large merit for this ordering and administration, setting down the rules (rather perfectionistic) for herbarium techniques which prevail to the present day. Goethart also established a medium for publication, the 'Mededeelingen van 's Rijks Herbarium' (n. 1–70, 1910–1933), of importance for Asian botany as it contains most of Hallier's works. The growth and ordering of the Rijksherbarium during the period had made it, as Merrill emphasized in 1931, from his experience: 'an outstandingly important collection of historical botanical material' and apart from this he claimed that 'no botanical institution of the world contains such a mass of Malaysian material as that preserved at Leyden'. This is still true.

During the 19th century progress in Malesian botany by contributions of the Rijksherbarium hinged on lamentably few taxonomists, properly only on those by Blume, Korthals and Miquel. The only Dutch botanist who could have changed the picture and perpetuated Miquel's work was Scheffer, who went to Bogor in 1867 as Director of the Gardens and died early (1880). His few taxonomical publications were promising and gave testimony of his capacity in this field.

Shortly before, Beccari had launched a most important work, 'Malesia' (3 vols, 1877–1890) which, however inconsistently, more or less attempted to cover the Malesian flora; he revised several families in this work. How incompletely known the flora was at that time is illustrated by his treatment of *Icacinaceae*, of which he had 14 genera and 36 species, against Sleumer in 1971 with 23 genera and 101 species; and of *Dichapetalum* of which he had 3 species, against 15 given by Leenhouts in 1957.

After Treub succeeded Scheffer as Director of the Botanical Garden at Bogor in 1880, Burck was attracted to the work of revising some 'useful' families, but he did not go beyond *Dipterocarpaceae* and *Sapotaceae*. Treub was fully aware of the still primitive state of exploration and knowledge of the Malesian flora. The perspective of a 2nd edition of 'Flora Indiae Batavae' he deemed premature and out of the question. Therefore, he was very cautious in launching projects. To start with an important one, he could engage in the first place Boerlage who had been a custodian

of the Rijksherbarium since 1881 and who had made an exploration visit to Java in 1888. Boerlage agreed to compile a sort of precursor which took shape in his 'Handleiding' (3 vols, 1890 – 1900, incomplete) which he wrote at Leiden. It is an important, more or less critical 'Genera Plantarum Malayensium', largely adapted from Bentham & Hooker's 'Genera Plantarum'. It was intended as a tool enabling people in the Dutch East Indies to familiarize themselves with plant forms. Though lured to stay at Leiden by an assistant-directorship of the Rijksherbarium and a lectorate, Boerlage yielded to Treub's plea to rehabilitate plant taxonomy at Bogor, which had been dormant since the small efforts by Scheffer and Burck.

The departure of Boerlage, the eminent and only taxonomist of the Rijksherbarium, in 1896, to Bogor, meant a heavy loss to Leiden. More unfortunately, Boerlage, in search of 'Rumphian' plants in the Moluccas, met there an untimely death, in 1900, through tropical illness.

In passing, I should mention here a frustrated effort towards a 'Flora Malesiana' launched by Warburg, who had made, during 1885 – 1889, huge collections in Malesia. In Berlin, he had in addition many other Malesian herbaria at his disposal, e.g. those made by Riedel, Meyer and the Sarasins in Celebes, Meyen, Jagor and Haenke in the Philippines, Beccari and Forbes in various parts of Malesia, and material of the Kaiser Wilhelmsland expeditions. He started a great folio work, 'Monsunia', of which only one volume appeared in 1900, containing Cryptogams and Gymnosperms. The work was not a proper 'Flora', but an enumeration of records and descriptions of new species, without keys and without a definite, circumscribed area, with records from Korea, Japan, China, etc.

Meanwhile, by Treub's initiative, the torch of creative taxonomy of the Malesian flora was, after a lapse of some 70 years, switched back from Leiden to Bogor, a rapidly built up, thriving centre which regained its place as the centre of scientific botany of the colony. The escalated activity at Bogor led to the resumption or establishment of new media for publication, the 'Annales', 'Mededeelingen', 'Bulletin', 'Icones Bogorienses', while two fairly large but restricted taxonomic projects were undertaken, a 'Flore de Buitenzorg' and the 'Bijdragen tot de kennis der Boomsoorten van Java'. Besides Boerlage, some capable botanists were engaged (Valeton, Smith and Backer, the latter two self-made). Exploration was encouraged, provisionally only in Java, but also in Central Sumatra and North Celebes by Koorders, later extended through the forestry service to other islands.

During these years the ties between the Bogor activity and the Rijksherbarium were almost non-existent, apart from the sending of duplicate specimens to Leiden. A most important enterprise, evaluating the results of several New Guinea expeditions, embodied in the work 'Nova Guinea', was entrusted to Pulle at Utrecht, not to Hallier of the Rijksherbarium in Leiden. Pulle also revived tropical taxonomy in Holland and trained students in this field.

In the early twenties Herbarium Bogoriense, urged by the Forestry Department and Heyne's 'Museum for Economic Products', started the production of a series of family monographs, 'Contributions à l'étude de la Flore des Indes Néerlandaises' (no. 1 – 34, 1923 – 1937), and its staff was for this purpose fortified by a team of young taxonomists (Lam, Van Slooten, Danser, later myself) mostly educated by Pulle in Utrecht. Aware of insufficient exploration, this series had no pretensions beyond its being precursory to a comprehensive Flora, in a similar way that the 'Materials' of King & Gamble had been for Malaya; hence the cautious title of the series.

1933-hodie

With the appointment of Lam to Leiden, in 1933, as director, the Rijksherbarium resumed creative taxonomical research of the Malesian and Asian floras. By lecturing on taxonomy he activated students to participate in research on Malesian plants, thus giving a proper goal to his 'tropical section', small as it was. He replaced the 'Mededeelingen' with the journal 'Blumea' which was soon to become an indispensable medium for publication in Malesian botany. He promoted also collaboration with Bogor and published important revisions of Danser in Groningen, who had also activated students in the study of the Malesian flora. Thus, in the early thirties, progress in Malesian botany looked hopeful.

However, the world slump soon cast its shadows over this perspective. Especially the Bogor centre suffered severely, whereby its creative output necessarily fell to a low ebb: from 1935 – 1940 its staff for flowering plants consisted only of myself and Van Slooten. Lam and Danser also could not increase their staff.

In spite of these conditions, the idea of a 'Flora Malesiana' as the main goal, to integrate all previous efforts since Blume's time, lingered in these circles.

I started preparations for it in earnest about 1929. Two immediate tools seemed necessary anyway, viz. (i) a complete bibliographic file arranged by families, and (ii) a complete inventory of existing collections in the world's herbaria. Furthermore, I had to familiarize myself with the flora and plant-geography of Malesia in order to find a natural, scientific basis for the geographical delimitation of the project (1948). Finally I had to solve a most important practical point: the style and design of the Flora (1954). The aspects to cover in a scientific compromise were: critical taxonomy, comprehensiveness, source for ecology, plant uses, vernacular names, etc. to be a useful, botanical, cyclopedic tool for academic users in all fields of applied botany. Conciseness was most desirable in view of the size, estimated at some 25,000 species of flowering plants.

On the other hand completeness in evaluation of all names used in the past would be a conditio sine qua non, as such a large regional Flora would only be produced once. Expediency demanded that family revisions should be published when they became available, a procedure already in use in the 'Flore de Madagascar', and nowadays adopted in all large tropical Floras. As a matter of fact, in such Floras a 'system' has no proper function. As to size, family revisions would range from one to several hundred pages; it was therefore preferable to have them bound in volumes; a cumulative index in each volume giving access to all previous revisions. Some general chapters would provide information for users as well as collaborators, viz. on matters of variability, vegetation, plant-geography, dates of publication, literature, while the first volume would contain a comprehensive account of collections, collectors and their itineraries. This was the final compromise which has proved satisfactory till the present day.

Such a large, critical regional Flora would also have two international aspects. In the first place it would be of great importance for the botany of neighbouring countries, especially continental Southeast Asia with which it has much in common. Secondly, it would be of importance for 'big taxonomy' as it would, in certain families, represent a major part of the whole family, e.g. in *Dipterocarpaceae*, *Nepenthes*, etc. This facet had become increasingly important by virtue of the incompleteness of the 'Genera Plantarum' in the delayed 2nd edition of the 'Pflanzenfamilien'. For certain families, a reconsideration of their basic taxonomy

was, and still is, sometimes necessary, e.g. in *Loranthaceae*, *Sapotaceae*, *Sapindaceae*, *Dipterocarpaceae*, *etc.*

It was a blessing that in 1940, with the great rehabilitation of the Bogor Botanical Gardens through the Leiden professor, Baas Becking, the project 'Flora Malesiana' was approved by the Government. The idea was that, in view of its magnitude, it should be composed under international collaboration (1947), but emanate from Bogor with the close cooperation of Danser in Groningen as editor, and Lam of the Rijksherbarium in Leiden.

The international collaboration appeared especially essential in view of the fact that in the original plan 'Flora Malesiana' was divided into five series: I. Spermatophytes, II. Pteridophytes, III. Bryophytes, IV. Fungi and Lichenes, V. Algae. Discussions with mycologists and algologists soon made it clear that these series could not be well executed. Later this appeared also undesirable for the Bryophytes. For the Pteridophytes, however, it did appear to be feasible, and this series II is slowly blossoming under the editorship of Prof. R. E. Holttum (Kew), who is up till the present also its chief author.

World War II prevented its immediate realisation and unfortunately the collaboration of the eminent Danser came to nothing through his untimely death in 1943. But the postwar Dutch East Indian Government remained loyal to the prewar agreement and permitted me to start publication and visit herbaria in Australia, Europe and America to seek their support. In 1950 the Indonesian Government loyally lumped together all financial and administrative matter for the production of the Flora in a 'Foundation Flora Malesiana' (21 Oct. 1950, Bogor).

The task came to rest on three pillars, viz. (i) Herbarium Bogoriense, (ii) Flora Malesiana Foundation staff together with that of the Rijksherbarium at Leiden, (iii) foreign contributors. Together this would ensure a sufficiently large circle of international collaborators.

By contract with the Foundation the publishers would provide 300 copies out of the 1000 printed ones, at cost price and intended for official use only to Bibliotheca Bogoriensis at Bogor, thus ensuring availability to future generations of scientists in Indonesia.

Because of the excentric situation of Bogor, far from the big standard herbaria and libraries of Europe, it was clear that the redaction should be centred in Leiden, where the guest-team enjoyed the facilities of the Rijksherbarium under the benign eye of Lam.

During the war years Lam had himself undertaken a large botanical project, the publication and finishing by his staff of the MS, 'Flora of Java', Backer's life work. In view of the war risks this was initially published in Dutch in a mimeographed emergency issue of 25 copies. A later translation into English and a nomenclatural overhaul by Backer's main collaborator, Bakhuizen van den Brink Jr, made the printed English edition (3 vols, 1963 – 1968) a most important critical contribution to Asian botany by the Rijksherbarium. In fact it is the most accurate, complete and nomenclaturally up-to-date tropical island flora of similar size of the century, only recently equalled by Adam's 'Flora of Jamaica'. It contains descriptions of over 2000 genera and some 6100 species, among which over 4000 are native to Java. A flaw is that it does not account for all names recorded or described from Java in the synonymy.

It is true that such local tropical Floras are in a way premature; they should follow and be based on a regional Flora as I have earlier advocated (1949). From the

standpoint of 'big systematics' they are inefficient and a waste of time. In Malesia there was no regional Flora, and it should also be admitted that a good local Flora is useful and encouraging to local people. However, but for the presence of Backer's MS, I do not believe that Lam would have initiated a Flora of Java.

Another enterprise of Lam was the contribution of his staff members to the journal 'Nova Guinea' which was issued in octavo format in postwar times (1955–1966).

To return to Foundation Flora Malesiana, the team at Leiden, consisting of four botanists, an artist and a typist worked in marvellous harmony in producing the first volumes.

The Foundation Flora Malesiana team at Leiden was, of course, very important for the Rijksherbarium and formed a substantial complement to its tropical section, attracting collections and collaborators, extending the ties which it already had abroad.

As the Rijksherbarium, since 1879, had been given an official association with the University of Leiden, there was also an increase in the number of post-graduate students and promovendi attracted by the project 'Flora Malesiana'.

Unfortunately after seven years, its existence was threatened, with the abrupt cessation of funding on Dec. 31st, 1957, due to political difficulties. All attempts to approach large world foundations proved futile. However, fortunately, in Oct. 1958, a settlement was made, through the intermediary of the Netherlands Organization for the Advancement of Pure Research (Z.W.O.) by which the University of Leiden could adopt, in three years, the whole Flora Malesiana team, which could then go on with its task as official staff of the Rijksherbarium, the situation as it is today. Lam had eagerly promoted the merging, whereby his tropical section was considerably enlarged and gained a most responsible, clearly defined purpose which would occupy it for many years to come, possibly more years than he had anticipated.

In 1961, when the merging of staff of the Foundation Flora Malesiana with that of the tropical section had been completed, the section consisted of Bakhuizen van den Brink, Ding Hou, Jacobs, Kalkman, Kern, Leenhouts, van Royen and Sleumer. Afterwards others filled new posts or vacancies: van Balgooy, van Beusekom, Geesink, van der Meijden, Nooteboom, Veldkamp, Vink, de Vogel, and de Wilde. Hoogland had belonged to the staff of Flora Malesiana till 1952 and de Wit till 1953. Furthermore, there were some honorary collaborators of Flora Malesiana, supported by small grants: Backer, Jansen, Monod de Froideville, or working in a honorary position: van Slooten. There were also a fair number of temporary collaborators, often students or promovendi: Bentvelzen, van Borssum Waalkes, Caspers, den Hartog, van der Linden, Moeliono, Payens, Stemmerik, and Tuyn. Finally, Flora Malesiana enjoyed the collaboration of foreign contributors which appears from the pages of the Flora; the recent increase in their number is gratifying and most welcome.

The intensified work on Flora Malesiana led the Rijksherbarium to instigate important expeditions to under-explored areas of Malesia, notably New Guinea and its mountain flora. Also it has proved very remunerative for monographers to collect for themselves, to give them in situ field knowledge about their groups and a deepened insight into variability and ecology.

These collections are rapidly pre-identified and duplicates dispersed, from which other herbaria also gain profit.

Many other collections made in Malesia are sent to the Rijksherbarium by forest services, universities, pharmaceutical colleges, and by private explorers engaged in palynological, cytological, ethnographical and linguistical studies, attracted as they are by the prospect of having their collections pre-identified, at least to genus and, as far as possible, to species within a reasonable time. This service enriched the collections in no mean degree.

The definite home of Foundation Flora Malesiana having been established at Leiden enriched the Rijksherbarium also with some important publication media, Besides 'Flora Malesiana' itself, with 'Flora Malesiana Bulletin' (no. 1 – 31, 1947-hodie), 'Identification Lists of Malesian Specimens' (no. 1 – 56, 1958-hodie), and the 'Miscellaneous Records' (no. 1 – 4, 1959-hodie), while 'Pacific Plant Areas' (vols 1 – 3, 1963-hodie) also belong in this category.

The annual 'Bulletin' is an extensive newsletter on personalia, work in progress or planned, publication dates, conservation, and a full bibliography on taxonomical and plant-geographical work in the whole of Indo-Australia and the Pacific. Through the full indexes it has become an indispensable medium for information.

'Identification Lists' are a supplement to the revisions in Flora Malesiana and expose the identity of the material on which they were based.

'Miscellaneous Records' are a few mimeographed issues, preliminary to later publications and are intended for internal use.

'Pacific Plant Areas' was instigated, following suggestions by Lam, as a publication serving to illustrate plant-geography of the Pacific Is, including Malesia, by providing complete, accurate range maps, and informative text to each of these. The volumes also contain a bibliography to all published maps of Pacific and Malesian plant taxa.

In addition to these media the Rijksherbarium has recently started to continue the Supplements of Blumea as a separate serial, 'Leiden Botanical Series', intended for monographs which are too voluminous for Blumea. The series was inaugurated by a revision of the Old World species of *Symplocos* (1975), of great importance for Asian botany.

The precursory papers which, in part, belong to the revised families and (in greater part) to other studies of Malesian genera by staff members and collaborators (c. 750 in the period 1947 – 1977) are of great use to the progress of Asian botany, because frequently revisions involve the study of extra-Malesian species, mostly Asian & Pacific, in a few cases Australian plant species. Annually reprints are freely distributed to institutes in the Indo-Australian part of the Old World.

This great activity in research and publication by the Rijksherbarium on Flora Malesiana has of course a great impact on the botany, pure and applied, of the bordering areas of Asia and even Australia. In the regional Floras of Indochina, 'Flore du Cambodge, du Laos et du Vietnam' and the 'Flora of Thailand', and the local 'Flora of Ceylon' and 'Tree Flora of Malaya', abundant use is made of Flora Malesiana. For some groups, staff members of the Rijksherbarium were asked to collaborate for their speciality. Especially for the Flora of Thailand, staff members have been deeply involved in exploration, in collaboration with the Forest Herbarium of Bangkok.

We feel happy that in and around the Malesian area there is such a warm and close collaboration between botanists and their institutions, both pure and applied. It is a well-ploughed field promising rich harvest for years to come.

Though the Rijksherbarium is far away from the actual area under study, it is

proud to have taken a prominent part for one and a half centuries, in the preparation and execution of the common, international effort of botanical exploration and publication.

I am not infrequently asked three questions about Flora Malesiana, viz. (i) how many species are estimated to occur in it, (ii) to what extent will it be complete when finished, and (iii) when will the project approximately be finished. It may be of interest to make some estimates from my experience.

(i) The estimate should, of course, refer to the number of species after revision, not to the number of taxa actually described or recorded in the past. The experience has been that the work largely consists of reduction through integration, not so much of describing novelties. This reduction varies with the families, ranging from 20 to 60%. There is always a sprinkling of new genera and new species. This is also very variable, as some families have had great attention in the past, while others remained almost untouched for a century. A few examples may illustrate the point: *Ericaceae* now count 737 species among which 236 were newly proposed; in *Fagaceae* these numbers were 171 and 54; in *Loranthaceae*, 171 and 43; in *Cyperaceae* 327 and 24; in *Symplocos* 57 and 15; in *Bignoniaceae* 31 and 2; in *Leea* 25 and 1; and *Utricularia* 22 and 1. This variation defeats the possibility of attaining a standard measure of reduction and cannot lead to a reasonable estimate.

There is, however, another statistical method to reach a tangible estimate. It has appeared that there is in large regional floras, and for that matter, also in the world's flora, a ratio between the number of genera and that of species of Angiosperms, usually assumed to be an average of some 8 species per genus, for example in 'Flora Europaea'. This is approximately true for the five published volumes of Flora Malesiana: 477 genera and 3530 species, average c. $7^1/_2$. For the medium and large families which mostly contain also the largest genera it came to c. 1:10. Whereas the families still to be revised are generally large the average will probably be nearer to 10 than to 8. As the total number of genera is about 2300, the total number of species will be c. 23,000, which is close to my estimate of 30 years ago of 25,000.

(ii) From the 'Addenda et Emendanda' at the end of each volume it has already appeared that we cannot cherish the hope that Flora Malesiana will be complete. This holds true, of course, for all Floras; even to that of the Netherlands a few records of native species were added in recent years. What concerns us here is a matter of proportion.

The tropical rainforest offers in this respect singular features requiring intensive exploration. The enormously complicated flora of these endless forests, coupled with the fact that many indigenous plants have an unusually low population density and seem to be sometimes extremely scarce, makes completeness out of the question, notwithstanding the c. $1^1/_2$ million collections which have already been made. Almost every year some unknown or new genus is recorded which was not represented in earlier collections. The same is even more the case for species. So, exploration must go on by all means; especial desiderata are in Celebes and in the Moluccas.

However, on the whole the experience has been that the bulk of the species are present in the herbaria.

In this respect it is fortunate that Flora Malesiana started rather late in comparison with other regional Floras, such as those of Brazil, continental S.E. Asia, tropical and South Africa, and Australia. For this reason Flora Malesiana will be probably more complete.

Before finishing my comment on this second question, one thing must be stated, especially for the information of taxonomists in the northern temperate and subtropical regions: this is, the impossibility of making a tropical Flora as complete and detailed as Floras of their own countries. In the first place collections will be less in number because of the complex structure of the tropical vegetation, its huge amount of species, and the height of its many trees and lianas, requiring the help of tree-climbers, or else the cutting down of large trees; and, furthermore, the often difficult accessibility of the terrain requiring equipment for large expeditions.

Secondly, the absence of seasons in the rain-forest makes the collecting largely a matter of chance encounter. Taxonomists in the field, in search for certain species of the family they are working on, especially when hoping to study the variability of populations, should be well aware of this difficulty. The more so when taking into consideration the usually very low population density of most species in the tropical rain-forest, as correctly stressed by Fedorov.

It is agreed that hunting for special groups will help specialists to observe their plants in the living state, but the bulk of their species, especially trees and lianas, will perforce have to be studied in the Herbarium.

Even when tropical Floras are worked out and composed in tropical centres – which is in my opinion for many technical reasons not advisable – the above-mentioned difficulties remain.

Tropical botanical gardens may help along the study of tropical plants if they are well stocked with indigenous species, far more so than botanical gardens in temperate regions.

Whereas temperate species are mostly abundantly represented in herbaria, many tropical species are poorly represented, apart from weeds and plants from secondary vegetation.

Tropical collections are often incomplete in so far as they are but seldom with both flowers and fruit, and besides mostly with insufficient herbarium specimens to cover the complete geographical distribution of a species. Especially the sterile specimens form a problem: a considerable percentage of the forest specimens are collected during forest surveys. In the latter case forest services often made collections of all trees, irrespective whether they were in flower or fruit or sterile.

Botanical collectors should be aware that the times of the 'grab as grab can'-collecting are over. They should only take specimens in mature state, either in flower or in fruit, preferably in both, which certainly will require extra efforts in dioecious plants. Besides, collecting activities should be lifted to a higher scientific plane by giving careful attention to the making of ample field notes, as I have argued some years ago (1977).

The scarcity of complete material and of ample field notes will hamper the work of the plant taxonomist who deals with tropical genera; he can but do his best. The result is that the use of a tropical regional Flora often falls short of expectation when trying to identify incoming specimens. Without sufficient fertile material this is an impossibility. There is admittedly no essential difference between elaborating a tropical Flora or one of the temperate or subtropical regions, but just the same the composition of a tropical research Flora is of a different magnitude encountering more handicaps.

A serious handicap in composing tropical Floras, not encountered in the elaboration of northern temperate Floras, is the absence of reliable literature and precursory studies published by predecessors, as a sort of basis to start with. For

Flora Malesiana this basis is largely absent. Almost all revisions have to start from scratch in digesting a chaotic literature, the synthesis of which frequently concerns the delimitation of genera, and sometimes even of families and their subdivision.

(iii) The last question: to give an estimate when it will be completed is hazardous to attempt, as this is tied up with the unknown future development of pure science in the world.

Even if the question is framed in a more restrictive sense, viz. by asking for an estimate of how much time and labour is involved, the answer is still hard to give. Long ago I tried to calculate this estimate in a discussion with Danser. We concluded that, if he was exempt from other obligations, an ambitious taxonomist could possibly achieve the revision of an average of 80 accepted species a year, so that the whole work would then involve 300 man/years of work.

This has proved far too optimistic, even taking into consideration that we had in mind then a far more simple style and more concise work than we actually now envisage. Still, superficially, it may appear rather easy to achieve an average of the revision of one species every four days, but in practice this appears, with a single exception, to be a severe over-estimate. By comparison with similar work, a century ago, revisions are, of course, far more time-consuming, because of the enormous increase in literature to be digested, the number of names to be evaluated, the very large amount of material to be administered, and the number of types to be unearthed. The average will thus be closer to 15–20.

I do not believe that the speed of progress depends on the group and that there are easy and difficult groups involving great differences in time required to be spent on them. Difficult aspects may vary but they are always there, either in generic of specific delimitation of taxa, due to variability of taxa, complication through bulky material or extensive literature and synonymy, etc. On the average all families will appear to be approximately equally time-consuming.

Above all, production will depend on personal qualities and conditions. It is true that nowadays hardly any taxonomist can devote all his time to research, except some strong-willed, ambitious persons who resist the loss of time in diffuse, marginal tasks or unnecessary minutiae, and give instead priority to research behind the binoculars in preference to that behind the typewriter. But, indeed, most cannot escape from part-time educational tasks.

Then again there is great variability in production, in that some botanists are able to reach conclusions earlier than others and work more concisely – which is not to say that the first category performs less accurate work. It is partly a matter of experience, partly also of setting aims and claims. Between accuracy and hyper-conscientiousness, there is a wide range of claims, but the time involved in the same sequence is one with distinctly diminishing returns. One has to be practical and make a reasonable choice in degree of accuracy to produce useful work.

Experience has shown also that there are, and have been, relatively, only exceptionally few taxonomists who possess a Benthamian or Hookerian tenacity and balance and are satisfied with and take pride in a life-long production of monographic works.

I cannot refrain from touching on a sociological aspect involved in the future. Many decades ago research positions were reserved for the ambitious small élite. Nowadays, it is obvious that researchers are no longer an élite group, but are just supposed to do a job of eight hours a day. There is a distinct trend in society not to put such a high value on disinterested scientific work as before, a tendency which

contributes to the suppression of ambition. I cannot share the opinion that scientific ambition is equal to the rat-race. I have been brought up under the ideal that disinterested pure science is a noble part of our civilisation in order to understand nature. This opinion may now appear to many as conservative and outmoded.

But this trend is a fact and must not be underestimated as it involves the interest of future generations in taxonomy, which is a distinctly disinterested branch of the natural sciences. The trend is probably in part due to uneasy feelings that whereas mankind expected wonders of science, its achievements have become, in many fields, a disappointment, and in certain aspects are seen as a menace. Not only the man in the street, but also university people now tend to consider whether it should not be so that science must be focussed on welfare, economy, environment and social problems – in short, it should be focussed on what is useful to mankind. This philosophy pervades the education of youngsters from the kindergarten till their doctor's degree and must influence their later thinking on achievement. Therefore, the unravelling of the secrets of organic evolution by the taxonomist may, in the future, not hold the same fascinating attraction it had before, and contributions to pure science slow down accordingly.

To conclude, the estimate of what lies before us to be done to complete the Flora Malesiana, in the face of the unknown future, is at least half a century of work, present conditions remaining the same.

What has been achieved so far in printing or finished MSS, is only one fifth of the total. If other, rather critical precursory revisions and monographs of families or genera listed in the tabulation below are added, the estimate is that about one third of the work has been done.

Let me finish this sketch by answering a fourth question, which emerges from the comment given on the third one.

I should emphasize then, for the uninitiated, that critical plant taxonomy of the tropical flora is extremely important to mankind, especially to its future. Man simply must know his environment holding his essential resources. These resources are three-fold, viz. the substratum (rocks, water and soil), the animal kingdom, and the plants from the unicellular to the highly organized. The latter especially, are of essential importance, in that they form the base of any food-chain in the living world. This makes the study of plants a special asset in man's welfare.

But knowledge of plants and their qualities is only possible by means of their identity, their name, which is the key to all published knowledge about them. And besides the name, it must also be clarified how they can be distinguished from each other.

A scientific survey or inventory of the plant kingdom is, therefore, no cerebral whim of the mind, it is the framing of an indispensable tool, for both pure botany, and for the very many fields of applied botany.

No data on pharmaceutical or medicinal properties, and phytochemistry can be used or checked without a proper name of the plant concerned. The same holds true for all plants used in silviculture, horticulture, agriculture, fruit-culture, fodder, weeds, noxious and poisonous plants, food plants, condiments, and all species used in plant industry, including timber and forest products (gums, oils, resins, fibres, latex, rattans, etc.).

Accurate names of plants must also be available to plant ecologists, to those engaged in the planning of land-use, for plant protection, and for nature conservation. Correct identity of pollen is most useful for geological and archaeological

stratigraphy, and so is systematic wood-anatomy. Recently it has even been found that certain plants accumulate metals in their tissue and can be used as tracers for metals in the bedrock and they may be useful for mining prospectors.

Whereas the tropics represent the largest variety of plants in the world, and man in the tropics is largely dependent on its flora, it is clear that a critical inventory is badly needed, as a basic tool in very many respects. The Rijksherbarium is engaged in framing this tool in the Flora Malesiana, which will prove to be indispensable for the Third World in the Asiatic palaeotropics.

It is our sincere hope that its importance will be well realized, both by the Governments and University authorities concerned and by the young botanists on whose sympathy, enthusiasm, devotion, and capacities it will depend, to bring it, at some future time, to a successful end. They should be aware that by their scientific enterprise they are doing something useful for mankind, whatever plants they work on.

Experience has taught that the usefulness of plants cannot be foretold; also, the importance of usefulness changes with the development of society and its techniques. Several plants may appear to have no clear useful qualities at present, but they may well prove to be useful in the future.

Let it suffice to say that they all belong to the natural resources, which, in the tropics, represent a bottomless reservoir, for the large part yet untapped and still to be discovered.

STATE OF THE FLORA MALESIANA UNION

In the published volumes 4–8 (1948–1978) 123 families were revised in ser. I, Spermatophytes. It appears worthwhile to tabulate those revisions which remain to be done. It seemed instructive to arrange them roughly into a number of categories, in proportion to the amount of precursory work devoted to them. For simplicity I have left out a number of small to very small families which do not contain more than 10–15 species. Those which are supposed to count more than 200 species are marked by an asterisk*, those with over 500 species with two asterisks**.

I. Families under actual revision or almost finished

(a) MSS ready or far-advanced

Araliaceae I
Cunoniaceae
Cyperaceae II (Caricoideae)
*Dipterocarpaceae
Liliaceae I
**Moraceae
Rosaceae I

(b) In the process of revision

(i) In the Rijksherbarium, Leiden

Aristolochiaceae
*Gramineae
Magnoliaceae
*Myristicaceae
Polygalaceae
**Rubiaceae
Sabiaceae
*Sapindaceae
Winteraceae

(ii) By foreign collaborators[1])

*Apocynaceae
*Araliaceae II
(Schefflera)
Begoniaceae
Casuarinaceae
Coniferae
Elaeocarpaceae I
(Elaeocarpus)
Guttiferae I
(Calophyllum)
*Lauraceae
Melastomataceae I
(Memecylon)
Menispermaceae
Monimiaceae
Oleaceae
Opiliaceae
**Palmae
*Pandanaceae
Potamogetonaceae
Rhamnaceae
Rutaceae
Theaceae

II. Families of which almost final or important revisions were published formerly

Ebenaceae
Hernandiaceae
Loranthaceae
Malvaceae
Nepenthaceae
Polygonaceae
Ranunculaceae
*Sapotaceae

III. Families which are not yet under revision

(a) Of which rather substantial precursory papers are published of certain genera or groups of genera

**Acanthaceae
Bombacaceae
Boraginaceae
*Caesalpiniaceae
*Compositae
Eriocaulaceae
**Euphorbiaceae
Lecythidaceae
*Melastomataceae II
Rosaceae II
(Chrysobalanoideae)
Santalaceae
Scrophulariaceae
Sterculiaceae
Tiliaceae
Verbenaceae

(b) Families on which no, or only small or occasional or local previous revisional work has been published

*Annonaceae
Aquifoliaceae
*Araceae
*Asclepiadaceae
Balsaminaceae
Cucurbitaceae
Elaeocarpaceae II
Gentianaceae
*Gesneriaceae
Guttiferae II
Lythraceae
Marantaceae
*Meliaceae
Mimosaceae
Musaceae
*Myrsinaceae
**Myrtaceae
Olacaceae
**Orchidaceae
*Papilionaceae
Piperaceae
Saxifragaceae
Solanaceae
*Urticaceae
Vitaceae
*Zingiberaceae

[1]) Since this manuscript was written an agreement was reached with four collaborators to revise Annonaceae, Bombacaceae, Boraginaceae, and Olacaceae, listed here under III.

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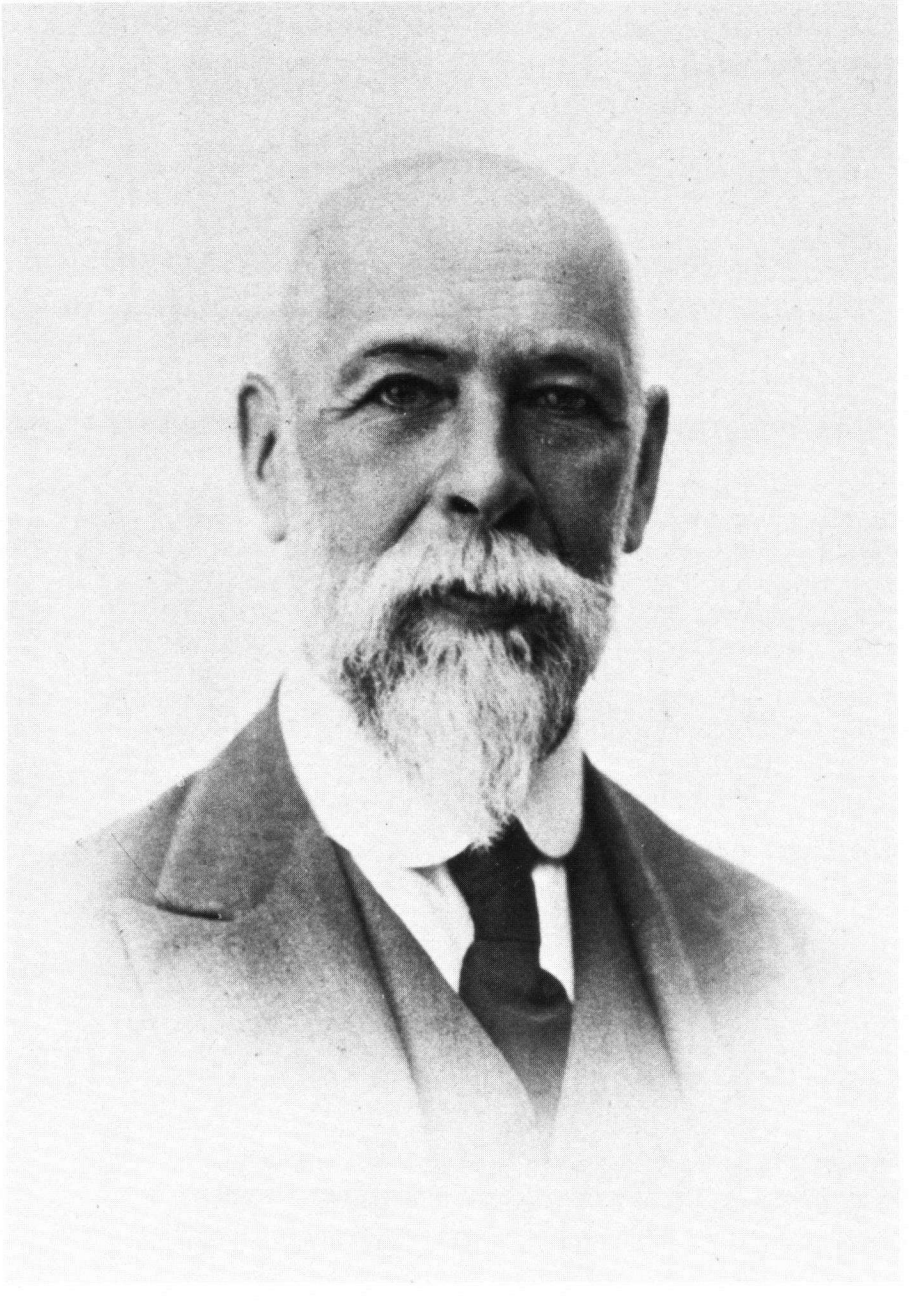

J. W. C. Goethart (1866 – 1938)
Conservator 1897 – 1910, director 1910 – 1932
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