

SHORT HISTORY OF THE PHYTOGRAPHY OF MALAYSIAN VASCULAR PLANTS

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INTRODUCTORY REMARKS

For various reasons the space occupied by pre-Linnean Malaysian phytography in this concise history seems too large and out of proportion in comparison to the survey of post-Linnean work. Modern plant description, though based on, and derived from, ancient beginnings and traditions, maintains but slender contacts with plant sciences earlier than the 18th century and it might claim to be allotted by far the larger space on account of its superior results, its greatly increased efficiency, its consciousness of limitations and capabilities, its output, and its clearness of purpose.

There exists, however, during the last decade, an increasing interest in the nearly forgotten botany of centuries long past, not only because of a certain taste for the quaint and attractive flavour of scientific efforts from minds so remote from our own, but also on account of a growing insight into the hidden springs of modern thought and method, which flow deeply, emerge unexpectedly, and appear to rise from distant roots. There is also, in connexion with this, the absorbing spectacle of discovery and of growth *i.e.* the development of a field of human culture that has bound devoted and excellent personalities in its service from the first glimmerings of our civilization.

Phytography is defined here as the art and science of describing plants by words or images with an intent to depict their appearance accurately, which is usually connected with the aim of furnishing a means of distinguishing one kind from another.

In LINNAEUS's time, phytography has found its manner of expression; its main standards and its technique, broadly speaking, were set. Later authors might conceive new or better views or adopt improved methods but the principles remained unchanged. The history of pre-Linnean phytography, therefore, deserves the scrutiny and study it is now receiving; it is an essential step towards an understanding of the rise of more recent descriptive botany.

It has also been necessary to reduce the chaos of literature connected with 19th and 20th century Malaysian phytography to proportions which allowed a survey of the course of events; any summary of the publications on the subject with a view to completeness otherwise than in a vast bibliography of titles, threatens to swamp the reader

with an endless sea of names. A severe selection has been unavoidable, and much deserving work has had to remain unmentioned, simply because admission of more references would have outgrown the adopted limits. May the choice, now made, not be too often unjust.

As regards the last decades, a practical reason for reducing the discussion of post-Linnean phytography is that many phytographers to whom reference would have had to be made because of their important work, are still among us, and so more comment than a brief review of their publications would be out of place.

A history of Malaysian phytography ought not to be composed without regard to its surroundings and background as phytography forms part of the general history of the natural sciences. It was not intended, however, to make a broad survey (*e.g.* in the manner of SIRKS's *Indisch Natuuronderzoek*), nor were plant collectors or collections mentioned beyond a very broad outline, though plant collecting, of course, must precede plant description. The data concerning the securing of the materials are being arranged in the first volume of this Flora. Biographical facts are in this short history but sparingly given and, very often, may be preferably traced through the references contained in the first volume just mentioned. Finally, it must be realized that bibliographical particulars, or exhaustive lists of publications, should find their place, at some future date, in a Malaysian bibliography.

The early contributions to Malaysian phytography were incidental. According to the data incidentally supplied to European naturalists by some eccentric sea-captain, or observant traveller, new facts reached the printer. Very often it cannot be ascertained whether some botanical discovery described from 'the East' or 'the Indies' is Malaysian or not. Even to the 18th century botanist, 'India' meant the tropics between Arabia and China (and Australia), and it would scarcely be worth while, it was believed, to distinguish between the SE. Asiatic continent and 'India Aquosa'; they were, it was thought, covered by a similar vegetation.

In the following paragraphs, no effort has been made to disentangle what never was intended to be kept apart, and the 'Indies' are 'defined' as in pre-Linnean times. Of course, it was attempted to

demonstrate how Malaysian phytophography crystallized from its confused beginnings until, in the 19th century, it became distinctly demarcated and developed more and more independently. In the past hundred years, this independency tended to turn into isolation, which was still more accentuated by political boundaries and led, sometimes, to a neglect of the flora of neighbouring regions to the detriment of phytophography.

As regards the description of Malaysian plants, I have felt that those species should be accepted as Malaysian which are now met with in the region, irrespective of whether they are new arrivals now commonly cultivated or forming a notable part of the vegetation, or whether they are truly autochthonous. Malaysian phytophography and the *Flora Malesiana* have to deal with both immigrants and residents of long standing.

PHYTOGRAPHY BEFORE THE SETTLEMENT OF THE EUROPEANS

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1. *The oldest traces*

Botanical sciences in tropical Asia remained essentially superficial and were directed solely to utilitarian or religious purposes till the arrival of western explorers. Ancient Chinese and Indian authors, twenty to thirty centuries ago, refer repeatedly to Malaysian vegetable products. Chinese seafaring traders from time immemorial carried cloves, areca nuts, sappan wood, and other renowned produce from Malaysia to China and when commenting on their treasures, composed the earliest descriptions of plants in the eastern tropics (1). These are of little value phytophographically, being vague and obviously intended to facilitate economic enterprise.

References: (1) BRETSCHNEIDER, *Botanicon Sinicum* 1-3 (1881 or '82-1895).

2. *The Hindus*

The peoples inhabiting the Indian peninsula and adjacent territories though closer acquainted with Malaysian plants, were occupied in describing their medical virtues in the first place but also concerned with the religious and economic aspects of some kinds. E. F. H. MEYER, an authority on ancient Indian botany, concluded (1) after discussing the AYURVEDAS, the main Sanscrit botanico-medical work of uncertain age, that it contained between 600 and 700 plant names but, he said: (transl.) "I doubt whether a single one's identity might be guessed with any likelihood of accuracy from the casually mentioned characters, and nothing is found in other Sanscrit works resembling any real plant description."

The great temple of Borobuddhur built in Central Java in the 8th and 9th centuries when the Buddhist kingdom of Mataram flourished, is covered with reliefs; these have been subjected to some botanical study. As was to be expected, the pictures of plants carved in stone by craftsmen who were sooner artists than botanists, hold but a limited interest from a phytophographical point of view. It is uncertain if the sculptures are stylized representations of species native to the remote country

of origin of the builders or, possibly, are adapted portraits of plants occurring in East Java. The absence of the rice plant is remarkable (2).

I know of no work of Malaysian native origin that contributed to Malaysian phytophography appreciably.

References: (1) MEYER, *Geschichte der Botanik* 1-4 (1854-1857). (2) BAKHUIZEN VAN DEN BRINK *Sr in Trop. Natuur* 20 (1931) 181-186, also CAMMERLOHER *ibid.* p. 141-152, and STEINMANN, *ibid.* 31 (1934) 198-224.

3. *The Greek*

Europe received its first scraps of information through CTESIUS, court physician to ARTAXERXES, ruler of Persia (c. 400 B.C.) who among his tributes from tropical Asia received rare animals or plants. CTESIUS, when writing to Greece, reported faithfully on these wonders of nature adding, however, in good faith all the fabulous stories brought into the bargain. His letters were edited and further elaborated by HERODOTUS and, in the 17th century, by GRONOVIVS (1). There was the marvel of 'the reed that grew nearly as high as a ship's mast' and a shrub producing a wool finer and better than that of sheep (2).

When ALEXANDER'S armies penetrated into the regions of the Indus and the Punjab (330 B.C.), he was accompanied by scientific advisers who had a keen eye for botany. They came across the Banyan tree (*Ficus benghalensis* L.), and their notes enabled THEOPHRASTUS, the father of plantgeography, to write his excellent account of the great tree which 'sheltered an army under its boughs'. They called it 'Indian Fig', a name which has been a source of much confusion afterwards, and explained correctly its peculiar habit by stating that a central trunk gave rise to horizontal branches from which aerial roots descend till the earth is reached. Penetrating into the soil these roots stiffen, thicken, and gradually assume the appearance of a secondary columnar tree trunk which supports the heavy boughs spreading from the primary central trunk. This habit is typical of several very closely allied species of tropical figs, native of Malaysia or adjacent regions.



AMES



BACKER



BAKHUIZEN SR



BAKHUIZEN JR

The Greek noted that the pendent growth from the branches was at first tender, of a light colour, and hairy, and THEOPHASTUS decided that the true nature of the 'secondary branches' was that of roots (3).

These accurate Greek observations and interpretations, were overlooked and misunderstood by later authors. A higher appreciation of Greek phytophraphy results if it is realized that a professional European gardener, G. MEISTER, who worked in the 17th century for several years in Java, described (4) this (or a similar species) as having roots growing vertically from the ground upwards till merging into the branches. Among 18th century travellers this story is, in a revised edition, still commonly repeated, when they speak of the tree which bends its branches downwards till they strike root. This tale, in fact, goes back to PLINIUS, and even to the Indian vernacular name which ascribes to the Banyan 'downward growing branches'. A recent American book, by N. S. KNAGGS, the popularly written account (5) of a plant hunter in the tropics, caps all previous efforts in telling the story of the fig tree which sinks its branches into the soil, these emerge again and grow upright to a new tree, again to sink and to emerge, and so the tree marches through the forest. This may serve as an instance of the errors of fanciful explorers and the merit of data obtained by sober unbiased observers.

The botanical studies of THEOPHASTUS are lost for the greater part but the remainder contains, for example, a description of *Cycas* and of the mangrove community. The data pertain, actually, to the mangrove of the Persian Gulf but as the aspect and composition of this plant community on the mudflats and beaches in tropical coastal waters hardly varies in the whole of its area, these first notes have their interest also in relation to Malaysia. The habit and stilt roots of *Rhizophora* were compared to 'cuttle-fish grasping the soil' and it was observed that the fruit of *Avicennia* had internally one 'seed-leaf' folded round the other. The attempt to distinguish between the kinds of mangrove trees was not successful.

The botany of ancient Greek authors as regards tropical plants has not been exhaustively studied; it demands a knowledge of languages and an experience of systematic tropical botany as is rarely

found in one person (6). The works of MEGASTHENES (\pm 300 B.C.), the first European to see and report on *Borassus flabellifer* L., are among many still to be searched (3).

References: (1) cf. C. MÜLLER in HERODOTUS, ed. DIDOT (1858). (2) BALL, in Proc. Roy. Irish Acad. sér. 2, II (1885) 336. (3) GREENE, Landmarks of Botany I in Smiths. Misc. Coll. 54¹ (1909) 1-329. (4) MEISTER, Der Orient.-Ind. Kunst-u. Lust-Gärtner (1692). (5) KNAGGS, Man's first plastic (1947). (6) BRETZ, Botanische Forschungen des Alexanderzuges (1903), also VINCENT, Suppl. Commerce and Navigation of the Ancients, 2 vols (1807).

4. The Egyptians

The Egyptians, destined by their geographical position to hold the main port-of-call for traders with the East, received in the first century about 45 kinds of vegetable products from the East Indies. They were on the alert when plants of economic promise were to be introduced and at that time had e.g. *Arum esculentum* L. in cultivation. KUNTH's record of *Mimusops elengi* L. rests, however, on a misidentification (1). The first century must be regarded as the earliest period of regular connection with western Malaysia; nutmegs and (decidedly later) cloves from eastern Malaysia reached Alexandria only towards the close of the second (2). Phytophraphy may seem to have been little developed but the possibility cannot be excluded that works of importance were destroyed in the great fire of the Alexandrine library. Only in the 6th century, COSMAS INDICOPLEUSTES, Greek-alexandrine seafaring philosopher and explorer, brought home some descriptive notes on pepper and the cocos palm (3). Even accounting for possible losses, it would seem that (Malaysian) phytophraphy after the decline of Greece, in the first ten centuries of our era was held in little or no esteem among the scholars though some modest achievements from Arabian sources may be mentioned.

References: (1) cf. PICKERING, Chron. Hist. Plants (1879) 618. (2) MEYER, Geschichte der Botanik 1-4 (1854-1857). (3) COSMAS, Topographia christiana, ed. THEVENOT, Relation des voyages 1 (1695), also VINCENT, Commerce and Navigation of the Ancients 2 (1807) 111, 505.

5. *The Arabs*

The Arabs, in their splendid but brief period of dominance (c. 700–1200), were active traders between the Persian Gulf and Kedah on the Malay Peninsula and contributed in some degree to Malaysian botany. Following MEYER (1), I quote the name of ISHAQ BEN AMRAN (\pm 900) who made good descriptions of Indian fruits and roots and in particular a good pen portrait of *Ipomoea* (*Pharbitis*) *nil* (L.) ROTH. A travelling geographer of the 11th century, MASUDI, reported on 'Cubebo' (*Piper cubeba* L.) from Java. He said that 'on an island in the far South' a tree occurred 'with fruits resembling human heads crying 'wak, wak', which is possibly a reference to *Hernandia peltata* MEISN., a shore tree with spherical vesicular fruits which produce a humming sound in the wind. There are also the famed writings of ABU ALI HUSAIN IBN-ABDALLAH IBN-SINA or AVICENNA (980–1037), who brought from India the first accurate reports of *Musa* and the cocos palm (1).

Twelfth century records, among a shapeless mass of confused data, contain a description of "a fruit four palms long, round, resembling a shell and with a red skin; inside an acorn-like kernel rests. When roasted it is eaten like a chestnut whose taste it also possesses. The flesh of the fruit is very sweet and a pleasing food, in which the flavour of the apple and the pear are combined, and it even suggests the banana and the 'Moql'. It is an attractive fruit, estimated above all in the Indies". This has been interpreted as a Bread fruit, but I believe that MEYER is undoubtedly right in recognizing this as *Mangifera indica* L. though a truly red colour is not found among Mangoes. The recognition of the shape of the shell in the contour of a mango fruit is the touch raising the description to fine phytography.

Arab botany as a whole was compiled by IBN BAITHAR (OR IBN-EL-BAITHAR), an Arab of Spanish birth, who died in 1248 after far travels but without visiting the Indies (1). He was probably the best informed of the 13th century Arab scholars. His *Mofridat* or Catalogue, is an enumeration of 2600 alphabetically arranged entries on medicine, among which are 1400 plants, elucidated with descriptive notes, some original but the majority copied or translated. There is no doubt that the book contains data on Malaysian phytography. He used, for instance, the Greek works as sources but knew in addition the biological peculiarity of several mangrove trees of bearing germinating seeds on the tree. His compilation is the main key to Arab knowledge of natural history. Soon after, Arab botany lags behind and no longer demands attention.

References: (1) MEYER, *Geschichte der Botanik* 1–4 (1854–1857).

6. *Early explorers (Portuguese, Spanish, Italian)*

From Constantinople, starting point of the land routes to the East, members of the Venetian merchant family POLO, in 1264, set out for the journey

into Asia which was to mark the history of the world. MARCO published in 1296 the narrative of his travels. In 1292, when visiting northern Sumatra, he found rice cultivated there and made some notes concerning *Arenga pinnata* (WURMB) MERR., *Cocos nucifera* L., *Dryobalanops aromatica* GAERTN. f., and collected seeds of a plant which was taken 'with the roots and used for dyeing'. This was a species of *Indigofera*. He also wrote an account of *Metroxylon* (1).

The Italian Franciscan friar, ODORICO OF PORDENON, in India the first missionary upon record, wandered through Ceylon (1331), Malabar, Java, Sumatra, and the Moluccas, told of sugar cane, of *Arenga*, made a particularly good description of pepper, and gave the earliest reliable account (2) of the occurrence of siliceous concretions in the hollow internodes of bamboo ('tabasheer'). There are the first vague allusions to the 'most terrible poison of the world', heralding the sensational literary career of the Upas tree (*Antiaris toxicaria* LESCH.), which were, possibly, confirmed by his contemporary fellow missionary JORDANUS CATALANUS, who saw (c. 1335) in the islands of spices a tree which, when in flower, killed everybody (3).

NICOLA DI CONTI, MARCO POLO's compatriot, gave in the 15th century the earliest description of a Bornean plant from personal observation (*Piper*), and added accurate notes on camphor, mango, *Artocarpus integra* (THUNB.) MERR. (Jack fruit), and other fruits; his lucid story of the Cingalese cinnamon tree and its product is also the earliest (1444); he was in India between 1420–1440. His work is inserted in RAMUSIO (4).

Towards the close of the 15th, and in the beginning of the 16th century, the Portuguese penetrated into the East; in Europe, somewhat later, scientific botany came to life. New standards were set for the representation of plants in painting or drawing by O. BRUNFELS (1530) and L. FUCHS (1542), for description by V. CORDUS (1563), and for taxonomy by A. CAESALPINUS (1583), but during Portuguese supremacy in the Indies little notice was taken of the progress of phytography in Europe.

The explorer DUARTE BARBOSA, a man of uncommon ability whose work is a main source of information on the first decades of Portuguese settlements (c. 1500–c. 1520), showed little interest in botanical sciences and so an unparalleled opportunity for study in these fields during his long and repeated visits to the East Indies was largely missed. He has made, however, the first good description of nutmeg and clove trees. In Malacca he saw 'the great ships coming from the kingdom of Java' and noted that 'the cables and all the shrouds of these ships were made of canes which grow in the country'. Among many articles rice, garlic, and onions were imported (4).

ANTONIO PIGAFETTA, some time his companion—both partook in MAGELHAËS's voyage—gave better information; he observed the occurrence of melons, gourds, cucumbers, cabbages, and onions in North Borneo at that time. The descriptions of clove and nutmeg, and their cultivation, were much improved (5).

In 1526, New Guinea was reached by the Portuguese (perhaps even before), and they remained in power in Malaysia till the 17th century though, after 1580, under the banner of Spain. The botanical results of that period are small; glimmerings of some attention to phytography are few and far between. MANOËL G. DE EREDIA wrote, after FERDINANDEZ LOPEZ's rough outline, a meritorious account of the Moluccan sago palm (6). CHRISTOPHORUS A COSTA, acting surgeon on the coast of Malabar and Cochin, made chiefly compilatory studies, preferably on medicinal plants. Some of his notes deal with *Croton tiglium* L. which he knew to originate from the Moluccas; its seeds ('grana de Molucco') were a famed remedy. He recorded and described the new arrival, *Anacardium occidentale* L. at Cochin and stated that *Ananas comosus* (L.) MERR. was brought in 1578 to the East, and in 1599 first to Java. A strikingly good description of *Nyctanthes arbor-tristis* L. is from his pen (7).

Easily first among contemporary scientists in the East ranks GARCIA AB ORTA, a name probably referring to a botanical garden (the first in India) which he established near Bombay and where he studied and described the plants brought home from his travels (8). A landmark in the history of civilisation is the publishing of his *Aromatum Historia*, the third European book to be printed in the East Indies (1563). Pharmacology was the main theme but in addition botanical observations were allowed space. GARCIA described the leaf movements of *Tamarindus indica* L. and the reactions of the foliage of *Biophytum sensitivum* DC., and drew a sharp distinction between sappan wood (*Caesalpinia sappan* L.) and red santal wood (*Pterocarpus santalinus* L. f.); *Strychnos* was treated in connection with its powerful medicinal virtues.

Finally I mention NICOLO MONARDES, founder of a Colonial Museum at Sevilla in 1554, who gave a good description of the circular, flat, winged pod of *Pterocarpus indicus* WILLD. while perceiving the

outline of a dragon in the course of the veinlets on its surface as he had been informed that the tree exuded a red resin, that resembled the renowned 'dragon's blood'. He also first described the fruits of *Sapindus rarak* DC. which produced a soapy froth in water (9).

These occasional contributions to phytography prove that no lack of skill or of observation caused the crop of good descriptive work to be so meagre; the mind of the author of the day only rarely freed itself to such an extent from the all-pervading desire for profit to body or purse, that it became inclined towards the seemingly unnecessary, and at any rate unusual, achievement of delineating plants by means of fitting words or phrases. Nearly always the description was accompanied by a stated reason for it, as it were an apology; a plant was described, the phytopographer hastened to say, because it was a rarity, a poison, a spice, or whatever the case may have been, but not for its own sake, unexplained, and not with the main purpose of rendering its characters available to comparative scientific study.

References: (1) POLO, ed. YULE and CORDIER (1903) and Add. (1920). (2) ODORIC DE PORDENONE, ed. CORDIER (1891), also MULLER, Voorloopers en navolgers van Marco Polo (1944). (3) VINCENT, Commerce and Navigation of the Ancients, 2 vols (1807). (4) BARBOSA, ed. DAMES 2 vols (1918-1921), also RAMUSIO, Navigazioni e viaggi vol. 1 (1554). (5) PIGAFETTA, ed. ALDERLEY In The first voyage round the world by MAGELLAN (1874) 35-163. (6) EREDIA, Informaçao da Aurea Chersoneso 1599 (1st ed. 1807); Malaca, l'Inde Méridionale et le Cathay (1862). (7) A COSTA, Tractado de las drogas y medicinas de las Indias Orientales (1578, ed. CLUSIUS 1593). (8) AB ORTA, Coloquios dos simples (1563, ed. FICALHO 1891), Aromatum et Simplicium . . . historia (ed. CLUSIUS 1567). (9) MONARDES, Dell' historia . . . semplici aromati . . . dall' India Orientali pertinenti (1589).

MALAYSIAN PRE-LINNEAN PHYTOGRAPHY IN EUROPE

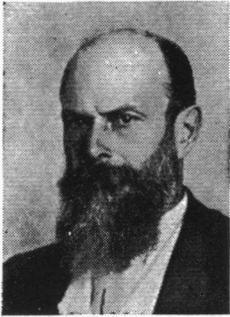
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7. Van Linschoten

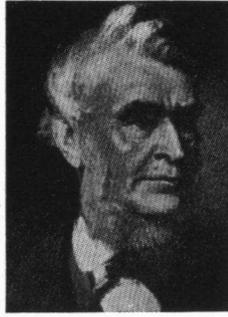
The rise of the 17th century Dutch empire in the East was accompanied by an equally splendid development of sciences at home. The very first of the Dutch bent on discovering the route to the East actually to arrive at Goa, JAN HUYGHEN VAN LINSCHOTEN, collected so many botanical data among a wealth of other information (1) that he seems to introduce a new era of discovery and scientific progress. His descriptions though more independent of previous works than those of his contempo-

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raries, are not quite free from superstition and the time-honoured custom of copying earlier authors, then judged a hallmark of learning and good sense but, nevertheless, he shows a keen eye and a lively spirit. It seems in place to enumerate the best of his descriptions: they are of the pineapple (*Ananas comosus* MERR.), Jack fruit (*Artocarpus integra* MERR.), mango (*Mangifera indica* L.), cashew nut (*Anacardium occidentale* L.), djambu's (*Eugenia spp.*), lobi-lobi (*Flacourtia inermis* Roxb.), gandaria (*Bouea gandaria* Bl.), citrus (*Citrus spp.*), and include notes on the bisexuality of paw paw (*Ca-*



BECCARI



BENTHAM



BINNENDIJK



BLANCO

rica papaya L.), of the 'Indian fig' or bananas and plantains (*Musa spp.*), coconut (*Cocos nucifera* L., fully a treatise!), sweet potatoes (*Ipomoea batatas* LAMK), durio (*Durio zibethinus* L.), bamboo (*Dendrocalamus?*), sugar cane (*Saccharum officinarum* L.) and several other plants e.g. *Datura sp.* and *Nyctanthes*. Of course, commercial vegetable products such as spices and condiments, got due attention and full reference was made to pepper (*Piper nigrum* L.), cinnamon (*Cinnamomum zeylanicum* BL.), cloves, nutmegs, ginger, cardamon (*Elettaria cardamomum* MATON), lacquer (*Rhus sp.*), benzoë (*Styrax benzoin* DRYAND.), santal wood, eagle wood (*Aquilaria malaccensis* LAMK), camphor, tamarind (*Tamarindus indica* L.), cassia (*Cinnamomum cassia* NEES ex Bl.), &c.

Born at Haarlem in 1563, LINSCHOTEN lived from 1583-1589 at Goa and at Cochin, from 1589-1591 in the Azores; in 1592 he returned to Enkhuizen. PALUDANUS (BERENT TEN BROECKE) received all his plant specimens and edited his *Itinerario* in 1595 (2nd vol.) and 1596 (1st vol.), adding learned commentaries to LINSCHOTEN's observations in the pompous style of the day borrowing many data from GARCIA. The book was copiously illustrated, the botanical figures were made by JOANNES and BAPTISTA à DOETECHUM. The elaboration and systematical study of LINSCHOTEN's materials as a whole by an experienced botanist inaugurated the

"Memorie voor die Appotteckers ende Chyru-gins die den jaer 1602 op de vlote naer Oost-Indien vaeren sullen.

Dat zij mede brenghen tusschen pampier geleyt taxkens met haer bladeren ende vruchten ende bloemen waert mogelijk, van: muscaten nooten beyde soorte mannekens ende wijfkens, swarte peper, witte peper, lange peper betle, cubeben, mangas, mangostons, ende diergelijcke boonen van eene soorte cattoen dat bij Bantam wast met taxkens ende bladeren ende te vraegen hoedat sij daer noemen.

Item taxkens van alle andere soorte van boomen die vremd sijn, ende daer wassen met bloemen bladeren ende vruchten, soo mogelijk was de fatsoen van de boomen te teekenen, oft sij groot ofte cleyen syn, inde winter groen blijven ofte niet. Haer naeme op haer maniere, ende waertoe sij te gebruycken etc."

custom of later centuries, and was a distinct improvement of method.

References: (1) LINSCHOTEN, *Itinerario* (1595-1596).

8. The East India Company

In 1600, after some preliminaries, the Dutch East India Company was founded, and chartered in 1602. The Honourable Company, if not described in our time as a conspiracy of robbers and heartless oppressors, at least by many judged to have been nothing better than a body of greedy traders, behaved, it is a pleasant historical truth to record, honourably towards natural sciences and obstructed scientific progress rarely and only when its results were believed to be directly contrary to their interests. The exemplary phythographical works of the 17th and 18th century, which ensured Holland a leading position in botanical knowledge at the side of Britain, have been achieved almost without exception through the Company's benevolent attitude towards botany and the generous support of its directors.

Without delay, in 1602, a special order was issued to all apothecaries and surgeons of the Fleet to collect and dry specimens not only of tradable plants but also of all other kinds which might be secured, and to make notes and drawings of them.

"Recommendation for Apothecaries and Surgeons sailing on the fleet in the year of 1602 bound for the East Indies.

They shall bring, laid between paper, branchlets carrying leaves and fruits and flowers whenever possible of: nutmegs both species male and female, black pepper, white pepper, long pepper betle, cubebas, mangoes, mangosteens, and similar beans of a kind of cotton growing in Bantam with branchlets and leaves and enquire after their local names.

Similarly branchlets of all other kinds of trees that seem strange and grow there with flowers leaves and fruits, when possible the habit of the trees to be designed, whether they are large or small, whether green in winter or not. Their names in the vernacular, and to what end they are used etc."

The taste for rarities of the period was rivalled by a scientific interest, the introduction of living plants into the European hothouses was enthusiastically tried and it may be said that, in the course of the 17th century, the botanists of the Netherlands came to possess the best information and collections of Malaysian plants.

9. *Clusius and his contemporaries*

Among the scholars of the period CHARLES DE L'ESCLUSE, or CAROLUS CLUSIUS, ought to be mentioned first. The European flora and that of the Near East took most of his time but he contributed materially to East Indian botany. The utilitarian principle CLUSIUS removed deliberately to a second place; his scientific views approached those of modern times and he followed a primitive binomial system, though not consistently. Most important to phytohistory in particular, and to the science of plants as a whole, is his custom of referring to the names of previously described plants together with the name of their describer.

His trips to France and Spain (1564–1565) yielded him some additional data on tropical East Indian plants; returning he took AB ORTA's book with him and afterwards brought it to fame by his remodelling, condensation, and translation of the original (1). Under his supervision, PETER VAN DE BORCHT illuminated *Aromatum Historia* with 16 wood-cuttings (1567); the later English, French, and Italian editions are based on CLUSIUS's revision, not on the Portuguese text.

Sir FRANCIS DRAKE, after his voyage round the world (1577–1580), supplied him with observations and specimens, partly from Malaysia, gathered during the expedition. In 1582 CLUSIUS published *Aliquot notae in Garciae Aromatum Historia* dealing, however, with DRAKE's data mainly. CLUSIUS re-edited and enlarged DODOENS's *Cruydeboeck*; the 5th edition of this herbal (1608) contained a considerable appendix and a reasoned description of all known exotics. From the 'East Indies' more than 200 species are discussed (some pictured), practically all abstracted from CLUSIUS's previous studies. A complete list of the species would require too much space; it may be noted though, that cloves, nutmegs, areca, and cocon were—as usually discussed but that in the whole of the work the endlessly redescribed objects of trade have lost their preponderance; they receive no more attention than is their due among the other plants of the East. Short notes announce in a preliminary manner new discoveries. *Mimosa pudica* L. is described and pictured; the fruits of *Sindora sumatrana* MIO., a popular vegetable in Bantam (*Blumea lacera* A.DC.), a twig of *Lanea coromandelica* (HOUTT.) MERR. from Batavia, and *Gnetum gnemon* L. were some of the novelties. In 1618 the 6th edition of DODONAEUS's herbal appeared containing a first description and picture of a capoc fruit from Java.

A random instance which may illustrate CLUSIUS's merit as a phytohistorian and botanist is a brief discussion concerning a leaf he had received

from the Indies. The donor said it grew like *Nymphaea* in water, only its flowers were blue. This made CLUSIUS draft a close description of the fan-wise folded specimen and, evidently, a palm leaf is at hand, perhaps *Borassus* or, possibly, *Litsea*. CLUSIUS himself quietly doubts the relationship to *Nymphaea* and suspects affinity with the Palms! Considering the erroneous data, this proves clear insight. Leaving much unsaid regarding CLUSIUS's influence on East Indian phytohistory, I wish to point to his descriptions of tropical plants in *Exoticorum libri decem* (1605), a small book of great importance. The first specimen from Bali is put on record (*Salacca edulis* REINW.) and, among many others, a plant which, I think, is a species from the mountains of Central or East Java (*Anaphalis* or *Gnaphalium* sp.); CLUSIUS referred it to *Lavandula*. In his *Rariorum plantarum historia* of 1601, the description of a Philippine plant occurred: *Illium* sp.

CLUSIUS held the Chair of Botany at Leyden (1592–1599) and died in 1609. His manuscripts were partly edited posthumously and partly disappeared. Of his Herbarium no trace is left. To obtain a knowledge of Malaysian botany at the beginning of the 17th century, a detailed study of CLUSIUS's works would be indispensable; this ought to be based on the CLUSIUS monographs by F. W. T. HUNGER (2).

In many of the 16th century herbals in Europe chapters or appendices were devoted to tropical, partly Malaysian, phytohistory, their contents being a conglomeration of earlier published notes and incidental scraps from traveller's stories. W. TURNER's *New Herball* (1551, 1562, and 1564) and the illustrated account in CASTOR DURANTE's Italian herbal (1585) of East Indian plants are about the best of contemporary writing on the subject. The *Pinax theatri botanici* (1623) of CASPAR and JOANNES BAUHIN, a first attempt towards a nomenclator, wants further investigation as regards Malaysian species; the brothers received directly, or by way of Holland, plants from Farther India, and their Herbarium is still preserved at Uppsala.

After CLUSIUS's death, the ardour to study Indian plants grew dim, the herbals of the first half of the 17th century repeating the available information and adding next to nothing to the store of knowledge. Seventeenth century wealthy plant amateurs, in Holland, England, and Central Europe, continued and stimulated the search for novelties from the Malaysian flora and so laid an excellent base for future descriptive writing. About the middle of the century, however, the scene of creative study had shifted and Malaysian phytohistory was best executed in the East itself—as will be demonstrated later: only in the closing decades of the century, the centre of activity returned to Europe. In F. ERASMUS's *Ost- und West-Indischer Lustgarten* a summary of the known facts at that time (1668), written in GARCIA's fashion but of lesser quality, may be consulted; it deserves notice mainly to gauge the progress made in fifty years, which is not very impressive.

References: (1) AB ORTA, ed. CLUSIUS (1567). (2) HUNGER, Charles de l'Escluse 2 vols (1927, 1943).

10. Hermann and Sherard

The work of PAULUS HERMANN revived interest among European scientists, and proved to be an important foundation upon which new original study was built. Born in 1640 in Saxony, he studied botany and, having graduated, went to Holland, there readily obtaining employment as a physician to the East India Company on recommendation of some plant-loving Directors. He then travelled widely, collecting in Africa, India, and Ceylon. Remaining in that island in office from \pm 1672 till 1679, he made two considerable collections mainly from the coastal region of Colombo and, therefore, to a large extent of plants found also in Malaysia. He had some 400 drawings made. On being appointed to the Chair of Medicine and Botany at Leyden, he returned to Holland introducing many species for the first time. He built a Museum, rearranged the Gardens, and erected the first glass hothouses of the University. His initial illustrated work *Catalogus horti academico Lugduno-batavi* (1687) is little concerned with Indian plants, and his earliest contribution to Indian botany is contained in a section of *Schola Botanica* of 1689. Its author, who must have made a liberal use of HERMANN's notes, is indicated on the title page as 'S. W.A.'; the initials are believed to refer to SAMUEL (or SIMON) W(H)ARTON, AUCTOR, a pupil of HERMANN's. Some declare SAMUEL to be a 'mythical person' and adhere to the view that WILLIAM SHERARD is responsible for the publication. The initials then would mean 'SHERARDUS WILHELMUS ANGLUS'. I admire the ingenuity of the latter explanation but remain a believer in the one-time bodily existence of WARTON because in a Latinized author's name 'Wilhelmus' ought to have read 'Guilhelmus' which demands 'G.' The problem is of bibliographical interest; the merit is HERMANN's. Among his collaborators L. PIJL, Governor of Colombo, is to be remembered, who sent many times living plants, often with descriptive notes used by HERMANN.

WILLIAM SHERARD or SHERWOOD, Founder of a Chair of Botany at Oxford, acquired after HERMANN's death (1695) his disordered manuscripts and notes, and in 1698 published *Paradisus Batavus*, a considerable work particularly well illustrated with 111 etchings. It gives e.g. a first system of tropical Asiatic *Araceae*. This was followed by a second work based on HERMANN's materials, *Museum Zeylanicum* (1717). Ceylon lies, of course, outside the boundaries of this present Flora, but the books contain descriptions of numerous plants then or now abundant in Malaysia, or of species common to both regions.

The main part of the Herbarium of HERMANN, consisting of 4 volumes of dried plants and one volume of drawings formed the base of LINNAEUS's *Flora Zeylanica* (cf. § 18). HERMANN's herbarium had been believed to be lost but came into the hands of an apothecary at Copenhagen who lent

it to LINNAEUS. After this elaboration, the specimens again changed hands repeatedly until BANKS purchased them and brought them into security in the British Museum. H. TRIMEN studied the plants of HERMANN anew (1867) in connection with *Flora Zeylanica* (1).

In the Rijksherbarium at Leyden is another set of HERMANN's plants in 2 volumes of excellently preserved specimens. A list of the species was composed by S. J. VAN OOSTSTROOM (2), who added titles of relevant literature (1937). The volumes contain probably a Cingalese collection sent by HERMANN to J. COMMELIJN (§ 11).

References: (1) Journ. Linn. Soc. Bot. 24 (1887) 129-155. (2) Blumea Suppl. 1 (1937) 193-209.

11. Resident botanists in Holland

HERMANN's plants formed a large proportion of the material base of J. BURMAN's *Thesaurus Zeylanicus* (1737), a book of 235 pages and 110 plates. The *Thesaurus* shows no attempt towards any natural classification or outline of the main characters of the Cingalese flora. In it are enumerated alphabetically the genera; the species are quoted with reference to literature, the new ones being described with some accuracy. The book, though having no nomenclatural status introduces several generic names for the first time, which were later adopted and validated in Linnean publications (e.g. the Euphorbiaceous genus *Antidesma*). A list of vernacular names occurring in *Hortus Malabaricus* (see below), referable to more scientifically named plants in the *Thesaurus*, followed; the book is concluded by cataloguing some Cape collections.

J. BURMAN, born in 1707 at Amsterdam, was appointed there to the Chair of Botany in 1731. Though not greatly gifted as a botanist, he was a worker of considerable industry and ability; his death in 1779 was generally felt as a serious loss to science; his *Thesaurus* remained his only independent contribution to Malaysian botany (§ 21).

Concurrently with these developments at Leyden (§ 10), botanical science at Amsterdam was promoted by JOANNIS COMMELIJN, and his nephew CASPAR. JOANNIS, merchant and pharmlacapist, had had made a truly magnificent collection of coloured drawings of exotics cultivated in the Amsterdam Botanic Gardens ('Hortus Medicus'), but very scant attention was paid to plants from Malaysia. There are also only a few plants from the Indies described in the posthumously edited book of plants cultivated at Amsterdam *Horti medici Amstelodamensis rariorum . . . plantarum* (1697), consisting of 112 plates with text. J. COMMELIJN was one of the chief editors of *Hortus Malabaricus*.

His nephew CASPAR, published an extract of RHEEDE's work (see § 20) under the title of *Flora Malabarica* or *Malabaarse Kruythof* (1696), a publication mainly of bibliographical interest. CASPAR COMMELIJN largely limited his activities in the field of tropical botany to African and South American plants; his works of 1701 (2nd volume of *Horti medici &c.* with 112 figures, and chiefly based on J. COMMELIJN's manuscripts) and 1703, are both on



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plants cultivated at Amsterdam. These are his chief contributions to Malaysian phytography but, from a general point of view, it may be stated that though the Amsterdam gardens are reputed to have housed in the first decade of the 18th century the richest collection of Malaysian plants in Europe, the works of the COMMELINS do not support this, being decidedly poor as regards information of Malaysian species.

Apart from the scientific studies at the Universities but closely interwoven with them, appeared the results of able, usually non-professional, botanists who spared no effort in advancing their hobby. They were attracted to the fine living collections of prosperous East India merchants who desired books honouring their botanical treasures.

Among many, the hothouses of H. VAN BEVERNINGK, Superintendent of the Leyden Botanic Gardens, at Warmond, were widely famed and won the love of the clever and clear-sighted Danzig merchant, J. BREYNE (BREYNUS). In his student days at Leyden, BREYNE may have decided on this field of future work. On the whole, however, he studied European plants but, in spite of this, his works are of importance to every student of historical Malaysian phytography. Many of the plates which GEORG MEISTER brought him from Java were published at his expense and he was one of the earliest recipients of living tea-shrubs, while BEVERNINGK's gardens supplied him with the materials both for his *Exoticarum Plantarum Centurio prima* (1678), and his two *Prodrumi* of rare plants cultivated in Holland (1680, 1689). There is a final book of illustrations, *Prodrumi . . . icones &c.*, by his son PHILIP in 1739. F. KIGGELAER's *Horti Beaumontiani Exoticarum Plantarum Catalogus* (1690), a careful (anonymously published) list of S. BEAUMONT's garden at the Hague, may be mentioned. The survey of this group of 'pre-Linnean' publications in Holland may be concluded by LINNAEUS's own famous studies of CLIFFORT's plants, to which I will return below (§ 17).

12. Kaempfer

ENGELBERT KAEMPFER, mainly known by his classic investigations into Japanese ethnography, certainly deserves recognition among the contributors to

Malaysian botany of that age. Born in 1651, at Lemgö (Lippe, Germany), he travelled as a surgeon in the service of the East India Company to Ceylon, Coromandel, Bengal, and Sumatra, interrupting his long journeys by a seven months' stay at Batavia where he found Governor General J. CAMPHUYS a generous host, a powerful friend, and an inexhaustible source of information concerning Japan. CAMPHUYS owned a fine mansion and a botanical garden in the islet of Edam in the Bay of Batavia and KAEMPFER, though penetrating into the surrounding region, spent most of his time in the garden of CAMPHUYS (1689-1690). After his trips to Siam, China, and Japan he revisited Batavia when returning in 1694 to Europe. He died in 1716 in his native village.

Of KAEMPFER's considerable botanical results next to nothing has been published but many manuscripts are kept in the British Museum. The unpublished *Miscellaneous collections* and his *Plantae in Insula Edam repertae* certainly contain interesting data on Malaysian plants. His book on the Far East, *Amoenitatum exoticarum . . . observationes &c.*, published in 1712, presents among the descriptions of Japanese plants some particularly close and accurate descriptions of a rattan species (which he shows to be the true source of the famed 'Dragon's blood') and of two Javan orchids. The orchids were, after his directions, very well drawn by F. W. BRANDHAGEN. In general, it may be said that KAEMPFER's work demonstrates with clarity the advantage of composing descriptions on the spot, *i.e.* while staying in the East, and with the living plant growing in its natural surroundings at hand. The superiority of the descriptions of a phytographer working in daily touch with his subjects will be further stressed in paragraphs 19-21. For the moment the studies by J. BANKS (1) and by T. NAKAI (2), based on KAEMPFER's specimens and drawings, may be noted.

References: (1) BANKS, *Icones selectae plantarum &c.* (1791). (2) Journ. Arn. Arb. 6 (1925) 186-189.

13. Visiting plant amateurs in Dutch service

In the year of KAEMPFER's return another incidental, and decidedly lesser, student of botany sailed for Europe: F. VALENTIJS, a Dutch minister

of the faith. His course of life was not favourable nor does he impress one favourably as a person. He stayed several years at Ambon (together with RUMPHIUS). His reputation as a historian rests on his *Oud en Nieuw Oost-Indiën*, an encyclopedial work in a swollen, stuffy and, usually, tedious style appearing in 5 volumes from 1724–1726. The first half of the third volume (1726) deals with the natural history, mainly of the Moluccas, being drafted from facts, and copied from drawings, supplied by RUMPHIUS who, in return, is scarcely mentioned. The work is one of the rare sources of information on local affairs in remote islands at that period, reported by an eye-witness. Incidental details of some value are included when plants or plant-growth are discussed. Acknowledgment for this contribution to Malaysian plant description should go to RUMPHIUS, whose manuscripts were kept waiting to go to the press.

Sometimes the 17th and 18th century habit of publishing one's life and adventures after some experience overseas has added to botany but, of course, to a very limited extent. Among those whose writings yield some points of interest may be noted C. DE BRUYN, who in his *Reizen* (1714), offered some descriptive notes; his book makes pleasant reading. E. C. BARCHEWITZ, who arrived in 1711 at Batavia, held the command of the islet of Leti (Lesser Sunda Islands) during 6 years, and wrote a charming book with commentary to more than 40 easily identifiable plants, all first records from the island, and some appearing for the first time in print (1). Dozens of accounts of this nature remain to be studied. A French surgeon in Dutch service who published his phytography in England was L. GARCIN. In the service of the East India Company, he sailed between 1720 and 1729 three times to Java. He wrote two articles in the Royal Society's 'Philosophical Transactions' (1730 and 1734) of phyto-graphical interest, on *Biophytum* ('Oxyoides'), *Musa* and Mangosteen (*Garcinia mangostana* L.).

References: (1) BARCHEWITZ, *Der Edlen Ost-Indian. Comp. &c.* (1730).

14. English scholars: Morison, Ray, Plukenet, and Petiver

The second half of the 17th century in England shows developments of equal importance to those in Holland; the course of political history implied that plants from Malaysia were there only occasionally considered but, if incidentally, many species either common to the Deccan Peninsula and Malaysia or purely Malaysian were described, or previous data changed or improved.

ROBERT MORISON, born in 1620 at Aberdeen, studied botany at Paris and went in 1660 to England. Among several honourable appointments, he received the Professorship of Botany at Oxford (1669), where he published *Plantarum Historia Universalis Oxoniensis* (1672). In 1699, sixteen years after his death, the third part of his work was printed; it contained records of *Hortus Malabaricus* (§ 20).

To much greater fame came the work of JOHN RAY (he has been styled as the greatest botanist of his time in Europe), author of the classic *Historia Plantarum generalis*.

Born at Black Notley (Essex), after an outstanding career at Cambridge University, he travelled through the greater part of the Continent. Both the earlier volumes of his *Historia* (1686 and 1688) are only slightly less important to Malaysian phytography than the supplementary third volume of 1704. It is probable that RAY, although his astounding knowledge and industry would have induced him to take an active part in the description and classification of Indian plants, deferred tropical botany to some extent to specialized collaborators and friends. SHERARD, while helping to prepare the last volume for the press, certainly paid personal attention to the careful interpretation of *Hortus Malabaricus*; there was also T. ROBINSON, a surgeon and his 'Amicorum alpha', who had published some brief reviews of the great *Hortus*, that basic work of early Indian phytography which held in particular the attention of British botanists till the present day, and which I intend to discuss below (§ 20).

A friend of RAY's, and later an embittered adversary of PETIVER's, was L. PLUKENET. He was born in 1642 but did not publish before 1691, when in rapid succession his grand series of pictures, the *Phytographia* (containing the earliest picture of *Nepenthes*) began to appear; these were figures of plants in small but generally adequate cuts representing c. 8000, chiefly exotic species, among which many from Malaysia. This was completed in 1696 but in the same year a kind of catalogue to his plates, *Almagestum Botanici Mantissa*, appeared and was completed in 1700. His final illustrated book, containing more than 2500 figures, appeared in 1705: *Amaltheum Botanicum*. He died in the same year having held a Royal professorship at Hampton Court. All his works are of considerable importance to Malaysian phytography; his Herbarium rests in the British Museum.

A third contributor to Malaysian botany was the critical and active worker JACOB PETIVER. He showed an absorbing interest for exotic plants and, like CLUSIUS and LINNAEUS, prompted captains and surgeons sailing for the tropics to send him dried plants and prepared printed directions for them. Most fruitful were the collections by S. BROWN(E) who forwarded eight 'books' of herbarium from the Madras region. PETIVER gave an account in several volumes of the 'Philosophical Transactions' (1700–1704), preceded by a first letter to BROWN published in 1698. Many pharmacological, ecological, and systematical notes accompany the names and descriptions, while reference is made to *Hortus Malabaricus* and much other literature. It would seem that PLUKENET also studied part of these materials; several times HERMANN is mentioned as having sent plants, and so are many others. This series of papers is full of historical data and deserves a thorough study both in connexion with the developments of British Indian botany and, to a lesser extent, that of Malaysia.

Of PETTVER's other works I mention his *Plantae rariores* added as a supplement to RAY's *Historia*, 3rd volume (1704). Two years earlier appeared his *Gazophylacii naturae* in which he gave also a number of pictures of Philippine plants, possibly based on specimens from or drawings by KAMEL (cf. § 24). Another noteworthy publication was *Musei Pettiverani centuriae decem* (1692-1703).

15. English visiting plant amateurs

Among the diligent collectors who by their unselfish efforts built the material base of Malaysian phytography, JAMES CUN(N)INGHAM(E) ought to be remembered. He sent RAY, and in particular PLUKENET and PETTVER, several species of Malaysian plants; his course of life and the stations where he, sometime surgeon at Amoy in China (1698), collected are not sufficiently known. He secured some specimens when staying at Batavia, probably also on his two days' visit to, and later on his prolonged residence on, the western coast of Borneo and his sojourn on Pulo Condor (c. 1705).

WILLIAM DAMPIER, commander of an English man-of-war and buccaneer, sighted New Guinea on January 1st, 1700. Touching at Ceram and Timor, he reached Batavia. He repeatedly visited the Archipelago, but only on the first voyage drawings, proving an exceptionally able hand, seem to have been made. His notes on the vegetation, his pictures (he stated that one of his shipmates made them, but probably this is modesty), and the herbarium specimens he brought to England give him a right to be remembered as a contributor to Malaysian phytography (1).

Finally I mention ALEXANDER BROWN, as an important collector of Cape and Indian plants.

References: (1) DAMPIER, *A New Voyage Round the World*, ed. Hakluyt (1927), also LEE, *Early explorers in Australia* (1925).

16. English botanical gardens

The cultivation of tropical plants in England was no less advanced than in Holland, which aided the study of Malaysian plants in a similar manner. There was for example the flowering of *Carica papaya* L., much to the satisfaction of SHERARD (§ 10), who in the summer of 1701 was able to prove the correctness of the drawings in *Hortus Malabaricus* by this fresh material. Since LINSCHOTEN's first note (§ 7) and CLUSIUS's (§ 9) close description (2), *Carica* had roused much interest as an instance of morphologically clearly different males and females. PLUKENET cultivated *Dioscorea bulbifera* L. at Hampton Court. Gardeners of European fame who sometimes published their results (1) were e.g. J. GORDON and PH. and J. F. MILLER, father and son, who successively tended the 'Physick Garden' at Chelsea. The finest result of botanical work of this nature is perhaps the set of coloured plates (1750-1773) by G. D. EHRET, the *Plantae selectae* (cf. § 17).

References: (1) MILLER, *The Gardener's dictionary* (1731). (2) CLUSIUS, *Curae post.* (1611) 78-81.

17. Linnaeus and his work in Holland

The rising star of CARL VON LINNÉ commanded more and more the attention of the botanists of Europe about 1735 when he, having graduated at Harderwijk University, stayed with J. BURMAN at Amsterdam. He was a young man, 28 years of age and keen to extend his practical experience. The exceptionally fine Herbarium of his host made him postpone his return to his native country, Sweden. The manuscripts of RUMPHIUS and the plants from Ceylon (cf. §§ 10-21), attracted him and at the Amsterdam 'Hortus Medicus' he was soon counted among the faithful visitors. Meeting him there, GEORGE CLIFFORT invited him to inspect his private collection at his country seat near Haarlem, and the bait was taken; LINNAEUS became botanist of the 'Hartecamp'. Of tropical Asiatic plants were present cloves, mangosteens, cocos and other palms, *Cassia*, *Acacia*, *Tamarindus*, pepper, *Annona*, and *Musa*. A good museum and library formed a worthy setting for this gem of 18th century science. In January 1736, *Musa* flowered for the first time in Holland (*Musa Cliffortiana*, 1736).

In the same year, LINNAEUS published *Bibliotheca botanica*, which was twice reissued (1747 and 1751) and is a guide to early phytography, also as regards Malaysia. After a brief visit to England he returned and wrote *Hortus Cliffortianus* (1737), a shining proof of LINNAEUS's ability and CLIFFORT's munificence; many East Indian plants were treated. The book was illustrated by G. D. EHRET, a young draughtsman of LINNAEUS's age and his devoted pupil whom he met when arriving at the 'Hartecamp', and whose extraordinary gift for drawing flowers found a happy expression in applying the Linnean doctrines in his illustrations. After LINNAEUS's return to Sweden, EHRET went to England where his work was greatly appreciated as has been indicated above (§ 16). Sir JOSEPH BANKS, after his death, acquired many of his drawings which were finally deposited in the British Museum.

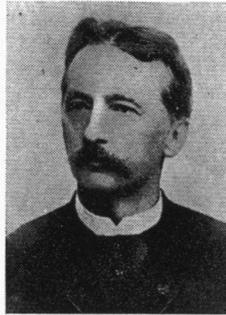
18. Flora Zeylanica

In Sweden LINNAEUS wrote his only work devoted solely to Indian plants: *Flora Zeylanica*, in 1747. The immediate cause was the rediscovery of 4 volumes of HERMANN's Herbarium; these served as a keystone to the work (cf. § 10).

H. TRIMEN demonstrated (1) that the nomenclatural importance of the work lies in the subsequent quotation of all entries in the *Species Plantarum* of 1753; the text of the book typifies many names. A second identical edition followed in 1748. LINNAEUS believed the Javan flora to be the same as that of Ceylon; the theory that the tropics were inhabited by an identical flora in all parts was held by leading botanists long after him. *Flora Zeylanica* had not been drafted according to a binomial system. Applying his artificial classification, LINNAEUS analysed 397 species. Another 31 he indicated as 'obscurae', that is plants of which the fructification was as yet insufficiently known; 13



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BURCK



BURKILL



BURRET

further numbers were occupied by plants without any fructification ('dubiae'), and a section was somewhat disparagingly kept apart as 'barbarae' (plants of which HERMANN noted the name but did not preserve dried specimens). Yet, LINNAEUS enumerated them with all available data hoping that others would investigate. It may humour the modern systematist to meet LINNAEUS in a pre-Linnean period looking for type specimens to 129 numbers of 'barbarae'. A group of 'annihilatae' he considered to be rejectable. Fourteen pages, separately numbered, contain 30 new genera of Cingalese plants proposed by S. M. DASSAW, one of LINNAEUS's pupils, among which *Pavetta*, *Cissus*, *Mimusops*, *Memecylon*, *Connarus*, *Indigofera*, and

Sterculia, all to be included in *Species Plantarum*; several had been taken from earlier work, e.g. from J. BURMAN. It is stated by TRIMEN that 591 species of HERMANN's Herbarium were described and included by LINNAEUS, eight additional species though present as dried specimens were not published. A good deal of the main set are found also in Malaysia.

I must abstain from discussing the by no means negligible achievements in France and various other parts of Europe, and confine myself to a general outline of the most obvious aspects of pre-Linnean phytography outside Malaysia.

References: (1) Journ. Linn. Soc. Bot. 24 (1887) 129-135.

PRE-LINNEAN PHYTOGRAPHY IN TROPICAL ASIA AND MALAYSIA

19. The foundations of phytography in Malaysia	lxxxii	23. De Jager, Ten Rhijne, and Witsen	xcii
20. Hortus Malabaricus	lxxxii	24. Philippine pre-Linnean phytography; Father Kamel	xciii
21. Herbarium Amboinense	lxxxiv	25. Pre-Linnean period in the Malay Peninsula	xcii
22. Bontius; phytography in Java	xc		

19. *The foundations of phytography in Malaysia*

In contrast with the dozens of botanical publications in Europe describing Malaysian plants in large or small numbers, only a few books were written in the Indies, these latter demonstrating, however, a truth that could be confirmed again and again in the course of history: the great advantage to the phytographer of working on the spot *i.e.* in daily contact with his living subject in its natural surroundings. Two pre-Linnean books form the foundation of all phytography of the region; their qualities are so convincing that they were, on appearing, immediately acknowledged to be authoritative, and they maintained their pre-eminent place to the present day as sources of reliable information. These are *Hortus Malabaricus* and *Herbarium Amboinense*.

20. *Hortus Malabaricus*

The main directive power in composing *Hortus*

Malabaricus was H. A. VAN R(H)EEDÉ TOT(VAN) DRAA(C)KE(N)STEYN. In 1637 he was born at Draakesteyn Castle, near Utrecht, and after an adventurous but prosperous career in the Dutch East India Company was appointed Governor of the territory of Malabar (1669). Some not quite explained difficulties caused his return to Europe (1677), where he devoted much of his time in supervising—together with learned gentlemen at Leyden—the edition of the botanical work written during his term of office. In 1684 he was again sent to the Indies on an important auditing commission but, in the middle of his task, died in 1691.

This short biography suggests no scientific training and RHEEDE himself stated his inexperience as a botanist candidly. Nevertheless, he must have been an exceptionally good observer because, while his contemporaries scarcely noticed more component parts of the tropical vegetation than, as a rule, some variety of edible fruit, RHEEDE noted: (transl.) "I observed on my travels the extraordinary diversity of the trees . . . so that it

would be difficult to obtain two trees of the same kind in one forest; I saw trees girdled and covered by other plants, while others . . . with the tree they were covering, were confounded until they could hardly be distinguished; I noticed often also, speaking in comparison, numerous ivies of different kinds clinging to one tree, and besides many growing into the very branches of the trees, and on the foot of the trunk other and still other plants forming a most attractive spectacle, and on one single tree ten or twelve different sorts of leaves, flowers, and fruits might be met with."

Here, for the first time, a man who was not overwhelmed by the welter of luxuriant green of the tropical vegetation, but one who analysed and defined its components, discerning both the structure of the whole and the variety of its details. So far, explorers had been repelled and daunted by the wild primeval forests; now they were discovered to offer a 'most attractive spectacle'; here lies the mainspring to RHEEDE's achievement.

RHEEDE, with all his interest in botany, knew his limitations and wanted assistance but, on the Kuching coasts of India, where he resided as Governor, trained botanists were rare. Becoming acquainted with a Neapolitan Carmelite missionary, Father MATTHEUS (PIETRO FOGLIA or MATTEO DI S. GUISEPPE), he found that this roving priest had occupied himself a long time with the flora of the region. He had collected and made many notes and drawings. RHEEDE's aim, from the beginning, was to attempt a description of all species of the territory, and he set out with MATTHEUS for the great task. MATTHEUS's data proved not wholly satisfactory; his dried specimens were not always suitable for an adequate picture—this lack naturally became the more apparent when the living plant was at hand and could be compared; and his drawings were not quite clear in certain details. MATTHEUS and RHEEDE went out together to hunt for better samples but MATTHEUS, well past fifty, had lost much of his agility and the Governor, much the younger but fond of a good life, scarcely proved a better collector. At this time, HERMANN passed some weeks at Kuching and was asked for advice. For a moment it was considered to put all materials into his able hands but HERMANN declined and, while the pair of bold amateurs availed themselves of his help as long as he would stay, it was decided to look for other assistance. JOHANNES CASEARIUS was invited to join forces.

CASEARIUS was a Reformed Church minister, officiating on behalf of the East India Company at Kuching (1675-1677), who loved plants but was scarcely better equipped for scientific botanical work than RHEEDE and MATTHEUS; he has been described as 'a man most versed in all learning, if only Botany was excepted'. He had, however, command of Latin and might be expected to translate the texts into good erudite language; CASEARIUS thus wrote the Latin version of the first two volumes of *Hortus Malabaricus*. Shortly before CASEARIUS began work, RHEEDE ordered (1674) the learned Brahmins RANGA BOTTO, VINAQUE PANDITO (the Pandit Vinaus?) and APU BOTTO to as-

semble all plants contained in the ancient work *Manhaningattnàm* and to add all they knew about these. HERMANN's counsel may be readily divined in this change of policy: *Hortus Malabaricus* now was placed on the scientifically most favourable base that could be procured, a book representative



RHEEDE

of old local learning and on an accumulation, interpretation, and revision of all available data gathered by men who might be regarded as best informed. Another specialist was added to this Staff, ITTI ACHUEM, a native Pegu physician, who was bidden to Malabar, contributed many native plant names, and taught the reputed medicinal virtues of certain species.

These initial steps towards a 'complete' flora took nearly two years. Then, confronted with the reality of the immense task of composing a book of this scope—one understands the size and endless variety of the tropical Asiatic flora only gradually as experience and knowledge grow—RHEEDE felt that *Hortus Malabaricus* required a still larger Staff.

Four native draughtsmen, for this special purpose in his service, now accompanied him on his trips (though the final work contains a number of drawings made after MATTHEUS's originals), a body of fifteen or sixteen Brahmin naturalists and physicians drafted descriptions; in addition, all native princes and chiefs in the territory had been asked for help. Collectors went out, instructed to search for specimens in flower or fruit; many first sketches were done on the spot to be perfected at home, and hundreds of samples arrived which were classified, studied, and delineated by word and pencil. The Governor, swamped by materials, sighed: "often were more plants roughly outlined in one day than could be drawn and described in

several months by the draughtsmen and CASEARIUS*.

After CASEARIUS, fallen ill, had left (he died 1678 at Batavia), the Latin translation was entrusted to CHR. H. DE DONEP (OF VAN DOUET), who for his work used the Portuguese version by E. CARNEIRO, the latter having in his turn received the text in the vernacular of Malabar, written by COLADDA, another Pegu physician, the teacher of ITTI ACHUDEM. There was also, at some stages, help from the able WILLEM TEN RHIJNE, repeated afterwards in Holland during the printing of the first two volumes. Whether he aided as substantially as PETER believed (1), remains to be decided.

When the differences in training and scientific standing among the numerous collaborators in this early instance of team work are realized, apart from the necessary and repeated translations by interpreters unschooled in natural sciences, the results are amazing and are to be understood only if the skill of the editors in Holland is recognized.

RHEEDE began to send manuscripts and illustrations asking the Leyden scientists to keep these till the whole work could be completed and suitably arranged; owing to enthusiasm, it may well be supposed, printing started without delay. ARNOLD SEYEN (OR SYEN), Professor in Leyden University, presented the first volume on May 8th, 1678, to the Board, having added to the text notes partly supplied by HERMANN in letters from Ceylon; it was published in the same year. SEYEN died and was succeeded by J. COMMELIJN, who edited the descriptions and attended to the publication till, in 1703, the 12th volume brought the *Hortus* to an end.

Other co-editors were J. MUNNICKS (vol. 2-5), T. J. VAN ALMELOVEEN (vol. 6), and A. VAN POOT (vol. 7-12). The entire work contains 784 plates and descriptions.

The *Hortus Malabaricus* attracted the attention of all the learned world; its early publication, numerous first records, and wealth of new facts made it hold the interest of Indian and Malaysian botanists ever since. Originally a separate Dutch version was intended but a translation of the first two volumes only came from the press (1688 or 1689), reissued with a changed frontispiece in 1720. J. HILL made an English edition and added a Linnean *Index* in 1774.

The identification according to modern systematics of the species under discussion has been thwarted by the absence of dried specimens; as far as is known RHEEDE sent no herbarium to Europe, though he forwarded living plants from Ceylon and Malabar to the Amsterdam 'Hortus Medicus'; he also cultivated many species dealt with in *Hortus Malabaricus* in his residential garden at Kuching. Although there has been made no thorough search for authentic specimens of RHEEDE's, it is doubtful whether the discovery of some specimens would do more than confirm what is known and be more than a historically interesting find. The interpretation of the species is, if based only on description and plate, in but a few cases impossible or uncertain, the majority having been pictured and described with unmistakable clarity.

The arrangement of the plants in the several volumes is, partly due to their premature issue, somewhat disordered and, considering the period of their publication, decidedly primitive. The Theophrastan division of the vegetable world into trees, shrubs, and herbs is followed and even that not strictly. Typically pre-Linnean traits may be noticed e.g. *Caesalpinia pulcherrima* Sw. (2) is meticulously drawn and very closely described but in the drawing not a single flower shows the correct number of stamens. A separate (7th) volume is—much to the taste of the day—devoted to woody climbers.

C. COMMELIJN was first in attempting to create order by publishing a catalogue and index to part of the work in 1696 (cf. § 11). This *Horti malabarici catalogus* contains an important bibliography of early Indian botany and RHEEDE's names are reduced and made conform to the existing scientific literature. In 1769, J. BURMAN made another *Index* in accordance with LINNAEUS's *Species Plantarum*. A. W. DENNSTEDT wrote a key in 1818 (3).

The first critical study and interpretation was written by F. BUCHANAN-HAMILTON, Director of the Calcutta Botanic Gardens (1814-1815) but printing was discontinued in 1837 when but three volumes had been dealt with (4). BUCHANAN's entire manuscript is in possession of the Linnean Society of London, and a similar, also partly published, study of the 'Herbarium Amboinense' (see later) is in manuscript owned by the Wernerian Society of Edinburgh. J. K. HASKKARL (§ 53) made elaborate but not entirely successful interpretations in 1861, 1862 and, finally, in 1867. A new interpretation of *Hortus Malabaricus*, I am told, is now kept in provisional manuscript by Dr A. H. G. ALSTON.

References: (1) Philos. Trans. 20 (1698) 331. (2) Hort. Mal. 6, p. 1. (3) DENNSTEDT, Schlüssel zum Hort. Ind. Mal. (1818). (4) Trans. Linn. Soc. London (1822-1837); for other lit. on RHEEDE cf. VETH in De Gids (1887); SIRKS, Ind. Nat. Ond. (1915).

21. *Herbarium Amboinense*

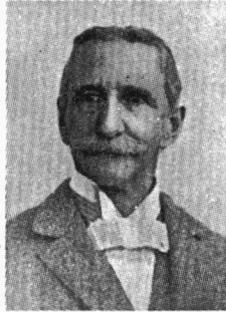
While the *Hortus Malabaricus* was being composed as the foundation of all post-Linnean western Malaysian botany, there lived and worked in the lonely most eastern outpost of European enterprise, the Moluccas, another botanist, G. E. RUMPF, whose *Herbarium Amboinense* made a perfect footing to all modern knowledge of the eastern Malaysian vegetation (1). If RHEEDE and his collaborators had at their command all material and official support, all transport and other facilities they could wish for, RUMPF, though a man of notable standing and better education, needed the consent of many superiors for his plans and activities and was repeatedly cruelly hit by adversities of fate. *Hortus Malabaricus* is a fine testimony of industry, ability, and progressive endeavour but *Herbarium Amboinense* a proof of a never abating fervour for scientific botanical studies, of amazing skill combined with such a devotion to botany as is very rarely found; it is a work of genius.



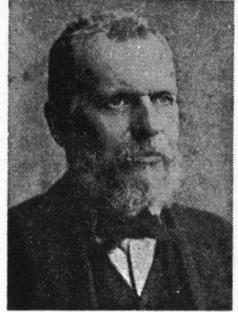
A. P. DE CANDOLLE



AUG. DE CANDOLLE



CAS. DE CANDOLLE



CLARKE

GEORG EVERHARD RUMPF, better known as RUMPHIUS, was born in 1628, probably at Hanau on the Main, ancient town with a population half of German and half of Dutch stock. His early life's adventures (for a fuller account see *Rumphius Gedenkboek* 1902) brought him to Portugal, from where he returned with the resolution to study the wonders of tropical nature. In 1652, having enlisted in the service of the Dutch East India Company, he left for the East never to see his native country again. He had given his christian name as 'Jeuriaen' which has induced one of his biographers to raise the question whether he had reason to cover his identity; I wish to offer the happy explanation that 'Jeuriaen' is nothing but the low-Dutch diminutive for 'Georg', and probably the name by which he was known. The supposed adoption of this name now obtains quite another aspect; could it possibly indicate a closer affinity to the Dutch than would appear from his family name and so explain, perhaps, why RUMPHIUS wrote a Dutch prose of remarkably good quality with no trace of German idiom and why he, in his plant descriptions, had non-technical Dutch words at his command which pictured to perfection the plant-characteristics he wished to define?

About the middle of 1653 he landed at Batavia, soon to continue his way to Hoamohel, an islet near Amboina, where he remained (1654). Military service held him till 1657, when he was appointed as a 'second merchant', at Larika, in the north of Amboina. In 1660 he was promoted to 'Chief' (Op-perhooff) of the whole of the northern peninsula Hitoe, and again, in 1662, to 'first merchant'.

Being now a man of note and repute, who received a good income, he found leisure for his coveted research. Some proof of his ability had been the design of the fortification at Banda and he now wrote to the Directors of the Company announcing his intention to write a 'work wherein will be described in Latin such plants, herbs, animals etc. as he has come across and still will meet with during his time of residence in the Indies'.

In 1666, a small botanical garden near the City Hall at Ambon, provided an opportunity of introducing desirable plants and of keeping for study others in close proximity. More and more absorbed in his pursuit of natural sciences, he wanted to

resign at the expiration of his contract (1667); his official work was 'a mask I am compelled to wear in order to secure a daily living for myself and my family'.

His request to be allowed to stay another 8 months in the island as a private citizen was, according to the strict regulation of the day, refused but a reasonable solution to the problem was proposed and accepted: he was to remain another year in the service of the Company and not to be forced to leave Amboina during that period. It was understood that he continued his studies to such an extent that the interests of the Company did not suffer; on these conditions RUMPHIUS remained at Ambon.

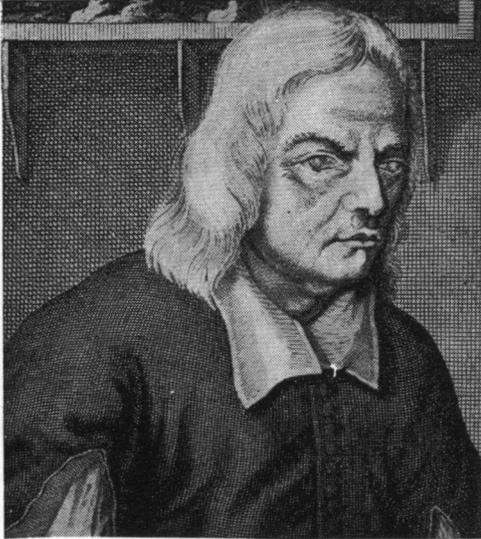
The Ambonese herbal must have progressed rapidly but not fast enough: in April, 1670, RUMPHIUS became blind. Minor officials dismissed him, disabled, on the instant but an appeal to Governor General J. MAETSUYCKER was successful and RUMPHIUS was replaced in 1671 in all his former functions and dignities without reserve. A very satisfactory report on the fortress 'Victoria' to the High Government, a work that must have been made at considerable pains, may tacitly testify to his gratefulness; the *Herbarium Amboinense* seemed safe.

In 1674, a violent earthquake destroyed his house, killing his wife and daughter, but grief again failed to stop his ceaseless activities. While perfecting his herbal, he wrote a historical-topographical work on Amboina, an advice on Agriculture and several other papers, listed by ROUFAER and MULLER (1).

Gradually the botanical work of RUMPHIUS received wider attention. He corresponded on botanical matters with H. DE JAGER A. CLEYER W. TEN RHINE, CHR. MENZEL and others; the *Academia Naturae Curiosorum* at Nurnberg appointed him as a member (1681). Many of his letters have been incorporated in the third volume of *Natur- und Materialienkammer* (1704) by M. B. VALENTINIUS, Professor in the University of Giessen.

A new calamity befell him. In the great fire of Ambon (1687) perished his books, collections, drawings, and manuscripts (among these a written key to the first two volumes of *Hortus Malabaricus* and an interpretation of BONTIUS, cf. § 22); a most

fortunate precaution made it possible to replace the manuscripts by means of copies stored elsewhere but all original drawings were irretrievably lost, his blindness preventing him from making new ones by his own hand.



RUMPHIUS

The coloured plates, kept at Batavia till 1692, were copied by C. ABRAMSEN, a personal servant and pupil of RUMPHIUS's who also drew plants to the satisfaction of Governor General CAMPHUYS and of CLEYER. The plates made under RUMPHIUS's own direction—it was at first intended to illustrate the *Herbarium Amboinense* with coloured drawings—went down on the voyage to Holland with the 'Waterland', but ABRAMSEN's copies reached port and are preserved in the Amsterdam University Library. The illustrations in the *Herbarium Amboinense*, having never been corrected by RUMPHIUS's own critical inspection, are of lesser weight than the descriptions which are authentic; nevertheless the figures have proved to be generally trustworthy.

The losses were practically repaired mainly by

'hij wast op de manier als den Calappus-Boom, dog den stam is wat dikker, maar ook veel lager, en qualyk zoo hoog als een Pinang-Boom, bij de wortel effen, en geentsins uitpuilende, zynde met zyn zwart-groen looff, wilt en droevig in 't aanzien, ook ligt van andere Boomen te onderkennen: den stam is mede eenigszins in trappen verdeelt, doch zeer oneffen en ruig van mosch, als mede met veelderley soorten van Vaaren en *Polypodium* zoodanig bewasschen en bedekt, dat men hem qualyk herkennen kan, voor en al eer hy van de Tieffadoors gezuivert wert; zoo dat hij met zijn leelyke en wilde gestalte niet qualyk een dronken Boer gelijkjt, zoo als die met zijn gelapte klederen, en verwarde hai-

the unwavering perseverance of RUMPHIUS, also by the help of friends. The 'Lords XVII', Court of Directors of the Honourable Company, allowed him another assistant.

In 1690, the first 6 books of the *Herbarium* were shipped to Batavia, and dispatched (1692) to Holland by the unfortunate 'Waterland', which was attacked and sunk. CAMPHUYS, a man of considerable merit in many fields of Malaysian botany, had copied the manuscripts and so, in 1696, a MS. of the lost 6 books together with 3 further books sailed for Holland to reach their destination safely. In the course of 1697, the 3 concluding books followed. An *Auctuarium*, or supplement to *Herbarium Amboinense*, reached Holland in 1704, and was published as the 7th volume. It was his final work. RUMPHIUS died, 75 years old in 1702 at Ambon. In Malaysia his work, as a whole, has never been surpassed and, in part, rarely equalled. His character and work deserve the many highly admiring and enthusiastic biographies by e.g. LEUPE (2), HENSCHEL (3), HEERES (4), HARTING (5), SIRKS (6), and BALLINTIJS (7).

When RUMPHIUS, in 1663, began to write in earnest it was, perhaps, not entirely a disadvantage that he had few books at his disposal. The Company gave free transport for books purchased for him by RULICIUS, a divine at Amsterdam, but these were not many. The scarcity of works of reference will have stimulated him to use his own resources: his sound judgment, his eyes, hands, taste, and talent for description, and it promoted a closer contact with his plants. This poor equipment from a scholar's point of view may have materially contributed to the everlasting freshness of an excellent observer who, forced to find terms in composing his descriptions, coined his phrases without restraint and so wrote, being a man with a lively sense of humour, critical mind, and unremitting urge to investigate, a book which now, after more than two and a half centuries, is a joy to read and an inexhaustive source of good information.

Familiarity with Rumphian style and expression adds substantially to the appreciation of the Malaysian flora; when meeting with plants described in *Herbarium Amboinense* one is pleasurably excited on recalling his pen-portraits which, many times, by some master stroke, picture them vividly and true to life. This is a portion of the article on *Arenga pinnata* (WURMB) MERR. (Herb. Amb. I, p. 57):

(transl.) "He grows in the manner of the Coconut Tree, but the trunk is somewhat stouter, also much lower and hardly exceeding the Pinang Tree, smooth near the roots and not at all bulging, being in its black-green foliage wildly and sombrely attired, also easily distinguished from other trees: the trunk is, in addition, slightly transversely ribbed and not only very uneven, and rough with mosses, but also so much overgrown and covered by a variety of Fern and *Polypodium* that he is scarcely recognisable before being cleaned by the gardeners; which makes him seem a drunken peasant, as he leaps from his sleep in his patched clothes and ruffled hairs; verily, it is the least attractive among

ren, uit den slaap opspringt; immers het is de leelykste van gedaante onder alle Boomen. De takken staan bij malkander boven in den top, gelyk die van den Calappus-Boom, dog hier en daar hangt er een oude by den stam af: zy zyn vyfthien en zeventien voeten langk, styver en ruiger dan den Calappus-takken, niet uitgeholt, maar hoekig, en zonder eenige doornen aan de kanten, te weder zyden met breede bladeren bezet, gelyk die van den Calappus-Boom, dog grooter, te weten vier vingers breed, en vier voeten langk, wel te verstaan omtrent het midden van de tak; want aan beide eynden worden ze allengskens korter, voor met een breede stompe spitze, als afgebroken, of in mindere spitzten verdeelt, en het alder-voorste is het alderkortste, breedste, en driezijdig; haare randen zyn bezet met weinige ydele en subtile doortjes, doorgaans aan de oude bladeren, en hangen de meeste nederwaarts omtrent de midden afgebroken, en door malkander verwert, aan de bovenste zyde glat, donker of zwart-groen, van onderen gryd of witachtig."

Apart from the picturesque and fitting comparison of the appearance of *Arenga pinnata* with that of a drunken 17th century peasant, it is to be observed how skilfully RUMPHIUS describes the general habit of this palm by contrasting it with a related 'tree', how he does not even omit to point to the swollen base of the Cocos Palm which is

"Het bloeizel komt voort aan groote en uitgebreide trossen, daar aan ziet men groote bloemen, in de gedaante van violen, doch grooter, yder op een groen lank steeltje, niet gedrongen, maar ydel van malkander staande, doch die evenwel door haar swaarte den tros wat nederbuigen, zynde yder gemaakt van 5 geele blaattjes, waar van de drie onderste uitwaarts geboogen hangen, de bovenste zijn bultig, en inwaarts gekromt en daar binnen staan verscheidene groenachtige en lange draaden, ook een weinig gekromt met grauwe noppen, waarvan er vier buiten de bloem uitsteeken en van dezelve is de middelste nog langer, dikker, en groender, dan de andere, als een zikkel gekromt, en zonder nop, waar uit de vrucht voortkomt, zo dat uit een bloem maar een vrucht, of houwe groeit, en niet twee of meer, gelyk zommige gemeent hebben, hoewel de meeste part van de bloemen tot vruchten werden, en weinige komen af te vallen."

This quotation has similar—and other—qualities as have been indicated above. It was not easy to compare a *Cassia* flower to a well-known allied flower; *Caesalpinaceae* do not occur in northern Europe, nor are there related species in Amboina familiar to every botanist. To select a violet for the purpose is surprisingly and admirably suitable. The following words of GREENE (8) illustrate my meaning: "If the born botanist—not the machine made one—write of plants he will find language wherewith to enable his readers to see what he has seen in a plant; and this is phytography."

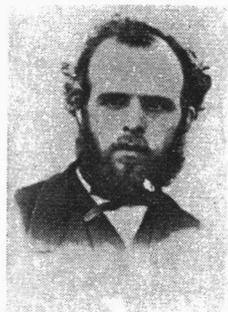
RUMPHIUS had several assistants, all of them untrained in botanical matters when they entered

all trees. The branches are placed together at the top, like those of the Coconut Tree, but here and there an old one hangs down the trunk: they are fifteen and seventeen ft long, stiffer and rougher than the Coconut branches, not furrowed, but angular, and without any spines on the edges, on both sides bearing broad leaves in the manner of the Coconut Tree, but larger, that is four inches wide and four feet long, to be sure about the middle of a branch; because at both ends they gradually become shorter, the top with a broad blunt end, as though broken or parted in smaller tips, and the foremost is the most smallest, broadest and triangular; their margins are beset with sparse, distant, and minute spinelets, usually on the older leaves, and the majority hang downwards, broken about the middle, and confused, the upper surface being smooth, dark or black-green, the lower surface grey or whitish."

absent in *Arenga*. From the broad outline he descends into detail and, with sure instinct, notes what are important characteristics in the leaflets. This example of his art in describing vegetative organs may find its counterpart in a description of a flower, chosen at random. He says concerning *Cassia fistula* L. (Herb. Amb. 2, p. 83):

(transl.) "This blooms in large and extended racemes, in which one sees large flowers, of the appearance of violets, but larger, each on a green slender stalk, not close together but remote, though they bend by their weight the stem somewhat downwards, each consisting of 5 yellow petals, of which the three lower are spread and bent outwards, the uppermost are bullate and bending inward, and inside there are several greenish long threads, also somewhat bent with ash-coloured knobs, of these four exerted from the flower and among these the central one still longer, thicker, and greener than the others, curving like a sickle, and without knob, out of this latter comes forth the fruit, so that from one flower grows one fruit, or *siliqua*, and not two or more, although the majority of the flowers set fruit, and a few are shed."

his service. Ablest of all was PAUL AUGUST (died 1705), his son, who made a number of the most successful drawings. CHR. GIERAARDS (or GERARDE) accompanied him often on collecting trips (before 1691); in 1680 he was temporarily helped by D. CRUL. Of great support to the blind RUMPHIUS was a sailor boy and draughtsman, PHILIPS VAN EYCK (1688–1696). J. PH. SIPMAN wrote part of the text of the *Rariteitkamer* (1705) and collected himself; he was possibly the best of his servants. Dr VAN STEENIS, in Nov. 1946, examined a volume of SIPMAN's plants among KIGGELAER's specimens in the British Museum (Herbarium Sloane 220, vol. VIII); apparently not all are Ambonese. J. HOOG-



COGNIAUX



CORNER



DANSER



DECAISNE

BOOM made drawings for RUMPHIUS in 1685; P. DE RUYTER, a talented soldier schooled by VAN EYCK before he left Amboina (1696), perhaps remained at Ambon till RUMPHIUS's death.

In 1700 the Directors of the East India Company were approached with a request to release the manuscript for publication. There is ample evidence that the scientific value of RUMPHIUS's book was recognized and, also by the Company, was appreciated but it contained jealously guarded trade secrets. The carefulness with which it was prevented that data concerning spices would spread is illustrated by the fact that in 1685 only one nutmeg tree, closely supervised, was kept at Batavia by a special privilege.

Soon, the desire for scientific enlightenment prevailed and, in 1702, publication was consented to, with some slight restrictions. For some reason, I am not certain which, printing was further delayed until, in 1736, J. BURMAN acquired the manuscript. He added short notes and prepared it for the press. Between 1741 and 1750, the 6 volumes appeared; the *Auctuarium* followed in 1755. BURMAN's editing work was good. There exist some discrepancies with the manuscript which may form the subject of a botanico-historical study.

Only the *Auctuarium* (1755) is to be considered in matters of nomenclature. RUMPHIUS wrote long before the binomial system had been brought to some perfection by LINNAEUS; his work, with all its sterling qualities, is essentially pre-Linnean in style and execution. Rumphian plant names could never be admitted under rules based on the Linnean binomial technique but, as many modern names are typified by pre-Linnean phytographical publications, Malaysia is fortunate in having the *Herbarium Amboinense* for its part.

The whole work contains more than a thousand species, 1660 pages of letterpress and 696 plates. Taxonomically, the structure of the book is crude though it cannot be denied a logical sequence adapted to practice. In the first place, the ancient division into trees, shrubs, and herbs is roughly followed; further, the plant is considered in its relation to man on a utilitarian principle, and finally it is skilfully attempted to explain to the reader which plant is under discussion by contrasting it against related species and comparing it to com-

monly known kinds. Although Moluccan, and among these Ambonese, plants are the very large majority, the *Herbarium Amboinense* by no means deals only with those nor is it a complete Ambonese flora.

C. B. ROBINSON (9) counted the references made to the several regions outside Amboina. From many, I cite: 125 entries from Java, from Celebes 83, Ceram 77, Bali 74, Philippines 20, Borneo 8, Sumatra 8, New Guinea 4. These figures are interesting especially when considered in comparison with the state of botanical knowledge of those regions at present.

MERRILL, who wrote the best commentary (9) to the work (1917), said that all Rumphian plants were lost and that interpretation of the species therefore had always to be based on the descriptions, and to some extent on the drawings. Generally speaking, this is true but there is, on the other hand, a certainty that at least some Rumphian plants may be traced (10). PETIVER, and also RAY, have owned plants sent by RUMPHIUS and there are other possibilities. As is the case with *Hortus Malabaricus*, the time required in tracing specimens which have been in his hands would probably, from a scientific point of view, be largely lost; some scattered specimens most likely would add little or nothing to what is known already, but it may be assumed to be a point of duty to locate at least some material originating from the greatest pre-Linnean phytographer Malaysia had.

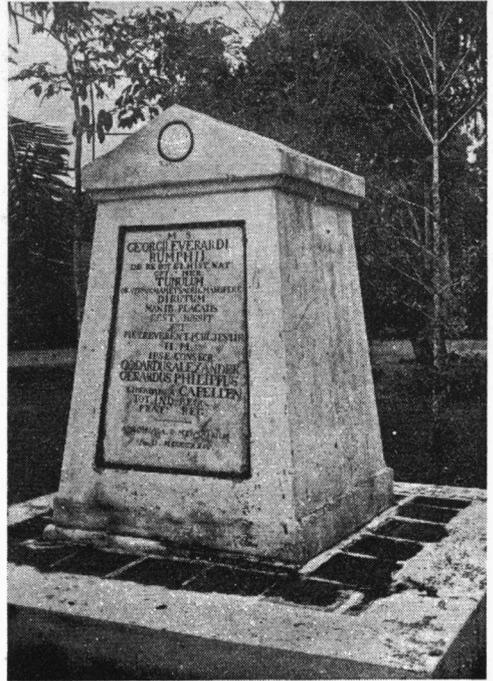
The difference in skill and knowledge of RUMPHIUS's draughtsmen has caused differences in the quality of the drawings and sometimes also discrepancies with the text. In order to solve the various problems regarding a correct interpretation of his plants many efforts have been made. LINNAEUS, STICKMAN (11), BURMAN, LOUREIRO, and LAMARCK's are among the earliest, though some of them incidentally; of their many mistakes MERRILL (9, p. 28-29) gave some interesting cases. It may be stated that these slips appear to be due rather to a lack of material or careful research than to RUMPHIUS's writings. Two botanists of merit lost their life when trying to secure illustrative plants on the classic grounds. The first was J. G. BOERLAGE, who died from tropical fevers (1900) soon after he had arrived, and C. B. ROBINSON, who was murdered

by superstitious natives (1913) after having brought together a considerable collection. E. D. MERRILL, then in charge of the Manila Herbarium under whose auspices ROBINSON had worked, distributed his duplicates. Those assumed to represent Rumphian species, are the 'Plantae Rumphianae Amboinenses', the remainder are 'Reliquiae Robinsonianae' (13).

LINNAEUS ought to have incorporated *Herbarium Amboinense* in his *Species Plantarum*, which necessitated an interpretation after his principles. He realized this and excused himself by pretending that he did not secure a copy of the Ambonese herbal until the manuscript of *Species Plantarum* had been completed. This can hardly be true, for the whole of the *Herbarium Amboinense* had been published in 1750, the first two volumes as early as 1741. BURMAN, moreover, was preparing the manuscript for the press in 1738 when LINNAEUS spent some weeks in his home at Amsterdam. MERRILL detected only 19 references to the *Herbarium Amboinense* in the whole of *Species Plantarum* and one cannot escape the thought that LINNAEUS avoided interpreting the *Herbarium Amboinense* which cannot be explained with certainty. Many Rumphian species cannot easily be reduced to and made to fit in the Linnean system, sometimes because the descriptions lack the details required for that purpose. Possibly, an interpretation of the entire *Herbarium Amboinense* in *Species Plantarum* would have left much in the dark and have cost too much time; the result, at that moment, would have been unsatisfactory. In addition, it seems that LINNAEUS underestimated the merits of the *Herbarium Amboinense*. And it seems possible that he felt that his book on HERMANN's Ceylon plants (§ 18), which was entirely incorporated in *Species Plantarum* gave an adequate picture of the tropical Asiatic flora, as he believed that the flora of the tropics was identical in all regions. LINNAEUS wanted some study of *Herbarium Amboinense*, however, and charged one of his pupils, O. STICKMAN, to study and identify the plants it contained; the result was a somewhat superficial and fragmentary interpretation in 1754, reprinted in 1759 in the 4th instalment of the Linnean serial *Amoenitates Academicae*. Approximately 300 of RUMPHIUS's plants are reduced to Linnean binomials, many of them wrong. The reprint is different in that the *Auctuarium* is also considered and a number of reductions are either corrected or added, raising the total to c. 330 (MERRILL).

BURMAN published an *Index* to the whole work, according to the Linnean system in 1755, a second *Index* from his hand followed in 1769. Now 458 binomials adorned the Rumphian species. J. C. M. RADERMACHER, in his *Naamlijst* (§ 38), reduced RUMPHIUS's plants as far as they had been assigned to Java (1781). BUCHANAN-HAMILTON also worked on the Linnean interpretation but never completed his study (1826-1832). A *Clavis Rumphiana botanica et zoologica* by A. G. E. T. HENSCHEL (1833) summarized the findings of professional botanists and added no fresh opinion in this respect. Among the numerous students of parts of the *Herbarium*

Amboinense—any botanist studying to some extent Malaysian plants will find occasion to refer to RUMPHIUS—C. L. BLUME deserves to be mentioned; he amply and ably discussed aspects of Rumphian discoveries in many pages of his *Rumphia* (see in particular vol 1, 1845). H. ZOLLINGER com-



THE 2ND MONUMENT ON RUMPHIUS'S GRAVE

posed an incomplete key (manuscript in the Buitenzorg Herbarium). A good compilation of all literature extant augmented with data was supplied by J. E. TEYSMANN, who on his Moluccan expedition paid special attention to Rumphian plants. Another key, based on study of new materials, was made by J. K. HASKKARL (1866) but that author was not very successful in his attempts at additional reductions (12). His reasoning is not lucid and mere variants or details are overstressed. Notwithstanding these shortcomings, his efforts furthered appreciation and understanding of the *Herbarium Amboinense*.

MERRILL's admirable *Interpretation* (9), in its concise, direct, and accurate style, is by far the most valuable study yet written (1917). He estimates that the 7 volumes contain about 1200 species, 930 of which can be referred to definite binomials; another 140 may be placed in their respective genera. Some 350 Malaysian species are now typified by Rumphian figures and descriptions.

The commemorative volume *Rumphius Gedenkboek* (1902) may be referred to for a bibliography and exhaustive commentaries on RUMPHIUS's life and work.

References: (1) *cf.* Rumphius Gedenkboek (1902). (2) Verh. Kon. Akad. Wet. 13 (1871) 1–63. (3) HENSCHEL, *Clavis Rumphiana . . . accedunt vita G. E. Rumphii etc.* (1833) 139–202. (4) Rumph. Gedenkboek (1902) 1–12. (5) *Album der Natuur* (1885) 1. (6) SIRKS, *Indisch Natuuronderzoek*



J. BURMAN

(1915) 25–61. (7) BALLINTIJN, *Rumphius* (1944). (8) GREENE, *Landmarks of Botany I*, *Smiths. Misc. Coll.* 54¹ (1909) 223. (9) MERRILL, *Interpr. Rumph. Herb. Amb.* (1917) 14. (10) MARTELLI, *Le collezioni di G. E. Rumpf etc.* (1903). (11) *Amoen. Acad.* 4 (1759). (12) *Abh. Naturf. Ges. Halle* 9 (1866) 145–389. (13) *Philip. J. Sci. Bot.* 11 (1916) 243–319.

22. Bontius; *phytography in Java*

Turning now our attention to Java, we find JACOBUS BONTIUS writing during his stay at Batavia (1627–1631) the earliest botanical work of importance there. A son to GERAERT DE BONT (or DE BONDT, Professor of Medicine and Botany and Director of the Leyden Botanic Gardens since 1587), he was born in 1592, arriving at Batavia in the retinue of Governor-General J. P. COEN, as his personal surgeon. Dutch power in the East Indies was young and in BONTIUS's term of office Batavia was twice besieged (1628, 1629). He suffered repeatedly from tropical diseases; it was rarely possible to leave the precincts of the town with some degree of safety, and he was a very busy physician and lawyer (he had brought his library of 2000 volumes with him, the largest consignment of books that had ever entered the Indies). Though his botanical writings cannot stand comparison to RHEEDE's and RUMPHIUS's works, when the period and circumstances are brought into account, his studies (main-

ly pharmacological) are to be highly appreciated. Here I limit myself to his phytographical results; particulars regarding his life and work may be found *e.g.* in SIRKS's *Indisch Natuuronderzoek* (1915).

He exchanged his botanical news and findings with those of A. VAN DUEREN, fellow-surgeon at Batavia. He was a good linguist, a sharp-eyed doctor, a reasonably good describer, but a poor draughtsman. His drawings are often difficult to understand, sometimes manifestly wrong. A helping hand (ADRIAAN MINTEN) failed to produce better results. The picture of *Ceiba pentandra* as a tree in Java is, however, the earliest in print and his 'Fructus sacer mangam' a good drawing, accompanied by some notes, of *Neesia altissima* Bl., a species that remained unnoticed for two centuries after.

BONTIUS evidently was no keen systematist nor an outstanding phytographer, but his was an inquisitive mind if not very critical. His notes, pharmacological facts and general remarks on about 70 species of easily identifiable plants are a chief source of information of the botany of the Batavia district at the time. Like RUMPHIUS he compared tropical species to those he had known at home and often guessed relationship with commendable accuracy. He was the first to point out the preponderance of trees and shrubs in tropical *Leguminosae* in contrast with the usually herbaceous European species.

It is to be regretted that BONTIUS's manuscripts came into incapable hands in Holland. His brother WILLEM waited 10 years before publishing the books (1642) and then only the first four, which have little to do with botany. A second edition (1646 or 1648) remained practically unnoticed, the third (1658) consisting now of six books appeared as a section in G. PISO's *De Indiae utriusque re naturali et medica* and has the *Historia Plantarum*; this at last received the recognition it deserved. The time-honoured custom of unauthorized changing and trimming before publication of manuscripts written by others, sometimes with undesirable results, seems here to have been replaced by indifference, which caused the loss of several of BONTIUS's notes; in *Historia Plantarum* 5 chapters appear to be left out by some oversight.

If BONTIUS, at least, had the makings of a good botanist, his successor in Javan plant description was a man of lesser gifts as a scientist.

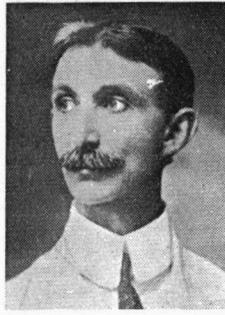
J. NIEUHOFF, a restless traveller in many parts of East Asia, was an intelligent though superficial observer. At Buru and Amboina (1659) he wrote (1) some general notes on the flora, and so he did at Malabar (1662); more important are his remarks on the Batavian flora. Visiting there for the second time in 1667, he was forced to stay till 1670. He said (ed. CHURCHILL): "During those three years I had sufficient opportunity to take a full view of the city, both within and without, in which I was so curious, as not only to make draughts of all its public structures, but also of such plants and trees as grow in and about that city; tho' to confess the truth, the same could oftentimes not be undertaken without great hazards, as well from the wild



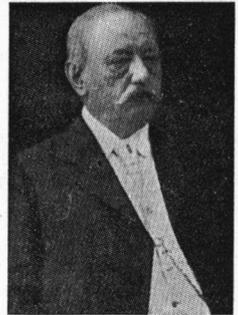
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ENGLER

beasts, as from the barbarous Javanese, so that I durst not venture far out of the town without a good guard." He got acquainted with more than 125 kinds of plants, wild or cultivated, the majority clearly identifiable. NIEUHOFF's records contain many now forgotten medical applications, and several species appear in print for the first time. His padding out of his writings by means of the observations of BONTIUS and others without plainly indicating his sources, a breach of scientific custom which was in that period considered to be a smaller offence than at present, was commented on none too kindly by his contemporaries. He described and recorded for the first time in Java a number of species, mainly herbs or cultivated shrubs as he avoided the forest.

Of *Ricinus communis* L. he knows two varieties, a green and a purple one, and comes to an amazing conclusion: "On the top sprouts out a bunch of green buds, which opening by degrees, produce yellowish flowers; after which comes the fruit, not unlike a chestnut, containing a bean or kernel, which is very good food." This peculiar slip may be less due, perhaps, to lack of information than to a very recent introduction of the powerful seeds.

The activities of ANDREAS CLEYER, soldier of fortune, an enlightened if unreliable character, some time in the military service of the Company, some time Rector of the Batavian Latin School, and also holding high offices, decidedly furthered Malaysian plant description. Apart from his exchange of plants and letters with RUMPHIUS, he sent him PHILIPS VAN EYCK (1688), who proved to be of great service. In the last decades of his life, CLEYER occupied himself mainly with his hobby although he wrote only on Japanese plants; he died 1697 or 1698 at Batavia. On behalf of his botanical gardens and his studies, he introduced many species from Japan, assisted, when staying there, by his compatriot GEORG MEISTER, a Thuringian who had decided to try his profession (that of gardener) overseas.

On arrival at Batavia (1677), MEISTER was added to the garrison of the Castle. Soon after, he made a trip into the interior with an auxiliary expedition to a native prince. Without sighting an enemy, MEISTER returned after two months. In his narrative he does not appear to have noticed the flora

at all. He superintended in Java CLEYER's three botanical gardens (§ 36). In 1687, MEISTER sailed for Holland and in 1692, published a book on tropical gardening. Most unfortunately, MEISTER in his wish to compete with fashionable travel stories, filled his book largely with Japanese ethnology and all manner of irrelevant, sham erudite, data. In the history of Malaysian botany his book deserves a modest place; as regards phytography it is disappointing. There are again several first records for Java but, possibly, most important was his transfer to Europe of some 400 kinds of seeds, mostly Malaysian, more than 300 coloured plates of Malaysian and Japanese plants and a considerable living collection. He also must have assisted CLEYER in the forwarding of herbarium specimens to several botanists in Europe. (e.g. to COMMELIN, *Pterocarpus indicus* WILLD., and *Cassia javanica* L.).

References: (1) NIEUHOFF, *Zee en Lant Reize* (1682), ed. CHURCHILL, *Voyages & Travels* 2 (1732).

23. De Jager, Ten Rhijne, and Witsen

Pre-Linnean Malaysian phytography received notable aid from HERBERT DE JAGER, roaming doctor and linguist, who sailed for the Indies in 1663. He was repeatedly obliged to travel to Persia but journeyed also far and wide in other directions. He met RHEEDE and his assistants on the Malabar Coast (c. 1680), studied plants on the coast of Timor some time before 1683, in that year stayed at Batavia, and went in 1684 to Malacca, always on the move in spite of bad health, always exchanging plants and letters on scientific problems with the best minds of the age, in particular RUMPHIUS. To the latter he sent e.g. descriptions of the Lontar Palm, Camphora, Santal Wood, and Benzoë; from Malacca he forwarded several plants. N. WITSEN, scientist-burgomaster of Amsterdam, one of his pen friends, testified at his death (1694, at Batavia): (transl.) "his erudition caused his death in poverty at Batavia; he left a treasure of learned annotations, but all were neglected, hardly anybody among us being interested". DE JAGER's severe opinion on the work of other scientists (he knew Father MATTHEUS (cf. § 20) and judged him to be 'not even in the slightest degree a botanist'), his often somewhat self-asserting style of writing, his erratic per-

sonality, and his untiring linguistic research in connexion with botany, find a curious parallel in H. HALLIER (see § 70). Contrary to the latter, however, he was not a very keen-sighted taxonomist and he is partly responsible for the long sustained misconception of LINNAEUS and others that a generally identical vegetation flourished in all parts of the tropics as he reported to have noticed no significant change in the flora on his journey from Batavia to Ispahan (1).

N. WITSEN, who held a place in the scientific world somewhat similar to that of Sir JOSEPH BANKS a century later, had a considerable interest in East Indian plants. In 1700 he received a consignment of Javan plants and ordered them to be pictured in colours. A volume of 232 sheets is still kept at TEYLER'S Museum at Haarlem; the drawings were indexed and named by J. BURMAN in 1748, and again by M. VAN MARUM and BLUME.

I have had occasion to mention W. TEN RHIJNE (§ 20), a surgeon of great fame, who in those years led a life much resembling that of DE JAGER'S. He had a collection of Timor plants and also took part in the scientific intercourse in letters, his correspondents in particular being English botanists; he helped RHEEDE and sent living plants to Europe. Among the collectors of the day SYLVANUS LANDON (also 'LANDMAN') ought to be remembered. The earliest record of a Bornean herbarium specimen (before 1702) has his name attached to it; in the SLOANE herbarium VAN STEENIS observed some specimens from Flores, collected by him in 1679.

References: (1) DE JAGER, Letters in VALENTINIUS, Natur- und Materialien Kammer 3 (1704).

24. Philippine pre-Linnean phyto-graphy; Father Kamel

An outline of pre-Linnean botany in the Philippines (1) has been drawn by E. D. MERRILL (1926). As a matter of record may be noted his statement that CLUSIUS'S *Rariorum Plantarum historia* (1601) contains a first reference to a Philippine plant *i.e.* *Illicium sp.* In 1582, CLUSIUS already published on DRAKE'S specimen of *Gnetum gnemon* L. collected in 'Beretina' in the Philippines (§ 9), and I am not at all certain that Philippine botany begins not even earlier. MERRILL'S conclusion on the botanical writings of the period is: "The most that can be claimed for them is a slight historic value, chiefly in reference to the approximate time of introduction of various economic plants." This is undoubtedly correct, if seen from the point of view of modern systematic botany; pre-Linnean botanical science in the Philippines maintained very slender contacts with Europe and, consequently, was only very incidentally considered by phytographers. An exception must be made for GREGORIUS JOSEPHUS CAMELLUS (G. J. KAMEL S. J.).

Father KAMEL, a Jesuit missionary, was born in 1661 at Brünn (Bohemia) and, after having followed his calling in the Marianes, went to the Philippines. His general interest in taxonomic botany surpassed his pharmacological occupation (he had a little shop at Manila where he supplied the na-

tives with medicinal herbs) and made him send considerable treatises and many drawings of Philippine plants to RAY and PETIVER (§ 14).

A first note on the 'true Amomum' appeared in 1699 followed in the same year by a paper (2) on the 'Nux vomica legitima serapionis' and an exciting anecdote concerning the 'St Ignatius beans'. An important phytographical contribution was his *Descriptiones Fruticum et Arbrum Luzonis*, published as a separate section in RAY'S *Historia* (vol. III, or 'Supplement'), which also contains his study *Herbarum aliarumque stirpium in Insulâ Luzone Philippinarum primaria nascentium*. The illustrative drawings accompanying these papers were probably later published by PETIVER (3). Four sets of descriptions of climbing plants, *Tractatus de plantis philippensibus scandentibus*, appearing in the 'Philosophical Transactions' (1704-1706), concluded his work, that has been too little studied, no doubt, because his influence on botanical nomenclature has been slight.

KAMEL made the first deliberate attempt towards a Philippine flora, and the identification of the majority of his species would not seem difficult as the descriptions are reasonably detailed and accurate though, sometimes, rumours were too readily accepted for fact. Pater CAMELLUS died in 1706 at Manila.

As regards a number of unpublished manuscripts by other priest-authors and some minor data, *e.g.* Father J. E. NIEREMBERG'S botanical notes (4), I may refer to MERRILL'S essay.

References: (1) MERRILL, Enum. Philip. Fl. Pl. 4 (1926) 43-56. (2) CAMELLUS, in Philos. Transact. 21 (1699) 2-4, 88-94. (3) PETIVER, Gazophylacii naturae (1702). (4) NIEREMBERG, Historia Naturae (1635).

25. Pre-Linnean period in the Malay Peninsula

The Malay Peninsula, apart from scattered references in literature and occasional scraps of observations by travellers, seems to have produced in pre-Linnean times no phytographic literature of historical importance. Only one small paper dealing solely with peninsular plants appeared, by Father CLAUDE DE BÈZE S. J. (also spelt DE BAIZE). It contained descriptions of 9 kinds of fruit (1). This is good thorough work, and it is to be regretted that no more of his observations were laid down, the more so as he—about 1690!—gave a first indication of the limits of the Malaysian flora towards that of India. He stressed the point that some plants occurred both in the Malay Peninsula and in India others, however, grew in the Malay Peninsula but were absent from India.

After a life of hardship and adversities (he was even kept prisoner by the Dutch but treated with the civility usually extended in the 17th and 18th centuries towards captives of scientific or spiritual distinction, and so enabled to continue his studies in natural sciences), he died in 1695 in Bengal.

References: (1) DE BÈZE, Descr. de quelques arbres *etc.* in Mém. Acad. Roy. Sci. Paris 4 [1666-1699] (1731) 327-333.

FROM 'SPECIES PLANTARUM' TILL THE ESTABLISHMENT OF THE BUITENZORG GARDENS

26. <i>Species Plantarum</i> and Malaysian phytophraphy xciii 27. Swedish exploration; Retz and Thunberg xciii 28. Banks and his contemporaries xciv 29. English periodicals before the 19th century xcvi 30. French phytophraphy; Lamarck and his collaborators xcvi 31. French exploration; Poivre, Commerçon, Sonnerat xcvi 32. French expeditions; Deschamps, Lesschenault xcvi 33. French horticulture; E. P. Ventenat xcvi 34. Phytophraphy in Holland; Burman, Houttuyn xcvi	35. Incidental contributions; Gaertner, Willdenow xcvi 36. First establishment of botanical gardens in the East Indies xcvi 37. The 'Asiatic Society' and the 'Bataviaasch Genootschap' xcvi 38. Phytophraphy in Java; Radermacher and Von Wurmb xcvi 39. Incidental contributors in Malaysia; de Noronha xcix 40. Raffles and Horsfield c 41. Father de Loureiro's 'Flora Cochinchinensis' ci 42. Indian research; the 'United Brotherhood', Roxburgh ci 43. Penang Gardens ci 44. Philippine phytophraphy ci
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26. *Species Plantarum* and Malaysian phytophraphy

In 1753 a new era in botany, and especially in phytophraphy, was marked by the appearance of *Species Plantarum*. It was the first work in which an effort was made to give a comprehensive summation of all known species by means of succinct, systematically built, specific analyses; its briefness, its artificial but lucid and practicable taxonomic arrangement based—in general—on the sexual characters, and its name-giving, according to a consistently applied binomial method, earned it a foremost place, then and now, in systematic botany. Descriptive botany acquired new directives but the influence of *Species Plantarum* on Malaysian phytophraphy was neither immediate nor entirely favourable. Communications were long and scarce which made, in conjunction with the small number of academically trained botanists in Malaysia, for a delayed understanding of its importance; on the other hand, LINNAEUS seems to have been acquainted least with our region among all other parts of the world. Moreover, this 'complete' catalogue brought about a strong tendency to reduce all available specimens—whether old or newly discovered—to species included in *Species Plantarum* which prejudiced the studies and conceptions of describing botanists in the second half of the 18th century. This resulted in an unwarranted widening of original Linnean species-limits, and often in misinterpretation and confusion. A second wrong conviction thwarting rapid development was the belief, also advocated by LINNAEUS; that the tropics had a homogeneous vegetation round the globe. Dozens of species were based on material partly from tropical America or Africa and partly Asia, which could be right only in case of some pantropical weeds or fruits. Travellers in the tropics rarely succeeded in penetrating into the interior and the most striking features of the vegetation along the shores were pantropical species, already introduced and acclimatized during a considerable period. Though specimens from Malaysia

were awaited in Europe with eager interest, new species were, very often, not so much anticipated or desired as information concerning time-honoured but imperfectly known medicines.

So, if LINNAEUS's work was most conducive to clearer phytophraphy and constructive taxonomical research, yet this new light was focussed on Europe, (South) Africa and the Americas, leaving tropical Asia much in the same shadows as before.

27. Swedish exploration; Retz and Thunberg

Following the example of his illustrious predecessors, the energetic Swede, who occupied the Chair of Botany at Uppsala since 1742, persuaded sea-captains to bring him plants from remote regions and also instilled an enthusiasm into his pupils to roam in the wildest parts of the world in quest of remarkable specimens. M. LAGERSTRÖM, a Director of the Swedish East India Company, gave orders to this purpose analogous to those of the East India Companies of other nations (cf. § 8).

One of the pupils of LINNAEUS in the service of the Swedish Company was P. OSBECK (1723-1805), who sailed to China as a chaplain and stayed July 15-17, 1751, off the coast of West Java (near Anjer) where he collected, to return in 1752, when they cast anchor in Meeuwen Bay; again plants were secured. OSBECK's diary (*Dagbok*) appeared in 1757 and was subjected to a study by MERRILL (1916), who demonstrated that among many interesting observations on the ecology and biology of plants and animals, 26 species and 2 genera were new and legitimately described (1). The Linnean herbarium contains about 600 of OSBECK's specimens; he was the collector of the type specimen of Java's most popular orchid, *Phalaenopsis amabilis* (L.) BL. His materials arrived in time to be included in *Species Plantarum* but were largely neglected as happened to RUMPHIUS's records. C. G. EKEBERG and A. SPARRMAN collected also (1766) in West Java, much in the same localities as OSBECK, adding to their collections specimens from an islet



FOXWORTHY



FURTADO



GAMBLE



MISS GIBBS

near SW. Sumatra in 1767. Their plants were again studied by LINNAEUS. Passing by, for the moment, one of his other pupils who played a role in Malaysian phytography (D. C. SOLANDER, § 28) I may conclude participation in the advancement of Malaysian botany of the period in Sweden by referring to A. J. RETZ and C. P. THUNBERG.

A. J. RETZ(IUS), born in 1742, botanical demonstrator and professor in Lund University, wrote many phytographical publications which are now practically forgotten. An exception is his *Observationes botanicae* which appeared in six fascicles between 1779 and 1791, supplemented by J. G. KOENIG's studies (cf. § 42). A number of Malaysian plants were described on data supplied by P. I. BLADH and by 'Magister' WENNERBERG (Java and Sumatra). The small portion of RETZ's works now procurable without an intensive search suggests that his contributions should have received more recognition.

In 1770, C. P. THUNBERG (1743–1828), student of LINNAEUS's and his devoted friend, went to Amsterdam where he studied J. BURMAN's rich collections. Travelling at leisure and studying in the best places, he proceeded to Leyden, The Hague, and France, returning to Amsterdam in the following year. Together with several other plants lovers, BURMAN and M. HOUTTUYN introduced him into the benevolent attention of the wealthy Directors of the East India Company, and he embarked in their service for Batavia and Japan. His chief and lasting merits as a systematist and phytographer were gained in South Africa and Japan; our interest is limited to his contribution to Malaysian botany. He collected plants—which served as a base to his own later writings and those of others—in Java in the first half of 1777; on the voyage home he stayed 7 months in Ceylon (till February 1778), and then returned to Europe. He succeeded LINNAEUS's son in 1784 as a Professor of Botany in Uppsala University. Of his works *Nova Genera Plantarum* (1781–1801) and a *Florula ceilonica* (1825) are to be mentioned here. Under his direction were prepared, after the example set by LINNAEUS, a number of academical papers. Especially dealing with Malaysian botany are a paper on *Ficus* (1786), the *Arbor toxicaria macassarensis* (1788), *Myristica* (1788), *Caryophyllis aromaticis*

(1788), *Benzoë* (1793), *Oleo Cajuputi* (1797), *Styrax* (1813), and a *Florula javanica* by WINBERG and WIDMARK (1825). The latter book is a modest attempt by two of his pupils and consists of two small treatises. The first, by WINBERG, contains a list of 325 species brought by THUNBERG from Java completed by 16 described species; the second, by WIDMARK, has some new species among 27 descriptions and a further list of 402 names of THUNBERG's specimens. The booklet has had recently the attention it deserved (2). O. SWARTZ described several of THUNBERG's Malaysian ferns and orchids.

References: (1) Am. Journ. Bot. 3 (1916) 571–588. (2) *Blumea* 6² (1949).

28. Banks and his contemporaries

In England, the interest in and study of exotic plants (and also those of Malaysia) continued in this period in much the same manner as before (see § 14–16). The Gardens and collections at Kew, in the course of the years, advanced to the first place they have held ever since; Sir JOSEPH BANKS (1743–1820), among plant amateurs, set an example for all time by his munificence, his untiring efforts in promoting botany, and his fair and gentlemanly conduct towards fellow botanists irrespective of whether they belonged to enemy nations or not, his only criterion being if botany might prosper and serve all mankind (1). BANKS's excellent library and collections commanded admiration and eventually formed the nucleus of all collections pertaining to natural history in the British museum; among his numerous dried specimens from Malaysia were plants collected by himself and his librarian D. C. SOLANDER during their visit to the Archipelago with the 'Endeavour', the ship which carried J. COOK on his first navigation round the world. In the second half of 1770 they called at SW. New Guinea, and Savu Island, and in 1771 remained some time at Batavia and Anjer; they also explored some islets off the Java coast. In the same year they returned to England. Draughtsmen and painters had accompanied them, for instance S. PARKINSON, whose 'Journal' was edited in 1773 (2), and whose drawings are preserved in the British Museum as is a manuscript of SOLANDER's *Plantae Javanenses*. In 1773, SOLANDER resumed work in the British

Museum (he died in 1782) and J. DRYANDER, also a Swede, was employed by BANKS in his place.

DRYANDER's chief work is a masterly catalogue of the Library of BANKS (5 volumes, 1796–1800); Malaysian phytography was furthered by him directly in two small papers on Sumatran trees (3). In addition, he supervised with SOLANDER the first (1783) and, partly, the second edition (1810–1813) of *Hortus Kewensis*, by W. AITON (father) and W. T. AITON (son), in which many Malaysian plants were described; he also worked on ROXBURGH's *Plants of the Coast of Coromandel*. He died, a famed botanist, in 1810. To BANKS's third secretary and librarian, R. BROWN, I will return later (§ 49).

BANKS had assembled many of EHRET's drawings (§§ 16, 17) but on the latter's death (1770) England had no artist of equal skill and training. About 1790, however, the Austrian brothers FERDINAND and FRANCIS BAUER (FRANCIS having been persuaded by BANKS to remain in England since 1788), made exemplary plant drawings. FRANCIS in particular pictured many Malaysian species (orchids were his speciality) and published from 1791–1793 to 1800–1801 *Delineations of Exotic Plants*.

A somewhat isolated place was occupied by J. HILL, who was denied recognition as a scientist of standing during his life and afterwards. His publication of a part of *Hortus Malabaricus* has been mentioned (§ 20); in 1759 he wrote on the plants at Kew (*Exotic Plants*) and composed a *Vegetable System* in 26 volumes (1759–1775), which remains to be studied in its aspects to Malaysian botany.

CH. KONIG worked in the herbarium of BANKS and wrote some good papers of importance to Malaysian phytography, most of them appearing in 'Annals of Botany' (cf. § 29). I refer here to *Observations on the Durion* (4), *On Aegiceris fragrans* (5), *Some Account of the Sago Palm* (6), and *A few botanical observations* (7).

Other authors to be noted are CH. MILLER, first Curator of the Cambridge Botanic Gardens, who collected in Sumatra (Bencoolen and Musi Basin) giving an account in 1778 (8), and TH. PENNANT, who in volume 4 of his *Outlines of the Globe* presented a rather uncritical, here and there annotated, enumeration of mainly Malaysian and Indian plants after the Linnean method, with a synonymy of Rumphian and Rheedian names (1800). His is the word that remains true till the present day: 'Sumatra still wants its florist.' MERRILL studied the nomenclature connected with PENNANT's work (9).

English travellers, visiting Malaysia after COOK, also added to the description of its vegetation. There is a stirring narrative by TH. FORREST, who explored the Moluccas and New Guinea between 1774–1776 in search of seedling nutmegs on behalf of the English East India Company (10). From the Moluccas CHRISTOPHER SMITH sent ample materials for future Malaysian phytography to England (1798) and to ROXBURGH in Calcutta. Much English enterprise I must leave unmentioned.

References: (1) ARBER, Sir J. Banks and Botany in Chron. Bot. 9 (1945) 94–106. (2) PARKINSON,

Journal of . . . the 'Endeavour' (1773). (3) DRYANDER, Bot. Descr. Benjamin Tree of Sumatra in Philos. Trans. 77² (1787) 307–309; Bot. Besch. Benzoë Baum Sumatra in Mag. Bot. Zürich 1² (1787) 69–71. (4) Transact. Linn. Soc. London 7 (1804). (5) Ann. Bot. 1 (1805) 129–133. (6) *ibid.* 193–200. (7) *ibid.* 356–358. (8) MILLER, Account of Sumatra in Philos. Trans. 68 (1778) 161–179. (9) Journ. Arn. Arb. 29 (1948) 186–192. (10) FORREST, A voyage from Calcutta to the Mergui Arch. (1792).

29. English periodicals before the 19th century

This period also includes the starting point of several scientific journals, in England and in Europe generally as well as in tropical Asia, entirely or partly devoted to phytography. The earliest periodical papers contained among the most diversified subjects now and then descriptive contributions to Malaysian botany. The most important had been the 'Philosophical Transactions' (since 1665), and the Austro-German 'Ephemerides' (1670 onwards, under various titles).

A new serial mainly devoted to picturing plants, was the 'Botanical Magazine or Flower Garden displayed' (1787), begun by W. CURTIS, Director at 'Chelsea Physick Garden', later continued by J. SIMS, W. J. and J. D. HOOKER and others, as a truly magnificent series of plates and descriptions of undisputed scientific merit in which many dozens of Malaysian species have been treated. A history of this periodical, including a survey of 19th century English horticultural publications, was published by W. BOTTING HEMSLEY in 1906, further supplemented by the portraits and biographies of the persons to whom separate volumes were dedicated (1931). In this connexion Sir J. E. SMITH's 'Exotic Botany' is to be remembered, which was even better in appearance than CURTIS's Magazine but persisted only 2 years (1804–1805).

Of similar design was H. C. ANDREWS's 'Botanists' Repository' of which 10 volumes appeared between 1799 and 1811. Dealing partly or wholly with Malaysian plants, dozens of articles in which illustrations, if any, were of lesser importance, appeared in the botanical section of the 'Transactions of the Linnean Society of London' (since 1792). Some interesting papers are found in CH. KONIG and J. SIMS's 'Annals of Botany' (1805–1806, 2 volumes, e.g. on *Canarium* by CH. KONIG and on *Ficus* by C. L. WILLDENOW).

30. French phytography; Lamarck and his collaborators

In France the Linnean system met with opposition. There was, in 1763, the little appreciated *Familles des Plantes* by M. ADANSON, a versatile scholar who wrote, as a preface to his work a particularly important history of botany. He tried for a natural system but applied highly artificial methods; his contacts with Malaysian botany need further study. Classification according to the natural system advocated by A. L. DE JUSSIEU and his nephew B. DE JUSSIEU won a wider approval.

Of more direct importance to our region was J. B. A. P. DE LAMARCK's *L'Encyclopédie méthodique, botanique* (1783-1808). LAMARCK, to whom we owe the dichotomous key—so efficient a tool to every student of modern systematic botany—treated in this large work (and in several of his other publications) a great many plants from tropical Asia, collected by COMMERSON, SONNERAT, and others. The first four volumes were of his own pen, the fifth was composed in collaboration with J. L. M. POIRET, who wrote the concluding three volumes, supplementing these by another five volumes (*Supplément*, 1810-1817). This new attempt for an enumeration and description of all known species meant a decided advance in phytophraphy. The Linnean method of noting briefly and summarily some selected striking characters, which had contrasted against the usual pre-Linnean rambling and unordered, rather needlessly extensive, manner of description, was now avoided as well as the recently re-adopted habit of listing every conceivable property of the plant under consideration without differentiating between points of major and minor interest. It consciously tried to outline clearly the species-limits as a whole in a concise manner. The Linnean manner aimed at differentiation at shortest notice; the French school intended to compose descriptions which, by themselves, provided an adequate word-picture of the plant but had to be short in order to be easily handled in differentiating allied species. This principle was often successful though sometimes the enormous, rapidly expanding, task had to be accomplished with some neglect of desirable detail. Complementary volumes of plates, reasonably well executed, completed the cyclopedias (1).

References: (1) LAMARCK & POIRET, *Tableau encycl.* 3 vols, and *Recueil des Planches* 4 vols (1791-1823); for dates of publ. (*Encycl. méth.*) see WOODWARD, *Journ. Bot.* 44 (1906) 318.

31. *French exploration; Poivre, Commerson, Sonnerat*

In the exploration of eastern Asia, France had its share from the beginning. The second half of the 17th century saw the adventurous life of P. POIVRE, missionary and plant collector in China and Indo-China. Losing one arm in a sea-battle, he changed his profession and, in the service of the French East India Company, repeatedly sailed to Cochinchina, the Moluccas, the Philippines, and Madagascar. A trip to Timor and Celebes to smuggle nutmegs (1755) was succeeded by his appointment as Intendent of Réunion and Mauritius. He founded the Botanic Garden at Pamplemousses and Le Réduit, and returned to France in 1773; he died in 1786. Several essays and articles from his hand were published but more remained in manuscript; H. CORDIER gave some extracts. His plants were part of the Malaysian materials described by LAMARCK and POIRET. To these were added the huge collections of PH. COMMERSON.

COMMERSON, a naturalist of some repute and medical doctor, joined the expedition of L. A. DE

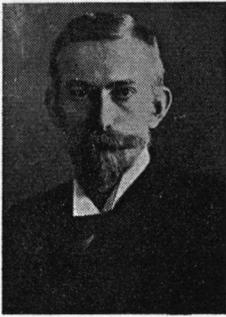
BOUGAINVILLE, first of a series of voyages under the French flag to the remotest corners of the globe, made for various reasons but always commissioned to promote natural sciences in every respect. In 1768 'La Boudeuse' and 'l'Étoile' entered the East Indian Archipelago, touched at Buru Island (Moluccas), and spent some time at Batavia. The ship returned to France but COMMERSON left the expedition to assist POIVRE at Mauritius. COMMERSON, after further exploration, died there in 1773. Many Malaysian plants were preserved in his Herbarium, at the time one of the finest in existence, counting more than 25000 sheets, which were most welcome to LAMARCK and POIRET (§ 30). The plants and manuscripts were brought to France after his death by JEANNE DARRÉ, his wife and fellow collector, the first woman to travel round the world. Some labels have been mislaid and thus some ferns and other plants were described for Timor or Java which actually belong to Réunion.

P. SONNERAT worked with COMMERSON in Mauritius for more than three years and then sailed, in 1771, with POIVRE to the Moluccas hunting economic plants and spices. They went to the Philippines also and, cruising southwards, came close to New Guinea. After COMMERSON's death, SONNERAT returned to France. Most of his plants were kept at Paris and some served to augment the material basis of LAMARCK's later volumes. His *Voyage à la Nouvelle Guinée* (1776) is phytophraphically unimportant.

32. *French expeditions; Deschamps, Leschenault*

The next French expedition to enter Malaysia would have contributed greatly to its phytophraphy if fate had willed it.

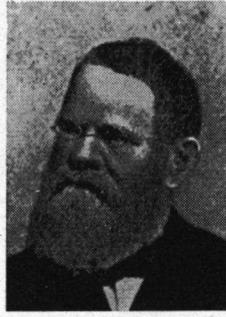
L. A. DESCHAMPS, a young surgeon and naturalist, had been asked to join the search for the lost French explorer J. F. G. DE LA PÉROUSE, under A. R. J. BRUNY D'EN TRECASTEAUX. 'La Recherche' and 'l'Espérance' sailed in 1791, bound for the Pacific. Charged with the study of natural history were, beside DESCHAMPS, J. J. HOUTOU DE LA BILLARDIÈRE, surgeon and botanist, the Roman Catholic priest and naturalist L. VENTENAT, the gardener LAHAË, and the artist PIRON. In 1792 the ships called at Ambon, the next year cruised in the east of the Archipelago and, after dropping anchor at Surabaya and learning the course of the French Revolution, the company were divided by internal political strife which ended by the ships and men being taken into custody by the Dutch. VENTENAT, on account of illness, was released and returned to Mauritius where he died (1794). DE LA BILLARDIÈRE was finally detained at Batavia, though receiving the freedom of the town and its surroundings. He collected plants and returned to France in 1795. His specimens (and all the herbarium made so far by the members of the expedition) were ceded to the English by D'AURIBEAU, at that time leader of the expedition, but Sir J. BANKS subsequently returned the majority to the care of DE JUSSIEU. Some observations made in Malaysia are found in *Novae Hollandiae Plantarum specimen* (1804-1806) and *Ser-*



HALLIER



HARMS



HASSKARL



HEMSLEY

tum Austro-Caledonicum (1825) by DE LA BILLARDIÈRE.

MRS VAN STEENIS has extracted for incorporation in vol. 1 of this Flora the itinerary of DESCHAMPS; contained in his diary. C. A. BACKER and C. G. G. J. VAN STEENIS have identified the plants depicted by him (1). I owe many of the following data to their communication.

The Javan vegetation was enthusiastically studied by DESCHAMPS. He accepted the offer from the Dutch to explore Java and so was, after some lapse of time, acknowledged by N. ENGELHARDT, Governor of NE. Java, as being commissioned to 'study all trees, plants, fishes, birds, and other animals through the whole of the highlands'. In four years (1794-1798) he travelled far and wide through the Javan wilds; many volcanoes were climbed by a European for the first time in history and he assembled in unexplored regions many species now exceedingly rare in the island. He intended to write a 'Flora Javana'. I must refer to VAN STEENIS and BACKER'S (unpublished) study for an account of his finds (which included the first record of *Rafflesia*). On returning to France (having resided at Batavia from 1798 to 1802 as a honoured citizen), he was in sight of his native land when his ship was intercepted by the British, and he lost all his papers and specimens. The plants are now untraceable but the manuscripts remain, most of these illustrated by exceedingly well executed drawings. An anthology from his papers seems a duty to this intrepid and untiring explorer and to the tradition of phytophany.

The next French expedition (1800-1804) led by N. BAUDIN, consisted of the 'Géographe', the 'Naturaliste', and the 'Casuarina', this latter vessel being under the command of DE FREYCINET. They were more favourably fated than their predecessors but brought only incidentally collected plants to Europe and might pass unnoticed had not J. B. L. C. TH. LESCHENAULT DE LA TOUR been brought to Java. LESCHENAULT, a world-wide traveller, afterwards Director of the Botanic Garden at Pondicherry, made important collections in Java, Madura, and Timor but, excepting his paper on *Antiaris* (2), published little of phytophany interest regarding Malaysia. His plants, preserved at Paris, gradually were studied and adopted as type mate-

rial of a number of Malaysian species and as the base of DECAISNE'S Timor Flora (1835, § 105).

References: (1) MS., not yet published. (2) Ann. Mus. Hist. Nat. Paris 16 (1810) 478.

33. French horticulture; E. P. Ventenat

In France, from horticultural sources, little was added to Malaysian phytophany in this period. E. P. VENTENAT, elder brother of the naturalist accompanying D'ENTRECASTEAUX, superintended the Malmaison Gardens, which made him publish a series of plates under the title *Jardin de la Malmaison* (1803-1805), a *Choix des Plantes* (1803) completed by a *Notice* (1807), and a *Decas Generum* (1808); these are able well-considered articles in which some Malaysian plants are described. Among the French periodicals I only refer to 'Annales du Musée d'Histoire Naturelle de Paris', appearing since 1802.

34. Phytophany in Holland; Burman, Houttuyn

Holland, though the natural centre for the development of Malaysian phytophany, contributed but rarely in print. Support was given to foreign artists, collections increased at no small care or expense, but few original studies reached the printer's.

N. L. BURMAN, having been schooled as a botanist by his father, after his visit to LINNAEUS (1760) who supplied him with some notes for his planned book, published a *Flora Indica* in 1768, consisting of 241 pages of text and 67 plates. MERRILL devoted one of his studies (1) to it and reported that 115 Javan and 90 Cingalese were among its c. 1305 species. The work is scarcely more than a compilation, though even this merit is dimmed by a lack of accuracy. MERRILL has pointed out that in most cases the species have been assigned to their native region, but he indicated some peculiar errors. MERRILL studied *Flora Indica* from a bibliographic point of view and interpreted the species contained in it guided only by the text. The descriptions in the book, however, are too summarily drafted to allow this method and examination of the typifying material is indispensable. A close interpretation is, moreover, vital in many cases

where priority of name is considered; BURMAN'S *Flora* appeared rather soon after *Species Plantarum* and well before the flora of Malaysia had received the attention of various 19th century phytographers. It is, therefore, most fortunate that BURMAN'S plants have been preserved at Geneva (DELESSERT Herbarium) though scattered through the general Herbarium. Given the time and patience, the majority, if not all, may be and should be traced one day, and a critical interpretation so become possible.

HOUTTUYN'S numerous works—mostly phyto-graphical—formed also the subject of MERRILL'S taxonomo-bibliographic investigations. M. HOUTTUYN was a medical doctor at Hoorn, since 1781 a member of the Batavian Society (cf. § 37). MERRILL made an exhaustive list of HOUTTUYN'S publications (2). HOUTTUYN'S main botanical work is the 2nd series of his *Natuurlijke Historie*, a 14-volumed work in imitation of *Species Plantarum*, appearing from 1773–1783, entitled *Handleiding tot de plant-en kruidkunde*. HOUTTUYN'S works were almost forgotten—MERRILL thought this partly due to their rarity, but many are among the commonest of 18th century books—and they should be considered in matters of nomenclature. The *Handleiding tot de plant-en kruidkunde*, consisting of more than 8600 pages of text supplemented by 105 copper plates, was several times reissued, and also incorporated in G. F. CHRISTMANN and G. W. F. PANZER'S *Vollständiges Pflanzensystem* (14 vols, 1777–1788). MERRILL estimated that the neglect of HOUTTUYN'S unscholarly written books caused 160 new binomials to be omitted from all reference works; 40 of these pertain to the Indo-Malayan region. HOUTTUYN wrote also on Sumatran benzoë and camphor (3), on the 'nutmeg flower' (4), and an extensive illustrated work on indigenous and exotic timber (*Houtkunde*, 1773–1791, with SEFF).

References: (1) Philip. J. Sci. Bot. 19 (1921) 329–388. (2) Journ. Arn. Arb. 19 (1938) 291–375, also *ibid.* 20 (1939) 264–268. (3) Verh. Holl. Mij. Wet. 21 (1784) 257–287. (4) *ibid.* 26 (1789) 211–231.

35. Incidental contributions; Gaertner, Willdenow

Important additions to Malaysian phytography appeared in other parts of Europe. J. GAERTNER, born at Calw in Württemberg, wrote his classic *De Fructibus et Seminibus Plantarum* (1788–1807). Visiting wherever fruits might be studied (BANKS and THUNBERG'S Herbaria), he composed a carpology that was never equalled, the base for the modern interpretation of fruits and seeds. C. F. GAERTNER, his son, published corrections in 1825(1). A. J. CAVANILLES, between 1793 and 1801, published his *Icones et Descriptiones Plantarum*, largely of importance to the West Indies but not to be overlooked when studying the acclimatized elements in Malaysia and the Philippine collections of the 'Malaspina' (see § 44). C. L. WILLENOW edited in 6 volumes the 4th edition of *Species Plantarum* (1797–1830) both in scope and as regards phytography a decided improvement, particularly in respect of the Malaysian flora (cf. also §§ 29, 41, 42).

References: (1) *Flora* (1825) 476–480.

36. First establishment of botanical gardens in the East Indies

Phytography, though essentially a branch of science thriving in a European climate, had emancipated itself in this period and great progress was made in tropical Asia often in close collaboration with Europe. In the following lines, tropical Asiatic and Malaysian phytography are considered as one whole; only in the latter half of the 19th century Malaysia and its surrounding regions followed each more or less independent courses of development.

Botanical gardens—collections of living plants kept for scientific purposes—since GARCIA, RHEEDE, and RUMPHIUS, were destined to form in the East the natural centre for phytography; whether many of the Gardens were maintained with an eye to the necessity of having a ready supply of medicinal herbs and fresh vegetables is irrelevant, the point is that they did offer an opportunity for scientific investigation, and were understood to do so.

At Buitenzorg, since 1744, the Honourable Company maintained a mansion and gardens which were to provide, in 1817, the grounds for the present Botanic Gardens. Another botanic garden, not yet mentioned in this history, (§ 22), was that of CHR. KLEINHOF, situated (c. 1750) somewhere near the centre of Batavia. It is known that it produced plants sent to BURMAN, but there is very little information and it has disappeared without trace. In Malacca was a botanical garden owned by C. DE VENDT (cf. § 42), and in the Philippines a Government sponsored garden at Manila (cf. § 39), both these gardens existing c. 1790, and this is about all (cf. §§ 38, 39) that has become known about them (1).

References: (1) BACKER, Verkl. Woordenb. (1936); RETZ, Obs. bot. 3 (1783) 62; Philip. J. Sci. Bot. 7 (1912) 363–369.

37. The 'Asiatic Society' and the 'Bataviaasch Genootschap'

The foundation of the Calcutta Botanic Gardens (1787, by R. KYD), followed by the issue of the 'Asiatick Researches' or 'Transactions' of the Asiatic Society of Bengal (in 1788) put phytography in India on a new footing. The Asiatic Society's 'Straits Branch' at Singapore, published in later years many papers dealing with the phytography of the Malay Peninsula in its 'Journal' (since 1878); the 'Journal' of the mother society contributed incidentally to Malaysian phytography till the present (started 1832).

If, however, the English had set an example to the Dutch in active research and field work, the Dutch were first (1778) to establish a learned society in the East, the 'Bataviaasch Genootschap van Kunsten en Wetenschappen' (Batavian Society for Arts and Sciences) which, since 1779, published 'Verhandelingen'. The 'Bataviaasch Genootschap' transferred the promotion of natural sciences in 1850 to the 'Koninklijke Natuurkundige Vereeni-

ging' (Royal Society for the Natural Sciences; 'Royal' since 1860) and phytophraphy thus disappeared from the 'Verhandeligen' (cf. § 61).

38. *Phytophraphy in Java; Radermacher and Von Wurmb*

About the middle of the century, phytophraphy made small progress in the Dutch East Indies. There was merchant J. G. LOTEN, who brought DE BEVERE(N) with him to Java from Ceylon. DE BEVERE made (1754-1757) a set of 144 beautifully executed coloured plates for him (13 plates purely botanical), but they never appeared in print excepting a number used in zoological works of later date (1).

J. C. M. RADERMACHER, when he arrived in Java for the second time (1764) had made a good start both as a student of natural history and as a servant of the Company and now he rapidly climbed to a position enabling him to launch the 'Bataviaasch Genootschap'. This society purposed the advancement of ethnography, linguistics and natural sciences and, in addition to the efforts of many among the 192 members residing in all Asia between the tropics, they were aided by a Government order to all officials for collaboration. RADERMACHER presented a house to the Society, to store the growing library and collections, which included a small herbarium. An explicit instruction for preserving and forwarding dried plants completed the first volume of the 'Verhandeligen'. RADERMACHER wrote rather indifferently on a wide range of subjects. He accomplished what might be expected of a director: he drew the attention of desirable protectors, fostered scientific investigation, and contributed himself. To phytophraphy his *Registers* are important. In 1779 the first appeared, then, from 1780-1782, a *Naamlijst* was published composed of four *Registers* (2). The first sums up the plants of Batavia and surroundings. Another list contains an alphabetical index to Rumphian names with a reduction to their (supposed) Linnean equivalent. RADERMACHER had prepared the ground for phytophraphical progress; the Secretary of the Society, FREDRIK, BARON VON WURMB, made good use of it.

Arriving in 1775 from Saxony, VON WURMB proved to be a clear-eyed and cautious observer, able to describe plants with a consideration of the Linnean prescripts. In 1779 he made a note on the 'Order of the Palms', in 1780 papers on *Licuala*, *Nipa*, and *Uncaria* followed, and shortly before his death an article on *Cycas* appeared (1781), all in the 'Verhandeligen'. Among his activities was the establishment of a small botanic garden in an allotment donated by one of the Batavian members to the Society. His death (1781) was a serious blow to Malaysian phytophraphy that so recently had come to rely on an organized body of nature lovers and a durable centre: a library and a herbarium. Posthumously, some of VON WURMB's notes appeared in the 'Verhandeligen' of 1786.

Although it was stated that VON WURMB's papers were lost in the Indies after his death (3), a

book on the 'curiosities of the East Indies' appeared in 1797 (4). I have failed to trace a copy but it is reported to contain considerable contributions to Malaysian botany.

RADERMACHER's violent death (1783), following so soon after VON WURMB's, proved too much for the slender interest in botanical sciences. An order issued to all officers of the Company (1795) in the Outer Possessions to forward seeds and plants of all trees which might be useful to experiment with in Java, while they 'had to be accompanied by a description' was neglected. Phytophraphy in the Dutch East Indies had to wait for new designed, progressive efforts till the opening years of the 19th century.

References: (1) VAN HOUTEN, in Bull. Kol. Mus. Haarlem 34 (1906) 71-76. (2) RADERMACHER, Register der geslagten in Verh. Bat. Gen. 1 (1779) 87-110. (3) VON WURMB & VON WOLLZOGEN, Briefe . . . auf ihren Reisen . . . Ostindien 1774-1792 (1794). (4) VON WURMB, Merkwürdigkeiten aus Ostindien (1797).

39. *Incidental contributors in Malaysia; De Noronha*

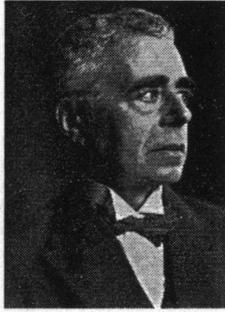
VON WURMB, as a student of the Java flora, was to some degree succeeded by C. F. HORNSTEDT, a pupil of THUNBERG's; he was paid by the Society in 1783 and 1784. Returning soon to Europe, he wrote a doctor's thesis on Javan edible fruits (1).

An effort to revive the grisly stories of the Upas Tree was made by N. P. FOERSCH (2), surgeon of the Company at Batavia and/or Semarang (c. 1774) which miscarried but had, unwillingly, the merit that the tree was now demonstrated to grow in Java, and that these fabulous rumours made LESCHENAULT, HORSFIELD, and later authors, write delectable and exhaustive studies on this interesting plant (3).

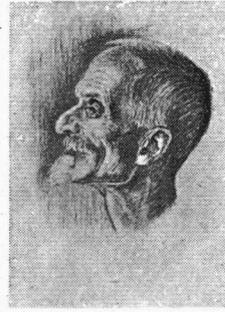
F. DE NORONHA, a Spaniard who had worked for some time in the ancient Botanic Garden at Manila—nothing more is known about this garden which must have existed about 1790 and may have been established by J. DE CUELLAR (4)—came to Java in 1786 and, with Government support, penetrated into the interior as far as the eastern spurs of the Kendang mountains. His draughtsman made a set of more than 111 coloured figures (his extreme secrecy about his botanical investigations induced a secret copying of his plates so that more than one set exists), and his results were embodied in three papers, one (in honour of Governor-General W. A. ALTING, who promoted his studies) on *Altingia* (5), the second on *Gluta reinghas* (6), and the third a list of Javan plant names with their Latin denominations (7). These *nomina nuda* drew the attention of botanists (he was the first trained botanist to penetrate into the interior of Java with the purpose of collecting plants and to ascend a Javan mountain) and HASKKARL wrote a list of, what he thought might be, the scientific equivalent names. A thorough study by BACKER and VAN STEENIS has been prepared and contains a study of his plates which had never been identified



HENDERSON



HEYNE



HOCHREUTINER



HOLTUM

and 'have a unique historical value'. In 1787, DE NORONHA left suddenly for Mauritius, taking with him all his Philippine and Malaysian collections, to die there in the next year. His collections have disappeared but his MSS are preserved at Paris. He had planned to write a 'Flora Javana'.

References: (1) HORNSTEDT, *Fructus Javæ esculenti* (1786). (2) FOERSCH, in *London Mag.* (1783), also *Alg. Vaderl. Letteroef.* (1784). (3) for liter. on *Antiaris* see GRESHOFF, *Nuttige Ind. Pl.* (1894). (4) *Fl. Mal. I*, 1 (1950) 120. (5) *Verh. Bat. Gen. S* (1790) 1-20. (6) *ibid.* p. 1-9. (7) *ibid.* p. 1-28.

40. *Raffles and Horsfield*

An order of the Company in the closing years of the 18th century to re-activate the study of economic plants had no effect but the wish to renew phytographical and botanical research was most happily fulfilled when TH. HORSFIELD, after a first visit to Batavia in 1800, returned in 1801 and resolved to study the natural history of the island. Elected as a member of the Batavian Society while obtaining the post of Army surgeon, the American was charged to search after indigenous medicinal plants.

After preliminary work in the Buitenzorg district and West Java, he travelled extensively in Central and East Java, with brief intervals till 1811, accompanied by draughtsmen and securing a large herbarium (1); important botanical discoveries were made in the mountains which had been so rarely visited by botanists before him. The Javan mountain flora was now shown to include many genera characteristic of the temperate climatic zones.

He intended to write a 'Flora Javana' but this, like so many earlier efforts by others, did not materialize. Volume 7 of the 'Verhandelingen' (1814) has, in addition to the narrative of his travels, studies on *Antiaris*, *Crinum asiaticum* L., *Inocarpus edulis* FORST., and *Sapindus rarak* L. He shows himself an enthusiastic botanist, but now and then a lack of training betrays itself.

RAFFLES, temporarily in charge of affairs in the Indies and determined to let the British empire profit whenever possible, succeeded in attaching HORSFIELD to his train. An investigation of Banka started but, after some time, HORSFIELD barely es-

aped with his life; his herbarium was lost but, returning after some months to Soerakarta, he gave a fine *Account of Banka* (1817). RAFFLES made HORSFIELD acquainted with BANKS and his eminent secretary R. BROWN; co-operation was the result. New exploratory trips in Java were undertaken but, before RAFFLES left and the island was restored to the Dutch, it was arranged that all HORSFIELD'S specimens would be dispatched to England. In 1818 he left for Bencoolen, shipping his herbarium at Semarang, and investigated the SW. Sumatran region together with RAFFLES. A last visit was paid to Java, then he left for London being appointed Assistant in the Museum of the East India Company, where he remained till his death (1859). His personal phytographical contributions are small but his collections, especially those of eastern Java, of particular importance. From 1838-1852 appeared a beautiful volume *Plantae Javanicae Rariores* by R. BROWN and J. J. BENNETT. The book is, apart from its fine illustrations, a series of carefully written essays, most readable and phytographically as well as historically a classic. BROWN directed the drawing, analysed and described. BENNETT was in particular entrusted with the habit description, the history, and the surveys of literature. Written in the quiet mood necessary for the understanding of plants, the studies in *Podocarpus*, *Antiaris*, *Cyrtandra*, *Dialium*, and *Sterculiaceae* make fascinating reading. *Plantae Javanicae rariores* is one of the best books on Javan plants; it contains many new names and rare records. The colours of the plates are not always exact, as these had to be determined from the collector's notes, from memory, and dried materials, but similar small slips occur also in BLUME'S and KORTHALS'S coloured plates (cf. §§ 47, 51). HORSFIELD'S plants were also treated in MIQUEL'S *Flora Indiae Batavae*, to which they were to provide an indispensable source of data.

R. BROWN'S other works, dealing directly or indirectly with Malaysian plants, will be indicated in § 49.

BENNETT was BROWN'S lifelong friend and assistant, succeeding him at his death (1858) as Keeper of the Botanical Department in the British Museum.

References: (1) BENNETT & BROWN, Preface to *Plantae As. rar.* (1838-1852).

41. *Father de Loureiro's 'Flora Cochinchinensis'*

The *Flora Cochinchinensis* by Father JOÃO DE LOUREIRO S.J. (2 vols, 1790) is the only 18th century work on the flora of Cochinchina that is of importance to Malaysia; it was re-edited by C. L. WILDENOW in 1793.

LOUREIRO's other publications (apart from a study on epiphytes in 1799) are insignificant botanically but large manuscripts and volumes of drawings are preserved at Lisbon. In 1935, MERRILL wrote an extensive study and an interpretation (1) of *Flora Cochinchinensis*, and estimated that it contained c. 1150 species, among which were 630 new at that time, and 185 new genera. He judges its phytophagical contents in this manner: "Many of his descriptions are excellent, in fact distinctly superior to . . . many . . . prepared by LOUREIRO's contemporaries in Europe. In other cases they are short, incomplete, indefinite, and sometimes very inaccurate." LOUREIRO's Herbarium is preserved in the British Museum.

References: (1) Am. Philos. Soc. Trans. new ser. 24² (1935) 1-445.

42. *Indian research; the 'United Brotherhood', Roxburgh*

Botanical studies were, in India, mainly pursued by the 'United Brotherhood', a society founded by J. G. KOENIG (of the Danish settlement at Tranquebar), counting among its members B. HEYNE, KLEIN, and J. P. ROTTLER. An indefatigable traveller and collector, KOENIG, a pupil of LINNAEUS, made the first exhaustive descriptions of species of Malaysian *Scitamineae* and of a number of *Orchidaceae*; his main articles were published (1) by RETZ (1779). He seems to have worked to his satisfaction in the botanical garden of C. DE VENDT in Malacca. Planning new travel, he died in 1782 at Tranquebar. Many of his observations on plants belonging to other families are contained in a paper by Sir WILLIAM JONES, published (2) posthumously in 1795.

HEYNE, a Moravian missionary, surgeon and botanist in the service of the Company, sailed in 1777 to Madras. He was in charge of the spice gardens and in 1812, when leaving for Europe, he spent five weeks in Pulu Tikus—'Rat Island', near Bencoolen—where he collected about 70 species of plants. A. W. ROTH, at Bremen, identified these but the 'Catalogue of the Flora of Rat Island' was lost. A considerable work (3) by the same author on HEYNE's plants is very largely based on Indian materials only (1821). ROTTLER's description of the Madras region was edited (4) and annotated by C. L. WILDENOW (1803).

In these years of rapid and often brilliant progress in British India, W. ROXBURGH, the most productive of the 'United Brotherhood', wrote or prepared a number of exceptionally important phytophagical works; he is referred to as the 'Father of Indian Botany'.

Being appointed in the Company's Medical Establishment at Madras in 1776, he explored the

interior towards the North and gathered the materials which, with KOENIG's notes, would form his 3-volumed *The Plants of Coromandel* (1795-1819), issued in coloured and uncoloured copies. His transfer to Calcutta, succeeding KYD as superintendent of Calcutta Gardens (1793), made him plan a flora of a wider scope but, on his return on account of ill health to Europe (1813, died 1815), nothing had been published. He left more than 2500 coloured pictures and vast manuscripts to the care of one of his successors at Calcutta, W. CAREY. First appeared *Hortus Bengalensis* (1814), an enumeration of plants cultivated at Calcutta with very scant phytophagical details (both ROBINSON (§ 21) and ALSTON (§ 20) studied (5) the nomenclatural standing of the names); this was followed by a volume of *Flora Indica* in 1820, followed by a second part in 1824. This first volume was re-issued together with two additional volumes in 1832 which incorporated many of N. WALLICH's notes ('CAREY's edition'). In 1874 a reprint of CAREY's edition was issued through the care of C. B. CLARKE. In *Flora Indica* many species from the Moluccas, collected by English sailors, were described for the first time.

References: (1) J. G. KOENIG in RETZ, Obs. Bot. 3, 6. (2) As. Res. 4 (1795) 237-312. (3) ROTH, Novae plant. species (1821). (4) WILDENOW on ROTTLER, Ges. Naturfr. Berlin, neue Schr. 4 (1803) 180-224. (5) ROBINSON, Philip. J. Sci. Bot. 7 (1912) 411-419; ALSTON in Ann. Roy. Bot. Gard. Perad. 11 (1930) 299, Fl. Ceyl. Suppl. 6 (1931) and MS.

43. *Penang Gardens*

In Penang Island, a botanical garden developed from spice gardens. The first (1800-1805) was followed (RAFFLES) by a second (1822-1826), and a third. Originally, this was a forest nursery but CH. CURTIS succeeded in rising it to a famed botanical garden of which he became the first Curator (1884-1902). Their influence on and the opportunities they offered to Malaysian phytophagy have been considerable in this and in later periods. W. ROXBURGH's son and namesake collected plants in Penang in 1802. W. HUNTER, apart from papers on pepper (1) and gambir (2), catalogued the Penang plants about this time; his manuscript was published in 1909 by H. N. RIDLEY (3).

Penang Gardens were made over to the administration of the Municipality of Georgetown (1910) and MOHAMED HANIFF, a widely known plant collector, was put in charge. In 1912 it was returned to the Singapore Gardens. R. E. HOLTUM described this 'Waterfall Garden' in his *Guide* of 1934. The Penang Herbarium, built up by CURTIS, and enlarged by the collections of dozens of botanists, is kept at Singapore.

References: (1) As. Res. (1803). (2) Trans. Linn. Soc. (1807). (3) Journ. As. Soc. Str. Br. 53 (1909).

44. *Philippine phytophagy*

The most conspicuous event in the Philippines in these years, after P. SONNERAT's Luzon collections

(1771), was the visit of the corvette 'Descubierta' under A. MALASPINA, a Spanish scientific expedition round the world (1789-1794).

TH. HAENKE and L. NÉE made large collections which were sent to Spain, where an unfavourable state of affairs caused the herbarium to be stored under bad conditions till 1818. HAENKE's plants—in so far as they were saved—arrived in 1821 at Prague, and were partly elaborated by C. B. PRESL in *Reliquiae Haenkeanae* (1825). The history of this herbarium explains why several South American plants were believed to occur in the Philippines,

the authors being led into error by mislaid labels. PRESL published large studies on Ferns generally.

From this period date many references to Philippine plants which are contained in DE NORONHA's unpublished manuscripts, Dr VAN STEENIS informs me (*cf.* § 39).

The Romanzoff Pacific expedition on the 'Rurik' stayed off Luzon (1817-1818); A. VON CHAMISSO collected in the Philippines and published on these with D. VON SCHLECHTENDAL (1826-1836) in 'Linnaea'.

FROM THE ESTABLISHMENT OF THE BOTANIC GARDENS AT BUITENZORG (1817) TILL THE DEATH OF SCHEFFER (1880)

<p>45. 19th century standard works; De Candolle, Bentham & Hooker and contemporaries cii</p> <p>46. Reinwardt and the Buitenzorg Gardens ciii</p> <p>47. Blume civ</p> <p>48. Miquel and De Vriese cv</p> <p>49. Visiting phytographers; Brown, various expeditions cvii</p> <p>50. The first years of the 'Natuurkundige Commissie' cviii</p> <p>51. Korthals cix</p> <p>52. The final years of the 'Natuurkundige Commissie'; Junghuhn cx</p> <p>53. The Buitenzorg Herbarium and Library; Teysmann, Hasskarl, Binnendijk, and Kurz cx</p>	<p>54. Zollinger cxiii</p> <p>55. Scheffer civ</p> <p>56. Philippine phytography; Blanco's Flora de Filipinas, Fernandez-Villar; Cuming cxv</p> <p>57. West Malaysia; Jack cxv</p> <p>58. The Malay Peninsula cxvi</p> <p>59. India; Wallich and contemporaries; Flora Indica cxvi</p> <p>60. Resident amateur botanists in Malaysia cxvii</p> <p>61. The 'Natuurkundige Vereeniging'; periodicals cxvii</p>
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45. 19th century standard works; De Candolle, Bentham & Hooker, and contemporaries

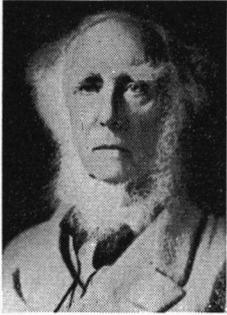
The period between 1816 (restoration of Dutch sovereignty in the major part of the Archipelago) and 1880, the year of SCHEFFER's death, embraces the larger and middle part of the 19th century, *i.e.* the fast and splendid rise of the natural sciences. Phytography and botany in general gradually could draw from comprehensive descriptive studies, and came to rely on new directions for, or methods of, description which resulted in books vastly more reliable, accessible, and fruitful than any earlier publication.

The 19th century was the age of standard works, often of a thoroughness and covering so wide a field, as was rarely attempted in the 20th. The following is a rough picture of the main authors and books which left an imprint on Malaysian phytography.

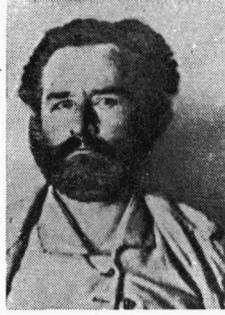
A. P. DE CANDOLLE, in 1813, by his *Théorie élémentaire* opened the new era by his method of applying the principle of conformity when evaluating morphological characters. Born at Geneva (1778), he collaborated in his earlier years with LAMARCK; together they edited a 3rd edition of the *Flore Française*. In the first volumes, LAMARCK brought his ingenious invention of the dichotomous key into effect (see § 30). LAMARCK also at-

tached new meanings and fresh accents to rudimentary or abortive organs. DE CANDOLLE, adding his brilliant gifts and inexhaustible capacity for work to the latter's principles, and basing his studies on the French school (the family conception of the DE JUSSEUS, the monocotyledons, acotyledons and pluricotyledons distinguished by R. L. DESFONTAINES as morphologically distinct groups), made Geneva into a main centre of phytography after he had returned to his native town as soon as it was wrested from Napoleon's grip (1814).

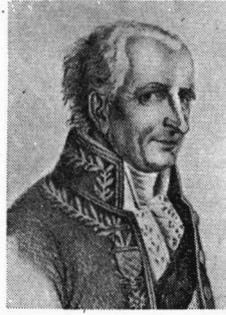
In 1818, there appeared his *Regni vegetabilis systema naturale*, as a bold attempt to emulate *Species Plantarum*, while describing the species in the new French style; a second volume (1821) followed, but by then the enormous demands of the undertaking made it clear that it was bound to remain unfinished. A shorter manner of treatment was chosen: *Prodromus systematis naturalis*. When DE CANDOLLE died (1841), of the 195 recognized families 102 had been completed, including the *Compositae*. The happy collaboration with his son ALPHONSE (who brought the *Prodromus* to completion, vol. 17, 1873) was reflected in ALPHONSE's collaboration with his son, CASIMIR, which resulted in the *Monographiae Phanerogamarum* or *Suites au Prodrome* (with several collaborators, 9 volumes, 1878-1896). Among A. DE CANDOLLE's other works I note *La Phytographie* (1880) of unusual interest



J. D. HOOKER



JUNGHUHN



A. L. DE JUSSIEU



KING

and containing an important list of herbaria and collections, and his classical *Origine des plantes cultivées* (1883).

General German works which put their mark on Malaysian phytography are J. J. ROEMER and J. A. SCHULTES's 16th edition of LINNAEUS's *Systema vegetabilium, ed. nova* (1817-1830), C. H. PERSOON's *Synopsis Plantarum* (5 vols, 1817-1821), C. SPRENGEL's editions of LINNAEUS's *Systema vegetabilium* (1826) and of *Genera Plantarum* (1830-1831), S. ENDLICHER and E. FENZL's masterly *Genera Plantarum* (1836-1840), a synoptical descriptive treatment of all known genera according to a natural system, the contemporary *Plantarum Vascularum Genera* by C. F. MEISNER (1836-1843), and W. G. WALPERS's *Repertorium botanicae systematicae* (4 vols, 1842-1848), followed by *Annales botanices systematicae* (1). The second edition of E. G. STEUDEL's *Nomenclator botanicus* (2 vols, 1840-1841) may be seen as a further approach to the future *Index Kewensis* (§ 9).

G. W. BISCHOFF's *Handbuch der botanischen Terminologie* (3 vols, 1833-1844) and his *Wörterbuch* of 1857 (2nd ed.), proved of the highest value to phytography as it led to a closer and unambiguous interpretation of botanical terms. Time made G. A. PRITZEL's *Thesaurus literaturae botanicae* (1st ed. 1851), of which the much improved 2nd edition appeared in 1872, to a bibliographical classic and an invaluable source of references. His *Icones botanicarum Index* (2 vols, 1855-1866) is now superseded by *Index Londinensis*.

The British contributed by G. DON's *General History* (4 vols, 1831-1838), intended as a new and improved edition of PH. MILLER's *Gardener's Dictionary*. G. BENTHAM and J. D. HOOKER wrote *Genera Plantarum* (3 vols, 1862-1883), a lasting monument to the genius of its authors and so universally marking the concept of the limits of natural genera and the trend of plant phylogeny that, also in Malaysian phytography, studies may be separated into groups before and after the publication of *Genera Plantarum*.

In France, appeared H. E. BAILLON's *Histoire des Plantes* (1870-1895), in the wake of *Genera Plantarum* less noticed than it deserved. Its qualities assured it, however, a place as a work of reference and authority, though it came too late (1870-1895) to

influence Malaysian phytography in this period to a large extent.

Holland did not produce any work of a scope comparable to those just mentioned. In this period, a comparatively large number of the Dutch phytographers either stayed in Malaysia or devoted their time to the study of its flora at home. Many works appeared, dealing with the Malaysian flora as a whole or confined to a portion of it. Often, as regards contents, manner of treatment, and execution, they could easily stand comparison with the best work of a similar character written outside the boundaries of our empire.

References: (1) WALPERS, *Ann. bot. system.* 7 vols (1848-1868), vols 4 & 5 with K. MUELLER, vols 6 & 7 by K. MUELLER.

46. Reinwardt and the Buitenzorg Gardens

After the English interregnum of Java which stimulated research in some fields of natural sciences, the Dutch Government, on being restored to power, decided to follow this lead and among the Commissaries to take over, one was appointed and given full authority to promote a scientific development of the colonies.

This first emissary of the Government representing the learned world in Holland, was C. G. C. REINWARDT, Director of Agriculture, Arts, and Sciences in Java and adjoining Islands, who arrived with Commissary-general G. A. G. P. VAN DER CAPELLEN on April 27, 1816, off Batavia.

Being 43 years old, he had gained repute as a capable versatile scientist; he was entrusted with the care of practically all aspects of natural sciences, education, and ethnography. It is worthy of notice that among so many tasks no mention is made of a botanical garden and, therefore, REINWARDT's initiative and insight are to be thanked that, a year after his arrival, a piece of waste ground adjacent to the old Palace Garden at Buitenzorg was turned into a garden where plants could be kept both for scientific and economic purposes (May 18th, 1817). From that moment, Malaysian phytography had found its natural centre and, in the course of time, pharmacology, forestry, horticulture, agriculture, and in brief, all botanical science in Malaysia were to reap from the

abundant harvest of data and materials provided by the Buitenzorg Botanic Gardens, now a cherished and envied proof of Dutch progressive effort in the tropics and an example of harmonious international co-operation, and then again a neglected and starved remnant of former glory, but always surviving through its true virtue.

REINWARDT, in the opening years of the Gardens, was assisted by the garden intendents W. KENT (who had served under him in the same capacity during his professorship at Harderwijk), and J. HOOPER, of Kew Gardens. Botanical draughtsmen were A. J. BIK and J. TH. BIK. Although REINWARDT executed his commission with unabating industry, collecting plants on his official tours (many were lost by shipwreck; for his manuscripts see also DE VRIESE, § 48), and was an able organizer and outstanding teacher, he himself added only modestly to phytochemistry. In 1822 he returned to Holland, to occupy the Chair of Botany at Leyden till 1845. His main phytochemical publications are on polyembryony in *Mangifera* (1) and *Sylloge plantarum novarum indicarum* (1825–1826), published on the request of his friend F. HORNSCHUCH, with whom he wrote the first paper in history on Javan mosses (1826), with coloured plates by J. STURM and preceded by a study of *Hepaticae Javanicae* by himself, BLUME, and E. G. NEES AB ESENBECK (1824). After THUNBERG's first publication of 3 species from Java, now 59 appeared new in print.

His address to the Berlin Academy of Sciences, *Ueber den Character der Vegetation auf den Inseln des Indischen Archipels*, though one of the earliest is not one of the most successful attempts to characterize and describe the vegetation of Malaysia in general (1828).

On REINWARDT's departure, botanical sciences in the Netherlands East Indies were entrusted to the 'Natuurkundige Commissie' (see § 50) and to BLUME, appointed Director of the Gardens at Buitenzorg in 1822.

References: (1) *Nova Acta Nat. Cur.* 12¹ (1824) 341–346.

47. Blume

C. L. BLUME has been one of the ablest phytochemists ever to work on the Malaysian flora; his works have never been surpassed in this field, as regards technical execution (printing and reproduction) and boldness of conception. Objections have been made against BLUME's disposition to monopolize all materials (both collections and manuscripts) he could lay hands on in his official capacities, but it cannot be denied that botany (and phytochemistry in particular) thrived through his zeal for productive research and his proud ambition to achieve more and better than any previous or contemporary author. Much would have remained obscure or be forgotten till the present day that was brought to light by his, admittedly not always considerate, endeavour.

Born in 1796 (at Brunswick in Germany), he reached Java in 1818, charged with the medical

supervision of vaccination. Soon after he joined REINWARDT as his 'adjunct Director for Agricultural Affairs' and after REINWARDT's departure (1822) accepted appointment as Director of the Buitenzorg Botanic Gardens. BLUME started to collect vigorously and, in the course of time, travelled in many parts of West and Central Java.

BLUME first published (1823) a *Catalogus van 's Lands Plantentuin*, listing more than 900 species (of which more than 300 were denoted by REINWARDT in manuscript); the Linnean classification is followed and brief Latin diagnostic descriptions accompany the new names. In 1823 he gave the botanical report of an ascent of Mt Salak (descriptions especially of *Magnoliaceae*, *Meliaceae*, and *Loranthaceae*); its counterpart, a report of a trip to Mt Gedeh, appeared in 1825. Of first importance to all later studies on Malaysian *Fagaceae* was his *Bijdrage tot de kennis onzer Javaansche eiken* (1825). In these years fall his studies on *Raflesiaceae*, and his *Bijdragen*, a series of great interest consisting of 17 fascicles (the 6th fascicle being supplemented by *Tabellen en platen voor de Javaansche Orchideen*), published in 1825 and 1826. The *Bijdragen* have descriptions of hundreds of new species (± 1200 spp. are described in all) and are based on REINWARDT, KUHLE, and VAN HASSELT's specimens and notes (§ 50) and on his own collections made in 1823 and 1824. A. J. BIK and LATOUR were his draughtsmen but their work was published much later. The *Bijdragen*—partly issued after BLUME had returned to Europe (1826)—appear to have been hurried. Reference to literature is, and could be, scarcely made, it is hardly attempted to contrast the species with each other, and the phytochemistry, though suggesting the author's ability, is not quite up to the mark. A monograph on East Indian pepper species (1826) was last to appear in Java (1).

BLUME took with him much that had been secured so far—either by himself or by contemporaries—and this herbarium formed the nucleus of all future Malaysian collections of the 's Rijks Herbarium' (National Herbarium) to which BLUME was appointed Director on its establishment at Brussels in 1829.

It has been asserted that BLUME took with him to Holland all herbarium present at Buitenzorg. He left there, on the contrary, a large set of several thousands of duplicate authentic specimens, a valuable collection which, it would seem, was not regarded as such. A remarkable coincidence proved BLUME's intention of providing Buitenzorg with an efficient foundation for future systematic study. In 1837, a collection of Javan plants was offered him for sale which proved to be the duplicate set he had left behind (2).

In 1830 the 's Rijks Herbarium' was moved to Leyden and combined with the 'Academisch Herbarium'.

In 1827–1828, BLUME had had printed an *Enumeratio* of the Javan species (a work insufficiently considered by many later authors) and then, in collaboration with J. B. FISHER, he began his magnificent *Flora Javae*, in folio, with 238 coloured plates

which surpassed all earlier published pictures. Draughtsmen were LATOUR, ARCKENHAUSEN, VIVIEN, SIXTUS and, eventually, BLUME himself. The book was also issued in an uncoloured edition. From 1828, parts of the work appeared (3). In 1830 the work halted with the 3rd volume and was not resumed till 1847; the second volume was entirely devoted to Ferns.

A variety of papers, some of them written with remarkable skill, appeared in the scientific periodicals of the following years (e.g. on *Aspidistra*, and the establishment of the family of 'Gnetaceae'). Largely at BLUME's own expense, between 1835 and 1845, another serial work was published: *Rumphia*. The coloured plates (c. 200 in 4 volumes) are beautiful but do not equal those of *Flora Javae*. *Rumphia* was written somewhat in the spirit of international co-operation, in particular the French helped considerably (B. DELESSERT, A. DE JUSSIEU, A. BRONGNIART, and in particular J. DECAISNE). The 2nd and 3rd volumes contain extensive phyto-graphical work on the Palms by BLUME; his systematical arrangement has been criticized. The plant pictures were drawn by VAN OORT, BIK, and LATOUR; the landscapes by others.

The years 1849 and 1850 are characterized by violent quarrels with other botanists, especially with F. JUNGHUHN (cf. § 52) and W. H. DE VRIESE (cf. § 48). As the point of issue is of phyto-graphical interest, I may be excused to refer briefly to these unfortunate incidents.

JUNGHUHN believed to have made a first rate discovery in Sumatra. He had collected specimens of a *Dacrydium*, a conifer, having twigs densely covered by flattened awl-shaped leaves (1842). When hastily travelling in the mountains, he had secured some branchlets of the big tree and provisionally named it 'Lycopodium' on the label. The mistake was published by unsuspecting colleagues and so JUNGHUHN's 'tree-like Lycopodium' appeared in print.

BLUME, sensing some mistake inquired whether DE VRIESE, who had access to JUNGHUHN's Herbarium, which BLUME had not, agreed to JUNGHUHN's views, and DE VRIESE unwisely replied, without investigating the matter, that he did.

In the third volume of *Rumphia* (1849), BLUME broadly announced his discovery that the 'Lycopodium' should rightly be a *Dacrydium* and this was accompanied by a honied commentary which cast a somewhat peculiar light on JUNGHUHN and DE VRIESE's abilities as botanists.

From these small beginnings, the controversy grew to large proportions, and I must refer the reader to examine the publications dealing with the incident, if he feels inclined to do so; no phyto-graphy was involved after this first stage (4).

The *Museum Botanicum Lugduno-Batavorum* (vol. 1, 1849-1851, vol. 2, 1856) is decidedly the least attractive among BLUME's works. It contains hundreds of uncritical descriptions, and being largely without illustration, its contents are often rather perturbing to the systematist confronted with the task of settling the true status of the names. In these years occurred the issue of *Mélanges bo-*

taniques (I in 1855, II in ? 1856), a very rare publication, in which a new taxonomical arrangement of Malaysian *Rosaceae* was proposed. In 1858, a new series of *Flora Javae* was begun but ended with the completion of volume 1, a volume entirely devoted to Malaysian orchids. Soon after his death (1862) at Leyden, sets of 23 unissued coloured plates *Planches Inédites* without text, were offered for sale by his publishers (3).

References: Verh. Bat. Gen. K. & W. 11 (1826) 139-245. (2) VAN STEENIS in Bull. Bot. Gard. Buitenzorg 18 (1949). (3) *Blumea* 3² (1939) 203-211; VAN STEENIS in Fl. Mal. Bull. no 2 (1947) 49. (4) JUNGHUHN, Inlichtingen aangeboden . . . over zek-ker geschrift in Alg. Konst & Letterb. 41 (1850), Over den boom Sambinoer op Sumatra in Ned. Kruidk. Arch. 2 (1850) 261-278; DE VRIESE, in *ibid.* 2² (1850) 1-16, also in Ned. Kruidk. Arch. 2 (1850) 139-143; BLUME, Opheldering van de inlichtingen (1850), Antwoord aan De Vriese (1850); HASSKARL, Antwoord aan den Heer C. L. Blume (1850).

48. Miquel and De Vriese

The first comprehensive flora of Malaysia was *Flora Indiae Batavae* by F. A. W. MIQUEL, professor of Botany at Amsterdam (1846-1859), Utrecht (1859-1871), and Director of the Leyden National Herbarium ('s Rijksherbarium') from 1862 till his death in 1871. Of French parentage, born in Germany (1811), he studied in Holland, his work being strikingly successful. Early publications on the botany of the ancients, on medicinal plants, and on other subjects (1834-1838) he followed up by research into Malaysian plants, and papers appeared (1) on *Piperaceae* (1839-40, 1843), *Casuarina* (1840), and monographs on *Cinnamon* (1841) and on *Cycadaceae* (1843). Notes and papers of various importance were collected in his *Analecta botanica Indica* (1850-1852). His editorship of *Plantae Junghuhnianae* (1853-1856)—many revisions of JUNGHUHN's plants he elaborated himself—lasted while his *Flora Indiae Batavae* began to come from the press (1855-1859), partly written in Latin and partly in Dutch. MIQUEL delimits his region towards the West by the Andamans and Nicobars, to the East it included West New Guinea; he is uncertain about the Philippines although in his *Flora* these are considered consistently. While advocating a wide species concept, MIQUEL was cautious in rejecting species even if he failed to establish clear reasons from literature for preservation. He was thoroughly aware of the high desirability of observing plants living in their natural surroundings in order to judge their morphological potentialities which is an invaluable aid when studying herbarium materials. This is demonstrated by his reproach to botanists 'who derived all their knowledge from dry specimens'. Yet, he himself had very little else at hand.

It is a remarkable fact that MIQUEL, when writing his *Flora Indiae Batavae*, had no materials from Leyden (BLUME!) at his disposal. The work is based, first of all, on the JUNGHUHN, ZOLLINGER, and HORSFIELD collections, moreover, he received



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KORTHALS



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large, and valuable, consignments from Buitenzorg, assembled by TEYSMANN and by HASSKARL. (cf. § 53). The Paris Herbarium gave assistance.

The authentic specimens of BLUME, KUHL & VAN HASSELT, ZIPELIUS, SPANOGHE, KORTHALS and others preserved in the Rijksherbarium, came only within reach when he became its Director after BLUME's death (1862), and in his main work MIQUEL had to be satisfied, in hundreds of cases, with copying the species descriptions from earlier literature.

MIQUEL's wish for completeness induced him to base the descriptions of a number of new species on deficient specimens but, on the whole, the unavoidable errors, typical of describing botanists who are unacquainted with the living tropical vegetation (MIQUEL never visited the tropics), are rather few and this, added to the careful compilation of previous literature, made MIQUEL's *Flora* a greatly appreciated and most useful book. More than 9000 species of Phanerogams are described, a considerable number of genera and species new.

The frequent new finds during further exploration in the Archipelago made it apparent that 'completeness' had scarcely been approached. A *Supplementum I* to the *Flora* was published under the title *Prodromus Florae Sumatranæ* (1860–1861) which contained more than 1300 species descriptions, more than half new and to a large extent based on TEYSMANN's, and his relation DIEPENHORST's, collections. This latter work is not up to the standard of the *Flora Indiae Batavae*, but has an important essay on the botany of Sumatra. MIQUEL's final term of office (as BLUME's successor in the Rijksherbarium) is remembered in Malaysian phytography by his *Annales Musei botanici Lugduno-Batavi* (4 vols, 1863–1869). These contain a series of critical revisions, the majority of MIQUEL's hand. His death (1871) interrupted the publication of the *Illustrations de la Flore de l'Archipel Indien* after 2 fascicles had appeared in 1870; W. F. R. SURINGAR published a 3rd fascicle some months after his death. Only two pupils of MIQUEL's published on the Malaysian Flora: P. DE BOER on Conifers (2), which remained his only contribution, and R. H. C. SCHEFFER who was destined to further greatly the progress of Malaysian phytography (see § 55).

When MIQUEL began work at Leyden, study of the botany of Malaysia (in particular its phytography), was an established tradition there. Besides C. L. BLUME's splendid publications, there appeared W. H. DE VRIESE's works, more modestly edited but not to be overlooked.

DE VRIESE, taking an active part in editing the botanical periodicals of the time (3), spent much of his energy for horticultural purposes but, fired by the steady and fast developments in the knowledge of Malaysia's flora, published more and more descriptive studies.

From his writings one gains the impression that he was a cautious and critical observer and it is to be deplored that his scattered interests in several branches of botany prevented his writing more comprehensive studies. His texts are always well built, and his phytography results in close and thorough plant portraits. In particular there may be referred to: *Plantarum Javanicarum minus cognitarum . . . sylloge* (4), *Descriptions et figures des plantes nouvelles et rares du Jardin Botanique de Leyde* (1847–1851), *Marattiaceae Indiae Batavae* (5), *Illustrations d'Orchidées des Indes orientales Néerlandaises* (1854), *Illustrations des Rafflesias Rochussenii et Patma* (1854), *Mémoire sur le Camphrier de Sumatra et Borneo* (1856) and, of foremost importance, his books on REINWARDT's life (6) and collections (7). He was REINWARDT's successor to the Chair of Botany at Leyden and edited *Tuinbouw-Flora van Nederland en zijne overzeesche bezittingen, &c.* (3 vols, 1855–1856).

The unexplored treasures of the Malaysian vegetation attracted him so strongly, that he decided to make a trip to the East Indies. Meeting Garden Superintendent TEYSMANN at Buitenzorg, he travelled with him in many parts of the Archipelago and secured fine collections from Java, Sumatra, Borneo, Celebes, and the Moluccas (1860). Seriously ill, he returned to Holland and died soon after arrival (1861); his plants were studied by MIQUEL and others.

REINWARDT, after his fruitful work in the East Indies (see § 46), occupied the Chair of Botany at Leyden (1822–1845), while DE VRIESE held a similar post at Amsterdam (1834–1845). He succeeded REINWARDT at Leyden (1845–1861). BLUME, first Director of the Rijks Herbarium (1828–1862) was

succeeded by MIQUEL (1862–1871). W. F. R. SURINGAR replaced DE VRIESE and, when MIQUEL died, received an additional appointment as Director of the Rijksherbarium. This implied that two functions of first importance to Malaysian phytography were now entrusted to one person and as SURINGAR devoted his considerable talents to other fields of botany, the descriptive work on the Malaysian flora fell into neglect. Only gradually the interest in Malaysian phytography regained its former position at Leyden with the result that at present it is one of the chief interests of the Rijksherbarium.

References: (1) MIQUEL, *Commentatio de vero Pipere cubeba* (1839); *Animadvers. in Pip. Herb. Hooker.* (1845); *Collectanea nova ad Cycad. in Linnaea* 19 (1847) 411–430, *ibid.* 21 (1848) 563–568. (2) DE BOER, *De coniferis Arch. Ind.* (1866). (3) DE VRIESE, *cf. Tijdschr. Nat. Gesch. & Phys.* 1–12 (1834–1845), *Tuinbouwflora* (1855–1856), also *Ned. Kruidk. Arch.* (4) *Tijdschr. Nat. Gesch. & Phys.* 11 (1844) 336–347. (5) *Ned. Kruidk. Arch.* 3 (1851) 183–196. (6) DE VRIESE, *Reis naar het Oostel. ged. . . door Reinwardt* (1858), with J. PIJNAPPEL. (7) DE VRIESE, *Plantae Ind. Bat. Or. quae . . . expl. Reinwardt, fasc. 1–2* (1856–1857).

49. Visiting phytographers; Brown, various expeditions

The 19th century being—apart from the frequent attempts at comprehensive and constructive works on the floras of certain regions or on the vegetable kingdom as a whole—an exploratory age, numerous scientific expeditions or visiting botanists entered Malaysia and secured sometimes large and sometimes small collections which, again, were according to circumstances studied as a whole or partly. Some brief notes on the larger expeditions and best-known scientists must suffice here.

In 1803, some years before the beginning of the period now under discussion, R. BROWN visited Timor with FLINDERS's expedition to New Holland.

BROWN's close friendship with BANKS and his exemplary studies as librarian both to BANKS and the Linnean Society (since 1820), his work in the British Museum (since 1827), his discovery and description of the cell nucleus (1831) and further cytological and embryological research influenced the course of Malaysian phytography.

In § 40, I referred to his direct contributions to the plant description of our region, his exemplary work in connection with HORSFIELD's plants. His paper on *Rafflesia* (illustrated by F. BAUER) is familiar to every systematist (1); it described the amazing find of J. ARNOLD and T. S. B. RAFFLES in Sumatra when exploring Bencoolen in 1818. His *Prodromus Florae Novae Hollandiae* (1810) had much indirect bearing on Malaysia (he did not adhere to the Linnean artificial principles of classification!). It has been said that he was 'cautious to excess . . . and never propounding a view which he did not know how to prove, perhaps no naturalist ever taught so much in writing so little or made so

few statements that had to be recalled or even recast'. Phytographically, his descriptions though short are lucid, sure of touch, and balanced.

The French nation also continued its excellent scientific endeavour; the pursuit of natural history in remote regions took place under the guidance of an exemplary seamanship. It is to be noted, however, that these world voyages only paid incidental visits to Malaysia and that in reality only small additions to our branch of science were made. L. DE FREYCINET, leading 'l'Uranie' and 'La Physicienne' round the globe (1817–1820), was accompanied by CH. GAUDICHAUD as botanist. The latter published (1826–1830) a *Botanique du Voyage*, illustrated with 120 plates among which were plants from Timor and Rawak (off New Guinea). Soon after, L. J. DUPERREY, with 'La Coquille', again sailing round the world (1822–1825), secured rich treasure. J. B. G. M. BORY DE ST VINCENT and AD. BRONGNIART elaborated the plants. The first published a *Cryptogamie on the Algae, Lycopodiaceae, and Ferns* (1827–1829), partly pertaining to Malaysia. BRONGNIART's volume on the Phanerogams ceased to appear in the middle of a description after a small number of families had been treated; an incomplete atlas accompanies this work (1829). The collecting had been done by R. P. LESSON and J. S. C. DUMONT D'URVILLE.

The latter was in command of 'L'Astrolabe' which explored between 1826 and 1829; during this expedition A. LESSON, nephew to R. P., collected. The botanical results were embodied in one volume out of twelve on the expedition, and consisted of a *Sertum Astrolabianum* (1834) and a *Flore de la Nouvelle-Zélande* (1832) by A. RICHARD and A. LESSON. It seems very probable that the materials collected in Malaysia were incompletely studied. In 1839, another French expedition touched at Batavia, DUMONT D'URVILLE again in command of 'l'Astrolabe' and H. JACQUINOT of 'La Zélée'; J. B. HOMBRON and JACQUINOT collected, together with DUMONT D'URVILLE and GUILLOU. The Phanerogams were elaborated by J. DECAISNE and the Cryptogams by J. F. C. MONTAGNE, in two volumes *Botanique* (1845). DECAISNE, also added the text of a small volume on the results of 'La Vénus' (1836–1839), which never entered Malaysia, to an atlas by A. DU PETIT-THOUARS (28 plates, 1846) containing pictures of some plants from Borneo and the Sulu Archipelago. A comprehensive survey of the additions to Malaysian phytography, published and unpublished, obtained by the French exploratory voyages of the period, might form an interesting study.

Other expeditions which gathered specimens used in Malaysian phytography were the English 'Sulphur', which circumnavigated the globe between 1836–1842, carrying the collector R. B. HINDS whose plants were elaborated by G. BENTHAM (1844). More important was the United States South Pacific Exploring Expedition (1838–1842) under CH. WILKES; the Pteridophytes were described by W. D. BRACKENRIDGE (2), the Mosses by SULLIVANT (3), and the Phanerogams by A. GRAY (4).

There were, for example, the Danish 'Galathea' expedition (1845–1847), the Prussian Expedition to East Asia (1858–1863; Ferns by F. A. M. KUHN and *Algae* by E. VON MARTENS (5)), the Austrian 'Novara' expedition (1857–1859), and, to conclude a summary of only the best known, the English 'Challenger' expedition (1879), with H. N. MOSELEY. MOSELEY's narrative of the voyage is botanically unimportant but his specimens were elaborated by W. B. HEMSLEY in a volume *Botany* (1884–1885). The Netherlands Geographic Society sponsored an expedition into Central Sumatra (Mt Kerintji, Djambi, Palembang) in 1877–1878; the plants collected by A. L. VAN HASSELT, the leader, were in 1884 enumerated by J. G. BOERLAGE (6).

References: (1) Trans. Linn. Soc. London 13 (1822) 201–234. (2) BRACKENRIDGE, U.S. Expl. Exp. Botany (Cryptog.) (1854) VII, 1–357, Atlas 1–46. (3) SULLIVANT, *ibid.* Musci (1859) 1–32. (4) GRAY, *ibid.* Phanerogamia 15 (1854) 1–777. (5) VON MARTENS, Preuss. Exp. Ost-Asien Bot. Th., Die Tange (1866) 1–152, t. 1–8. (6) BOERLAGE in VETH, Midden-Sumatra 4 (1884) 1–49.

50. *The first years of the 'Natuurkundige Commissie'*

The English interregnum in Java (1811–1816), in addition to promoting the natural sciences, had made the Dutch realize that the time-honoured tradition of ranking among the foremost botanists in tropical Asia had been taken from their hands. A ready response to this challenge was the establishment of a botanical garden at Buitenzorg and, soon after in Holland, the appointment of the 'Natuurkundige Commissie'.

The 'Natuurkundige Commissie' (Board for the Natural Sciences), founded on April 20, 1820, consisted of young Drs H. KUHLE and J. K. VAN HASSELT; they were to be assisted by the draughtsmen G. VAN RAALTEN and G. L. KEULTJES. Born at Hanau, KUHLE was a fellow citizen of RUMPF's, whereas VAN HASSELT was native of the Dutch town of Doesburg. They entertained a friendship of long standing and had a vigorous desire for research in common, both being equally well equipped for fruitful work. M. GRESHOFF's stirring account (1903) of their self-denying efforts in Java ought to be consulted for further particulars (1); here I note only that they, sacrificing their lives in unremitting strenuous expeditions (1820 onwards), amassed a large and valuable, annotated, herbarium in western Java. KUHLE died 9 months after arriving, VAN HASSELT prepared manuscripts (*e.g.* on *Orchidaceae* and *Asclepiadaceae*, partly edited posthumously by J. G. S. VAN BREDA, 1827–29), wrote a monograph of higher fungi containing 158 new species (unpublished), and continued exploration (in later years helped by J. TH. BIK) until death put an end to his, I may say, heroic endeavour (1823).

New appointments replenished the ranks of the 'Natuurkundige Commissie'; as regards contributors to phytography, A. ZIPELIUS ought to be remembered for his important exploratory work and

collections. ZIPELIUS (not ZIPPEL nor ZIPPILIUS), a horticulturist (6) born at Würzburg, had been appointed (1823) in the Buitenzorg Botanic Gardens and replaced KENT (§ 46) since 1825 as 2nd garden intendent. In 1827 he joined the 'Natuurkundige Commissie' and participated in 1828 in an expedition on the 'Triton' by way of Macassar and Amboyna to the coasts of SW. New Guinea. After some months of discovery and also of great hardship, disease forced them to return. In October, Kupang on Timor was reached, where ZIPELIUS died on December 31st, 31 years old. ZIPELIUS has been characterized as an egocentric, shy personality who was nevertheless much appreciated with his companions for his integrity and unabating industry.

Of his work, very little was published, at least, so it seems. In 1826, he wrote a catalogue of the Buitenzorg Gardens, on BLUME's request, in which 3385 species were listed. After his death, his extensive manuscripts and drawings were entrusted to BLUME, who undertook to arrange and publish all that he thought fit. This never materialized and only one of ZIPELIUS's letters, dealing with the flora of Banda and the Lobo region of N. Guinea, reached the press (1829), without BLUME's intermediary (2). The manuscripts contained descriptions of hundreds of species of New Guinea, Timor, Banda, and other islands, and gradually these data were incorporated in various botanical publications (*e.g.* MIQUEL, SPANOGHE), also, it is assumed, in BLUME's, but it would appear that ZIPELIUS as a phytographer has not been done justice.

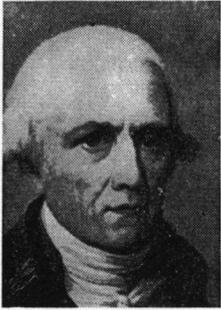
I wish to add a quotation from LLOYD (3) who found at Leyden "coloured drawings of a large number of Javanese fungi, and they are the best I have ever seen of tropical fungi. The name of the author of these icones has been lost, but I think I have found evidence to trace them to ZIPELIUS."

KEULTJES had died two days after KUHLE; at Kupang, where the expedition of the 'Triton' stayed after ZIPELIUS's death, VAN RAALTEN died in 1829. A large portion of the New Guinea manuscripts was lost in the Chinese rebellion of 1832.

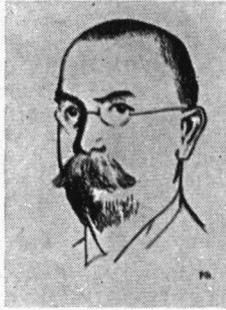
The botanical results achieved so far by the 'Natuurkundige Commissie' at so much sacrifice, apart from the several plant collections, were pitifully small. All members participated in collecting, of course, in widely different amounts and regions, but only ZIPELIUS's collection was really valuable. As regards KUHLE and VAN HASSELT's botanical writings, these are to some extent incorporated in BLUME's works (*cf.* § 47); there is also VAN BREDA's edition of fifteen species and some general letters were published in periodicals (4). The fate of ZIPELIUS's work has been indicated above. Finally a list of plants of the New Guinea coast was composed (5) by H. C. MACKLOT, member of the 'Commissie' from 1827 till his death in 1832.

The 'Natuurkundige Commissie' needed new members and in 1830 P. W. KORTHALS was appointed to replace ZIPELIUS (*see* § 51).

References: (1) GRESHOFF, Alb. der Nat. (1903), also VAN SWINDEREN in Alg. Konst- en Letterb. (1825). (2) ZIPELIUS (ZIPPEL), Auszug eines Briefes in Flora 12¹ (1829) 281–287. (3) LLOYD, Meded.



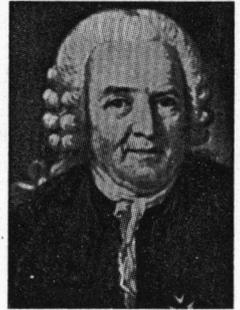
LAMARCK



LAUTERBACH



LINDLEY



LINNÉ

Rijksherb. 10 (1912) 1-5. (4) *Alg. Konst- en Letterbode* (1822¹) 99-104, 149-153; *I.c.* (1823²) 130, 230, 242, 264, 341; *Ind. Mag.* 2e twaalfstal, nos 3-4 (1845) 85-91. (5) *Bijdr. Nat. Wet.* 5 (1830) 142-182. (6) VAN STEENIS in *Bull. Bot. Gard.* Btzg III, 18 (1949).

51. Korthals

In 1832 the Board travelled in West Java but a local rebellion resulted in the loss of much scientific material. In 1833 an expedition was made to Sumatra (Padang region) by KORTHALS and others. Returning in 1835 to Buitenzorg, KORTHALS embarked for Borneo after some minor trips in Java. He explored the river districts above Bandjermasin and penetrated into the Tanah Laut Lands. KORTHALS left in 1837 for Holland.

KORTHALS's writings are many. His style is smooth; his sentences run harmoniously, and his phrases are well considered which, together with his patient and detailed observation, makes his texts most readable. Papers of a general nature, discussing the vegetation of Java, Sumatra, and Borneo as seen on his travels, appeared in *Tijdschrift voor Natuurlijke Geschiedenis en Physiologie* (1834-36) and various other periodicals till 1854. VAN STEENIS (1) demonstrated that KORTHALS introduced into botanical literature the assumption that plants of the mountains of Java seem to occur at lower altitudes in Sumatra. Of his descriptive and systematic papers, studies in *Nepentaceae* (2), *Guttiferæ* (3), *Gnetum* and *Conifers* (4), *Santalaceae* (5), *Loranthaceae* (6), and *Rubiaceae* (7) are important. His description of the peculiarities of the seedling in some *Loranthaceae* was a distinct advancement. His chef-d'œuvre, however, is the volume *Kruidkunde* of the *Verhandelingen over de Natuurlijke Geschiedenis* (1839-1847), an acknowledged classic to this day and a worthy counterpart of BENNETT and BROWN's *Plantae Javanicae Rariores*.

The *Verhandelingen over de Natuurlijke Geschiedenis der Nederlandsche Overzeesche Bezittingen* is a serial work embodying the studies of the 'Natuurkundige Commissie' issued under the auspices of REINWARDT, BLUME, VAN DER HOEVEN, and C. J. TEMMINCK. S. MÜLLER treated the geography and

ethnography of the New Guinea expedition in which some details on the vegetation were given, drawn from ZIPELIUS's notes, another volume was devoted to Zoology; KORTHALS is the author of the *Kruidkunde* or Botany. The latter volume appeared in a number of fascicles (1840-1844).

The book is largely based on KORTHALS's own splendid collections (some 6000 numbers), and in it no attempt was made towards a general flora. The volume is a sequence of treatments of certain groups, illustrated by coloured, ably executed plates by J. GAJKEMA and W. T. GORDON, though many floral details and anatomical drawings are from KORTHALS's own hand. An opening chapter on *Nepenthes* has, in addition to 3 new species, a first anatomy of the curious pitchers; a chapter on *Dipterocarpaceae* contains e.g. 11 new species and particulars on wood anatomy and biology; there are equally well composed descriptions on *Leguminosae*, *Theaceae*, *Rubiaceae*, *Guttiferæ*, *Hippocrateaceae*, *Tiliaceae*, *Fagaceae*, *Melastomataceae*, *Bombacaceae*, and *Rosaceae*. Considerable interest is shown here—as in numerous works of the middle decades of the 19th century—in the possibilities of plant anatomy, for it was held in high hopes that this would prove to be directive in taxonomy; R. BROWN's anatomical and cytological discoveries made this method an often adopted line of research. It has become clear, however, that though the microscopic morphology of tissues may influence taxonomical views and conceptions it represents auxiliary information. Phytochemistry, cytology, and genetics soon after their rise about the beginning of our century were similarly expected to supply decisive data to many taxonomical problems but I think that they will all be seen more and more as valuable auxiliaries to taxonomy in so far as the delimitation and relationship of systematic groups are concerned, and that they will never govern or replace the judgment and insight of the taxonomist. The vehicle common to all is descriptive morphology *i.c.* phytophagy.

Returning to KORTHALS, we find a final series of articles (e.g. on *Myrtaceae*, *Sterculiaceae*, *Magnoliaceae*, *Rubiaceae*), written about 1839 but only published in the *Nederlandsch Kruidkundig Archief* of 1846, '50, and '54. At that time he had withdrawn from botanical studies, preferring serene,

impersonal, philosophical reflection to the strife and disagreements clouding relations among the botanists of his day. In view of the excellence of his studies and his attitude towards his work, which never permitted him to lay down his pen unless he had studied and considered all aspects of the problems to the best of his knowledge and abilities, it is much to be deplored from a botanist's point of view that he spent the rest of his life remote from the science he had furthered so considerably; in 1892 he died, 84 years old.

After KORTHALS had left, the 'Natuurkundige Commissie' languished, partly because a Museum for Natural History (or Colonial Museum) founded in 1835 at Batavia, demanded time of its members (it was much too early for putting an accent on sedentary work!), partly because the wish to promote natural sciences in the Indies among leading Dutch biologists, waned. Only two members in the remaining years need mention in respect of phytography: the unfortunate E. A. FORSTEN, and F. JUNGHUHN.

FORSTEN arrived in 1838. A year passed in useless quibbles of an administrative character, though he managed to secure plants in the Buitenzorg district. In 1840 he arrived in N. Celebes where he made large collections; he also explored in the Moluccas and Ceram. A fatal illness ended his strenuous efforts, probably in 1843. Through an unforgivable neglect his manuscripts were sold at a public auction and, since then, have disappeared. His collections were never studied as a whole, they are partly in the Leyden Herbarium.

References: (1) VAN STEENIS in Bull. Jard. Botz. III, 13 (1933) 38. (2) Bijdr. Nat. Wet. 5 (1830) 6pp. (3) Tijdschr. Nat. Gesch. & Phys. 3 (1836) 16-22. (4) Alg. Konst- & Letterb. 2 (1837) 290-293. (5) Verh. Bat. Gen. K. & W. 17 (1838) 187-196. (6) Tijdschr. Nat. Gesch. & Phys. 3 (1836) 187-202, also Verh. Bat. Gen. K. & W. 17 (1839) 199-288. (7) KORTHALS, Observationes de Naucleis Indicis (1839).

52. *The final years of the 'Natuurkundige Commissie'; Junghuhn*

A reorganization of the 'Natuurkundige Commissie' (1842) failed; new appointments included that of F. JUNGHUHN (for the second time) in 1844. JUNGHUHN, prototype of a solitary, restless, uncompromising, and idealistic personality, never submitted to the demands of team work. His deliberate neglect of the 'Commissie' was one of the several reasons which led to its official discontinuation in 1850.

JUNGHUHN's explorations in Java and Sumatra have become as widely known as appreciated. In 1835, he published *Topographische und naturwissenschaftliche Reisen*, a forerunner of his great work on the geography, geology, and vegetation of Java. The latter includes both the lowland and the mountain flora (between 1835 and 1848 he successively climbed all major Javan mountains), and is a result of personal observations. It bears the title: *Java, zijne gedaante, zijn plantentooi en inwendige bouw* (several editions e.g. in 4 vols, 1853-54). The

bibliographies in M. C. P. SCHMIDT (1909) and W. C. MULLER's (1910) books (1) on his life and work may be consulted for the various editions of this classic (German translation by HASSKARL, cf. § 53), and the history of the collections he secured. He was the first to collect the star of the Javan mountains: *Primula imperialis*. His descriptions of Javan plant communities far exceeded all that had been attempted before and much that came after, and gave SW. Malaysian phyto-geography a first solid base. JUNGHUHN elaborated and defined for Malaysia von HUMBOLDT's scheme for the distribution of plants in altitudinal zones in S. America. Though he wrote one of the earliest accounts (1847) of the vegetation of the interior of northern Sumatra (in 1840 he had explored the Batta(k) lands where he found *Pinus merkusii*, *Dacrydium* (cf. § 47), and *Casuarina sumatrana*), he was, as a rule, not inclined to spend much time and attention to close and detailed phytography. To be noted are a paper on cryptogams (*Praemissa in Floram Cryptogamicam Javae insulae* (3)), followed in 1841 by a study in *Balanophoraceae* (4) and two on the mountain flora in general (5), in 1845. His herbarium was elaborated by a number of botanists e.g. BENTHAM, HASSKARL, MOLKENBOER, and DE VRIESE; the results were published as *Plantae Junghuhnianae* (1851-1856) which, while being edited and partly written by MIQUEL, suddenly ceased to appear for a reason unknown to me. JUNGHUHN was the discoverer of fossil plants in Java. His collection of tertiary fossils was studied (6) by H. R. GÖPPERT (1857), who wrote also on *Balanophoraceae*.

References: (1) SCHMIDT, Franz Junghuhn (1909), MULLER, Gedenkboek Franz Junghuhn (1910), and KROON in De Dageraad 4¹ (1864) 415-462. (2) JUNGHUHN, Die Battaländer auf Sumatra (1847) (3) Verh. Bat. Gen. K. & W. 17 (1839) 3-86. (4) JUNGHUHN, on Balanophora, Nova Acta 18 (1839) Suppl. 203-228. (5) JUNGHUHN, Physiognomie der toppen (1845) and Diagnoses et adumbrationes (1845). (6) Die Tertiärflora auf der Insel Java (1854), cf. also POSTHUMUS in Bull. Bot. Gard. Botz. III, 10 (1929) 374.

53. *The Buitenzorg Herbarium and Library; Teysmann, Hasskarl, Binnendijk, and Kurz*

The Botanic Gardens at Buitenzorg under the directorship of BLUME increased both in acreage and collections though BLUME made few provisions for its improvement or future. When he left in 1826, the post of Director of the Gardens was officially discontinued. J. HOOPER, a pupil from Kew, cared for the Gardens till 1830 (when he left fatally ill for Europe) and was succeeded by J. E. TEYSMAN(N) in 1831. No eulogy of TEYSMANN's unforgettable services to phytography and botanical sciences in general is needed here; his life and work have been repeatedly described (1). The following is a brief account of his management and work. Born at Arnhem in 1808, TEYSMANN received but little schooling as a gardener. He found the Buitenzorg Gardens (1831) practically without funds and sub-

jected to the rule of the military intendent of the Palace Grounds. His only recourse was the 'Natuurkundige Commissie' who was charged to supervise his work when botanical matters were concerned. In addition to a vigorous health, an excellent memory, and a ready wit, TEYSMANN had the inestimable virtues of perseverance, common sense and an open mind. Once convinced of the desirability of certain steps or measures in the interest of the Gardens, he took care of proposals of that nature, advocated by his collaborators, as if they were his own and battled against many obstacles and the weighty opinions of authorities until a victory was won; he made the Buitenzorg Gardens earn more and more recognition as a scientific institution, until, at last, the Gardens regained their independence as a Government botanical institute of first rank (1867).

TEYSMANN retired in 1869 from the Gardens but, in recognition of his merits, was made 'Inspecteur honorair der cultures' and as such devoted his inexhaustible energy to exploratory travel and added to the never equalled wealth of herbarium and living specimens he had assembled, nearly to the day of his death (1882).

Between 1838-1840, TEYSMANN laid out a number of small gardens for agricultural experiments in the West Javan mountains which were the precursors of the Tjibodas Mountain Garden established in 1862.

TEYSMANN introduced hundreds of economic or ornamental plants into Java in exchange for large consignments of specimens to various countries, first of all to the Netherlands. BLUME, and P. F. VON SIEBOLD, tried repeatedly to reduce the Buitenzorg Botanic Gardens to an overseas department of the Leyden institutes (1839-1846). TREUB, the historian of the first chapters of the history of the Gardens (1) has reviewed stroke and counterstroke of the adversaries at Leyden and at Buitenzorg. Eventually, the course of events proved abundantly that TEYSMANN had been right in his policy of defending and developing the Gardens; on the other hand, BLUME may be excused in considering that the Buitenzorg Gardens, at the time barely tolerated by the Netherlands Indian Government, provided no basis for scientific development and autonomous research. After all, the valuable collection he had left behind for the future benefit of botanists in Java, had been offered him for sale in 1837 (*cf.* § 47).

Apart from these clashing interests, TEYSMANN himself made good use of the opportunity to observe plants, both in the Gardens (papers on *Arenca* (2), *Lodoicea* (3), *Fourcroya* (4), *Cycas* (5), *Pisonia* (6), etc.) and on his never ending travels. Between 1853 and 1877 he explored the Archipelago in all directions either in company or alone, amassing thousands after thousands of selected specimens, a veritable treasure of the Herbarium and, till the present day, the main stock of the Gardens. TEYSMANN's plants supplied MIQUEL with excellent materials when he wrote his chief works (§ 48). His travel accounts, filled with important botanical observations, are found in many of the volumes of

the *Natuurkundig Tijdschrift voor Nederlandsch-Indië* (vol. 8-40, *passim*). His phytographical work together with S. BINNENDIJK is referred to below.

The earliest of TEYSMANN's collaborators during his guardianship of the Gardens (1831-1869) was J. K. HASSKARL. From the moment of his appointment (1838) he initiated reorganizations which would add to the scientific standing of the Gardens. Within 5 years, he succeeded in rearranging the living collections into a systematic grouping, which P. DIARD, French plant explorer on Java, and Directing Member of the 'Natuurkundige Commissie' (as such more or less acting as a Director of the Buitenzorg Botanic Gardens), had suggested; the method has certain practical disadvantages but is of great educational value. HASSKARL seized the opportunity (7) of acquiring a small collection of botanical works by purchase from an estate (1842). This formed the nucleus of the future Buitenzorg Library ('Bibliotheca'), an essential to the growth of phytography.

TEYSMANN's wholehearted co-operation was not sufficient to crown with success his efforts to found a Herbarium, but after HASSKARL had returned to Europe (1843), renewed efforts from TEYSMANN succeeded and a first building for a Herbarium was erected (April 9th, 1844), a home for the phytography of Malaysia and the first purely scientific institution incorporated in the Gardens and now a worthy counterpart of the Library. HASSKARL's merit has not been acknowledged in stone but will be remembered as long as botanists study the Malaysian flora.

Of his publications on geography, physiology, etc. I select his studies in *Aroideae* (8) and the *Aanteekeningen over het Nut door de bewoners van Java aan eenige planten van dat eiland toegeschreven* (1845). Phytographically important are e.g. *Catalogus plantarum in horto botanico Bogoriense cultarum alter* (the first catalogue to be published (in 1844) after BLUME's, though written in 1839; it contains nearly 3000 names and was partly recast in accordance with ENDLICHER's *Genera Plantarum* and, to some extent, revised by H. ZOLLINGER, § 54). To be added are *Plantarum rariorum Horti Bogoriensis Decas prima* (9) continued in 1842 and, in the same year, supplemented by a paper (10) on *Leguminosae* (*Leguminosarum quarundum etc.*) and on other groups *Plantarum genera etc.* (11) and *Adnotationes de plantis etc.* (12).

Sailing in 1843 for Europe, he continued to publish his articles based on copious notes made from living specimens when staying in Java. In 1844, *Papilionacearum quarundum etc.* (13), *Plantarum rariorum vel minus cognitarum horti Bogoriensis pugillus novus* appeared (14). In 1845 he wrote a second *Adnotationes de plantis etc.* on Buitenzorg plants (15). After a brief return to Java (1845-'46), during which he wrote a paper on the floral morphology of *Gramineae* (16), HASSKARL continued work in Europe. On Ferns he published (17) in 1855 and '56, and on *Sapotaceae* (18) in 1855; his *Retzia, sive Observationes Botanicae* (19) appeared in 1856 (2 'Pugilli'), new genera of the Botanic Gardens followed in 1857 (20), with a



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study on *Asclepiadaceae* and *Apocynaceae* (21), and a new series of *Retzia* from 1858 to 1860 (22). To historical phytography he added *e.g.* by an interpretation of DE NORONHA's plants (23), his keys to *Hortus Malabaricus* (24), and to *Herbarium Amboinense* (25).

As a phytographer HASSKARL lost himself into too much detail. An attempt to create an adequate word-picture of a species was never his favourite aim, instead he preferred the reality of one or two specimens at hand and, by careful observation, added one small character to another, scarcely bothering to distinguish between major and minor points. To taxonomy this method has little value but it, at least, has the considerable merit that, when his material was good, his descriptions leave no doubt as to their correct interpretation. His original Javan herbarium was nearly entirely lost so this easy interpretation is no mean advantage and it may be said that though nearly all HASSKARL's names disappeared into synonymy (critical taxonomic research never was his best side), very few have remained a problem, while he supplied many valuable data.

Apart from his hard-won additions to the *Cinchona* (26) culture (he was again in Java from 1855 till 1856), he translated several important botanical works into German (*e.g.* JUNGHUHN's 'Java'), regularly published on the progress of botany in Malaysia and, basing his main publications on its specimens, he added considerably to the fame of the Buitenzorg Gardens. His final contribution to phytography was a monograph of *Commelinaceae* (27) (1870). He was a man of restless activity, often obliged by financial difficulties to do semi-scientific work but never stooping to pot-boiling. In spite of the loss of his Java Herbarium, that he had to leave behind by Government order, he assembled in Europe enormous, new, mostly non-Malaysian collections, now resting in the Leyden Herbarium, which received from HASSKARL *e.g.* its set of CUMING's specimens (*cf.* § 56).

TEYSMANN had realized HASSKARL's wishes by founding the first Herbarium and Library in the Gardens but, after HASSKARL had left, no scientist was to avail himself of these new facilities till, in 1850, S. BINNENDIJK arrived. BINNENDIJK, a practical horticulturist but gifted with a talent for phy-

tography and trained by DE VRIESE in Holland, began to write a new Catalogue together with TEYSMANN (1851) but, though the manuscript was printed (1854), it was never issued. Two copies were kept for reference at Buitenzorg, the rest being destroyed. Together they wrote on *Rafflesia* (28). Only male flowers had been described so far, they discovered the female flowers. They published on *Eusideroxylon* (29), *Euphorbiaceae* (30), and described nearly 250 new species in good fashion (31) as *Nieuwe plantensoorten in 's Lands Plantentuin te Buitenzorg* (3 instalments, 1851-'53), 20 new species of Orchids (1854), and *Plantae novae vel minus cognitae etc.* (3 instalments, 1863-'67). The third published garden catalogue of 1866 is also the result of their collaboration. The next year the Gardens were officially declared to be separate from the Palace Grounds and recognized as an independent Governmental scientific institution.

Too short was the term of office of TEYSMANN's next assistant, S. KURZ, who as a soldier of German birth under the name of J. AMANN, arrived in Java (1857). Military duties made him go to Banka (1857-'58) and Celebes (1859) but he was stationed in the Gardens before 1860. His findings in Banka are embodied in a list of 166 vascular cryptogams (32), (under the pen-name J. AMANN), a general study of the vegetation, ecologically and phytogeographically, an enumeration of 959 species, completed by a list of the vernacular plant names by TEYSMANN, and a number of new descriptions by himself (1864).

In 1864, he accepted a post in the Calcutta Gardens but retained a lively interest in the Malaysian flora and regularly discussed problems connected with our region and the Indian flora. KURZ, in spite of his somewhat hurried decisions, was a versatile botanist and talented phytographer; he had a particular flair in defining the plant communities composing a vegetation. Being appointed Curator at Calcutta (1865), he published a long series of large and small articles (*e.g.* a study he had made at Buitenzorg: the earliest paper (33) on the growth rate of bamboo), on systematics and phytogeography.

His position at Calcutta offered him the opportunity of comparing many Malaysian species with authentic Indian materials (34) and this resulted in

changes in nomenclature or other rectifications which sometimes caused spirited debate in the scientific press. In his articles much critical attention was paid to Sumatran species, previously described by MIQUEL. I mention studies of *Lemnaceae* (35), *Pandanaceae* (36), *Palms* (37), the *Report on the vegetation of the Andaman Islands* (1868 and 1870), his three *Contributions towards a knowledge of the Burmese Flora* (38), the *Preliminary report on the forests . . . of Pegu* (1873-'76, also given as 1875), *Sketch of the vegetation of the Nicobar Islands* (1876), and the *Forest Flora of British Burma* (2 vols, 1877). These numerous works, important to the Malaysian flora not only because several species common to both our and his region, new described or already known, are treated, but also because they are excellent comprehensive surveys of the vegetation in relation to climate, soil, and geophysics of the border areas of Malaysia, were accomplished in a surprisingly short time; KURZ died, in 1878, only 44 years old.

References: (1) TREUB, J. E. Teysmann in *Teysmannia* 1 (1890) 1, also in *Geschied. van 's Lands Plantentuin* (1889) and *Gedenckboek van 's Lands Plantentuin* (1892); SIRKS, *Indisch Natuuronderzoek* (1915) *passim*; VAN SLOOTEN, Teysmann heracht in *Nat. Tijds. Ned. Ind.* 41 (1931) 27. (2) TEYSMANN, *Nederl. Mij Aanm. Tuinbouw* (1853) 58-64. (3) *Nat. Tijds. Ned. Ind.* 31 (1870) 44. (4) *Ned. Kruidk. Arch.* 2 (1850) 191-201. (5) *Nat. Tijds. Ned. Ind.* 1 (1850) 109-114 and *Ned. Kruidk. Arch.* 2 (1850) 172-190. (6) TEYSMANN, *Widjojo Koesoemo* in *Nat. Tijds. Ned. Ind.* 9 (1855) 349-356. (7) TREUB, *Inleiding op den Catalogus der Bibliotheek van 's Lands Plantentuin* (1887). (8) *Verh. Bat. Gen. K. & W.* 17 (1838) 139-158, also 'Postscriptum' (1839) 1-4, and *Tijds. Nat. Gesch. & Phys.* 5 (1838-1839) 230-232, *Alg. Konst- & Letterb.* (1842), and *Flora* 30 (1847) 463-469. (9) *Tijds. Nat. Gesch. & Phys.* 5 (1838-1839) 253-271, *ibid.* 9 (1842) 115-180. (10) *Beibl. Flora* 25 (1842) 57-114. (11) *ibid.* p. 1-56. (12) *Tijds. Nat. Gesch. & Phys.* 10 (1843) 115-150. (13) *ibid.* 11 (1844) 49-111. (14) *ibid.* 11 (1844) 178-208. (15) *ibid.* 12 (1845) 77-139. (16) *Nat. & Gen. Arch. Ned. Ind.* 3 (1846) 185-194. (17) HOOK. *J. Bot.* 7 (1835) 321-326. (18) *Flora* 38 (1855) 577-579. (19) *Pugillus I* in *Nat. Tijds. Neerl. Ind.* 10 (1856) 1-253, and *Pugillus II* in *Acta Soc. Scient. Indo-Neerl.* 1 (1856) 1-54. (20) *Flora* 40 (1857) 529-535. (21) *ibid.* p. 97-106 (22) HASSKARL, *Hortus Bogoriensis descriptus*, *Pars II* in *Bonplandia* 7 (1859) 170-183, 254-274, *ibid.* 8 (1860) 90-100. (23) *Tijds. Nat. Gesch. & Phys.* 11 (1844) 209-288. (24) HASSKARL, *Horti malabarici clavis nova* in *Flora* 44 (1861) *passim*, 'Nachträge' in *ibid.* 45 (1862) *passim*; *Clavis locupletissima* in *Abh. K. Leop.-Car.* 34 (1867) 1-134. (25) HASSKARL, *Neuer Schlüssel* in *Abh. Naturf. Ges. Halle* 9 (1866) 145-389. (26) cf. BOERLAGE in *Teysmannia* 4 (1894). (27) HASSKARL, *Commelinaceae indicae* (1870). (28) *Nat. Tijds. Ned. Ind.* 1 (1851) 425-430, *ibid.* 2 (1851) 651, and *ibid.* 12 (1856) 277-281. (29) *ibid.* 25 (1863) 289-294. (30) *ibid.* 29 (1867) 231-240. (31) *ibid.* 3-29 (1852-1867) *passim*. (32) *ibid.* 23 (1861) 399-412, and

ibid. 27 (1864) 142-258. (33) *Indian Forester* 1 (1876) 220-269. (34) *ibid.* 28 (1865) 164-168. (35) *J. Linn. Soc. Lond.* 9 (1867) 264. (36) *Ann. Mus. Lugd. Bat.* 2 (1865) 52 and *J. As. Soc. Beng.* 38 (1869) 145. (37) *ibid.* 43 (1874) 192. (38) KURZ, *Contributions I-III* in *ibid.* 43 (1874) 39; 44 (1875) 128; 46 (1877) 49.

54. Zollinger

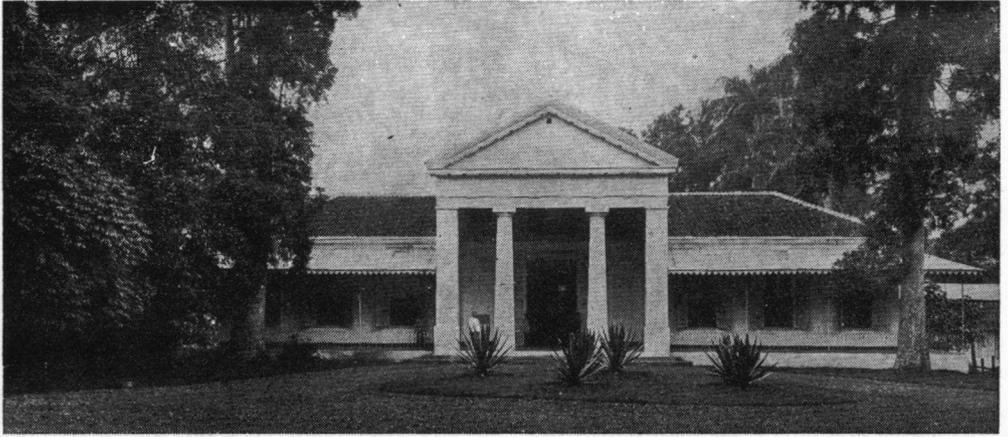
An extremely sharp-sighted observer was the professional plant collector H. ZOLLINGER. He holds, both by his life and work, a somewhat isolated position. A Swiss student of A.-P. DE CANDOLLE's, he went on the proposal of his teacher to Java (Dec. 1841) with the purpose of exploring its flora. The enterprise needed a financial basis, and it was decided that ZOLLINGER would compose sets of dried specimens which were to be forwarded to A. MORITZI, professor of Botany at Solothurn.

From 1842 till 1847, ZOLLINGER travelled tirelessly, climbing a dozen Javan mountains (1) and shifting his research more and more to East Java, where he did most of his collecting. In 1845 he travelled in S. Sumatra (2), in the next year in Bali (3), and Lombok (4), in 1847 in S. Celebes; finally in Sumbawa (5). He found it hard to cover his expenses by the revenue from the sale of duplicates. TEYSMANN's intermediary procured him a temporary Government allowance for collecting on behalf of the Buitenzorg Gardens.

A failing health, and a disappointment in connection with a Government post, made him return to Switzerland (1848). In 1855, he decided to leave again for Java and settle there as a coconut planter. He found time, however, to study *Euphorbiaceae* in the Buitenzorg Herbarium (6). In 1858, he went to Madura on a botanical trip (7), and he made in that year some geographical and geological observations in Bali. He died in 1859 in East Java, 37 years old.

ZOLLINGER had not only a lively interest in but also a good grip on many fields of natural history. He was a considerable collector of, and author on, terrestrial and aquatic fresh water molluscs of the Sunda Islands; his observations on volcanism and geology in general drew attention, and led him, together with his studies on the vegetation to a conclusive view regarding the demarcation of the Malaysian flora. In 1857, he coined the term 'Flora Malesiana', and pointed out how its boundaries had to be drawn; his limits have been confirmed and, on the whole, are now expressed in the design of the present *Flora Malesiana* (8).

It had been arranged that MORITZI should name and distribute ZOLLINGER's plants, and in 1844 a first consignment reached Europe. ZOLLINGER's industry is demonstrated by the fact that it consisted of more than a thousand species and that the total amounted to 20,000 specimens. It is understandable, that not all specimens were found to be well prepared. On the other hand, ZOLLINGER is the collector of many very rare species in East Java, some of which waited rediscovery for more than half a century.



Herbarium of the Royal Botanic Gardens at Buitenzorg

MORITZI published a *Systematisches Verzeichniss* (1845–1846); it deals with 5 of ZOLLINGER's consignments, collected in 1841–1844. ZOLLINGER learnt quickly to describe his plants on the moment of collecting and, being a man of distinct opinions once he had acquired the knowledge enabling him to judge, he gradually preferred to take an active part in the description of his finds. He published e.g. *Observationes phytographicae* (9), to which a supplement appeared in 1857 (*novae*, 9).

Although the two scientists, one in Europe the other in Java, by no means always agreed as to the correct interpretation of the specimens, MORITZI seems to have appreciated ZOLLINGER's contributions, this at least explains why they decided to write jointly a 'Flora Malayana' (1848); MORITZI's death (1850) prevented a further development of the plan.

To ZOLLINGER's first period in Java belong also a paper on *Rafflesia patma* (10), and a *Florae Javae species* (11).

MORITZI's *Systematisches Verzeichniss* had not been drafted after the entire satisfaction of botanists. When ZOLLINGER was back in Switzerland, he was urged to supply fresh, or more extensive, data to many species which were thought to have been too summarily described by MORITZI, and to publish on his more recent explorations. This resulted, with the help of some colleagues, in a second *Systematisches Verzeichniss*, of which appeared 2 fascicles dealing with systematics and phytography (1854–1855) and a third (1855), which treated the plant physiognomy of the East Indies generally.

The phytographical papers of his second stay I have mentioned (5, 9); some extensive manuscripts, one a 'Pflanzenbeschreibung' and the other a 'Clavis Herbarii Amboinensis' rest in the Herbarium at Buitenzorg.

References: (1) Tijdschr. Ned. Ind. 6 (1843) 141, 347, also Besteigung Tambora auf Sumbawa (1855). (2) Tijdschr. Ned. Ind. 9 (1846). (3) *ibid.*

7 (1844). (4) *ibid.* 9 (1846). (5) Verh. Bat. Gen. K. & W. 23 (1850). (6) ZOLLINGER, Rottlera-Arten . . . zu Buitenzorg in *Linnaea* 28 (1856). (7) Nat. Tijdschr. Ned. Ind. 17 (1858–1859) 243. (8) ZOLLINGER, Begrip en omvang eener Flora Malesiana in *ibid.* 13 (1857) 293–322, also De Indische Archipel in Mitt. J. Peithes Geogr. Anst. v. Petermann (1858). (9) in Nat. & Gen. Arch. Ned. Ind. 1–3 (1844–1846), also Nat. Tijdschr. Ned. Ind. 14 (1857) 8. (10) Nat. & Gen. Arch. Ned. Ind. 2 (1845) 353. (11) *ibid.* 4 (1847) 24, 141.

55. Scheffer

R. H. C. C. SCHEFFER, a student of MIQUEL's, having written a doctor's thesis on Malaysian *Myrsinaceae* (1), arrived in 1868 at Buitenzorg and was appointed as Director of the Gardens.

SCHEFFER tried to make the Gardens into the acknowledged centre for agricultural and horticultural research, also in respect to education in these fields, and devoted much of his time to these purposes. A good draughtsman, C. LANG, was added to the personnel; in 1876 the first volume of 'Annales du Jardin Botanique de Buitenzorg' (*cf.* §79) appeared. This (and the second volume of 1885) has the highly satisfactory series of 'heliogravures' which he made of the palms described by SCHEFFER. Two years before, in 1874, the new-housed and rearranged 'Museum and Herbarium voor Systematische Botanie' had been opened to the public, on the site where it has remained till the present, although internal reconstruction and external additions had to follow in the course of time (Library or 'Bibliotheca' in 1897).

SCHEFFER's main phytographical work may be summarized as follows. *Observationes phytographicae* appeared in 3 instalments (2). In 1869 an essay on *Diplanthera* (3), was followed by studies on some palms of the group *Arecineae* (4); in 1874 a survey of botanical papers in foreign periodicals as far as relating to the botany of the Archipelago entitled

Bijdragen uit het Buitenland tot de kennis der Flora van den Indischen Archipel (5) appeared and in 1876 an *Énumération des plantes de la Nouvelle Guinée* based on TEYSMANN'S collections (6).

It would be an underestimation of SCHEFFER'S achievements if his work were only judged by his comparatively few, though careful and sound, descriptive studies. His indirect influence on phytochemical developments has been considerable.

SCHEFFER was an industrious man. Less than two years of collaboration with TEYSMANN was all his practical training though he made after that some trips in West Java (7) in company of the 'Inspector honorary' (cf. § 53). Much of his time was occupied in organizing the agricultural education of the native population and broadening the economic contacts of the Buitenzorg Gardens. By encouraging internationally the interests in Malaysian botany (BECCARI), by his care of the Herbarium and Library, and by his founding of the 'Annales' the Gardens came to be more widely appreciated and more and more drew the attention of botanists.

Prior to SCHEFFER'S term of office the Botanic Gardens at Buitenzorg were largely considered to be, in the first place an institution from where valuable materials for phytochemistry, or botany in general, might be had. In 1880, at SCHEFFER'S death, however, the Gardens were to be seen as a centre for exchange, both as regards specimens of plants and of scientific views. When TREUB came to succeed him, he found the ground well-tilled and ready to respond to his endeavour; TREUB'S excellent direction had striking results, also in respect to phytochemistry, but so much progress was possible only because SCHEFFER had planned so well.

References: (1) SCHEFFER, *De Myrsinaceis archipelagii indici* (1867). (2) *Nat. Tijds. Ned. Ind.* 31 (1870) 1-23, 338-375; *ibid.* 32 (1873) 387-427. (3) *ibid.* 31 (1870) 332-337. (4) *ibid.* 32 (1873) 149-193. (5) *ibid.* 34 (1874) 33-111. (6) *Ann. Jard. Bot. Buit.* 1 (1876) 1-60, 178-181. (7) *Nat. Tijds. Ned. Ind.* 32 (1873) 207-233.

56. *Philippine phytochemistry; Blanco's 'Flora de Filipinas', Fernandez-Villar; Cuming*

In the Philippines, botany had been, and largely remained throughout the 19th century, in the hands of missionary priests. In 1837 appeared MANUEL BLANCO'S *Flora de Filipinas*, followed by a second edition in 1845 and a third, in several volumes (4 vols. + 2 vols Atlas 1877-'83), containing also a first publication of some century old manuscripts of fellow priests (Fathers I. MERCADO and A. LLANOS). To the fourth volume of this 3rd edition was added the *Novissima Appendix* by A. NAVES and C. FERNANDEZ-VILLAR, the editors of the work. In this book the phytochemistry of the lowland flora received most attention. MERRILL, undeniably the best judge of BLANCO'S work, found that of 1136 species and varieties only 9 were wholly doubtful as regards their identity, an additional 40 could be referred to the genus, the remainder being reduced to a good binomial 'in the entire absence' of any specimens left by BLANCO.

The *Flora de Filipinas* should be used in conjunction with MERRILL'S *Species Blancoanae* (1918), a thorough and critical study made most instructive by the distribution of illustrative duplicate specimens to the larger botanical institutes of the world, and which also deals with LLANOS'S mainly interpretative *Fragmentos* (1851) and *Nuevo Apéndice* (1856).

A new botanical garden, laid out at Manila in 1858 (degenerated in 1898 into a city park), never held a place comparable to that of Buitenzorg or of Singapore.

Between 1836 and 1840, H. CUMING assembled a really important Philippine herbarium consisting of considerably more than 2000 numbers. These valuable materials hardly attracted the attention they deserved but, nevertheless, formed the base of the few contributions to Philippine phytochemistry which appeared in fifty years. To be noted are S. VIDAL Y SOLER'S *Phanerogamae Cumingianae* (1) and N. TURCZANINOW'S earlier series of articles in the periodical of the Moscow naturalists (2). Some of CUMING'S specimens were mislabelled and so assigned to wrong regions.

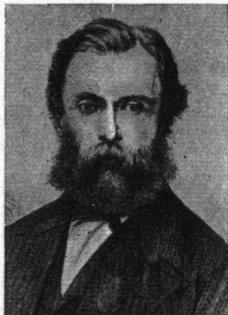
References: (1) VIDAL, *Phanerogamae Cumingianae Philippinarum* (1885), also *Revision de plantas vasculares Filipinas* (1886). (2) *Bull. Soc. Nat. Moscou* 19² (1846) 489-496, 497-510; *ibid.* 20¹ (1847) 148-174; *ibid.* 21¹ (1848) 250-262, 570-591; *ibid.* 24¹ (1851) 166-214; *ibid.* 25² (1852) 310-325; *ibid.* 27² (1854) 271bis-372; *ibid.* 31¹ (1858) 185-250, 379-476; *ibid.* 36² (1863) 193-227; *ibid.* 36² (1863) 228-365; *ibid.* 36¹ (1863) 545-615.

57. *West Malaysia; Jack*

In West Malaysia, scientists in the suite of T. S. RAFFLES promoted phytochemistry (cf. HORSFIELD § 40). In 1818, W. JACK, a Scotsman, followed his employer from Calcutta to Penang where he did pioneer work and reported his results to his friend N. WALLICH, Superintendent of Calcutta Gardens. After a stay of several months at Penang and Singapore, the party went to Bencoolen. J. ARNOLD also went with them but died some months after arrival (cf. § 40). Here the flora had been little touched. CH. MILLER (1771), CH. CAMPBELL (1800), W. ROXBURGH (1803), B. HEYNE (1812) had but incidentally collected and described. JACK worked here during four months, to interrupt his research for a voyage to Calcutta, and, returning in 1820, visited some islands off the Sumatran coast. Seeking recovery from his mortal illness he paid a short visit to Java but died in 1822 off Penang. JACK was a particularly inquisitive and able phytochemist as is convincingly proved by his papers on *Cyrtandraceae* (1), *Melastoma* (2), and other groups appearing in 1823 (3). His collections (partly) and some unpublished manuscripts perished in the fire of the 'Fame' when being dispatched to England; his printed articles *Descriptions of Malayan plants* were nearly forgotten. They appeared in a rare journal issued by the Sumatran Mission Press ('Malayan Miscellanies', 1820-'22) and, though W. J. HOOKER and GRIFFITH had them reprinted



MORITZI



F. VON MUELLER



J. MÜLLER-ARG.



MISS J. PERKINS

(4), many of JACK's names have been overlooked. Nevertheless, JACK left his mark on Malaysian phytography and will be remembered to have made a first reconnaissance of the SW. Sumatran flora including to some extent that of the interior and the highlands (5).

References: (1) *Trans. Linn. Soc. Lond.* 14 (1823) 23-45. (2) *ibid.* 14 (1823) 1-22. (3) *ibid.* 14 (1823) 114-130. (4) HOOKER, *Bot. Misc.* 1 (1830) 273-290, 2 (1831) 60-89, 219-224, 253-272. New repr. in *Calc. J. Nat. Hist.* 4 (1843) 1-62, 159-231, 305-374; also in *Misc. Pap. Indo-China & Ind. Arch.* II, 2 (1887) 169-228, 24 246-295. (5) *J. Roy. As. Soc. Str. Br.* 73 (1916) 147-268.

58. *The Malay Peninsula*

Botany in the Malay Peninsula, in these years, benefitted from WALLICH's collections at Penang (1822) enriched by those of G. PORTER, W. JACK, and G. FINLAYSON; H. CUMING (§ 56), on his return voyage to Europe, explored Mount Ophir and collected there. W. GRIFFITH, besides searching enormous tracts in British India, made the largest collections in the Malay Peninsula so far obtained (1841-'42, 1844); his manuscript notes and studies in Malayan plants have been gradually published among the *Posthumous Papers* by J. MCCLELLAND (4 vols, 1847-1854). His writings abound in clever suggestions, new data, and valuable observations. When writing the *Flora of British India* (in which the flora of the Malay Peninsula was also considered), HOOKER made use of GRIFFITH's notes.

The Malayan collections of GRIFFITH, as to size and importance, have in this period only been surpassed by A. C. MAINGAY's herbarium, secured in 1862-'69, which is exceedingly rich in Singapore and Penang specimens.

The period is characterized in the Malay Peninsula by the assembling of these (and some other) herbaria; in publications the Peninsula was only referred to incidentally, and very few papers appeared solely dealing with the plants of this region.

59. *India; Wallich and contemporaries; Flora Indica*

In India, as we have seen (§ 42), the manuscripts of ROXBURGH had been entrusted to CAREY and

N. WALLICH, the adopted name of the Dane N. WOLFF. From 1815, he was Superintendent of Calcutta Botanic Gardens and, when returning to Europe in 1828, he took with him a large Herbarium of 8000 species, including the specimens secured at Singapore and Penang by his helpers W. JACK and G. PORTER. His chief work is the magnificent 3-volumed *Plantae Asiaticae Rariores* (1830-1832) consisting of 300 beautifully executed plates, which was preceded by part of his *A numerical list of the dried specimens of plants in the East India Company's Museum etc.* (1828-'49). This 'WALLICH's Catalogue' was a mimeographed list issued in a limited number and accompanying the consignments of Indian specimens presented to various botanical institutions. It contained many new names (proposed in collaboration with BENTHAM and others) without descriptions.

This resulted in much confusion. In the 19th century, botanists were generally inclined to treat 'WALLICH's Catalogue' as a valid publication in so far as new species were concerned. In the works of HOOKER, DON, DE CANDOLLE and others many of WALLICH's are adopted and furnished with a description. On the other hand, phytographers who had WALLICH's specimens not at their disposal, rejected or neglected WALLICH's names, which was in the 20th century confirmed by the Rules of International Nomenclature (1905). In matters of priority, WALLICH's Catalogue names may now only be considered from the moment that they appeared in print interpreted and described by a later author.

The Madras botanist R. WIGHT, a man of 'remarkable sagacity and boundless energy' published an *Icones Plantarum* (7 vols, 1840-'56) which figured and described more than 2000 Indian plants, a *Spicilegium Nilghirense* (2 vols, 200 coloured plates) and together with G. A. WALKER-ARNOTT, professor of Botany at Glasgow, a *Prodromus Florae Peninsulae Indiae Orientalis* (1834). This work is written in a lively style, full of interesting observations, and it is greatly to be deplored that it was never completed. WIGHT wrote two volumes *Illustrations of Indian Botany* (1841-1850), intended to portray the plants of the *Prodromus*.

A Forestry Service in India had nominally existed since many years but increased its efficiency, and

its members produced considerable phytophagical works in the second half of the century. I confine myself to mentioning Colonel BEDDOME's *Ferns of Southern India* (2 vols, 1863, 1865-'70), and *Flora Sylvatica of the Madras Presidency* (1869-'73), D. BRANDIS and J. L. STEWART's *Forest Flora of NW. and Central India* (1874), and J. S. GAMBLE's excellent work on *Bambusaceae*; the latter was editor of 'The Indian Forester', an important monthly (1876-). GAMBLE based his study in *Bambusaceae* on Colonel W. MUNRO's monograph of 1866 (1).

A forerunner of the *Flora of British India* (see next paragraph) appeared in 1855: the single volume of a *Flora Indica* by J. D. HOOKER and TH. THOMSON. The introductory essay is one of the most valuable studies in taxonomic botany ever written (cf. Chapter 3, of this volume). For further details I must refer to e.g. KING's (§ 87) studies on the history of Indian botany (2) and I. H. BURKILL's (§ 90) MS. treating 150 years of Indian botany (now being written).

References: (1) Trans. Linn. Soc. Lond. 26 (1866) 1-157. (2) Gard. Chron. 26 (1899) 252-254, and J. Bot. 37 (1899) 454.

60. Resident amateur botanists in Malaysia

Phytophagy in this period in Malaysia was also furthered by another group of workers, the resident amateur botanists. The botanical work and interests of non-professionals in Malaysia (RHEEDE, RUMPHIUS) made there the first solid base of all future phytophagy, in contradistinction to the course of history in Europe where as a rule the foundations were laid by persons to whom knowledge of plants was an asset to their daily occupation (herbalists). After professional scientists had come to the fore—only when political and economic development after more than a century of European administration had created favourable conditions—the plant-loving 'lay-community' continued to take part in the progress of botany in a most gratifying manner.

J. B. SPANOGHE, born at Madras from Belgian parentage, a modest and little noticed, physically weak man, withheld his good *Prodromus Florae Timorensis* from publication when J. DECAISNE's *Timor Flora* (§ 105) appeared (1835). His considerable collections of plants, manuscripts, and drawings (now partly preserved at Leyden) were publicly sold after his death. D. F. L. VON SCHLECHTENDAL published this *Prodromus* in 1841 in 'Linnaea'; SPANOGHE's other publications are a sketch of the *Flora of Timor* (completed by a Catalogue of some 600 Timor plants, and a report on the Upas tree in collaboration with W. J. HOOKER (1).

C. F. E. PRAETORIUS, of German birth, President of Palembang, S. Sumatra (1829-'34), wrote an account of timbers in BLUME's short-lived 'De Indische Bij' (1843). His data will have served W. L. DE STURLER in his descriptive study of East Indian timbers (2). He wrote a book on agriculture, which relied too much on earlier Indian literature (3). An inventory of Riouw and East Sumatra was made by G. F. DE BRUYN KOPS (4).

The interest in plants as a hobby is often accompanied by an interest in their possible economic promise and this leads occasionally to the advancement of phytophagy. Among many, I mention surgeon TH. OXLEY, who wrote of his quest for gutta-percha producing trees in Penang, Singapore, and Sumatra (5), and J. MOTLEY's collections and letters on the same and similar subjects from Borneo (6). G. J. FILET, Dutch Army surgeon, wrote a dictionary, a *Plantkundig Woordenboek van Nederlandsch-Indië* (1876, improved 2nd ed. 1888), based on a rather uncritical list (7) of native names (1859). When specializing in the study of vernacular plant names he made, in 1854, the *Tweede Catalogus*, a second Catalogue of the plants cultivated in the botanical garden (better: pharmaceutical garden) of the Military Hospital at Weltevreden (Batavia). He listed 504 species. His work relied largely on literature studies, and he was not always fortunate in his choice. J. H. W. CORDES, a forester in Java and Sumatra, had an interest in phytophagy (9). His work on the teak forests of Java became widely known (10).

Towards the end of this period, the first papers on microscopic *Algae* appeared (11) by J. G. BERNELOT MOENS, phytochemist and quinologist, and by J. B. B. NAGELVOORT (12), a military apothecary who wrote also on *Rafflesia* (13).

References: (1) Hook. Comp. Bot. Mag. 1 (1836) 308-317. (2) DE STURLER, Beschrijving der Houtsoorten in Ned. Oost-Indië (1866). (3) DE STURLER, Handboek voor de Landbouw in Ned. Oost-Indië (1868). (4) Tijd. Ind. Taal-, Land- Volk. 1 (1859) 272-317. (5) cf. New Edinb. Philos. J. (1848). (6) Hook. J. Bot. Kew Gard. Misc. 9 (1857) 148-153. (7) Nat. Tijd. Ned. Ind. 19 (1859) 1-280. (8) *ibid.* 7 (1854) 19-36. (9) *ibid.* 29 (1867) 130-135. (10) CORDES, De djatiboschen op Java (1881). (11) Geneesk. Tijd. Ned. Ind. 4 (1872) 409. (12) Nat. Tijd. Ned. Ind. 35 (1875) 268-269. (13) *ibid.* 35 (1875) 171-180.

61. The 'Natuurkundige Vereeniging'; periodicals

Highly conducive to the promotion of phytophagy was the founding of the 'Natuurkundige Vereeniging in Nederlandsch-Indië' (1850, since 1860 'Royal'). This Society was liberally supported by the 'Bataviaasch Genootschap', and, intending to further the natural sciences, published the 'Natuurkundig Tijdschrift voor Nederlandsch-Indië'.

The title was modified to 'Natuurwetenschappelijk Tijdschrift, &c.' (vol. 101, 1941), and in Jan. 1947 changed to 'Chronica Naturae' (vol. 103).

The 'Natuurkundig Tijdschrift' had been preceded by the 'Natuur- en Geneeskundig Archief voor Ned.-Indië' (1844-'48). Another issue of the Society was the 'Acta Societatis Scientiarum Indo-Neerlandicae' (Verhandelingen der Kon. Nat. Vereeniging in Ned. Indië, 8 vols, 1856-'60). Phytophagical articles are also found in 'Tijdschrift voor Neerland's Indië' (1838-'48; after that year edited in the Netherlands till 1902, when it was incorporated in 'Indische Gids'). Finally is to be not-

ed 'Tijdschrift voor Nijverheid in Nederlandsch Indië' (1854-1917; 'en Landbouw' was added to

the title with volume 7). To the 'Annales' I have referred in § 55 (*cf.* also § 37).

MALAYSIAN PHYTOGRAPHY AFTER 1880

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62. *The state of phytography at the end of the 19th century*

Towards the close of the 19th century, the surge of general comprehensive standard works on taxonomic botany lost vigour. Several of the largest, issued over many years, neared completion and new ones, though here and there begun, were slow in starting and tardily continued, rather in the manner of serials written by a large number of experts. The time for systematic monographs, one author dealing with the whole plant system with regard for detail, was past; the vast collections, the endless stream of literature, the continually growing fund of data on all aspects of taxonomy demanded on one hand specialization and, on the other hand, team work if studies or detailed books of a general nature were desired. This implied a flood of usually small, scattered articles on incidentally chosen limited groups and a phytography of most diversified aspects and merits. To be kept informed of the current scientific developments required a measure of time and energy on the part of the phytopographer, the librarian, and the bibliographer as never before, and this scattered and varied phytography has made any general survey of necessity very incomplete; a satisfactory approach to the literature is only possible by means of voluminous bibliographical lists.

Phytography, in this period, sometimes followed the Linnean precepts or, less artificially, aimed at a brief description which laid sufficient stress upon specific characteristics and natural affinities (roughly: the English school). Sometimes, also, it was intended to draw a plant portrait which, preferably, ought to be brief but should be sufficiently close to delimit the plant species as such clearly, even if not contrasted against allies (roughly: the French school). Thirdly, phytographical analysis became long drawn and meticulously detailed on purpose: The latter method seems to indicate that the describer was not yet prepared to accentuate natural affinities (many species still being unknown) but wished to provide future students with as many data as possible; of course, by typographical means differential characters might be tentatively proposed (roughly: the German school). In

addition, distinction must be made between *specimen* description (unavoidable as often as 'only the type is known') and *species* description, and there are many variations on these methods and much hybridizing.

The three present centres of phytography in Malaysia did not develop simultaneously. Buitenzorg, under TREUB, had approached the best years of its history when, at Manila, under MERRILL in the opening years of the century, phytography only began its career; nearly simultaneously, at Singapore, under RIDLEY, the phytography of the Malay Peninsula found a definite home. It seems justified to sketch an outline of the history of plant description in the Netherlands East Indies during TREUB's term of office (1880-1909), and to postpone the survey of events in the Philippines and the Peninsula till the following chapter (§§ 80-94).

63. *General handbooks*

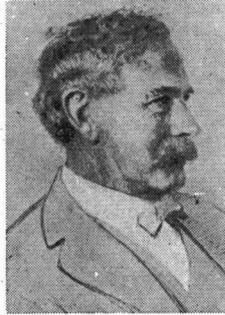
In the preceding chapter (§ 45), it has been demonstrated that BENTHAM and HOOKER's *Genera Plantarum* was close to completion when M. TREUB arrived in Java. This revision of genera was of eminent importance to Malaysia especially as regards the Netherlands Indies because the authors had examined considerable Malaysian collections. H. E. BAILLON's *Histoire des Plantes* (13 vols, 1867-1895) had the phytographical advantage of being illustrated, as was his *Dictionnaire de Botanique* (1876-'92). In 1889, (H. G.) A. ENGLER and K. PRANTL began their *Die natürlichen Pflanzenfamilien*, a serial work and treatise of the world's families and genera that, with the help of many collaborators; achieved completion in 1909; this was supplemented by *Nachträge* (3 vols, 1897, 1900, 1915). A second edition began to appear in 1924. The first parts of *Das Pflanzenreich*, a sequence of monographs edited by ENGLER, after the example of the *Suites au Prodrome* (§ 45) appeared in 1900; since 1905 this was continued under the editorship of L. DIELS. These great German works are a chief source of information to all taxonomic study. As regards phytography, the several fascicles differ much in quality and thoroughness; though some revisions rank among the best ever written, others are unsat-



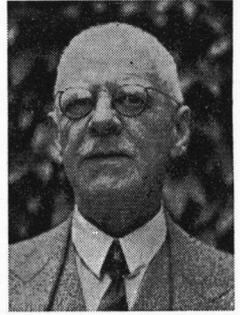
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isfactory. ENGLER's organizatory work and editorship was very effective; in rapid succession appeared a sequence of monographs which surpassed all that had been done before.

The *Genera Siphonogamarum* by C. G. DE DALLA TORRE and H. HARMS (1900-'07) provided an index to all generic names, arranged in conformity with the Englerian system, but with reference to the other standard works and, in the latter part, in accordance with the decisions of the International Botanical Congress at Vienna in 1905.

O. KUNTZE, world-wide traveller, wrote his taxonomically and historically important *Revisio generum plantarum* (4 vols, 1891-1898). G. KARSTEN and H. SCHENCK edited *Vegetationsbilder* (1903-1940), general descriptions and photographs of plant communities including some of Malaysia.

In England, the composition of a work enumerating all specific names with citation of literature was entrusted to B. D. JACKSON, author of *e.g.* the *Guide to the Literature of Botany*, in 1881. In collaboration with J. D. HOOKER two volumes appeared in 1895; they contained 'an enumeration of the genera and species of flowering plants, from the time of LINNAEUS to the year 1885 inclusive'. The necessary funds for this enormous work had been provided by a legacy from CH. R. DARWIN. *Index Kewensis* was recognized as an indispensable list of reference and it is now admitted that the study of systematic botany is impossible without recourse to this invaluable compilation. Ten supplements, after the first volumes, enumerated the species new described between 1885 and 1940. The 10th supplement summarizes also all plant pictures if accompanying new species made in the period 1936-1940 and so is in part a continuation of *Index Londinensis* (6 vols, 1929-'31), the list of botanical plates made under supervision of O. STAPP, which succeeded PRITZEL's earlier work. The two supplementary volumes by W. C. WORSDELL (1941) contained the list of pictures published in the years 1921-'35, and brought the issue to a close.

TH. A. DURAND, Professor of Botany at Brussels, compiled an *Index Generum Phanerogamarum* (1898), in which the systematic arrangement by BENTHAM & HOOKER was followed. The main French work of this class in later years is A. LEMÉE's *Dictionnaire descriptif et synonymique des*

genres de plantes phanérogames (8 vols, 1929-'43, vol. 7 containing keys to the families, vol 8a and 8b to the genera); an astonishing achievement for one single botanist and, as it contains generic diagnoses, in some respects a successful supplement to the above mentioned handbooks though not always critical and reliable in its details.

64. Chief phytographical works in neighbouring regions; Bentham

This summary of comprehensive handbooks narrows down to the general phytographical works dealing with the flora of the regions bordering on Malaysia, and so of direct bearing on the phytography of our region.

J. D. HOOKER began in 1872 his *Flora of British India* which, assisted by various botanists, he completed in 1897 (7 vols). Its lasting importance as a foundation to further study and a source of reference to Malaysian taxonomy, needs no comment. HOOKER also completed H. TRIMEN's *A Hand-book to the Flora of Ceylon*. TRIMEN, Curator of the Peradenya Botanic Garden (1879-'96) had published 3 volumes (1893-'95) but a failing health compelled him to desist from continuing his very critical reliable work. J. D. HOOKER wrote and published volume 4 and 5 (1898, 1900). In 1931 appeared A. H. G. ALSTON's supplementary volume in which the necessary nomenclatural changes were made and the latest data added. The value of TRIMEN's concise phytographical work is increased by his observations of plant ecology and biology. The *Medicinal plants* were treated in R. BENTLEY and H. TRIMEN's book (4 vols, 1880) and economic botany of the Indian peninsula received a firm basis in WATT's *Dictionary of economic products of India* (1889-'93).

The *Flore Forestière de la Cochinchine*, by L. PIERRE, a folio work of 400 beautiful and detailed lithographs of trees accompanied by descriptions, remained incomplete (4 vols, 1879-'99); the author's extensive and remarkably good collections were liberally distributed and enrich many herbaria, often providing conclusive evidence when compared with Malaysian material.

H. LECOMTE's *Flore générale de l'Indo-Chine* was planned in 7 illustrated volumes, and began to ap-

pear in 1907. After the 7th volume had been completed, it was tried to cope with the influx of new specimens in editing supplementary parts. In the 8th, or preliminary volume, concise historical and personal data in relation to the phytophany of Indo-China were supplied. It would seem that the writing of this Flora was started when collections were decidedly insufficient and many essential data were still wanting; LECOMTE and his collaborators, however, very often succeeded in composing revisions much helpful to Malaysian phytophany.

A general Flora of Siam (Thailand) was not attempted but W. G. CRAIB's *Florae Siamensis Enumeratio* is a good key to its phytophany. Although the book 'enumerates' the specific names, it contains many very valuable notes. The work was begun in 1925, and at CRAIB's death (1934) the 3-5th instalments of vol. 2 were edited by the late A. F. G. KERR, assisted by H. R. FLETCHER.

Here belongs a *Flora of Assam* by U. N. & P. C. KANJILAL, A. DAS *c.s.*; the first volume appeared in 1934, the fifth in 1940, containing the *Gramineae*, was written by N. L. BOR.

The floras of China, Formosa, and the Pacific Islands are so widely different from that of Malaysia that the books, or studies, of those regions have only rarely direct bearing on ours. Much more important is *Flora Australiensis* (7 vols, 1863-1878) written by G. BENTHAM, in part assisted by F. VON MUELLER.

G. BENTHAM has been repeatedly mentioned (§48) in this short history and it is necessary to add some additional titles selected from his numerous publications.

His was the execution of the first of the later British colonial Floras (*Flora Hongkongensis*, 1861) and so he drafted the model after which all posterior publications in this field were made. He was a firm believer in the constancy of species but, confronted with the host of persuasive facts collected by DARWIN, and of course unaware of modern experimental taxonomy, had the courage to submit to Darwinism 'with severe pain and disappointment'. Being essentially accurate, precise in his descriptions, and instinctively conscious of the weight of characters taxonomically, he was convinced that a 'typical individual' was only an abstraction as well as a 'typical species'. This complex of inborn convictions and acquired knowledge may have led to his delimitation of species which is, phytophany, strikingly good and, at the same time, sparing in detail. His larger studies (apart from those already mentioned) are his contributions to DE CANDOLLE's *Prodromus* (*Scrophulariaceae*, 1846; *Labiatae*, 1848), his revision of *Leguminosae* (1), and his notes on *Loganiaceae* (2).

F. J. H. (VON) MUELLER, Government Botanist of Victoria (SE. Australia) and, later, Director of the Melbourne Botanical Garden (1857-'73), wrote many articles on Australian botany and several on the flora of New Guinea and the Moluccas. There are dozens of small papers on plants of New Guinea and adjacent islands (3). His chief works are *Fragmenta phytophanyae Australiae* (12 vols, 1858-'82), *Descriptive notes on Papuan plants* (9

pts, 1875-'90), and *Iconography of Australian Species of Acacia and cognate genera* (1887-'88). VON MUELLER died in 1896, a German by birth, who worked entirely in agreement with the English school and, on several occasions, materially aided the Buitenzorg Gardens and Malaysian phytophany.

F. MANSON BAILEY, Colonial Botanist of Queensland, made a flora of this province (*The Queensland Flora*, 1899-1902, General Index 1905), a handbook often consulted by Malaysian botanists when studying the vegetation of New Guinea or that of the Lesser Sunda Islands. He wrote a series *Contributions to the flora of New Guinea* (4). In 1909 he published his *Comprehensive Catalogue of Queensland Plants*.

On the flora of Christmas Island (S of Java, phytophany a part of Malaysia) appeared E. G. BAKER's study in 1900 (5). There are also H. N. RIDLEY's *A day at Christmas Island* (6), *An expedition to Christmas Island* (7), and *Christmas Island Flora* (8).

References: (1) HOOK. Journ. Bot. 4 (1842) 323-418; London Journ. Bot. 1 (1842) 318-392, 494-528, *ibid.* 2 (1843) 423-481, 559-673, *ibid.* 3 (1844) 82-112, 195-226, 338-365, *ibid.* 4 (1845) 577-622, *ibid.* 5 (1846) 75-108; in MIQUEL, Pl. Jungh. (1852) 205-270; J. Linn. Soc. 4 (1860) Suppl. 1-134; Trans. Linn. Soc. 27 (1871) 503-591, *ibid.* 30 (1875) 335-664. (2) J. Linn. Soc. Bot. 1 (1857) 52-114. (3) see *e.g.* Descr. New Papuan Plants in Journ. Bot. 29-31 (1891-1893) *passim*. (4) Queensland Agric. Journ. 6-26 (1898-1911) *passim*. (5) 'Botany' in A monograph of Christmas Island (1900). (6) J. R. As. Soc. Str. Br. 23 (1891) 123-140. (7) *ibid.* 45 (1906) 137-271. (8) *ibid.* 48 (1907) 107-108.

65. Treub's scientific work

With these (and other, now unmentioned) general and special studies relating to Malaysian phytophany as a background, MELCHIOR TREUB, back in the eighties, built the Gardens at Buitenzorg into a world centre of botanical studies. It will be remembered that TREUB himself published some papers of great interest *viz* on *Spathodea* (1), on hydrocyanic acid in *Pangium* (2) (1896), on ant plants (3), on *Uncaria* (4), on *Dischidia* (5), and on other biological or physiological subjects. In addition, he investigated and described the re-establishment of the flora of Krakatoa (6) after the eruption (1883), on economic botany, on the development of the Gardens; he was a talented historian (*cf.* his preface to the catalogue of the Buitenzorg Library, 1887, his biography of TEYSMANN (7), BOERLAGE (8), and the short history (9) of the Botanic Gardens (1892).

MELCHIOR TREUB was born in 1851, in Holland and, a gold medallist, assisted SURINGAR from 1874 till 1880. His fellow students were HUGO DE VRIES and M. W. BEIJERINCK. At Leyden, TREUB demonstrated the true nature of Lichens by cultivating *alga* and *fungus* separately (10); research into growing meristems of *Palmae*, *Pandanaceae*, and *Selaginella* established him as a skilful microscopist.

He investigated also the embryology of Orchids (11), *Euphorbiaceae*, *Asclepiadaceae*, and *Urticaceae*.

At Buitenzorg, he continued his cytological work by studies (12) in *Lycopodiaceae*, *Zamia* and *Ceratozamia*, *Loranthaceae*, *Burmanniaceae*, *Avicennia*, *Casuarina* (chalazogamy!), and *Balanophora*; he wrote on the embryology of *Ficus hirta* and *Elatostema*. His studies and publications were not written with an intent to add to phytophagy although they contain here and there some descriptive parts.

References: (1) Ann. Jard. Bot. Btzg 8 (1890) 38-46. (2) *ibid.* 13 (1896) 1-87. (3) *ibid.* 3 (1883) 129-159, *ibid.* 7 (1888) 191-212. (4) *ibid.* 3 (1883) 44-75. (5) *ibid.* 3 (1883) 13-36. (6) Tijds. Ned. Ind. 17 (1888) 153; Ann. Jard. Bot. Btzg 7 (1888) 213; Nat. Tijds. Ned. Ind. 48 (1889) 338; Versl. & Med. Kon. Akad. Wet. Amsterdam afd. Nat. III, 5 (1889) 4. (7) *Teysmannia* 1 (1890) 1. (8) Nat. Tijds. Ned. Ind. 60 (1901) 396-412. (9) 's Lands Plantent. te Btzg (1892) 3-58. (10) TREUB, Onderz. natuur der Lichenen (1873). (11) Verh. Kon. Akad. Wet. 19 (1879) 1-50. (12) see Ann. Jard. Bot. Btzg 2-13 (1885-1896) *passim*.

66. Treub's organizatory work

Having held the post of Director during a quarter of a century, TREUB saw his Gardens grow to a complex organization of various institutions connected with all theoretical and practical branches of Malaysian plant science; ultimately, the Gardens were officially recognized as a full Department of the Netherlands Indian Government (Department of Agriculture, 1905). TREUB retired in 1909, to die a year later; with him the Gardens as a whole had passed their zenith.

TREUB used all his talents and resources to strengthen the position of the Gardens, to extend and to intensify their interests. His eminent direction has been repeatedly described. His parting words (1909) were: "Ensuite, j'ai pensé faire acte de patriotisme en engageant autant que possible les naturalistes de tous les pays à venir dans notre colonie hollandaise faire connaissance de la remarquable richesse et de l'exubérance de la flore et de la faune. J'ai cru agir—je tiens à le réitérer—dans la mesure de mes moyens, en l'honneur de ma patrie en facilitant les recherches des nombreux hommes de science qui se sont rendus à Buitenzorg." He made these sentiments to a living reality. To read his words in our present troubled days, fills one with a certain envy though it may be pointed out that this spirit still lives and is expressed in the organization of our present *Flora Malesiana*.

I must confine myself to an account of what made possible the progress of Malaysian phytophagy under his guidance. In particular after the opening of the first Foreigner's Laboratory (1885) and the establishment of the international 'Buitenzorg Fund' (1888), a financial support to visiting scientists, the idea of spending some time in the Gardens became familiar to botanists. The Tjibodas Garden, obtained a Laboratory (1891), and in

that year the Buitenzorg Gardens were increased by the 'Island', which meant another 30 acres lying in the larger river which runs through the Gardens, the Tjiliwong.

These facilities greatly furthered phytophagy while new laboratories or experimental stations also contributed to some extent. TREUB was instrumental in founding the Gutta-percha Station at Tjipetir (1885), the Pharmacological Laboratory (1888), the Phytopathological Laboratory (in the Economic Gardens, 1890), the Tobacco Research Station (1893, at Medan), Coffee Research Station (1896, at Bangelan with P. J. S. CRAMER in 1901), the 2nd Agricultural College (1900), the Indigo Experimental Station (1902), the Tea Experimental Station (1903), the Experimental Station for Rice and other Javan cultures (1905), the Geological Laboratory (1905), the Laboratory for Marine Research (1905), the Museum and Office for Economic Botany (1905), and the Office for Agricultural Analysis (1905).

TREUB remains the glory of the Buitenzorg Gardens. He built their complex organization by masterstrokes, with a deft and elegant touch, by an inimitable perception where, in the change of circumstances, lay advantage for the Gardens, and by an exemplary devotion and loyalty to his task; his work crowned what had been achieved in the past and gave it a new and deeper meaning. He made possible a future progress honourably matching the best results anywhere in the tropics. Malaysian phytophagy owes him a never to be quitted debt.

67. Treub as a promoter of phytophagy; *Burck, Jaheri*

TREUB, personally, had no intent to work as a systematist and phytophagist, but his are the words: (transl.) "Rightly it may be contended—and it ought to receive full emphasis—that, in the course of time, the upholding of the standard and repute of the Botanic Gardens first of all depends on the standing of the Herbarium" (from an official letter, 1893). This view governed his continuous efforts, during many years, to make the Gardens rank among the leading institutions in the field of Malaysian phytophagy.

TREUB, then, directed his attention to the Herbarium, the natural centre for Malaysian phytophagy as applied in taxonomy. He met with considerable difficulties.

MIQUEL, in charge at Utrecht of the education of students and the author of the first general *Flora* of Malaysia (§ 48), had hardly left any pupils. He believed his work to be conclusive (this feeling is frequently observed in scientists who have reached the end of fundamental and comprehensive studies) and a conviction of this nature will not attract beginning scholars. MIQUEL even persuaded the Minister that the post of Keeper in the Rijksherbarium at Leyden, after the publication of *Flora Indiae Batavae*, had become superfluous and the position was accordingly discontinued. TREUB, intent on promoting a science which he clearly saw had



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hardly past the first preliminaries, found himself practically with no suitable assistance to be called in from the Netherlands. It became his policy, realized only in the course of time after determined efforts, to have a small permanent Staff in the Herbarium. Temporarily appointed (usually foreign) systematists were to reinforce this Staff and stayed sometimes for several years at Buitenzorg.

When TREUB arrived, the Buitenzorg Herbarium contained slightly over 120,000 specimens. W. BURCK, became subdirector of the Gardens, and simultaneously Head of the Herbarium and Library (1881).

BURCK (born in 1848) was a pupil of SURINGAR's. TREUB was well acquainted with him but collaboration between them did not stay as smooth as might have been expected though BURCK did much to improve the Herbarium. His phytographical studies were in majority prompted by practical problems. The *Dipterocarpaceae* were investigated with a view to their valuable timber and resins (1), *Erythroxylon* on account of cocain (2), *Sapotaceae* (3) in order to discover the best source of gutta-percha (trip into the Padang district, 1883).

BURCK opposed those botanists who thought cross-fertilization all-important and studied the floral biology of *e.g.* *Rubiaceae* (4), *Connaraceae*, *Leguminosae*, and *Aristolochia* (5) to prove the importance of self-pollination. He left the Herbarium on European leave in 1891, and did not return to the Garden.

One of the best-known collections acquired in those years was that of Mantri JAHARI (Kei Islands, 1888). A collection of quite a different character was initiated by BURCK in 1889, the so-called 'Garden Herbarium'. Many seeds or seedlings secured on expeditions had gradually developed to mature plants in the Botanic Gardens, and the systematical collecting of flowering and fruiting specimens there has resulted in thousands of perfect specimens which added greatly to the value of the original fragments in the General Herbarium by supplying much supplementary data for later descriptions.

A third, much smaller set of specimens, each of the highest value taxonomically, was received as a number of duplicates extracted from KUHLE and

VAN HASSELT, BLUME, and JUNGHUHN's herbaria, preserved in Holland at Leyden and Utrecht, and selected on TREUB's request by J. G. BOERLAGE for transfer to Buitenzorg.

References: Ann. Jard. Bot. Btzg 6 (1887) 194-244. (2) *Teysmannia* 1 (1890) 385-398, 449-464, also Ned. Kruidk. Arch. 6 (1893). (3) Ann. Jard. Bot. Btzg 5 (1886) 1-85, also Med. 's Lands Plantent. 1 (1884). (4) Ann. Jard. Bot. Btzg 3 (1883) 105-118, *ibid.* 4 (1884) 12-88. (5) Tijds. Nijv. Landb. Ned. Ind. 28 (1883); Ann. Jard. Bot. Btzg 10 (1891) 75-114; Nat. Tijds. Ned. Ind. 49 (1890) 501-544; *Teysmannia* 2 (1891) 129-147.

68. Boerlage and Hochreutiner

BOERLAGE, like BURCK (§ 67) an old acquaintance of TREUB's student days, had investigated (1) the wood anatomy of *Moraceae* (1875). He had accepted employment at the Leyden Rijksherbarium in 1879, though SURINGAR only succeeded in reinstating the post of Keeper (§ 48) or 'Conservator' after a long struggle (1881). He wrote (2) subsequently on Malaysian *Araliaceae* in 1886 and 1887, and on *Achyranthes* (3).

In 1888, he went as a Buitenzorg stipendiary (§ 66) to Java, where he collected, and wrote a paper on *Gramineae*, in the meantime assembling data for a handbook on the genera of the Malaysian flora. Returning to the Netherlands, he published successively his main work *Handleiding tot de kennis der Flora van Nederlandsch-Indië* (5 inst. 1890-1900). His untimely death precluded completion and though its usefulness could not be denied, it followed rather closely its guide: BENTHAM and HOOKER's *Genera Plantarum*. Other articles by BOERLAGE are *e.g.* on *Erythrina* (4) and an elaboration of Sumatran plants collected on VAN HASSELT's expedition of 1877-1879 (5). He composed numerous contributions to the first edition of the *Encyclopedie van Nederlandsch Indië* (1896).

BOERLAGE stayed at Leyden and was appointed subdirector in 1894. Ignoring several refusals, TREUB persuaded him to come to Buitenzorg. In 1896, he arrived and became subdirector of the Gardens and Head of the Herbarium.

He began a new Catalogue of the Gardens

(1899); only a second instalment appeared posthumously (1900). VAN ROMBURGH's collection of rubber producing plants received his attention and he began work on a Flora of the Buitenzorg Phanerogams. In 1900, he left with J. J. SMITH for Amboina in quest of Rumphian plants; malignant fevers caused his death at Ternate within three months. TREUB wrote: (transl.) "He was one of those who know to utilize their talents as well as possible, and to whom the desire for earnest, thorough and genuine labour is always prevalent."—As a phytohistorian, BOERLAGE's descriptive work is trustworthy and satisfactorily modelled. The famed 'Icones Bogorienses', a series of fine lithographed plates accompanied by descriptions, he had initiated in 1897, being helped by J. J. SMITH and TH. VALETON who wrote in particular in the later volumes, while BOERLAGE himself described many *Annonaceae* in the first volume. The first World War caused its discontinuation after 400 plates, in 4 volumes, had appeared (1914); it was never resumed (§ 79).

BOERLAGE's study in *Gramineae* (6), then, when published in 1890, was intended as a first step towards a Flora of Buitenzorg, the first of a preliminary series of papers introducing a comprehensive Flora of the district. TREUB, confronted with the abundance of the tropical vegetation, no systematist himself, and with few assistants, thought it prudent not to embark on a Flora of the whole of the Netherlands Indies, let alone of Malaysia (cf. § 71).

B. P. G. HOCHREUTINER, a Swiss botanist of the Conservatoire et Jardin Botaniques at Geneva, since long a centre of Malaysian phytohistory, continued, more or less, BOERLAGE's work towards a new Catalogue of the Buitenzorg Gardens. In 1904–1905 appeared 2 instalments (7), composed during his stay at Buitenzorg (1903–1905). In a pamphlet *Plantae Bogorienses exsiccatae* preceding the fascicles of the Catalogue, a number of new species were described; 10 sets of illustrative specimens were distributed among the leading herbaria of the world (1904). In 1910 followed *Descriptiones Plantarum bogoriensium exsiccatarum novarum* (8) but the Catalogue was never continued; in 1908 an Index closed the issue. A famed series is *Plantae Hochreutineranae* (1912–1940); the 5th fascicle of 1940 contains an Index to the preceding parts (9). HOCHREUTINER described (among his numerous publications) in particular *Malvaceae* and *Tiliaceae* but preferably studied the families as occurring throughout the tropics.

References: (1) BOERLAGE, Bijdrage tot de kennis der houtanatomie (1875). (2) Ann. Jard. Bot. Btzg 5–6 (1886–1887). (3) Ned. Kruid. Arch. 5³ (1889) 421–430. (4) Teysmannia 3 (1892) 535–542, 5 (1894) 20–21 (5) in VETH, Midden-Sumatra 4² (1884) 49 pp. (6) Ann. Jard. Bot. Btzg 8 (1889). (7) Bull. Inst. Bot. Btzg 19 and 22. (8) Ann. Jard. Bot. Btzg, suppl. 3 (1910) 816–870. (9) Ann. Cons. Jard. Bot. 15/16 (1912) 145–246, Candollea 2 (1925) 317–513, *ibid.* 5 (1934) 175–341, *ibid.* 6 (1936) 399–488, *ibid.* 8 (1940) 47–60.

69. Koorders and the Forest Flora of Java

Since 1872, the Forestry Service had felt the need of a Forest Flora of Java. The increasing facilities for phytohistorical research in the Buitenzorg Gardens made the Service decide to offer TREUB the direction of the writing of a Java Forest Flora which was considered to be a fitting introduction to a Java Flora generally (1892). Forest Officer S. H. KOORDERS had been engaged in collecting the forest flora since 1885 and had assembled a vast annotated herbarium (cf. § 73), and since 1890 had begun to elaborate the materials. TREUB accepted and KOORDERS was transferred to the Gardens.

As a result of his own studies, and at the time that this Forest Flora of Java began to appear, KOORDERS wrote in 1892 a *Lijst der Geslachten van de Boomsoorten op Java*, in 1891–1893 *Zakflora of Sleutel voor de geslachten en families der Woudboomen van Java* (1) and, in 1894, a *Plantkundig Woordenboek voor de boomen van Java* (2). These publications demonstrated that he possessed the best field-knowledge of Javan forest trees, and TREUB ruled that KOORDERS should continue in bringing together a Java herbarium with a view to completeness while TH. VALETON (§ 72) described these materials and arranged them taxonomically, aided by KOORDERS's extensive field notes. In the serial *Mededeelingen van 's Lands Plantentuin* (continued as *Mededeelingen van het Departement van Landbouw*), separate volumes began to appear under the title *Bijdragen tot de kennis van de boomsoorten van Java (Contributions ad cognitionem etc.)*. Between 1894 and 1914, thirteen volumes were issued, together an impressive standard work of which the first eleven were written by VALETON and the final two by J. J. SMITH. Various sections of the work are of the highest phytohistorical value. It is now outdated and, of course, nomenclatorial changes have become necessary, but the book remains indispensable to all future study of Javan trees. Very few additional species were discovered since its appearance. When, in 1913, the Forest Research Station at Buitenzorg was opened, it could start the ecological and economic study of Javan forest trees relying on taxonomical resources as good as might be found anywhere in the tropics.

References: (1) Zakflora voor Java (1893), first publ. Nat. Tijd. Ned. Ind. 51 (1891) 361–372, and *ibid.* 52 (1892) 209–328. (2) Meded. 's Lands Plantent. 12 (1894), cf. also Teysmannia 5 (1894) 4–29, 229–256, 467–478, and Tijd. Nijv. Landb. Ned. Ind. 48 (1894) 205–244; also 'lets over de aanleiding en de resultaten &c.' (1894).

70. Hallier f.

Another local Flora was planned and begun by J. G. HALLIER, a German scientist also calling himself H. G. HALLIER of HALLIER-SCHLEIDEN, a pupil of E. HAECKEL's. In 1893 he came to Buitenzorg and, soon after being appointed as a botanist in the Herbarium, accompanied A. W. NIEUWENHUIS on his Central Borneo Expedition (1893–1894), bringing c. 2500 specimens back. This expedition

was organized by the 'Maatschappij ter bevordering van het Natuurkundig onderzoek van de Nederlandse koloniën' (established in 1890, TREUB being one of the founders), and the 'Indisch Comité' etc.', which was the Maatschappij's representative in the East Indies. HALLIER started preparations for a Bornean Flora mainly based on his own and on TEYSMANN'S collections. The plans never fully materialized but as a result many articles came from HALLIER'S desk (1), among which some of his studies in *Convolvulaceae*, a family which he studied generally and with preference (2).

In 1896 he left Buitenzorg and was appointed Assistant in the Botanical Museum at Hamburg; from 1902-'04, he explored and worked again in East Asia (Pacific, Philippines, Japan, Ceylon), and in 1909 accepted a post in the Rijksherbarium at Leyden. Of his phyto-graphical publications I select those on *Clematis* (3), *Passifloraceae* (4), *Ampelideae* (5), and *Acanthaceae* (6); he studied GAERTNER'S *De fructibus* (7) and the botanical results of the ELBERT expedition (8) to the Lesser Sunda Islands and wrote 4 instalments of miscellaneous new or interesting plants from Malaysia (9). His later papers deal with a variety of subjects, either botanical, linguistic or ethnographical or all simultaneously. He wrote: (transl.) "Words grow like plants, chiefly at the end by adding various portions of words to the ancestral form; they may be said to branch in this manner. After this they die off as a rule near their beginning through careless enunciation and resemble a peat-layer consisting of numberless desintegrating individuals. Within this stage, their original meaning moves, as it were, from its beginning onto the dying stems and branches, reaches the final derivations and suppresses former meanings." More and more his work became steeped with the mysticism that, a quarter of a century later, wrought havoc in the German mind.

The severe disciplines of pure taxonomy and phytography could not hold his sometimes brilliant, fast-flying thoughts. He developed daring plant-geographical theories (10) which, while hitting the mark now and again (e.g. the inadequacy of WALLACE'S Line in botanical problems), also went astray (e.g. exaggeration of Australian elements in the New Guinea flora, underestimation of the differences in the Formosan and Indo-Malayan vegetation). In addition, he endeavoured to construct a new vegetable system (11). His industry and penetrating intuitive mind largely counterbalanced a lacking sense of proportion but a perfectly adjusted and cautious awareness of relative values is essential for any attempt towards a general vegetable system. HALLIER'S monophyletic construction is mainly different from other, then existing, systems in that he derived the Monocotyledons from the Dicotyledons accepting as linking families, the *Magnoliaceae*, *Berberidaceae*, *Ranunculaceae*, and *Nymphaeaceae*; these four held a position also between Monocotyledons and Gymnosperms.

More successful was his claim that phytochemistry might yield data establishing relationship between certain groups (12).

HALLIER served in the Leyden Herbarium from 1909 till 1922; he died in 1932 at Oegstgeest (near Leyden). His bold theories command attention. He drew his conclusions sometimes too quickly and on too slender evidence, and gave more freedom to his sentiments and instincts than is usually thought admissible in scientific problems, but those sentiments were never cheap, never low, and his intuitive views not infrequently proved to be surprisingly right.

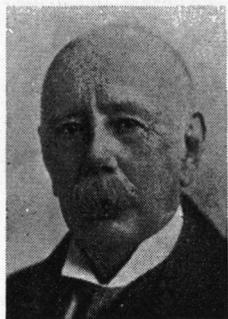
References: (1) Bull. No 14, Mij Bev. Nat. Ond. Ned. Kol. (1894). Versl. 's Lands Plantent. (1894) 15-19, 56-58; Nat. Tijdschr. Ned. Ind. 54 (1895) 450-452; Naturw. Wochenschr. 11 (1896) *passim*; Ann. Jard. Bot. Btzg 14 (1897) 18-52; Engl. Bot. Jahrb. 49 (1913) 369-380; Beih. Bot. Centr. 34² (1916) 19-55. (2) Engl. Bot. Jahrb. 18 (1893) 81-160, 453-591; Versl. 's Lands Plantent., Bijl. 2 (1895) 125-132; Bull. Herb. Boiss. 5-7 (1897-1899) *passim*. (3) Ann. Jard. Bot. Btzg 14 (1897) 248-276. (4) Meded. Rijksherb. 42 (1922) (5) Nat. Tijd. Ned. Ind. 56 (1896) 300-331. (6) Nova Acta 70 (1897) 195-240. (7) Rec. trav. bot. néerl. 15 (1918) 27-122. (8) cf. J. ELBERT, Die Sunda Exp. 2 (1912) 275-302 and Meded. Rijksherb. Leiden 14 (1912) 1-42, *ibid.* 22 (1914) 1-20. (9) Ann. Jard. Bot. Btzg 13 (1896) 276-327; Bull. Herb. Boiss. 6 (1898) *passim*; *ibid.* II, 1 (1901) 667-676; Meded. Rijksherb. Leiden 25 (1915). (10) Bull. Herb. Boiss. II, 3 (1903) 306-317; Ber. Deutsch. Bot. Ges. 23 (1905) 85-91; New Phytol. 4 (1905) 151-162; Arch. néerl. Sci. exact. & nat. sér. III, 1 (1912) 146-234; Meded. Rijksherb. Leiden 44 (1922) 1-41. (11) cf. J. ELBERT, Die Sunda Exp. 2 (1912) 275-302; Meded. Rijksherb. 13 (1912) 32. (12) C. R. XI^{me} Congr. Int. Pharm. 2 (1913) 969-978.

71. The 'Flore de Buitenzorg'

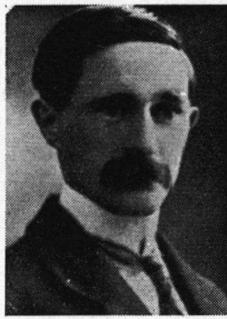
TREUB'S third scheme for a local Flora was the *Flore de Buitenzorg*. This Flora was to cover the Buitenzorg region, for this purpose delimited as a tract of land beginning at Tandjong Priok and ending on the summit of Mount Gedeh. In this fashion the Flora would describe all plants indigenous in West Java, from the beach to the highest mountains. The Flora, when it was discontinued, consisted of 6 volumes, only one being devoted to Phanerogams (*Orchidaceae* by J. J. SMITH), and the majority appeared to be monographs of a much greater scope.

O. PENZIG, an Austrian botanist in charge of the Museum at Genoa, when visiting the Gardens to work in the Foreigner's Laboratory, declared himself prepared to elaborate the *Myxomycetes*. His results appeared in 1898 as the first volume, *Die Myxomyceten der Flora von Buitenzorg*.

The author of the second volume of the Buitenzorg Flora was M. RACIBORSKI, a Polish scientist arriving in 1896 on TREUB'S invitation. He was an exceptionally good microscopist who, in the course of his career (1896-1900, Java; 1900-1917, in various Universities in Poland), worked very successfully in palaeobotany, histology, embryology, and physiology. His knowledge was exceedingly wide



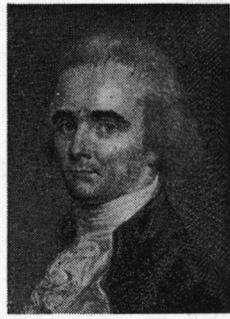
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and specialized on *Myxomycetes, Algae and Fungi*. His large work *Die Pteridophyten der Flora von Buitenzorg* (1898) proved him to be an able taxonomist and phytographer who dealt in a remarkably short time with the numerous problems waiting him in this branch of Malaysian botany. He wrote, among many other subjects, on the mode of branching in the Nutmeg tree (1), on myrmecophily (2), on fossil *Pangium* (3), on parasitic and epiphytic toadstools of Java (4), on Javan *Uredineae* (5) and *Myxomycetes* (6), on the germination of Javan orchids, on *Vanilla*, on seeds of *Andropogon etc.* (7). He discovered that tobacco seeds required light for germination (8).

The third volume of the *Flore de Buitenzorg* appeared in 1900, written by É. DE WILDEMAN, under the title *Les Algues, essai d'une flore algologique de Java*, which did not even pretend to confine itself to the Buitenzorg region. DE WILDEMAN had laid the base for Malaysian algology by his *Prodrome de la Flore Algologique des Indes néerlandaises* (1897-'99). DE WILDEMAN, a Belgian scientist, devoted his later life mainly to the phytography of tropical African Phanerogams.

V. SCHIFFNER revised part of the liverworts in the fourth volume of the Flora of Buitenzorg: *Les Hépatiques* (1900). Two years before he had published a *Conspectus hepaticarum archipelagi indici*. Since VAN DE SANDE LACOSTE's early study *Synopsis Hepaticarum javanicarum*, of 1856, very little had appeared on the subject and the book was acclaimed as a most valuable and progressive contribution to Malaysian hepatology. SCHIFFNER, a Czecho-Slovakian, was a botanist in the Prague University until he accepted a temporary post in the Buitenzorg Herbarium (1893) to replace HALLIER. SCHIFFNER returned to Prague in 1895 and, from 1902 till 1932, occupied the Chair of Botany in the Vienna University. The *Hepaticae* in ENGLER & PRANTL's *Die natürlichen Pflanzenfamilien* (1st ed.) are also from his hand; in addition he wrote some separate articles on Malaysian *Hepaticae*.

Javan bryology was in particular studied by DOZY and MOLKENBOER in their *Bryologica javanica* (started 1855) which, after the death of its authors, had been continued (since 1870) by R. B. VAN DEN BOSCH and C. M. VAN DE SANDE LACOSTE. The 5th volume of the *Flore de Buitenzorg*, now,

proved to be a monograph of world importance issued in four parts (1904-'22).

MAX FLEISCHER, a Silesian, a considerable painter (several of his fine landscapes are kept in the Indisch Instituut at Amsterdam and portray the type localities of new species which he discovered and described), had published his first bryological paper in 1892. TREUB, wanting an artist who might do justice to the pictorial beauty of the Buitenzorg Gardens, and a scientist to write a volume on the mosses, made an excellent choice and found in FLEISCHER both faculties combined. In 1899, FLEISCHER came to Buitenzorg where he remained till 1902. In 1908 he came again to Java and returned in 1913 to Germany. His later years were divided between his science (Berlin-Dahlem) and his art; in 1928 he finally settled at The Hague, to die in the same year.

In the *Musci der Flora von Buitenzorg*, FLEISCHER at first followed pretty closely the manner of treatment of the earlier volumes of the *Flore* but, gradually, his views extended and his grasp on his subject tightened; the work grew to a revision of the *Musci Frondosi*. His new taxonomical conceptions were approved and generally accepted while his phytography was pointed and clear. The final instalment (4th) of the 5th volume only appeared in 1922.

The concluding volume, the only one dealing with Phanerogams, appeared in 1905, by J. J. SMITH. It was a treatment of all Javan *Orchidaceae*. This volume was supplemented by an *Atlas* (1908-'14). SMITH, the most important Dutch orchidologist wrote, at Buitenzorg, scores of other articles on various groups of Malaysian Orchids, the majority published either by the Buitenzorg Gardens or by the Rijksherbarium at Leyden (*cf.* (9) and § 96).

References: (1) Ann. Jard. Bot. Btzg II, 2 (1909) 1-67. (2) Flora 87 (1900) 38-45. (3) Bull. Acad. Sci. Cracoviae (1909). (4) RACIBORSKI, Parasitische Algen und Pilze Java's, 3 fasc. (1900); also Bull. Acad. Sci. Cracoviae (1909). (5) Bull. Acad. Sci. Cracoviae (1909). (6) Hedwigia 37 (1898) 50-55. (7) *cf.* also Flora 85 (1898) 325-361, and Bull. Acad. Sci. Cracoviae (1902-1909) *passim*. (8) Bull. Inst. Bot. Btzg 6 (1900). (9) Bibl. in Blumea, suppl. 1 (1937).

72. 's Lands Plantentuin 75 years; Valeton

A good survey of what had been achieved at Buitenzorg in the first 75 years of the Gardens is found in 's Lands Plantentuin te Buitenzorg (1892), particularly in its bibliography. I must confine myself to discussing the work of four more phyto-graphers of TREUB's time. They are TH. VALETON, S. H. KOORDERS, and C. R. W. K. ALDERWERELT VAN ROSENBURGH, and the phyto-chemist M. GRESHOFF.

VALETON, a native of Groningen, was appointed in the Gardens in 1892, for the elaboration of a work on arboreous plants of Java. He was a student of P. DE BOER's when he graduated on a thesis *Critisch overzicht der Olacineae* (1886). His pensive slow-acting personality, paired to an extremely kind character and often abstracted moods, made him less eligible for a successful career in the brisk colonial practice but marked him as a scientist whose sole accomplishment would be his work. In 1904, VALETON was appointed Head of the Buitenzorg Herbarium; a plan for a Flora of Borneo with HALLIER (§ 70) did not materialize. Apart from this main work (the *Bijdragen*, see § 69), his phyto-graphical work deals with *Zingiberaceae* and *Rubiaceae* chiefly. He also compiled a list of species from New Guinea *Plantae papuanae* (1). His weak health damped his progress all his life and, in spite of admirable efforts, not unfrequently got the better of him. Nevertheless, he wrote the major part of the *Bijdragen* with close attention and, usually, in an exemplary style making it the only authoritative work on the Javan Forest trees in existence. He died in 1929 (2).

References: (1) Bull. Dép. Agric. Ind. Néerl. 10 (1907). (2) Obit. in Bull. Jard. Bot. Btzg III, 11 (1930) 1-11, incl. bibl.

73. Koorders

S. H. KOORDERS, born at Bandoeng (Java), in 1863, was educated in Germany as a forester. In 1884 he left Europe and began work at Buitenzorg. An article on the embryology of *Tectona* (embryology being one of the prevalent scientific fashions of the day) introduced his forestry studies (1). In 1888, he edited the 2nd edition of FILET's dictionary (see § 60). In the same year, 1888, KOORDERS initiated a new method of collecting trees, suitable to improve phyto-graphy. Planning a forest Flora, he wished to escape from the incidental specimens gathered by travelling collectors which, as a rule and particularly in case of trees, lacked either fruit or flowers or both. He began to attach numbered tags to wildgrowing individual trees. The same individual, then, might be visited at various intervals and yield material for phyto-graphical purposes; a perfect sequence of data concerning trees in primeval forest thus was obtained. This method he completed by devising labels provided with numerous headings under which all thinkable properties of the plant could be noted. So, at last, KOORDERS's collections of 7200 selected and marked trees, in addition to the normal field collecting, resulted in

a Javan herbarium that perhaps has been equalled in size but never surpassed in the amount of valuable data contained in it. Finally, the 'Herbarium Koordersianum' consisted of c. 50,000 numbers, collected in Java, Sumatra, and Celebes.

In 1890, KOORDERS set out to write a Forest Flora of Java relying on his own specimens. We have seen that TREUB, in 1892, accepted the direction of the work and that TH. VALETON wrote the *Bijdragen* with the help of KOORDERS (§ 69).

KOORDERS's method of mapping and numbering trees for a prolonged observation drew wide attention and was adopted e.g. in the Philippines.

In 1891, he accompanied J. W. IJZERMAN on his Central Sumatra expedition. In 1895 the first report appeared: KOORDERS was first to discover and describe peats and peat forests in Sumatra (2). With J. G. BOERLAGE he wrote on his Sumatran plants (e.g. in *Icones Bogorienses*). A trip into the Minahassa (Celebes), in 1895, resulted in a 700-page book (3); this was his well-known Celebes report, which was illustrated, and supplemented in 1901, 1903, 1918, and 1920 (4). In 1903, a collection of wood samples, pertaining to the entries in the *Bijdragen*, was sent to J. W. MOLL at Groningen, the base of H. H. JANSSONIUS's work on the anatomy of Javan timbers (§ 109).

KOORDERS, charged with the writing of a mountain Flora of Java, published in 1911-'13 his *Exkursionsflora von Java, mit besonderer Berücksichtigung der im Hochgebirge wildwachsender Arten* (3 vols). The work was compilatory, as was inevitable when a task of such a size was undertaken single-handed and when it had to be brought to an end within some years; yet, C. A. BACKER's passionate criticism (5), which claimed that it abounded in slips, omissions, and unwarranted statements, cannot be denied (6) and if a student of Javan botany felt gratified in having now for the first time in history a 'complete' Flora of the Phanerogams of Java, he soon saw his expectations come to nought when keys and descriptions failed him painfully often. An *Atlas*, or 4th volume, supplementary to the *Exkursionsflora* began to appear (1913) but scarcely justified the expense though it contained now and then valuable pictures. After KOORDERS's death (1919), his wife continued editing this *Atlas* (till 1925) and other works with unswerving loyalty. An *Atlas der Baumarten von Java*, illustrating the *Bijdragen* also was issued (1913-'18, 3 vols). In 1918, the first instalments of an unillustrated *Flora von Tjibodas* (posthumously completed by his wife in 1923), to a certain degree tried to and did make amends for the tragic failure of the *Exkursionsflora*: the book is a useful and reasonably complete summary of the vegetation of the mountain flora of the Tjibodas region (Mt Gedeh).

KOORDERS's books, large though they are, present by no means a satisfactory picture of his phyto-graphy. Concurrent with the issue of the *Bijdragen* (§ 69), he wrote a series *Bijdragen tot de kennis der Boomflora van Java* (partly together with BOERLAGE) appearing in the 'Natuurkundig Tijdschrift voor Nederlandsch Indië' (c. 1900), and another series *Notizen über die Phanerogamenflora von Java*

(7). A sequence of 20 papers appeared under the title *Bijdragen tot de kennis der Flora van Java*, a register to this was published (8) in 1919. Preliminary to the *Exkursionsflora* he published on the mountain flora of Mt Tengger (9). His *Kleine Schetsen van merkwaardige Javaansche planten* consists of 15 instalments (10). KOORDERS was a close observer, and described many morphological peculiarities in Malaysian plants which had not been recorded before. He made special studies *e.g.* of *Rafflesia* (based (11) on the work of ZU SOLMS-LAUBACH, *cf.* § 76), '*Coffea*' (12), of epiphyllous parasitic fungi (13). In 'Nova Guinea' (§ 106) he elaborated (14) several small families (*e.g.* *Taxaceae*). He published (15) on JUNGHUHN's inedited plants (*cf.* §§ 47, 48, 52) and was instrumental in founding the Netherlands Indian Society for the Protection of Nature (1912), of which he was a president till his death.

KOORDERS, in spite of some disappointing work, achieved so much and laboured so incessantly towards the progress of Malaysian phytophagy, that he will be remembered as an admirable explorer and a leader in his field. The *Systematisches Verzeichnis* (1910-'14) forms the key to his collections, the 2nd to 5th parts (1914) contain the Sumatra, Celebes, and Lombok data.

References: (1) *Nat. Tijd. Ned. Ind.* 51 (1891) 141-200, also *Engl. Bot. Jahrb.* 21 (1896) 458-498. (2) *Jahrb. Preuss. Geol. Landsamt* 30 (1909) 398-443, *cf.* also Chapt. 2 and 3 in IJZERMAN, *Dwars door Sumatra* (1895), and *Naturw. Wochenschr.* (1907) 658-664. (3) *Meded. 's Lands Plantent.* 19 (1898) 1-716. (4) *Nat. Tijd. Ned. Ind.* 61 (1901) 250-261, *ibid.* 63 (1903) 76-89, 90-99, also *Bull. Jard. Bot. Btzig III*, 1-2 (1918-1920); *cf.* also *Tijd. K.N.A.G.* 12 (1895) 395-398. (5) BACKER, *Kritiek op de Exkursionsflora* (1913). (6) KOORDERS, *Opmerkingen over eene Buitenzorgsche kritiek* (1914). (7) *Nat. Tijd. Ned. Ind.* 60-63 (1900-1904) *passim*. (8) *Bull. Jard. Bot. Btzig III*, 1 (1919) 137-139. (9) *Nat. Tijd. Ned. Ind.* 60-62 (1900-1902) *passim*, also *Teysmannia* 11 (1900) 238-252. (10) *ibid.* 10-12 (1899-1901) *passim*. (11) KOORDERS, *Bot. Overzicht der Rafflesiaceae* (1918). (12) *Teysmannia* 10 (1899) 491-496; *Koffiegids* 1 (1900) 740-745; *Ind. Mercur* 23 (1900) 235; *de Nieuwe Gids, Landb. Tijd.* 3 (1901) 337-352. (13) *Verh. Kon. Akad. Wet. Amsterdam* 13 (1907) 1-264. (14) *Nova Guinea* 8 (1910-1914) *passim*. (15) *Junguhn Gedenkboek* (1909).

74. Greshoff and Treub

M. GRESHOFF, born in 1862 at The Hague, went to the East Indies in 1887 as a military apothecary but was soon attached by TREUB to the Staff of the Gardens to investigate the chemico-pharmacology of the vegetable substances of the colonies, in particular with a view to their medicinal properties (1889). GRESHOFF subsequently published a list of poisonous plants used for fishing (1), a famed handbook of the medicinal phyto-chemistry. Plant toxicology received another contribution by his *Indische Vergiftrapporten* (2).

GRESHOFF, by no means limiting his research to pharmacology, made a new edition of F. S. A. DE CLERCO's *Nieuw Plantkundig Woordenboek voor Nederlandsch-Indië* (1909). DE CLERCO, retired Resident of Ternate and of Riouw, succeeded in improving on FILET (§ 60) and KOORDERS's earlier works on native plant-names; alphabetically arranged scientific names of the whole of the Netherlands Indies were provided with carefully chosen vernacular names, and a large collection of native botanical sayings and proverbs made DE CLERCO's book ethnobotanically important. GRESHOFF's finest phytophagical work is his admirable *Nuttige Indische Planten* (1894-1900), a series of 50 fine plates of Malaysian plants (drawn by W. CALMANN) inspired by Rumphian standards and so accompanied by careful descriptive notes. To these, he added a historical commentary of such excellence that this work may be said to have inaugurated the historico-botanical approach in Malaysia, a type of research that has made great progress since then and a branch of phytophagy still growing in our day. GRESHOFF died in 1909.

References: GRESHOFF, *Beschrijving der giftige en bedwelmende planten etc.* in *Meded. 's Lands Plantent.* 10 (1893), 29 (1900), and *Meded. Dep. Landb.* 17 (1913). (2) GRESHOFF, *Ind. Vergiftrapp.* 3 vols (1899, 1900, 1914).

75. Van Alderwerelt van Rosenburgh

C. R. W. K. VAN ALDERWERELT VAN ROSENBURGH devoted his life to the study of Malaysian ferns after he had retired from the Army (1904) at the age of 41. He became Curator of the Herbarium, later Assistant, and wrote at Buitenzorg his *Malayan Ferns* (1908), a step forward as regards completeness after RACIBORSKI's pioneer work (§ 71). At first he lacked the somewhat firmer touch of later years and only gradually, never entirely, he detached himself from the authority of earlier writers. In 1915 he published *Malayan Fern Allies*, supplemented in 1917. His work is the first deliberate attempt to describe the ferns of Malaysia as a whole and as such, it has become and will remain basic to new study. There are also a series of papers entitled *New or interesting Malaysian Ferns* (1908-1922) and an elaboration of New Guinean pteridophytes (1).

VAN ALDERWERELT wrote also on Malaysian *Araceae* (2).

References: (1) *Bull. Dép. Agr. Ind. néerl.* 18-27 (1908-1909) *passim*; *Bull. Jard. Bot. Btzig* 2-12 (1911-1922) *passim*; *Pteridophyta in Nova Guinea* 14 (1924) 1-72. (2) *Bull. Jard. Bot. Btzig III*, 1 (1920) 338-350; *ibid.* 4 (1922) 163-229, 320-347; *Nova Guinea* 14 (1924) 210-220 (with K. KRAUSE).

76. Visitors to Buitenzorg; Zu Solms-Laubach, Goebel, Schimper

Refraining from a survey of other aspects of botanical research at Buitenzorg when it rose to a leading phytophagical centre under TREUB, I wish, in retrospect but shortly, to refer to some visiting



SCHLECHTER



SCHUMANN



AIRY SHAW



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scientists and to the serial issues appearing in those years.

H. Graf zu SOLMS-LAUBACH came in 1883 to Buitenzorg. He chiefly studied and described parasitic Phanerogams in *Rafflesiaceae* (1), *Hydnoraceae* (1), and *Balanophoraceae* (2). He also published papers on *Caricaceae* (3), *Pontederiaceae* (4), and *Pandanaceae* (5); in addition he did some research in Cryptogams. Most widely known became his investigations into palaeobotany (6).

K. VON GOEBEL, a German botanist, since 1889 editor of *Flora*, a periodical of foremost importance to Malaysian phytography among 19th century German journals, was in 1885 and in 1924-'25 in Java. A series of 15 studies, mainly on Cryptogams, appeared under the title *Morphologische und biologische Studien* (7). In these he wrote e.g. on ferns (*Polypodium*, *Marattiaceae*), liverworts, tropical *Cyperaceae* and *Gramineae*, *Utricularia*, and Javan *Urticaceae*, accentuating their biology. His main work is *Organographie der Pflanzen* (1st ed. 1898-1901, 3rd ed. 1928-'33); the work owes much to Buitenzorg.

A. F. W. SCHIMPER, born at Straatsburg, joined in 1898 the German 'Valdivia'-expedition under CHUN. He had done phytographical work on West Indian tropical epiphytes (8) and wrote also on pharmacological and cytological subjects. In 1888, he began a series *Botanische Mitteilungen aus den Tropen*, the first instalments dealing with West Indian epiphytes and myrmecophilous plants which, of course, was a qualification to the study of plant life in Malaysia when he arrived in 1889. His observations in Java led to a paper on foliage transpiration in 1890. A very important volume of the *Botanische Mitteilungen*, however, was 'Heft 3', *Der Indo-Malayische Strandflora* (1891). This work should be consulted in conjunction with K. G. BOOBERG's paper on the Malay beach flora (10). SCHIMPER's physiological drought theory, propounded in his main work *Pflanzengeographie auf physiologischer Grundlage* (1898; repr. 1908), has drawn the attention for many years. He elaborated the *Rhizophoraceae* in the 1st edition of *Die natürlichen Pflanzenfamilien* (1892).

This summary of publications by botanists working at Buitenzorg, or studying Malaysian materials, who contributed to phytography incidentally

but did not describe plants with an intention of delimiting species and so of adding to taxonomy, might be considerably extended. After all, TREUB's institutions drew the attention of dozens of botanists. In this, and in the following paragraph, I have referred to those who, possibly, meant most to Malaysian phytography in TREUB's period.

References: (1) *Bot. Zeit.* (1874); *Abh. naturf. Ges. Halle* 13 (1875), *Bot. Zeit.* (1878); *Ann. Jard. Bot. Btzg* (1891), also *ibid.* *Suppl.* 2 (1898), *Suppl.* 3 (1909), and in *Pfl. Reich* (1901). (2) *Abh. naturf. Ges. Halle* 13 (1875). (3) *Bot. Zeit.* (1889), also in *Flora Brasiliensis* 106 (1889); *Nat. Pfl. Fam.* (1893). (4) in DE CANDOLLE, *Monogr.* 4 (1883). (5) *Bot. Zeit.* (1878); *Linnaea* 8 (1878); *Ann. Jard. Bot. Btzg* (1883); *Nat. Pfl. Fam.* (1888). (6) SOLMS-LAUBACH, *Einleitung in die Paläophytologie* (1887); also *Mitt. philom. Ges. Elsass-Loth.* 3 (1906). (7) *Ann. Jard. Bot. Btzg* 7 (1888) *passim*, 9 (1891) *passim*, 36 (1926) *passim*, 39 (1928) *passim*. (8) *Bot. Centr. Bl.* 17 (1884). (9) *Sitz. Ber. Kgl. Akad. Wiss. Berlin phys.-math. Cl.* 40 (1890) 1-18, *ibid.* 103 (1894), and 104 (1895). (10) *Bot. Jahrb.* 66 (1933).

77. Haberlandt, Tschirch, Koernicke; various other contributions

G. HABERLANDT, an Austro-Hungarian, came to Java on TREUB's invitation in 1891. His experiences are laid down in *Eine Botanische Tropenreise* (1893, 3rd ed. 1925). He belonged to the school of plant physiologists who assume a correlation between shape and function (1) and advocated his views in *Physiologische Pflanzenanatomie* (1884, 6th ed. 1924). He studied the leaflets of *Biophytum* (1885). In Java, his best work, possibly, was done on hydathodes (1) and on the nutrition of germinating mangrove plants (2).

A. TSCHIRCH, another of TREUB's guests, remained at Buitenzorg during 3 months (1888-1889) only. His stay there, however, made a deep impression and he went home with abundant materials for further study (*Indische Heil- und Nutzpflanzen und deren Cultur*, 1892). He became one of the foremost pharmacologists, and in that field of phytography distinguished himself by his *Handbuch der Pharmakognosie* (6th ed. 1925).

M. KOERNICKE reported on a trip to Java in

1908; he remained a lifelong friend of the Gardens. He wrote mainly on plant physiological subjects but also on the biology of *Loranthaceae* (3) and published a fine descriptive article on *Amorphophallus titanum* BECC. when it flowered in 1937 in the Botanic Garden at Bonn (4).

Reference could be made to literally hundreds of large or small studies containing, as a rule unintentionally, contributions to Malaysian phytography, either made by visitors to Buitenzorg or by botanists who did not travel in Malaysia.

An extensive revision of *Cyperus* as occurring in the Malaysian Archipelago was written by J. VALCKENIER SURINGAR (5), illustrated by a number of fine plates by Miss J. DE WILDE, who as the author's wife in later years was to illustrate his treatment of New Guinean *Cyperaceae* (6) in 1912. VALCKENIER SURINGAR's only other direct contribution to Malaysian botany was a 3rd edition of a key to the tree species of the teak forests in Java by KOORDERS (7). As a Professor of Dendrology in the Agricultural College at Wageningen, he studied and published on many problems of nomenclature and the interpretation of the Rules (8).

J. P. LOTSÝ, whose later works on taxonomy and the origin of species are more and more seen as worthy of the closest attention (9), wrote c. 1899, studies on *Gnetum*, *Balanophora* (*Rhopalocnemis*, with TH. VALETON) which have a secondary phytographical interest. The same applies to F. A. F. C. WENT, with WAKKER author of a book on sugarcane diseases and papers on Fungi. He published, when working at Buitenzorg, on the roots of climbers and epiphytes (1895), the branching of *Castilloa* (1897). From 1896–1934, WENT was Professor of Botany at Utrecht. Phytography was not his main interest but he published on *Podostemaceae* (11). Many of WENT's earlier papers appeared in the 'Annales' of the Buitenzorg Gardens as did many others e.g. of J. C. SCHOUTE's on branching systems of Monocotyledons and Palms (1912), D. H. CAMPBELL's ontogenetic study in Fern prothallia (1907, 1908). There are P. H. ELJKMAN and P. VAN ROMBURGH's pharmacological and phytochemical investigations, E. GILTAY's physiological research (1897), but it is impossible to try a wholly satisfactory summary of phytographical data scattered in the botanical literature of the time and there only present for other reasons than for the purpose of phytography.

References: (1) HABERLANDT, Anatomisch-physiologische Unters. ü. tropische Laubblätter (1895). (2) Ann. Jard. Bot. Btzg 12 (1895) 91–116. (3) *ibid.* Suppl. 3 (1910). (4) Ber. Deut. Bot. Ges. 55 (1937). (5) VALCKENIER SURINGAR, Het geslacht *Cyperus* in den Maleischen Archipel (1895). (6) Nova Guinea 8 (1912) 695–713. (7) VALCKENIER SURINGAR, Determinatie tabel der Boomsorten, welke in de djatiwouden op Java voorkomen (1915). (8) Med. Rijksherb. 55, 56, 57 (1928). (9) Lotsý, Vorträge über botanische Stammesgeschichte 3 vols (1907, 1909, 1911); Vorlesungen über Descendenztheorien 2 vols (1909), and Evolution by means of hybridization (1916). (10) Ann. Jard. Bot. Btzg 16 (1899) *passim*. (11) Rec. trav. bot. néerl. 25 (1928) 475–482; Trop. Natuur 19 (1930) 53–60.

78. Exploring phytographers in Malaysia; Beccari, Warburg

O. BECCARI, an Italian explorer of inexhaustible energy, an ardent and most successful collector besides being a biologist and phytographer of exceptional gifts, visited Malaysia repeatedly between 1865 and 1877. He was thus a visitor of SCHEFFER's but published his works in TREUB's time. His 3-volumed *Malesia* (1877–1890) is of first importance, both as regards systematics and in its biological observations (e.g. *Icacinaceae*, *Menispermaceae*, *Nepenthes*, *Palmae*). His collections from Sumatra ('Piante sumatrense') and still more those from Borneo ('Piante bornense') were examined by every student of Malaysian botany and many are the bases of first descriptions. He was the earliest describer of myrmecophilous plants in Malaysia (1885), and of *Araucaria* in New Guinea. His travels in Borneo are told in the botanically highly interesting *Nelle foreste di Borneo* (1). Three times he went on expedition into New Guinea. His fame as a phytographer rests to a large extent on his numerous papers on Palms; I confine myself to mentioning his Palm study in *Reliquiae Schefferianae* and his splendid series on *Asiatic Palms* in the 'Annals of the Botanic Gardens, Calcutta' (parts I–III, 1908–1918). In 1869 he founded 'Il Nuovo Giornale Botanico Italiano', a periodical containing several contributions to Malaysian phytography.

O. WARBURG, in some respects, was the German counterpart to O. BECCARI. In 1885–6, he visited Java and studied (lianas) at Buitenzorg during nearly a year. In many of WARBURG's later publications reference is made to his observations at Buitenzorg. He travelled for another two years in East Asia, went anew in 1888 to Malaysia and returned to Germany in 1889 after a visit, among several other trips, to Ceram laut and New Guinea (Kaiser Wilhelmsland, Finschhafen, Astrolabe Bay). The results were partly embodied in a *Beitrag zur Flora von Kaiser Wilhelmsland* (1894), one of several papers on F. HELLWIG's, U. M. HOLLRUNG's, and his own collections (15,000 numbers from Malaysia!) augmented by some materials from the 'Gazelle' expedition, secured in the Finisterre mountains (2). His most important contribution is *Beiträge zur Kenntnise der Papuanischen Flora* (3) in which many new species were described.

In 1921, he migrated to Palestine, his second fatherland where, after a most successful career as a systematist, phytographer, and economic botanist, he died in 1938.

He was the editor and founder of the 'Der Tropenflanzer', or 'Zeitschrift für tropische Landwirtschaft' (1897–1922), and author of classical monographs (*Die Muskatnusz*, 1897, *Monographie der Myristicaceen*, 1897). In 1900, he began a periodical 'Monsunia', more or less intended to emulate BECCARI's *Malesia*, but after a first volume it was discontinued.

To the *Fragmenta Florae Philippinae*, published by J. PERKINS, he contributed a considerable number of family elaborations (1904, '05).

The *Pandanaceae* in *Das Pflanzenreich* are from his hand (1900).

WARBURG was much occupied with plant-geographical problems. He investigated the Papuan flora with ardour (*Die Flora des Asiatischen Monsungebietes* (4) and *Vegetationsschilderungen aus Südost-Asien* (5)). His conclusion was, after studying the distribution of plants of eastern Malaysia, that 'Papuasiën' represented a distinct plant-geographical unit and that New Guinea was but an early SE. Peninsula of the Asiatic Continent. He stressed the importance of Torres Straits as a plant geographical demarcation line (3).

References: (1) BECCARI, *Nelle foreste di Borneo* (1902), Engl. transl. *Wanderings in the great forests of Borneo* (1904). (2) Engl. Bot. Jahrb. 16 (1892) 1-32; *ibid.* 18 (1894) 184-212, (3) *ibid.* 13 (1891) 230-455. (4) Verh. Ges. Deut. Nat. f. Ärzte 3 (1890). (5) Bot. Jahrb. 17 (1893) 169-176.

79. Periodicals in Treub's time

Apart from already mentioned serials and those continuing an issue starting previous to TREUB's arrival (§§ 55, 69; an index to the 'Annales', vols 1-30, in 'Supplement 4'), there appeared during TREUB's term of office some more periodicals of interest to phytography in the Netherlands East Indies.

Since 1890, 'Teysmannia' was edited under the auspices of the Gardens, a journal devoted to horticultural interests though phytographical contributions were not infrequently included. In 1922 'Teysmannia' was incorporated with the 'De Indische Cultures'. The several aspects of forestry were discussed in 'Tectona' appearing since 1908. In that same year the 'Proefstation voor de Thee' began its series of 'Mededeelingen'. The 'Archief

voor de Java Suikerindustrie', since 1893, was run without TREUB's intermediary. On the other hand, TREUB's activities led, indirectly, to the issue of the famed serial 'Nova Guinea'. This was published by the 'Maatschappij tot Bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën' and embodied the beautifully illustrated results of old and recent Dutch expeditions into New Guinea. Volumes 8, (1909-'14), 12 (1913-'17), 14 (1924-'32), and 18 (1916 →) so far have been devoted to systematic botanical contributions; volume 1 contains a history of New Guinean exploration (*cf.* § 106).

The series of illustrations and descriptions: 'Icones Bogorienses', mentioned before, appeared from 1897 till 1914, when the issue was abandoned on account of World War I (§ 68).

The 'Bulletin de l'Institut Botanique de Buitenzorg' (sér. I, 1898-1905) changed its name in 'Bulletin du Département de l'Agriculture aux Indes Néerlandaises' (1905-'11) when the Gardens became temporarily, as an extended institution, the Department of Agriculture.

The phytography executed in the institutions for applied botany, if the subject under study required this, is mainly contained in 'Mededeelingen uit 's Lands Plantentuin' (75 instalments, 1884-1904) continued as 'Mededeelingen van het Département van Landbouw' (18 instalments, 1905-'14); these two series also comprise the *Bijdragen tot de kennis der boomsoorten* (*cf.* § 69).

A source of references to Malaysian phytographical literature is found in the first Catalogue of the Central Library ('Bibliotheca') at Buitenzorg prepared in 1887; a second edition followed in 1894, after which additions were listed in supplements to the annual reports of the Gardens (1895-1919), or separately issued (after 1920).

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A. THE PHILIPPINES

80. *Phytography in the Philippines;*
Vidal and Rolfe

In the Philippines (cf. § 56), progress was during these years less remarkable. S. VIDAL Y SOLER, after his *Catalogo metodico* of the ligneous plants of Manila province (1880), published by the 'Comision de la flora y estadistica forestal de las Islas Filipinas' which he presided since 1876, continued his Spanish descriptive studies by a *Sinopsis de familias etc.*, in 1883, a study on *Phanerogamae Cumingianae Philippinarum* (1885), and a *Revision de plantas vasculares filipinas* (1886). VIDAL's books suffer from a lack of critical research caused, it would seem, rather by the slender resources available at Manila at the time than by lack of insight. He was the first in the Philippines to realize that collaboration with, and comparative studies in, European herbaria was imperative when real progress was desired; he founded a herbarium and a library which were both destroyed by a fire in 1897. VIDAL died in 1889, a worthy precursor of Philippine phytography as it developed fifteen years later.

R. A. ROLFE, a Kew botanist who assisted VIDAL there (1883), wrote a *Supplementary list of Philippine plants* (1) as a completion of the *Novissima Appendix*. He published numerous small papers, mainly on Orchids (2), and an important study in Philippine phytogeography (3).

The pretentious 3rd edition of BLANCO's *Flora de Filipinas* (1877-1883) mentioned above, falls in this period, the first three volumes being a verbatim reprint of the 1845-edition, and the fourth reprints of LLANOS's papers and a first edition of Father I. MERCADO's 16th century study in medicinal plants; this latter volume also contains the *Novissima Appendix* by Father C. FERNANDEZ-VILLAR and A. NAVES; MERRILL stated that 44 per cent of the species ascribed to the Philippines do not occur there at all.

The closing decades of the 19th century, in strong contrast with the greater part of Malaysia, yielded in this manner but little phytography of importance; but collections grew satisfactorily (Luzon, A. LOHER and, general, O. WARBURG). An account of collectors is found in volume 1 of this *Flora*, and another (general) survey of 'botanical work in the Philippines' was published by MERRILL in 1903. In the turbulent years 1896-1899 (rebellion, Spanish-American war) fires and looting caused the destruction of all literature and herbaria available in the public institutions in the Philippines.

References: (1) J. Bot. 23 (1885) 209-216. (2) Gard. Chron. 26 (1886) *passim*; J. Linn. Soc. Bot. 25 (1889) 211-240; Kew Bull. (1892, 1894, 1908, 1917) *passim*. (3) J. Linn. Soc. Bot. 21 (1884) 283-316.

81. *Merrill*

An uncertain rebirth of botanical research occurred in 1900 when the Forestry Bureau was opened. A new area started, however, in reality

when the Philippine Bureau of Agriculture was established at Manila in 1902 and when, in the same year, E. D. MERRILL arrived.

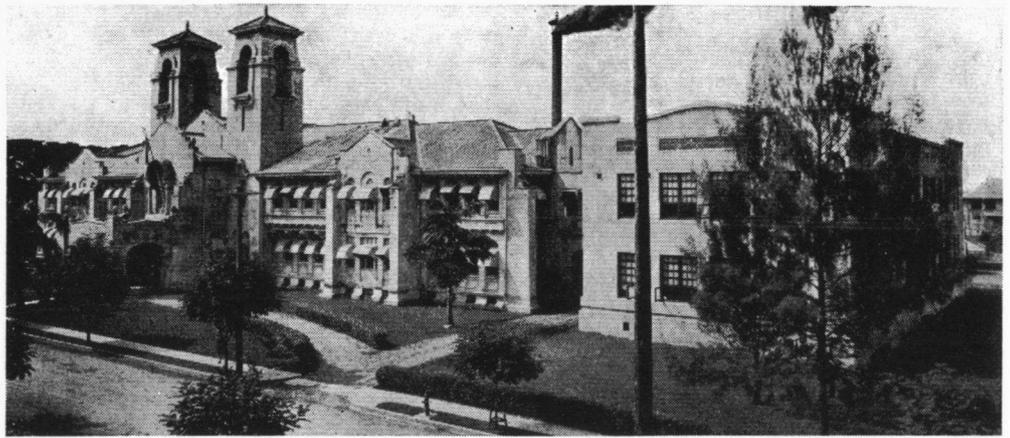
MERRILL was originally an agrostologist and had hardly any experience qualifying him for a leading position in Philippine botany. Being three times asked to accept appointment at Manila and replying that somebody familiar with Philippine botany ought to be sent, he was informed that there was nobody qualified, and that for this reason he might fill the post as well as anybody else. The outcome was that he accepted and that he made Philippine phytography in the course of twenty-five years at least an equal to what was found anywhere else in the tropics.

In 1903, re-organization brought the 'Bureau of Government Laboratories' into being which became the centre of botanical research in the Philippines for some years; in 1906 this institution was extended and the name changed to 'Bureau of Science'.

As this is not the place to discuss MERRILL's splendid achievements, as botanist or Director (1919-'23) of the Bureau, Professor in the University of California (1924-'29), Director of New York Botanical Garden (1930-'35), or Administrator of Botanical Collections, Harvard University (1935-'47), it is fortunate that, in 1946, in celebration of the 70th birthday of this 'American Linnaeus', a book appeared, *Merrilleana*, which gave an anthology from his works, a life history, and a bibliography. This special issue of *Chronica Botanica* ranks with the most informative works connected with Malaysian phytography published in this 'international collection of studies in the method and history of Biology and Agriculture'.

MERRILL's chief taxonomical and descriptive works are, as regards Malaysia: *Flora of Manila* (1912), *A bibliographic enumeration of Bornean plants* (1921), *An enumeration of Philippine flowering plants* (1923-'26), and *Plantae Elmerianae Borneenses* (1929). In 17 instalments appeared *New or noteworthy Philippine plants* (1). The historico-botanical method of research yielded under his hands a surprisingly large crop of handbooks: *An interpretation of Rumphius's Herbarium Amboinense* (1917), *Species Blancoanae* (1918) and *A commentary on Loureiro's Flora Cochinchinensis* (1935). I leave unmentioned several smaller studies, apart from accounts of OSBECK's, N. L. BURMAN's, and HOUTTUYN's plants (cf. §§ 27, 34). A standard reference work is *A Bibliography of eastern Asiatic Botany* (with E. H. WALKER, 1938); indispensable are also his bibliographies, of *Polynesian botany* (1926), of *Philippine Flowering Plants* (1926), and of the *Islands of the Pacific* (1947, with E. H. WALKER).

Several studies, some already mentioned, testify of MERRILL's attention to Bornean phytography (§ 102). Many new Philippine species were published in his contributions to the 'Philippine Journal of Science'. New Guinean discoveries by the ARCHBOLD expeditions were described by him, together with L. M. PERRY, in the 'Journal of the Arnold Arboretum' (1939-'45 cf. § 106). Sumatran materials were studied in the series *New Sumatran*



The Bureau of Science at Manila ± 1923. The Herbarium occupied part of the wings

Plants, published in the 'Papers of the Michigan Academy of Science' (§ 101), in the *Enumeration of the plants collected by W. N. and C. M. Bangham* (1934) and the account of the botanical results of G. VANDERBILT's Sumatran expedition (1940). The bibliography in *Merrilliana* may be consulted for further data on these and other subjects.

MERRILL created modern Philippine phytography and, besides, succeeded by a most effective administration and organization to assemble a large and excellent Herbarium and Library at Manila. A considerable percentage of specimens were contributed by the Bureau of Forestry in a similar manner as in the Netherlands Indies, where the 'Dienst van het Boschwezen' brought together for economic purposes ten thousands of specimens of forest trees but of which duplicates were ceded to the Herbarium of 's Lands Plantentuin at Buitenzorg for taxonomical studies.

It was a great loss when, in 1945, the disasters of war caused, once again, the destruction of the Manila collections. Most fortunate, the wise policy of a liberal distribution of duplicates opens the possibility of recovering from various other Herbaria the greater part of the data once contained in the Manila Herbarium.

References: (1) Bur. Sci. Publ. Manila 6, 17 (1904), also 29, 35 (1905); Philip. J. Sci. Bot. 1-20 (1906-1922) *passim*.

82. Perkins, Elmer, Ames

A group of distinguished phytographers worked with MERRILL, or at least integrated their studies with his publications.

Miss J. PERKINS, independently, published *Fragmenta Florae Philippinae* (1904-'05); three fascicles appeared of descriptions based chiefly on AHERN, JAGOR, LOHER, MERRILL, and WARBURG's collections. In collaboration with E. GILG, the *Monimiaceae* were elaborated by her as an instalment of *Das Pflanzenreich* (1901, *Nachträge*, 1911).

A. D. E. ELMER, a private collector who made a living out of the sale of botanical collections secured the 'largest single collection made by anyone individual' in the Philippines. He described his finds (sometimes helped by collaborators) in his *Leaflets of Philippine Botany* (1906-'39), which contain e.g. a number of local studies flora of Mt Apo, Mt Urdaneta, etc.). He made also a collecting tour in British N. Borneo.

OAKES AMES, working during a lifetime in Harvard University (U.S.A.) specialized in *Orchidaceae* and, in particular between 1905 and 1920, wrote a number of papers on Philippine Orchids. Recently, an anthology from his work and bibliography was published as *Orchids in retrospect* (1948).

83. Descriptive studies of Philippine economic plants

H. N. WHITFORD concentrated on the forest resources of the Philippines; phytographically are to be considered *The Vegetation of the Lamao Forest Reserve* (1) and *The forests of the Philippines* (2). He was a forester of the Forestry Bureau at Manila (1904-'12). W. H. BROWN compiled an illustrated cyclopaedia of the *Minor products of the Philippine forests* (3 vols) and on useful plants (3); he collaborated with A. P. WEST (4), with A. F. FISCHER on mangrove and bamboos (5), with D. M. MATTHEWS on *Dipterocarpaceae* (6), and with MERRILL on palms (7). The 'Bulletin of the Philippine Bureau of Forestry' afforded these and similar studies an opportunity to appear in print. The series of notable contributions to Philippine forestry (e.g. Gymnosperms and *Dipterocarpaceae* by F. W. FOXWORTHY, Assistant for Dendrology at Manila University (1911-1918) prior to his appointment in the Federated Malay States, are partly phytographical and partly economic; the majority appeared in the 'Philippine Journal of Science' (8).

Philippine food plants and cultivated fruit were

described by P. J. WESTER in the 'Philippine Agricultural Review', issued since 1908 by the Philippine Bureau of Agriculture (9).

References: (1) Philip. J. Sci. Bot. 1 (1906) 373-431, 637-782. (2) Philip. Bur. For. 10, 2 parts (1911). (3) *ibid.* 22, 3 parts (1920-1921). (4) *ibid.* 20 (1920) 224. (5) *ibid.* 15, 17 (1918), repr. *ibid.* 22. (6) Philip. J. Sci. Bot. 9 (1914) 413-561. (7) Philip. Bur. For. 18 (1919), repr. *ibid.* 22. (8) Philip. J. Sci. Bot., 2-4, 6, 13 (1907-1918) *passim*, also Leaflet. Philip. Bot. 6 (1913) 1949-1958. (9) Philip. Agric. Rev. 9 (1916) 150-256; 14 (1921) 211-384, repr. Philip. Bur. Agric. Bull. 39 (1924) 1-236.

84. *Pteridophytes described in the Philippines*

H. CHRIST, apart from his *Die Farnkräuter der Erde* (1897), devoted some research to Philippine pteridology. He elaborated the LOHER collections (1), made a local monograph of Philippine *Dryopteris* and repeatedly returned to further study of Malaysian ferns (2). Ferns were also the chief subject of E. B. COPELAND's numerous phytophagical papers; in addition he wrote on *Fungi* and some plant physiological papers (1905-'20). COPELAND worked from 1903 till 1917 at Manila and then accepted a professorship in the University of California. In 1929 he published *The oriental genera of Polypodiaceae*. His last work is a *Genera Filicum* (1947).

Selaginella, in particular of the Philippines, was studied by G. HIERONYMUS (3), who wrote also on *Rafflesia* (4) and a number of fern genera (5). W. HERTER specialized in *Lycopodium* (6).

References: (1) Bull. Herb. Boiss. 6 (1898) 127-154, 189-120; *ibid.* 6 (1906) 987-1011. (2) cf. Ann. Jard. Bot. Btzg (1896, 1898, 1904, 1906). (3) Hedwigia 41 (1902) 170-202; Fedde Rep. 10 (1911) 41-53, 97-116; Leaflet. Philip. Bot. 6 (1913) 1987-2064. (4) Gartenflora 34 (1885) 1-7; Bull. Congr. Int. Bot. St. Petersburg. (1885) 35, 36; HIERONYMUS, *Ueber Rafflesia Schadenbergiana* (1885). (5) Hedwigia 54, 55, 57, 59-61 (1914-1919) *passim*. (6) Bot. Jahrb. 43 (1909) Beibl. 98, p. 1-56; Hedwigia 49 (1909) 88-92; Bot. Arch 3 (1923) 10-29; Philip. J. Sci. 22 (1923) 57-76.

85. *Philippine periodicals; Quisumbing*

In 1906, the 'Philippine Journal of Science', a periodical issued by the 'Bureau of Science' (successor to the 'Bureau of Government Laboratories', which had 36 'Bulletins' to its name, several with phytophagical contributions) was destined to receive the greater part of Philippine plant description. (cf. § 81). A special section Botany was set apart (vols 1-13), but since 1919 botanical papers were published among those on other subjects of natural history. The Pacific war interrupted the publication of volume 76 in 1941, an almost entirely destroyed edition appeared in the years of occupation (1), but the 'Journal' was resumed in April 1947. E. QUISUMBING, now Director of the National Museum where a new Philippine Herbarium is to be housed, is in charge of the 'Journal'

(to which he has contributed in collaboration with MERRILL and which contains many of his own phytophagical publications, mainly on Orchids (1) and partly written jointly with O. AMES). Dr QUISUMBING also edits the 'Philippine Orchid Review', appearing since June 1948. He is the author of studies on Philippine bananas (2), a paper on Philippine weed seeds (3), descriptions of new Philippine plants (4), a monograph of *Piperaceae* (5), and of various other papers.

References: (1) e.g. Philip. Journ. Sci. 41 (1930) 315-371; *ibid.* 74 (1941) 175-185; *ibid.* 76 (1941) 81-97; *ibid.* 76 (1944) 37-55; *ibid.* 77 (1947) 1-18. (2) Philip. Agric. Rev. 12 (1919) 1-90. (3) *ibid.* 16 (1923) 1-53. (4) Philip. Journ. Sci. 37 (1928) 133-213, also *ibid.* 41 (1930) 315 and 56 (1935) 313-317. (5) *ibid.* 43 (1930) 1-246.

B. THE MALAY PENINSULA

86. *Phytophagy in the Malay Peninsula till Ridley's arrival*

The Singapore Gardens had grown to a considerable park under the stimulus of horticultural and public interests since 1859. When Sir J. D. HOOKER sent in 1875 H. J. MURTON to act as Superintendent, a more scientific spirit was instilled into the Singapore Gardens. Till 1874 they were the property of the Singapore Agri-Horticultural Society but in 1878, the Raffles Library and Museum were charged with their upkeep and, the next year, R. CAMPBELL was appointed to take care of the Gardens. Though MURTON had a lively interest in matters botanical (he compiled a manuscript flora of the island which disappeared together with the major part of his herbarium), his erratic activities achieved but little. He remained with the Gardens till 1880 and died in 1881 at Bangkok. Nevertheless, due to his efforts, many introductions enriched the collections, the identification of the species in cultivation was in an advanced stage, and a valuable herbarium had been secured; in addition a Garden Catalogue compiled by MURTON had been printed but was not made public as N. CANTLEY, in charge since 1880, suppressed it. A curious parallel is found in the story of S. BINNENDIJK's suppressed Catalogue at Buitenzorg of 1854 (§ 53).

As in the Netherlands East Indies, the need became apparent for smaller institutes in regions remote from the central establishment, and so, for the third time, a botanical Garden was opened at Penang (1884), the so-called 'Waterfall Garden'. At Kuala Lumpur (Kepong) a Herbarium was assembled and maintained by the Forestry Research Service (since c. 1927; the Perak Museum is mentioned in § 89).

CANTLEY, a Kew Gardener, was Superintendent at Singapore from 1880 till 1888, a diligent collector who arranged the Garden anew and extended its Staff (*Guide to the Botanic Gardens*, 1889, by W. FOX, latest *Guide* by I. H. BURKILL), grounds, and buildings; he initiated methodical Forest Research in the Peninsula. In 1889, H. N. RIDLEY was appointed as Director.

87. King's 'Materials'; PRAIN

The commencement of RIDLEY's most fruitful term of office coincided with the issue of the central 19th century phytographical work on the Peninsular flora: G. KING's *Materials for a flora of the Malayan Peninsula*, which appeared in the 'Journal of the Asiatic Society of Bengal' in 21 parts (4 vols, 1889-1900). KING was helped by some collaborators but most of all by D. PRAIN, and together they made the *Materials* into a basis for all future systematic studies of this province. Its genuine quality, its close and skilful descriptions, its effective keys have never been improved upon. KING, during many years Superintendent of the Royal Botanic Garden at Calcutta, in particular made a study of *Ficus* and monographed this exceedingly difficult genus (1). He also elaborated the *Magnoliaceae* (2), the Indo-Malayan species of *Quercus* and *Castanopsis* (3), the *Annonaceae* and the genus *Myristica* in British India (4), and historical botany owes him several most informative studies into the past of Indian Botany (5). KING may have been aware that the inclusion of the flora of the Malay Peninsula in HOOKER's *Flora of British India* was not only unwarranted from a plant geographical point of view but that the state of knowledge and the manner of treatment produced an unsatisfactory result as regards the data and conclusions concerning the species of the Malay Peninsula, and that a fresh approach was desirable.

D. PRAIN began his Indian career as a medical officer in the Army but was appointed at Calcutta Botanic Garden in 1887 where he served under KING till 1898 when he, himself, became Director. In 1905, he accepted the Directorship of Kew Gardens which post he held till 1922. PRAIN is one of the most prominent phytographers of the Indian but also of the Malay Peninsula both as regards the quantity and quality of his works. In addition to his standard elaboration of the *Leguminosae* in the *Materials* and his work on *Index Kewensis* (supplements 3, 4, and 5), there came to be widely appreciated his monographic work on various genera of *Leguminosae* (*Dalbergia* (6), *Pterocarpus* (7), *Ormosia* (8), *Azalia* (9), etc.).

In collaboration with I. H. BURKILL he wrote the sumptuously edited *Dioscoraceae* monograph (2 parts) in the 'Annals of the Calcutta Gardens' (1936-1939) after they had prepared the field either single-handed or together by a number of preliminary papers on the same subject (10).

The Monocotyledons as a section of the *Materials* were elaborated by RIDLEY, who showed in the earlier part of his career a predilection for that class of plants. They appeared as a separate issue in 1907-'08. Volume 5 of the *Materials* was composed by J. S. GAMBLE, who continued editing the work until, in 1936, the issue of a fascicle of some genera of *Euphorbiaceae* by his collaborator A. T. GAGE, brought this volume, and the issue of the work, to an end.

References: (1) Ann. Roy. Gard. Calcutta 1, 2 parts (1887-1888). (2) *ibid.* 3 (1891). (3) *ibid.* 2 (1889). (4) *ibid.* 3-4 (1891-1893). (5) *ibid.* 5 (1895);

J. Bot. 37 (1899) 454; Gard. Chron. 26 (1889) 252-254. (6) J. As. Soc. Beng. 70² (1901) 39-65, and Ann. Roy. Bot. Gard. Calcutta 10 (1905) 1-114. (7) Indian For. 26 (1900) 1-16. (8) J. As. Soc. Beng. 4 (1908) 447-457; Leaf. Philip. Bot. 5 (1913) 1589-1599; J. As. Soc. Beng. 10 (1914) 1-41. (9) Sci. Mem. Med. Off. Army India 12 (1901) 1-17. (10) Ann. Roy. Bot. Gard. 14 (1936-1939) 1-528.

88. Ridley

As was mentioned in § 86, RIDLEY came in 1889 to Singapore as the Director of Gardens, Straits Settlements. So far, the phytography of the Malay Peninsula had found a refuge outside the region (*cf.* § 87). A first step towards a medium for plant description within the Peninsula was put when, in 1891, RIDLEY founded the 'Agricultural Bulletin of the Straits and Federated Malay States', which was discontinued in 1912 and in 1913 re-appeared as the 'Gardens' Bulletin Straits Settlements'. This 'Bulletin' after an interruption from 1941 till 1947, concluded its 11th volume in the latter year.

The 'Gardens' Bulletin' celebrated in 1935 by a special 'Dedication Number' RIDLEY's 80th birthday and, along with many articles on various subjects, presented a list of his very numerous and diversified publications. RIDLEY travelled far and wide over the Peninsula assembling vast collections; he also explored parts of Sumatra (Djambi, Brastagi). Passing by many, the following titles are mentioned here. The *Prodromus florae timorensis* in FORBES's *Wanderings* (1885) as regards the Monocotyledons (1) is from RIDLEY's hand. Further work on Monocotyledons is *e.g.* Monocotyledons of New Guinea (2), in the paper on the flora of the Eastern Coast (3), Enumeration of Bornean *Orchidaceae* (4), Grasses and Sedges of Borneo (5), etc.; it appears also from these titles that RIDLEY had a lifelong interest in the Bornean flora while his additions to Bornean phytography have continued till the present day (6). He elaborated a number of monocotyledonous families in HANS WINKLER's *Beiträge* to the knowledge of the Bornean flora (7).

To Sumatran phytography RIDLEY added *e.g.* by describing and listing the collections of C. BODEN KLOSS (8) who had explored the Mt Kerinchi region, of MOHAMMED NUR (9) made in Upper Deli, and of C. J. BROOKS of Bencoolen (10). A large paper appeared (11) on the botanical results of the WOLLASTON expedition to Dutch New Guinea (1912-1913). He also studied the flora of Lower Siam (12).

On the plants of the Mentawai Islands, he wrote *Spolia Mentawaiensis* (13). The *Scitamineae* of the Philippines had his early attention (14). His participation in KING's *Materials*, I referred to in § 87; he described the flora of Christmas Island (*cf.* § 64).

RIDLEY made a Flora of Singapore (15), discussed the fruits of the Malay Peninsula (16), its timbers (17), drugs (18), composed a *Flora of Telom and Padang Valleys* (19), and described the flora of Mt Tahan (20); he reported on expeditions to Upper Perak (21) and discovered the fundamental im-



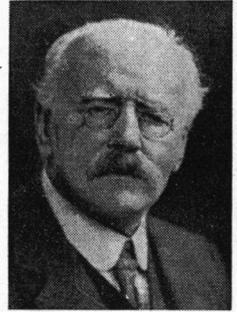
VAN SLOOTEN



A. C. SMITH



J. J. SMITH



STAFF

portance to plant geography of the Kra Isthmus (1911).

He published a considerable study on the ferns of the Peninsula (22). Historical papers (few exist on the botany of the Malay Peninsula) were devoted to Agriculture (23), the botanical Gardens (24), and the scientific exploration of the Peninsula (25). I may conclude this brief summary by *Spices* (1912) and *Dispersal of Plants throughout the world* (1930), both authoritative handbooks. RIDLEY's largest publication, though not his best, is the *Flora of the Malay Peninsula* (5 vols, 1922-'25).

RIDLEY proved himself a most diligent collector and tireless worker (cf. bibliography, 26); phyto-graphically his publications are unstable, now he is explicit and generally dependable, then again his descriptions are succinct to such a degree that desirable details are omitted and they appear to have suffered from errors due to hastiness. In particular his keys show shortcomings which he could have avoided. As it is, RIDLEY's capability as a research worker (he developed the modern method of rubber tapping!) and his power to demonstrate by his publications the practical and beneficial effects of phytography on plant science in all its aspects, convinced adversaries and succeeded in a surprisingly short time in pushing Singapore Gardens to the fore, as a centre of Malaysian phytography emulating and well matching their so much older sister institution at Buitenzorg.

This account of progress in the Malay Peninsula so far may have conveyed the idea that RIDLEY's general Flora was built on the data supplied by the *Materials*, by his own great collections and by his research; this was largely the case but, actually, a consideration of the phytography executed in the region proves that more sources could be drawn from. It may be true that local or district Floras should preferably follow the general Flora in any plant geographical area of great size, because a general outline and survey is necessary to place the details in the best manner, but in practice this never happens. Systematists confronted with a rapidly increasing mass of new data emerging from a little explored region which is, at a certain period, laid open to botanical investigation, usually feel that the available data are too incidentally picked and that too large "blank spaces" remain, to justify

a general Flora. Writing often in institutes far from the scene of discovery, they prefer to elaborate the materials they have in hand and their results appear as lists or as a 'botany' of a certain expedition or, eventually, as a district flora, which may lack the perfection attainable at some future date after the whole will have been arranged in a general Flora, but which has often the merit of supplying valuable facts and, not infrequently, basic information, while it has the weighty advantage of offering an early directive for further research. And so, when RIDLEY's Flora began to appear, there had been published, apart from the *Materials*, some local Floras which continued to appear when this general Flora was in the course of publication.

References: (1) Suppl. in J. Bot. 63 (1925) suppl. 115-127. (2) J. Bot. 24 (1886) 321-327, 353-360. (3) Trans. Linn. Soc. Bot. ser. 2, 3 (1893) 267-408. (4) J. Linn. Soc. Bot. 31 (1896) 261-306. (5) J. Roy. As. Soc. Str. Br. 45 (1906) 215-228. (6) Kew Bull. (1912-→) *passim*. (7) Engl. Bot. Jahrb. 44 (1910) 518-532. (8) J. Fed. Mal. St. Museum 8 (1917) 9-145. (9) J. Roy. As. Soc. Mal. Br. 1 (1923) 46-115. (10) Kew Bull. (1925) 76-94. (11) Trans. Linn. Soc. Bot. II, 9 (1916) 1-284. (12) J. Roy. As. Soc. Str. Br. 59 (1911) 15-234. (13) Kew Bull. (1926) 57-94. (14) Govt. Lab. Philip. Publ. 35 (1905) 83-87. (15) J. Roy. As. Soc. Str. Br. 33 (1900) 27-196; *ibid.* 35 (1901) 84-90. (16) Agric. Bull. S.S. and F.M.S. 1 (1902) *passim*. (17) *ibid.* 1 (1901-1902) *passim*. (18) *ibid.* 5 (1906) *passim*. (19) J. Fed. Mal. St. Mus. 4 (1909) 1-98. (20) *ibid.* 6 (1915) 127-202. (21) J. Roy. As. Soc. Str. Br. 57 (1911) 5-122. (22) J. Roy. As. Soc. Mal. Br. 4 (1926) 1-121. (23) Agric. Bull. S.S. and F.M.S. 4 (1908) 292-317. (24) *ibid.* 9 (1910) 97-105. (25) J. Roy. As. Soc. Str. Br. 75 (1915) VII-XI. (26) Gard. Bull. 9 (1935) 2-30.

89. Local Peninsular work; Curtis, Low's botanists

The earliest of these local studies was CH. CURTIS's Penang Catalogue (1) of 1894; CURTIS was Ass.-Superintendent of Forests in the Island. At first a traveller for VEITCH & Sons, he explored many parts of the Archipelago, collecting a good many specimens. As Garden Curator at Penang (1884-1902), he greatly added to his collections, and, in

fact, this former forest nursery was turned into a botanical garden 'chiefly from the enthusiasm of CURTIS' (BURKILL *in litt.*). The second local Flora was RIDLEY's own *Flora of Singapore* (cf. § 88), a record of increasing importance as the original plant cover of the island has now practically entirely disappeared. The third is the *Flora of Telom and Batang Padang Valleys*, also from RIDLEY's (cf. § 88), the fourth I. H. BURKILL and M. R. HENDERSON's *The Flowering Plants of Taiping* (2). The Taiping Hills were explored, and the collections preserved in the Perak State Museum, when Sir H. Low held office as a Resident of Perak. He stimulated and directed research e.g. the trips of L. WRAY, who was Curator of the Museum (1883-1908). In 1881, H. KUNSTLER, sent by G. KING (he was one of 'KING's collectors'), had made the first intensive search of the district. Father B. SCORTECHINI was the third explorer who made important discoveries (1882-'86). A list of 'Low's botanists' working in Perak was given by BURKILL and HENDERSON in the opening chapters of their *Taiping Flora*. The Flora contains a wealth of plant geographical and ecological data though the species are not described nor keys given.

References: (1) J. Roy. As. Soc. Str. Br. 25 (1894) 67-167. (2) Gard. Bull. 3 (1925) 303-464.

90. Burkill

J. H. BURKILL published in 1918 a history of Singapore Gardens and in 1927 a useful survey of the *botanical collectors, collections, and collecting places in the Peninsula*, graphically illustrating the state of knowledge of the plants in various parts of the country, and he compiled a list which contributes to a clearer understanding of many undetailed labels (1).

BURKILL was Director of Singapore Botanic Gardens from 1912 till 1925, and worked, like his predecessor, in various fields of phytography. I have alluded to his several papers on *Dioscorea* (2, also § 87) but he also wrote extensively on native drugs (3). His *Dictionary of the Economic Products of the Malay Peninsula* (2 vols, 1935), a masterpiece of synthesis, attracts the student in its easy and lucid style, its balanced articles which convey, often in few sentences, the purport of decades of research while supplying a good deal of factual and precise information. Introductory paragraphs to many of the main entries embody a history of the product under discussion and prove not only BURKILL's prolonged study into the history of Malaysian botany but demonstrate his considerable literary talent which enabled him to outline by simple means a complicated course of events and to seize and inspire the reader's imagination. It is to be noted that BURKILL was a former assistant of G. WATT, author of the famed *Dictionary of economic products of India* (1888).

At the moment, BURKILL is preparing a survey of 150 years botanical work in India.

Of the most recent phytography executed in the Malay Peninsula the brief account given in §§ 91-94 may suffice.

References: (1) Gard. Bull. 2 (1918) 55-63; *ibid.* 4 (1927) 69-77; and also p. 113-202. (2) *ibid.* 5 (1930) 51-58. (3) *ibid.* 6 (1931).

91. Corner

E. H. J. CORNER published the majority of his articles in the *Gardens Bulletin* (e.g. the second of his studies (1) in *Ficus*). The series *Notes on the systematy and distribution of Malayan Phanerogams* (2) attracted much attention. His delightful *Wayside Trees of Malaya* (2 vols, 1940) deals with much more than its title suggests. The conception 'wayside tree' is generously interpreted and the book full of close and ingenious ecological observations (e.g. on *Ficus* growth habits, mode of branching in tropical trees etc.); it will remain a preferred and authoritative source of information. CORNER's taste for morphological-ecological research is also apparent in his recent paper on *Centrifugal stamens* (3).

Soon after the English had returned to the Malay Peninsula, CORNER left Singapore (1946) and went to S. America, exchanging the Assistant Directorship of Singapore Gardens for the post of Principal Scientific Field Officer of the Hylean Amazon Project. In 1948 he resigned. Having resumed the study of Malaysian botany, he is at present Lecturer at Cambridge and an active collaborator in the writing of *Flora Malesiana*.

References: (1) Gard. Bull. 10 (1939) 82-161. (2) *ibid.* 10 (1939) 1-55, 56-81, 239-329; *ibid.* 11 (1941) 177-235. (3) Journ. Arn. Arb. 27 (1946) 423-437.

92. Henderson, Symington; descriptive forestry

At Kuala Lumpur, later Singapore, worked M. R. HENDERSON who made detailed, though not unduly long, descriptions of numerous Peninsular species; he adopted early the metric system in his records of measurements.

A number of regional studies on the flora were composed by him, such as *List of plants from Cameron's Highlands* (1), the *Flowering plants of Kuala Lumpur* (2), *Notes on the flora of Pulau Tioman* (3), the 'padang' flora (4), and the *Flora of the Limestone Hills* (5). He supplemented the *Flora of the Malay Peninsula* (6, cf. § 88), and made an extensive monograph of the Malayan species of *Eugenia* (8).

C. F. SYMINGTON's *Forester's Manual of Dipterocarps* was published at Kuala Lumpur in 1943; it was without his knowledge and without his consent. This *Manual* is the result of many years careful and devoted study in the intricate systematics of the *Dipterocarpaceae* on which he had published in the 'Gardens' Bulletin' since 1933 a series of preliminary articles on the subject. SYMINGTON did not live to see his final book in print (his death occurred in 1943).

SYMINGTON's work touches applied systematics in the shape of forestry, which had made since CANTLEY, RIDLEY, and CURTIS great progress in the Peninsula. A. M. BURN-MURDOCH, Conserv-



The Herbarium at Singapore

Photo M. R. Henderson

ator of Forests (1904-'14) published *Trees and Timbers of the Malay Peninsula* (1911-'12). DESCH also wrote on timbers, as did F. W. FOXWORTHY who after his work in the Philippines, had moved to the Federated Malay States in 1918 (*cf.* § 83). He published in 1921 *Commercial Woods*, and in 1922 and 1927 *Minor Forest Products of the Malay Peninsula*. *Dipterocarpaceae* were also preferably studied by FOXWORTHY. All these studies were issued as *Malayan Forest Records* of which 16 appeared between 1921 and 1943, published by the Forest Research Institute (Kepong).

References: J. Roy. As. Soc. Mal. Br. 5 (1927) 237-277. (2) Gard. Bull. 4 (1928) 211-373. (3) *ibid.* 5 (1930) 80-93. (4) *ibid.* 5 (1931) 234-240. (5) J. Roy. As. Soc. Mal. Br. 17 (1939) 13-87. (6) Gard. Bull. 7 (1933) 87-128. (8) *ibid.* 13 (1949) 1-293, also *ibid.* 11 (1947) 299-338.

93. Holttum

R. E. HOLTUM, the present Director of Singapore Gardens, worked in various fields of phytography. He brought the rather disturbing proof that Orchids may hybridize and produce 'species' which had hitherto never been suspected to be of hybrid origin (1). His numerous articles on Pteridophytes (2) and his chapter on the ecology of tropical Pteridophytes in VERDOORN'S *Manual of Pteridology* (1938) led to a *Fern Flora of the Malay Peninsula* (1942-'44) which was not published but furnished the materials for his *Revised classification of Lep-tosporangiate Ferns* (3). Dozens of new species of

Phanerogams were described at irregular intervals, especially Monocotyledons (4). He contributed to the phytography of Mt Kinabalu (5), studied Malayan bamboos (6), and did research in the comparative morphology of *Cyperaceae* (7); there are several other publications (8).

HOLTUM, in collaboration with BURKILL, investigated the flora of Fraser Hill; the outcome was a history of the 'warmth and moisture loving flora of the Malay Archipelago from the Miocene period' (8).

References: (1) Bull. Jard. Bot. Btzg III, 16 (1939) 113-115. (2) Gard. Bull. 4-9 (1926-1938) *passim*; Mal. Nat. Journ. 3 (1948) 1-9. (3) J. Linn. Soc. Bot. 53 (1947) 123-158. (4) Gard. Bull. 11 (1947) 267-298. (5) *ibid.* 7 (1934) 191-324. (6) J. Arn. Arb. 27 (1946) 340-346. (7) Bot. Rev. 14 (1948) 525-541. (8) Gard. Bull. 3 (1923) 19-111; *ibid.* 4 (1927) 92-105. (8). *ibid.* 5 (1931) 173-206.

94. Periodicals; some other authors

The study and interpretation of the International Rules of Botanical Nomenclature at Singapore fell in particular to C. X. FURTADO who, representing the formalist and strict school, published several papers on the subject (1). Apart from these applied theoretics, he wrote a considerable series of articles on the systematics of Malaysian *Palmae* (2) and *Araceae* (3).

C. E. CARR specialized in the phytography of Malayan Orchids since 1929. He wrote a paper on a collection of Orchids from Brastagi, N. Sumatra

(4). Of later years, he assembled vast collections in the Mal. Peninsula, in Borneo (Mt Kinabalu, §102), and in British New Guinea; he died there, still young, at Port Moresby in 1936. He was a man of considerable promise.

The 6th volume of the *Gardens' Bulletin* (1931) was entirely devoted to vegetable native medicines of the Malay Peninsula; extensive studies were contributed by BURKILL (*cf.* § 90), J. D. GIMLETTE, M. HANIFF, and D. HOOPER.

The main periodicals appearing in the Peninsula have been referred to (§§ 88, 92); it is to be noted that the 'Journal of the Straits Branch of the Royal Asiatic Society' changed its name to 'Journal of the Malayan Branch *etc.*' in 1923. An Index to the 86 volumes of the 'Journal of the Straits Branch' appeared in volume 5 of the 'Malayan' series.

In addition are to be included the 'M.A.H.A.' or 'Magazine of the Malayan Agri-Horticultural Association' (at Kuala Lumpur, since 1933), the 'Malayan Orchid Review' (since 1932), and the 'Malayan Nature Journal' (since 1945). The 'Singapore Natural History Society' (1921) published 'The Singapore Naturalist' which remained less noticed than the journal of its sister society in Java (*cf.* § 100).

References: (1) *e.g.* Bull. Jard. Bot. Btzg III, 16 (1939) 116–119; Gard. Bull. 10 (1939) 162–181. (2) *ibid.* 8–11 (1933–1941) *passim*. (3) *ibid.* 8–11 (1933–1941) *passim*. (4) *ibid.* 5 (1929) 1–50, 124–160; *ibid.* 7–8 (1930–1934) *passim*; Journ. Roy. As. Soc. Mal. Br. 11 (1933) 66–109.

C. INDONESIA

95. *Phytography at Buitenzorg, 1910–1918*

J. C. KONINGSBERGER succeeded TREUB as Director of the Buitenzorg Botanic Gardens (1910–'18). KONINGSBERGER, though a professional zoologist, supported vigorously the research into the Javan flora as had been planned and then was in progress. He was instrumental in the establishment of a Nature Reserve and botanical garden at Sibolangit (NE. Sumatra) on the lower slope of Mt Sibajak in 1914, which gave J. A. LÖRZING the opportunity to assemble an exemplary collection of indigenous specimens accompanied by extensive and most informative notes. LÖRZING wrote some good popular papers himself. The uncertain fate of Sibolangit Garden—deliberate Governmental neglect was never decisively conquered by the Buitenzorg Staff—is more or less comparable to that of the Penang Garden; Sibolangit yielded decidedly lesser results than Penang while it might have been a match, had circumstances permitted.

The outbreak of World War I greatly hampered contacts with Europe and impeded not only phytography in Malaysia generally but it even appeared in 1918 that two systematists, H. J. LAM and R. C. BAKHUIZEN VAN DEN BRINK *Sr* had unknowingly elaborated the same family, the *Verbenaceae* (1). Eventually, a second revision (2) appeared by joint authorship (1921, *cf.* § 99). The work of VALETON, KOORDERS and others has been discussed pre-

viously (§§ 69, 72, 73); for J. J. SMITH and C. A. BACKER see § 96 and § 100.

A concise, not highly successful, *Zakflora voor de Landbouwstreken op Java* by I. BOLDINGH appeared in 1916.

There were published, in these years, a stream of studies, either executed at Buitenzorg or based on materials acquired through the intermediary of the Buitenzorg Gardens. Phytography was only incidentally and indirectly served by them; the titles referred to here might be seen as a small selection.

A. ERNST and CH. BERNARD wrote morphological-biological studies on Javan saprophytes (3). ERNST published in later years numerous papers, usually cytological or biological on the data assembled during his extensive travels in the Archipelago. BERNARD did mainly work on phytopathology (*Fungi*).

F. C. VON FABER described *Coffea* (4), mangrove (5), and the crater vegetation (6); he elaborated the 2nd edition (1935) of SCHIMPER's *Pflanzengeographie* (§ 76).

W. M. DOCTERS VAN LEEUWEN (*cf.* § 97) investigated *Angiopteris evecta* (7) and, together with Mrs J. DOCTERS VAN LEEUWEN-REYNVAAN wrote on *Dischidia* (8); with H. H. KARNY they published *Beiträge zur Kenntniss der Gallen von Java* (9).

P. GUÉRIN and G. BREMER, both in 1916, published the *Reliquiae Treubianae* (10). J. C. COSTERUS worked on the morphology of *Zingiberaceae* and *Marantaceae* (11) and besides studied Malaysian teratology as a whole.

References: (1) LAM, The *Verbenaceae* of the Malayan Archipelago (1919). (2) Bull. Jard. Bot. Btzg III, 3 (1921) 1–116. (3) Ann. Jard. Bot. Btzg (1910–1914) *passim*. (4) *ibid.* 25 (1912) 59–160. (5) Ber. Deut. Bot. Ges. 31 (1913); *ibid.* 41 (1923). (6) VON FABER, Die Kraterpflanzen Javas (1927). (7) Ann. Jard. Bot. Btzg 25 (1912) 202. (8) Ann. Jard. Bot. Btzg 27 (1913) 65, also Trop. Natuur 2 (1913). (9) Bull. Jard. Bot. Btzg II, 10 (1913). (10) Ann. Jard. Bot. Btzg 29 (1916). (11) *Dodonaea* 6 (1894) 24–41; Ann. Jard. Bot. Btzg 15 (1898) 40–42; with J. J. SMITH *cf. ibid.* 13, 19, 23, 24, 28, 29, 32, 33, 39, 42 (1895–1931) *passim*.

96. *J. J. Smith*

J. J. SMITH shared the good fortune of some of his contemporaries; he lived to a high age (1867–1947) and published his phytographical papers in the course of more than half a century. This implies that the period of his activities began during TREUB's early years; continued through two World Wars and ended only recently. Rather arbitrarily, I have chosen to place a reference to his work here, more or less in accordance with the time of his holding the post of Head of the Buitenzorg Herbarium (1913–1924).

Born at Antwerp of Dutch parents, he came to the Gardens in 1891, and became Assistant Curator in 1893. Orchids became his lifelong cherished study but when he retired in 1924 he had also done remarkably good work in *Ericaceae* (1) and *Euphorbiaceae* (2); for the latter his basis was J. MUELLER'S

classic monograph. He published papers on some other, smaller families (3). SMITH went only on one large excursion; the unfortunate voyage to Ambon in 1900 with BOERLAGE in quest of Rumphian plants. BOERLAGE died and SMITH returned alone, himself seriously ill. After this, he confined his field work to some short trips in W. Java (cf. also § 21).

As regards Orchids, special mention is to be made of his numerous contributions to 'Icones Bogorienses' (4), and his series of 16 articles on *Orchidaceae novae malayenses* (5).

He enumerated the Orchids of Sumatra (6) and described in particular those of Java (7), Borneo (8), Celebes (9), Amboina (10), Ceram (11), the N. Moluccas (12), Talaud (13), Anambas and Nautoena Isl. (14), and New Guinea (15). L. J. TOXOPEUS's Boeroe collections (1921, published 1928) gave SMITH an opportunity (16) to demonstrate the intermediate position of the Moluccan Orchid flora between those of the Philippines and New Guinea. He composed a key to the genera of Malaysian Orchids (17).

SMITH ranks, with R. SCHLECHTER (New Guinea) and O. AMES (Philippines), among the leading orchidologists of the first half of the 20th century. He was essentially a 'pure' phytophagist, first of all seeking to describe his specimens with the greatest possible accuracy, with a love of detail. His scientific interest developed in a direction contrary to that observed in the majority of systematists: instead of starting with the study of small *taxa* and gradually applying and adding his results in the investigation of increasingly larger groups, or even of the system as a whole, SMITH limited his interest more and more to Orchids exclusively. Gradually he tried less to define species possibly because he preferred specimen-description at this stage of Malaysian Orchidology but certainly also because he was forced to found his species on single specimens, no other materials having been collected. Though the extent of his work on Malaysian Orchids surpasses by far any other study in this department, he never attempted a complete survey. Was it a premonition that the Malaysian *Orchidaceae* would prove to hybridize in a wild state to such a degree as can only be guessed at the moment and that a satisfactory species-delimitation, from a genetical point of view, will have to rely on future experimental research? This is as may be, SMITH left besides his thousands of patiently composed descriptions, his *Icones Orchidacearum Malayensium* a series of pen drawings at which he laboured till his last day (18).

He was one of the best contributors to 'De Orchidee' and to 'Orchideeën', the journal of the Netherlands Orchid Society. Similar periodicals devoted to Orchidology appeared in the Philippines (cf. § 85) and in the Malay Peninsula (cf. § 94).

SMITH is the author of an *Illustrated Guide to the Botanic Gardens, Buitenzorg* (1910, next year a Dutch version, second edition 1924), and composed a list of publications by Buitenzorg officials covering 25 years (§ 72). A special issue of 'Blumea'

commemorated at his 70th birthday in 1937 his life and work; a bibliography was included.

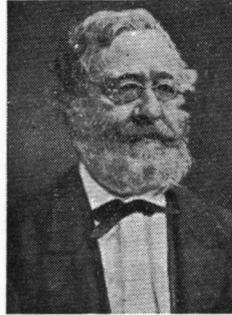
References: (1) Ic. Bog. 4 (1910-1912) *passim*; Med. Dept Landb. 18 (1914); Nova Guinea 12 (1914) 129-168; Med. Rijksherb. Leiden 25 (1915), 30 (1916); Nova Guinea 12 (1917) 495-537; Fedde Rep. 30 (1931) 162-178; *ibid.* 35 (1934) 292-297; Contr. Arn. Arb. 8 (1934) 122-129; Nova Guinea 18 (1936) 89-121. (2) Med. Dept Landb. 10 (1910); Nova Guinea 8 (1912) 779-796; *ibid.* 12 (1917) 543-548. (3) *Moraceae* in Med. Dept Landb. 2 (1906), also in Ic. Bog. 3 (1907) *passim*; *Burmanniaceae* in Ann. Jard. Bot. Btzg 23, 24, 26, 28 (1909, 1911, 1912, 1914) *passim*, also in Nova Guinea 8 (1909) 193-196; *Epacridaceae* in Nova Guinea 8 (1912) 797-803; *ibid.* 18 (1936) 89-121; *Ulmaceae* in Nova Guinea 8 (1912) 891-892. (4) Ic. Bog. 2-4 (1903-1914) *passim*. (5) Bull. Inst. Bot. Btzg 7 (1900) 1-5; Bull. Dép. Agric. Ind. Néerl. 5 (1907) 1-36; *ibid.* 15 (1908) 1-26; *ibid.* 22 (1909) 1-51; *ibid.* 45 (1911) 13-25; Bull. Jard. Bot. Btzg 3 (1912) 53-69; *ibid.* 8 (1912) 38-47; *ibid.* 13 (1914) 1-52; Bull. Jard. Bot. Btzg III, 2 (1920) 15-127; *ibid.* 5 (1922) 12-102; *ibid.* 8 (1926) 35-70; *ibid.* 8 (1927) 138-195; *ibid.* 9 (1928) 25-84; *ibid.* 12 (1932) 105-150; Fedde Rep. 36 (1934) 110-119; Bull. Jard. Bot. Btzg III, 14 (1937) 160-168. (6) Fedde Rep. 32 (1933) 129-386. (7) SMITH, Flore de Buitenzorg, vol. 6 (1905) with 'Figuren Atlas' 1906-1914; Bull. Dép. Agric. Ind. Néerl. 13 (1907) 1-78 (repr. in Fedde Rep. 5 (1908) 289-305); *ibid.* 43 (1910) 1-77; Bull. Jard. Bot. Btzg 9 (1913) 1-130; *ibid.* 14 (1914) 1-56; *ibid.* 26 (1918) 1-135; Bull. Jard. Bot. Btzg III, 3 (1921) 227-333; *ibid.* 9 (1927) 23-66; Fedde Rep. 29 (1931) 248-252; De Orchidee 3 (1934) 312-314 (see also Ic. Bog. and Tafeln Jav. Orch. Bull. Jard. Bot. Btzg III, 3 (1921) 245, tab. 18-37; *ibid.* 6 (1924) 9, tab. 1-25). (8) Bot. Jahrb. 48 (1912) 96-106; Mitt. Inst. allg. Bot. Hamburg 8 (1927) 9-76; Brittonia 1 (1931) 105-111; Bull. Jard. Bot. Btzg III, 11 (1931) 83-160; De Orchidee 4 (1935) 183-184. (9) Nat. Tijds. Ned. Ind. 58 (1898) 358-362; Svensk. Bot. Tidskr. 20 (1926) 470-482; Bull. Jard. Bot. Btzg 10 (1928) 1-24; Engl. Bot. Jahrb. 65 (1933) 449-508; De Orchidee 5 (1936) 154-156. (10) SMITH, Die Orchideen von Ambon (1905) 1-125; Philip. J. Sci. Bot. 12 (1917) 249-262; in MERRILL, Interpr. Rumph. Herb. Amb. (1917) 168-179. (11) Bull. Jard. Bot. Btzg 10 (1928) 85-172. (12) *ibid.* 11 (1930) 67-81. (13) *ibid.* (14) Fedde Rep. 30 (1932) 327-336. (15) Bull. Dép. Agric. Ind. Néerl. 5 (1907) 3-4; *ibid.* 19 (1908) 1-39; Nova Guinea 8 (1909) 1-148; Bull. Dép. Agric. Ind. Néerl. 39 (1910) 1-22; Bull. Jard. Bot. Btzg 2 (1911) 1-20; Nova Guinea 8 (1911) 521-611; Bull. Jard. Bot. Btzg 8 (1912) 70-79; Fedde Rep. 10 (1912) 136-140, 274-280; Nova Guinea 12 (1913) 1-108; Fedde Rep. 11 (1913) 552-560; *ibid.* 12 (1913) 24-34, 110-123, 394-406; Bull. Jard. Bot. Btzg 13 (1914) 53-77; Nova Guinea 12 (1915) 173-272, (1916) 273-477; Meded. Rijksherb. Leiden 23 (1915) 1-21; in GIBBS, A contrib. to . . . Arfak Mts (1917) 105-127, 203-206; Nova Guinea 14 (1929) 337-516; Engl. Bot. Jahrb. 56 (1934) 161-215; Nova Guinea 18 (1935) 9-85. (16) Bull. Jard. Bot.



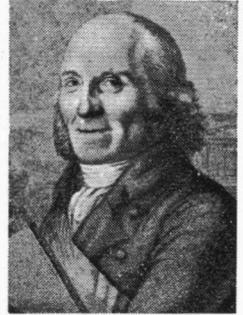
VAN STEENIS



SYMINGTON



TEYSMANN



THUNBERG

Btzg III, 9 (1928) 439-481. (17) *Blumea* 1 (1934) 194-215. (18) *Bull. Jard. Bot. Btzg III, Suppl.* 2-3 (1930-1941). (19) *DE CAND., Prod.* 15² (1866).

97. *The period 1918-1932 at Buitenzorg; Docters van Leeuwen*

W. M. DOCTERS VAN LEEUWEN, successor to KONINGSBERGER as Director at Buitenzorg (1918-1932), stimulated collecting and took an active part himself. He made e.g. an expedition to Salajar (1) in 1913, to Krakatoa (2) in 1919, to New Guinea with the Dutch-American Expedition in 1926; he reported on his observations on the summits of several Central and East Javan volcanoes (3). Being essentially a field biologist, his publications are but rarely purely phytographical; as a rule, they belong chiefly to the ecological and biological provinces of botany. He is a pioneer of E. Asiatic cecidiology and wrote together with Mrs J. DOCTERS VAN LEEUWEN-REYNVAAN *The zoocecidia of the Netherlands East Indies* (1926, supplemented (4) in 1941).

He wrote a large and instructive study on plants and animals and their relations in the upper parts of Mt Pangrango-Gedeh, the result of observations and research on often repeated trips to the region (5). He continued the investigation of the new Krakatoa flora; his book on the Krakatoa archipelago, which summarized the data obtained from 1883 to 1933, augmented by personally assembled materials, appeared as a volume of the 'Annales' (1936) and is a standard work on the subject. It contains an important bibliography.

He is the author of some hundreds of smaller papers on various fields of botany or biology. I have referred to some previously (§ 95) but wish to add a few more titles because DOCTERS VAN LEEUWEN's papers contain now and then detailed phytographical sections and, as these were added in order to discuss or demonstrate functions of the plant in relation to animals, sometimes descriptions of characteristics or organs are given not usually found in systematic literature. There are his papers on epiphytes dispersed by ants (6), on the early growth stages of *Loranthaceae* (7), and on flowers visited by birds (8).

Under DOCTERS VAN LEEUWEN's term of office

the Botanic Gardens at Buitenzorg were the source many valuable phytographical studies (cf. §§ 98 and 99).

H. A. B. BÜNNEMEIJER did most of his collecting (1916-'24) under DOCTERS VAN LEEUWEN's direction. BÜNNEMEIJER explored little known regions of Sumatra, Banka, Billiton, Riouw, and S. Celebes as a professional collector of the Herbarium and made fine collections. He wrote some small popular accounts (9).

Important publications on economic plants also appeared in this period which are mentioned later (cf. §§ 99, 100, 109); the latest Catalogue of 's Lands Plantentuin' by P. M. W. DAKKUS appeared in 1930 containing c. 10,000 names of species under cultivation (10) and was supplemented in 1938 by an Index to the genera. DAKKUS wrote a popular book on Orchids (1), and some popular notes of his experiences on the expedition (1924-1925) with HANS WINKLER into Central Borneo (12).

References: (1) *Blumea* 2 (1937) 239-277. (2) *Hand. 1e Ned. Ind. Nat. Wet. Congr.* (1919) 36-79. (3) *Ber. Deut. Bot. Ges.* 31 (1913) 151-157; *Nat. Tijd. Ned. Ind.* 85 (1925) 23-48; *Bull. Jard. Bot. Btzg III*, 11 (1930) 28-56; *Gedenkboek J. P. Thijssse* (1935) 57-62. (4) *Ned. Kruidk. Arch.* 51 (1941) 122-251. (5) *Verh. Kon. Akad. Wet. Afd. Nat.* 31 (1933) 1-278. (6) *Trop. Natuur* 18 (1929) 57-65, 131-139; *Ber. Deut. Bot. Ges.* 46 (1929) 90. (7) *Versl. Verg. Wis. & Nat. Afd. Kon. Akad. Wet.* 23 (1915) 1438-1449; *Trop. Natuur* 20 (1931) 103-118; *ibid.* 25 (1936) 24-27. (8) *Ann. Jard. Bot. Btzg* 42 (1931) 1-39; *ibid.* 48 (1938) 27-68. (9) *Trop. Natuur* 7-10 (1918-1921) *passim*. (10) *Bull. Jard. Bot. Btzg III, suppl.* 1 (1930) 1-305, *Index* (1938). (11) DAKKUS, *Orchideeën in Nederl. Indië* (3rd ed. 1935). (12) *Ind. Comité Wet. Ond.* (1925) 1-16; also *Trop. Natuur* 14 (1925) 129-139.

98. *The 'Contributions à l'étude &c.'*

During DOCTERS VAN LEEUWEN's Directorship, the plans for a Flora of the Netherlands East Indies came to an issue. In the 'Bulletin' of the Buitenzorg Gardens appeared from 1923 till 1941 a series of 34 *Contributions à l'étude de la Flore des Indes néerlandaises*. On page vii of this volume, Dr VAN STEENIS has pointed out what prevented these con-

tributions to represent ultimately a satisfactory 'Flora Malesiana', or at least a Flora of Indonesia.

The following families and genera were treated:

- Bignoniaceae* (No 16, VAN STEENIS, 1929)
- Boerlagellaceae* (No 5, LAM, 1925)
- Bombacaceae* (No 4, BAKHUIZEN Sr, 1924)
- Buddleiaceae* (No 1, CAMMERLOHER, 1923)
- Burseraceae* (No 22, LAM, 1932)
- Ceratophyllaceae* (No 25, VAN STEENIS, 1933)
- Cochlospermaceae* (No 29, VAN STEENIS, 1936)
- Combretaceae* (No 2, VAN SLOOTEN, 1924)
- Corynocarpaceae* (No 24, VAN STEENIS, 1933)
- Dipterocarpaceae*
 - Anisoptera* (No 8, VAN SLOOTEN, 1926)
 - Cotylelobium* (No 18, VAN SLOOTEN, 1929)
 - Dipterocarpus* (No 11, VAN SLOOTEN, 1927)
 - Dryobalanops* (No 20, VAN SLOOTEN, 1932)
 - Parashorea* (No 12, VAN SLOOTEN, 1927)
 - Vatica* (No 14, VAN SLOOTEN, 1927)
- Droseraceae* (No 27, VAN STEENIS, 1933)
- Ebenaceae* (No 33, BAKHUIZEN Sr, 1936-'41)
- Flacourtiaceae* (No 6, VAN SLOOTEN, 1925)
- Lauraceae*
 - Cinnamomum* (No 7, CAMMERLOHER, 1925)
- Loganiaceae* (No 1, CAMMERLOHER, 1923)
- Loranthaceae* (No 19, DANSER, 1931)
- Nepenthaceae* (No 15, DANSER, 1928)
- Orbanchaceae* (No 23, BAKHUIZEN Sr, 1933)
- Philydraceae* (No 28, SKOTTSBERG, 1933)
- Podostemaceae* (No 30, VAN STEENIS, 1936)
- Polygonaceae* (No 10, DANSER, 1927)
- Rubiaceae*
 - Ixora* (No 34, BREMEKAMP, 1937, '40)
 - Wendlandia* (No 31, COWAN, 1936)
- Sapotaceae* (No 5 & 13, LAM, 1925, '27)
- Sarcospermaceae* (No 5 & 9, LAM, 1925, '26)
- Stylidiaceae* (No 3 & 32 (err. 31), v. SLOOTEN, 1924)
- Styracaceae* (No 21, VAN STEENIS, 1932)
- Xyridaceae* (No 17, MALME, 1929)
- Zygophyllaceae* (No 26, VAN STEENIS, 1933).

99. The main authors of the 'Contributions'

R. C. BAKHUIZEN VAN DEN BRINK Sr was born in 1881. Originally a planter and amateur orchidologist, his collections and devotion to botany drew the attention of professional botanists. From 1917 till 1935, when he retired from official service, he worked in the Buitenzorg Herbarium. In later years, he collaborated voluntarily until his imprisonment and death during the Japanese occupation of Java (1).

His largest phytophagical studies are in *Bombacaceae* (2) and in *Ebenaceae* (3). He wished his work to be as perfect as humanly possible and made, to this purpose, long and conscientious studies of all available literature. This awakened in him an interest in the history of plants, and he discussed the species represented (4) in the reliefs of Borobuddhur (cf. § 2), and early American plant immigrants (5).

A series of papers on wild vegetables appeared from 1922-'24 in 'De Tropische Natuur'. These proved him eligible to write the descriptive para-

graphs of J. J. OCHSE's *Indische Groenten*, appearing in 1931. The same authors published *Vruchten en Vruchtenteelt in Nederlandsch-Oost-Indië* in that year.

Both books appeared in an English translation in the same year (*Vegetables in the Dutch East Indies and Fruits and Fruit-culture in the Dutch East Indies*).

BAKHUIZEN concentrated, in his trips, on West Java and, together with W. F. WINCKEL, or with his son and namesake, collected a large herbarium and discovered not infrequently botanical rarities. He indicated Tjadasmalang (S of Tjiandjoer) as a rich field for exploration, succeeded in obtaining protective measures for the area, and searched it thoroughly. Although the majority of his publications deals with the whole of the former Netherlands Indies, he added much to the collections of the West Javan flora. To his work in *Verbenaceae* has been referred above (§ 95).

B. H. DANSER stayed at Buitenzorg from 1925-'29. Returning to the Netherlands, he accepted a post in the University at Groningen where he succeeded J. C. SCHOUTE, in 1931, as Professor Extraordinarius, and was appointed Professor in 1943. In the same year he died.

DANSER was particularly attracted to the genetical aspects of systematics though his larger publications are taxonomical. In the Netherlands, he cultivated, crossed, and experimented with many species of *Polygonum* and *Rumex*, and described his results (6); in Java he treated species of *Stachytarpheta* in the same manner. He wrote on the species concept in botany and threw new light on species delimitation (7) by his theories (*comparium, commiscuum, and convivium*).

His extensive research into European *Polygonaceae* (1915-'26) found a natural issue in *Die Polygonaceae Niederländisch Ost-Indiens* (8) and various other studies on Malaysian *Polygonaceae* (9). His Malaysian studies were, chiefly, *The Nepenthaceae of the Netherlands Indies* (10), *The Loranthaceae of the Netherlands Indies* (11), a *Revision of the Philippine Loranthaceae* (12), and some papers on *Stachytarpheta* (13), *Cornaceae* (14), and *Santalaceae* (15). He proposed a new taxonomical arrangement of *Loranthaceae-Loranthoideae* (16) and wrote a considerable study of SE. Asiatic species of *Korthalsella* (17). He had undertaken to elaborate a part of the Malaysian Conifers for *Flora Malesiana* but the Pacific War and his early death prevented this. His biographers said: (transl.) 'his strictly scientific manner of discussion and his lively style made his publications often a pleasure to read'. Malaysian phytophagy lost in him, it is believed by many, its ablest worker.

D. F. VAN SLOOTEN, since 1931 Head of the Buitenzorg Herbarium, submitted as his doctor's thesis a revision of the *Combretaceae* and *Flacourtiaceae* of the Netherlands Indies (18). He went to Java (1919) where he remained till the present day. He is the author of ten of the *Contributions à l'étude etc.* (cf. § 98). Since 1926, he has been absorbed in the study of *Dipterocarpaceae*, a large family of forest trees of foremost importance and complicated systematics.

Recently, his results were laid down in *Sertulum Dipterocarpacearum Malayensium*, of which 4 instalments have appeared (19).

Together with C. A. BACKER, he wrote *Getllustreed Handboek der Javaansche Theeonkruiden* (1924), a work containing 240 good plant portraits of weeds in tea plantations. An evaluation of ZOLLINGER's botanical research (20) appeared in 1929; he published several articles connected with the history of the Buitenzorg Gardens (TEYSMANN (21), Herbarium (22)).

From 1919-'34 he was one of the main editors of 'De Tropische Natuur', which gained a reputation as one of the finest and most valuable popular biological periodicals appearing anywhere in the tropics.

H. J. LAM arrived in 1919 in Java, at the same time as VAN SLOOTEN. In 1920, he collected on an expedition to the Mamberamo region and the Wilhelmina Mountains in New Guinea; in 1926 he explored the Talaud Archipelago and, on both occasions, secured many new species. He remained till 1933 at Buitenzorg and returned to the Netherlands to occupy the Chair of Botany at Leyden, and as Director of the Rijksherbarium.

LAM wrote on many subjects. His main contributions to Malaysian phytography have dealt with the *Verbenaceae* (Dr's thesis, cf. § 95), *Boerlagellaceae*, *Sarcospermaceae*, *Sapotaceae*, and *Burseraceae*. These families formed the subject of revisions (cf. § 98); as a rule the *taxa* were not only described but their distribution was considered in connexion with plant geography. LAM published lively narratives of his travels. I mention those of his observations in New Guinea (23, cf. also § 106), on Mt Slamet (24), on Mt Tjaremé (25), the Minahassa (N. Celebes, (26), cf. also § 103), and on Mianghas (27).

A first study in plant geography in relation to WEGENER's theory was written in 1930 (28); an important morphological study is e.g. that on *Burseraceae* (29).

Useful surveys appeared in *Science in the Netherlands East Indies* (1929) which included a list of institutions of pure and applied science augmented by a summary of periodicals and, in 1948, a report of the botanical work done in the Netherlands and pertaining to the East Indies (1918-1943).

Phylogenetic problems have drawn LAM's attention during many years. A recent essay is *Classification and the new morphology* (30).

Under LAM's directorship, Leyden resumed its position as a leading institution for Malaysian phytography. Many articles in *Blumea*, the journal of the Rijksherbarium, in 1934 founded and since edited by LAM, testify of this reborn interest; the *Flora Malesiana* enjoys his vigorous support.

C. G. G. J. VAN STEENIS was appointed in 1927 in the Buitenzorg Herbarium. In the next year, he made a trip to the Anambas and Natuna Archipelago, partly together with HENDERSON (§ 92). In 1929, he explored the Ranau region in S. Sumatra, in 1936 Bali, in 1937 he penetrated into the Alas and Gajolands in N. Sumatra. He collected extensively and, by numerous smaller excursions in Java (preferably to investigate the mountain flora) add-

ed considerably both to the knowledge of the flora and to the plant geography of Java. Moreover, he studied the ecology, distribution, and biology of numerous species.

Dozens of papers contain the results of his trips (31). His main works, so far, are the 3 parts of *On the origin of the Malaysian mountain-flora* (32) and *Maleische Vegetatieschetsen* (33). These put the plant geography of Malaysia partly on new and, as a whole, on immeasurably firmer foundations than before (34). Of several handbooks, now in course of publication, volumes 1-3, and the present volume of this Flora may be consulted.

VAN STEENIS's many articles in 'De Tropische Natuur' are mainly devoted to ecological and systematic studies (35). In 1932, he published a descriptive account of the pteridophytes and phanerogams of the Deutsche Limnologische Sunda-Expedition (36). He wrote a doctor's thesis on *Bignoniaceae* (37) and afterwards elaborated a number of smaller families (see preceding paragraph) and genera (*Brugmansia* (38), *Arisaema* (39), *Sophora* (40), *Lonicera* (41), etc.). A series of *Miscellaneous botanical notes* is in progress (42). The finest collection of annotated coloured plates ever made, depicting the Javan mountain flora, and also a series of photographs with text, remain unpublished for lack of funds.

VAN STEENIS left Java in 1946, having protected the collections in the Herbarium and the Botanic Gardens against irreparable damage by his timely presence and untiring activity in the unruly months at the close of 1945 and first half of 1946.

He was appointed as general editor of *Flora Malesiana* and in that capacity also edits the 'Flora Malesiana Bulletin'. He continues co-editing the 'Bulletin of the Botanic Gardens, Buitenzorg'.

VAN STEENIS is the editor and co-author of the new *Schoolflora of Java* which has been published recently.

C. E. B. BREMEKAMP's work is finally to be considered among that of the authors of the *Contributions*. Originally a plant physiologist, BREMEKAMP later directed his interest to taxonomy. After some years of work at the Sugar Experiment Station at Pasoeroean and in South Africa, he returned to the Netherlands where he continued his taxonomical research at Utrecht. Although he did not limit his studies to Malaysia, he demonstrated a definite preference for our region and specialized in *Rubiaceae* (43) and *Acanthaceae* (44), writing many large or small papers on groups in these families.

He showed himself not satisfied with a close well-built species description but added detailed discussions of previous literature and of the reasons moving him when adopting a different view. Constantly he tested and tried to improve the taxonomical arrangement so far adhered to. In his papers an uncommonly high percentage of new species is proposed, owing to his conviction that specific limits may be drawn narrow, and that in case of an aberrant specimen a provisional distinction and assignment of a binomial are preferable to postponement of study and ultimate conclusion until more data will come to hand.

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150; Verh. Ned. Akad. Wet. sect. 2, 41 (1944) 12-16, 30; Verh. Kon. Akad. Wet. sect. 2, 45 (1948) 1-39, 1-78.

100. Recent phytochemistry in Java; Backer *c.s.*

In the preceding pages, repeated reference has been made to recent Javan phytochemistry (*cf.* §§ 65-77), but so far C. A. BACKER's publications have been passed nearly unmentioned. Nevertheless, BACKER is a leader of phytochemistry, and the recognized authority on the taxonomy of the Java flora.

Born in 1874, he went to Java and, being a schoolmaster at Batavia, met TREUB at Buitenzorg (1902). His intimate knowledge of plants induced TREUB to try to secure his talents for the Gardens; as regards his collections, these had grown to such dimensions that, when TREUB asked him to come again to Buitenzorg and bring his herbarium, BACKER asked, half-jokingly, if TREUB were willing to pay for the railway truck required for its transport.

In 1905, BACKER was appointed in the Herbarium and charged with writing a *Flora of Batavia* (another of TREUB's local Floras!) which appeared in 1907. It was a first volume of some selected families of Dicotyledons in which *c.* 250 species were closely described; the whole was planned in 6 volumes but only this first reached the printer. It was then preferred to have, first of all a simplified *Flora of Java* to be used in schools and comprising the more common wild or cultivated Javan plants. This resulted in 1908 in the *Voorlooper eener Schoolflora voor Java*, followed in 1911 by a *Schoolflora voor Java*. This latter book has remained in use till the present day though it deals only with a limited number of Choripetalous families.

BACKER was officially appointed as 'Botanist for the Java Flora' in 1912. In those years, this restless worker acquired an additional knowledge of modern and ancient languages which made his colleagues often, perhaps more often than ought to have happened, apply for his assistance. BACKER never refused to join forces but put aside his own work to give preference to the interests of others, and so there is scarcely any phytochemical work of importance published in the period in Java, which has not benefited from BACKER's support (both OCHSE's books on fruits and vegetables (§ 99), HEYNE's encyclopedical work on economic plants, generally, and in particular the *Gramineae*; (§ 109), JESWIET's studies on the systematics of sugar cane (§ 109), *etc.*).

In 1924, BACKER left the Herbarium to be employed as a botanist in the Experiment Station of the Java Sugar Industry at Pasuruan. His services were required; BACKER had demonstrated that indications regarding suitable localities for planting sugar cane, might be derived from the natural composition of the plant cover of the region. BACKER had made (with D. F. VAN SLOOTEN) a study of the weeds of the tea plantations (see § 99) and was now entrusted with the composition of a weed flora of the cane fields. When he retired in

1931, this great work had been completely published (1928-'34). About 750 species, mainly herbs, are described in detail but their characteristics are duly stressed. An excellent *Atlas* illustrates this *Onkruidflora der Javasche suikerrietgronden*. In 1941, 15 fascicles of this *Atlas* had been issued; it is doubtful if publication will be resumed.

Of a *Handboek voor de Flora van Java* appeared 3 instalments (1924-'28); these cover the majority of the Monocotyledons of Java.

The problem of Krakatau's new vegetation was studied chiefly from a critical point of view (1).

With O. POSTHUMUS, he wrote the illustrated *Varenflora voor Java* (1939), the first complete, and greatly improved, treatment after RACIBORKI's (cf. § 71), describing 515 species and provided with keys, reference to literature, and ecological discussions.

BACKER is one of the main founders of the 'Nederlandsch-Indische Natuurhistorische Vereeniging' (1911) and of its journal 'De Tropische Natuur' (first volume in 1912). His articles in that, and in some other periodicals, deal with a variety of botanical problems and always excel in their phytophraphy. I select from his publications that on naturalized plants in Java (2), on plants of the wet rice-fields (3), on Javan pasture grasses (4), on his search for Bantam plants (5), on *Clerodendron* (6), *Thunbergia* (7), on plants of the dunes (8), *Aristolochiaceae* (9), *Amorphophallus* (10), and on KUNTZE's types of Javan species (11).

In 1931, BACKER returned to the Netherlands. Five years later, 1936, appeared his *Verklarend Handwoordenboek*, a dictionary of the scientific names of wild or cultivated phanerogams and ferns of the Netherlands East Indies and the Netherlands. This dictionary ranks among the finest works ever written in relation to Malaysian phytophraphy. Its articles often twinkle with wit; its data are thoroughly reliable. Its only shortcoming is in that it is written in the Dutch language which is understood by many fewer than might avail themselves of this handbook.

Of BACKER's *Beknopte Flora van Java* (Concise Flora of Java), a mimeographed emergency edition, or *Nooduitgave*, began to appear in a very limited issue in November 1940. Till August 1949, eleven fascicles had appeared; it is expected to be completed in few years. BACKER received assistance in this final work from A. G. L. ADELBERT, G. J. M. AMSHOFF, R. C. BAKHUIZEN VAN DEN BRINK Jr, H. J. LAM, A. D. J. MEEUSE, and S. J. VAN OOSTSTROOM, but wrote the major part himself.

Some of these authors participated in his *Notes on the flora of Java* (12).

BACKER's phytophraphy is composed with painstaking accuracy though he never loses himself in too much detail. Some of his manuscripts he kept unpublished for years, always reconsidering, improving, adding new facts. *Flora Malesiana* is proud to have persuaded him to participate in its composition. His unsurpassed, partly undistributed, Java collections rest in the Buitenzorg Herbarium.

His devotion to his science tolerates no casual

approach, no slipshod research. He criticized bitterly when he believed authors to be hasty and careless, an attitude which has been judged by some as too severe (13). Let us be thankful for unselfish fighters in a good cause.

BACKER spent nearly twenty years employed in the Buitenzorg Gardens, seven in the Herbarium at Pasuruan. The members of the staff of the Experiment Station of the Java Sugar Industry have furthered Javan phytophraphy considerably. A survey was written by VAN SLOOTEN (14).

In addition to the authors already mentioned (cf. also sub DOCTERS VAN LEEUWEN), I have referred to I. BOLDINGH's *Zakflora voor de landbouwstroken van Java* (1916, cf § 95). J. G. B. BEUMÉE in 1913 employed in the Forest Research Service of Java, some time Head of the Buitenzorg Herbarium (1924-'31) and since 1948 Lecturer in the Agricultural College at Wageningen, specialized in the flora of the teak forests (15). He wrote several papers on the Javan vegetation (16).

A. H. BLAAUW published *De Tropische Natuur in Kleuren en Schetsen* (1913). De 'Natuurhistorische Vereeniging' published some attractive popular books which contained some good phytophraphy: I select *Uit de Tropische Natuur* (1925, H. G. DELSMAN), *Vacantie in de bergen* (1927, S. J. GEERTS-RONNER), and *In tuinen en langs wegen in de Indische laagvlakte* (1932, M. C. ENGLS-JULIUS).

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101. Recent phytophraphy of Sumatra

At the beginning of the 20th century, the largest work on the Sumatran flora was that of MIQUEL (1860-1861, cf. § 48) but his attempt towards a comprehensive Flora of Sumatra fell short of its mark. No further effort was made to compose a general Sumatran Flora and till now Sumatra's phytophraphy was added to incidentally. In this present account only the most important work is briefly touched on.

The Sumatran flora was chiefly investigated by Dutch, American, and English phytophraphers.



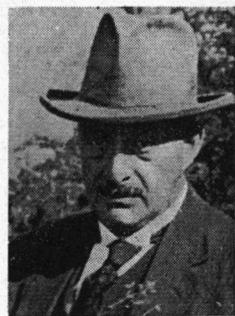
VALETON



DE VRIESE



WALLICH



WARBURG

The Botanical Garden at Sibolangit (1), its bright possibilities and its regrettable failure, has been alluded to in § 95. Collectors in the Dutch service were e.g. BÜNNEMEYER (§ 97), C. W. F. GRASHOFF (1914–1916); on behalf of the Forestry Service, A. THORENAAR and F. H. ENDERT (§ 109) practised 'intensive collecting' in the forested areas of the Palembang region (c. 1924).

KOORDERS's *Systematisches Verzeichnisz* (1914–1916, § 73) contains a list of Sumatran records. J. J. SMITH enumerated all known Orchids of Sumatra (§ 96). C. G. G. J. VAN STEENIS (cf. § 99) explored the Ranau region in S. Sumatra (2) and added also to the knowledge of the Sumatran flora in the *Pteridophyten und Phanerogamen der Deutschen Limnologischen Sunda Expedition* (§ 99). He made an expedition into the Alas and Gajolands (N. Sumatra) which led to the discovery of several SE. Asiatic continental species in the mountains and furnished many valuable data both to phytophagy and plant geography (§ 99).

Numerous popular papers, certainly not without phytophagical interest, are found in 'De Tropische Natuur' (e.g. by S. C. J. JOCHEMS, J. C. VAN DER MEER-MOHR, A. FREY-WYSSLING, C. N. A. DE VOOGD, and M. VAN DER VOORT).

B. POLAK wrote on Sumatran bogs and peat (3). O. POSTHUMUS, pteridologist (§ 108) and palaeobotanist (§ 110), travelled in 1925 in Djambi where he collected both living and fossil plants on which he wrote some studies (4).

American interest in the Sumatran flora (since HORSFIELD (§ 40)) was revived by resident employees of the East Coast plantations. Large amounts of materials were gathered by H. H. BARTLETT and C. D. LARUE (1918–1927), H. S. YATES (1923–1928), RAHMAT SI BOEBA (1927), B. KRUKOFF (1931–1932), the BANGHAMS (1932–1932), and the VANDERBILT expedition (1939). BARTLETT wrote a survey of the work done in particular by Americans in the Battak Lands (5). MERRILL is obviously the foremost contributor to Sumatran phytophagy based on these collections. He published *Notes on the Flora of Sumatra* (6), on the BANGHAMS's collection (7), four instalments of *New Sumatran Plants* (8), and on the specimens of the VANDERBILT expedition (9).

English participation consisted first of all of

RIDLEY's publications (§ 88). The plants collected by H. O. FORBES in Sumatra (c. 1880) were treated only forty years later, in 1924–1926 (10).

This brief outline sufficiently demonstrates why I am not prepared to agree with BURKILL's judgment (1939): 'such attention as its Flora received was the overflow of energy bestowed on Java'. Expeditions, local collectors, the Forest Service, residents of various nationalities did good work, either independently from that done in Java or in conjunction with the natural centre of phytophagy in the Netherlands East Indies at Buitenzorg. It is true, however, that Sumatran phytophagy is far less advanced than that of Java and that its Flora has too little been studied with the aim of treating the whole of the island. PENNANT's dictum of 150 years ago still stands: 'Sumatra still wants its florist.'

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102. *Recent phytophagy of Borneo*

A survey of the phytophagy of Borneo, made at the start of the 20th century would suggest that Borneo's great forests and its mountain giant Kinabalu had been explored by plant collectors at least as often as the wilds of Sumatra. KORTHALS (§ 51), TEYSMANN and DE VRIESE (§§ 48, 53) were among the main travellers, as was H. Low (§ 89) who had climbed Kinabalu for the first time (1851, 1858). J. MOTLEY had worked in Labuan (1852–1854) and at Banjermasin where he was murdered in 1859 (1). A. W. NIEUWENHUIS had crossed from Pontianak to the East Coast (1896–1897, and 1898–1900). Mantri JAHERI had made fine collec-

tions on that occasion and so did HALLIER (cf. § 70) who had climbed Mt Klam. The main sources of Bornean phytography, however, were found in BECCARI's collections, his *Malesia*, and in his *Nelle foreste di Borneo* (§ 78), and also in O. STAFF's description of Kinabalu plants (2).

The first half of the 20th century shows a rapid increase of the descriptive studies on the flora but still the same incidental progress of Bornean phytography; no general Flora of the island has been written. (cf. § 70). The English, Americans, Dutch, and Germans have the majority of phytographical publications to their name.

Roughly summarizing, it may be said that RIDLEY (§ 88) contributed very substantially in a series of papers extending over many years, *Additions to the Flora of Borneo and other Malay Islands* (3); he visited Sarawak and B. N. Borneo in 1905. RIDLEY enumerated the Orchids recorded from Borneo (4) and elaborated the Monocotyledonous families in HANS WINKLER's *Beiträge* (see below).

At Kew, H. K. AIRY SHAW repeatedly added to Bornean phytography. In particular he described several of the families contained in the herbarium assembled by the Oxford University Expedition to Sarawak in 1932; these studies formed part of the *Additions to the Flora of Borneo etc.* P. W. RICHARDS, who is responsible for the collections of the Sarawak Expedition, published on the ecology of the rain forest of Mt Dulit (6).

The main scene of field research in Br. N. Borneo remained Mt Kinabalu. Miss L. S. GIBBS wrote a particularly good book (7) on the Kinabalu flora in 1914. C. E. CARR, the Malayan orchidologist (§ 94), made large collections on the mountain (c. 1934), now preserved at Singapore (8). C. CHRISTENSEN and R. E. HOLTUM (§ 93) wrote on the Pteridophytes of Mt Kinabalu (9). At Sandakan, the Herbarium of the Forest Department Br. N. Borneo is now, after its destruction in the Pacific War, re-assembled by H. G. KEITH.

The centre of descriptive work in Sarawak is the Sarawak Museum where the 'Sarawak Museum Journal' is edited since 1911 (10). Curators of the Museum, and important collectors, were G. D. HAVILAND (1891-1895), J. HEWITT (1905-1909), and J. C. MOULTON (1909-1915); HAVILAND revised the *Naucleae* (11).

The Americans concentrated on the British section of Borneo, with the exception of E. D. MERRILL who compiled in 1921 a *Bibliographic enumeration of Bornean plants*, listing 4924 species of Phanerogams for the whole of Borneo. It is the most valuable key to Bornean phytography (12). In this connexion it is necessary to refer to G. MASUMUNE's Japanese *Enumeratio Phanerogamarum Bornearum* (1942) in which it was intended, on the base of MERRILL's work, to bring the census up to date. He refers to 7201 species of Phanerogams but this compilation was executed with a view to speed rather than accuracy and so the figure is certainly not reliable. In 1945 appeared an enumeration of Bornean pteridophytes by the same author.

MERRILL composed a survey of the botanical exploration of Borneo in 1930 (13). Another often

consulted work is *Plantae Elmerianae borneenses* (14), an annotated and descriptive list of the specimens gathered by A. D. E. ELMER, the collector and describer of Philippine plants (§ 82), who made also large collections in Br. N. Borneo.

Together with Miss M. L. PERRY, MERRILL wrote a local revision of Bornean *Syzygium* (15). There are also his *Additions to our knowledge of the Bornean flora* (16), *Plants from Banguay Island* (17), and three instalments of *New or noteworthy Bornean plants* (18).

Other American collections were those of F. W. FOXWORTHY (§ 83) and, the largest of all, of Chaplain J. CLEMENS and his intrepid wife Mrs M. STRONG CLEMENS (1915-1916, 1931-1933). Their specimens have been comparatively frequently referred to in literature (MERRILL, VAN STEENIS, HOLTUM, AMES, DANSER, etc.) but their herbaria still contain many undescribed discoveries.

The finest 20th century collection made by the Dutch in Borneo is probably that of F. H. ENDERT (1925) who went with the 'Midden Oost Borneo Expeditie' (Central East Borneo Exp.). Some preliminary report has been embodied in the 'Verslag' (19) but the collection as a whole was not studied though occasionally references may be met with in literature. Few publications written by Dutch authors treat Bornean plants only (20); these are usually considered as part of larger studies. There are, however, the studies on Bornean Orchids by J. J. SMITH (§ 96) and HALLIER's articles (§ 70).

Some popular publications were written by L. COOMANS DE RUITER (21).

HUBERT WINKLER, a German botanist, made an expedition into Borneo (1908) and published three, sufficiently detailed, papers on the vegetation of the SE. regions (23). L. DIELS and C. HACKENBERG also described the region (22).

HANS WINKLER brought home rich spoils from his Bornean trip of 1924-1925, with DAKKUS (§ 97) and RACHMAT of the Buitenzorg Gardens. His plants supplied the materials for a sequence of *Beiträge zur Kenntniss der Flora von Borneo* (24). E. IRMSCHER acted as general editor; the whole was planned in conformity of LAUTERBACH's *Beiträge* (§ 106). Collaborating phytographers were MERRILL (§ 81), O. SCHWARTZ (many families), ALSTON (§§ 20, 64), E. IRMSCHER, L. DIELS (§ 106), R. PILGER, etc.

References: (1) Hook. J. Bot. & Kew Gard. Misc. 9 (1857) 148-153. (2) Trans. Linn. Soc. Bot. 4 (1894) 69-263. (3) Kew Bull. (1930-1946) *passim*. (4) J. Linn. Soc. Bot. 31 (1896) 261-306. (5) Kew Bull. (1935-1939) *passim*; Hook. Ic. Pl. 35 (1947) t. 3474. (6) J. Ecol. 24 (1936) 1-37; *ibid.* 340-360. (7) J. Linn. Soc. Bot. 42 (1914) 1-240. (8) Gard. Bull. 8 (1935) 165-240. (9) *ibid.* 7 (1934) 191-324. (10) Fl. Mal. Bull. no 5 (1949) 130. (11) J. Linn. Soc. Bot. 33 (1897) 1-94. (12) J. Roy. As. Soc. Str. Br. Spec. Numb. (1921) 1-637. (13) J. N.Y. Bot. Gard. 31 (1930) 185-191. (14) Univ. Calif. Publ. Bot. 15 (1929) 1-316. (15) Mem. Amer. Acad. Arts and Sci. 18 (1939) 135-202, repr. Mem. Gray Herb. Harv. Univ. 4 (1939) 135-202. (16) Philipp.

J. Sci. 21 (1922) 514-534; *ibid.* 30 (1926) 79-87. (17) *ibid.* 24 (1924) 113-116. (18) J. Roy. As. Soc. Str. Br. 85 (1922) 151-201; *ibid.* 86 (1922) 312-342; *ibid.* Mal. Br. 1 (1923) 22-45. (19) Aneta Comm. M.O. Borneo Exp. 1-3 (1925); Verslag v. d. M.O. Borneo Exp. (1925) 117-312. (20) *e.g.* J. Bot. 72 (1934) 1-12. (21) Trop. Natuur (1932-1936). (22) Bot. Jahrb. 60 (1926) 293-316. (23) Bot. Jahrb. (1909-14). (24) Mitt. Inst. Allg. Bot. Hamburg (1927-1937).

103. Recent phytophagy of Celebes

From the preceding paragraph it will have been realized that Bornean phytophagy on the whole has developed scarcely beyond its first stage, that of collecting, though some notable contributions towards a description of its flora are present. This state of affairs is even more evident as regards Celebes, the Moluccas, and the Lesser Sunda Islands. With the exception of Timor, no recent attempts towards a phytophagy of one of these many islands has come to my knowledge.

After TEYSMANN (§ 53), FORSTEN (§ 52), BECCARI (§ 78), and WARBURG (§§ 78, 106) had explored in Celebes, KOORDERS spent 6 months in the extreme NE of the island (1894-1895). In 1898 he published a *Verslag* (Report) on these Minahassa observations and collections (1) which is represented, after D. OLIVER's *Note* on J. G. F. RIEDEL's Gorontalo plants (2), another initial step towards a Flora of N. Celebes. P. & F. SARASIN, Swiss naturalists who travelled in many parts of the world, explored Celebes (chiefly from a geological and zoological point of view) between 1893 and 1896, and 1902-1903. The Peak of Maros was climbed. They wrote a *Reisen in Celebes* (1905). H. CHRIST gave an account of their Fern specimens (3).

R. SCHLECHTER (§ 106), who travelled twice in Malaysia (1901-1902, 1907-1910), described *Orchids* and *Asclepidaceae* from Celebes; (4). A. H. EVERETT, an English collector of objects of natural history explored in S. Celebes; his plants were described by W. B. HEMSLEY *c.s.* (5). W. KAUDERN, a Swedish ethnographer and zoologist, brought together on his journeys in the island a collection of Celebes plants (1917-1920) of which the *Orchidaceae* and *Ericaceae* were elaborated by J. J. SMITH (§ 96). L. VAN VUUREN, accompanied by RACHMAT and NOERKAS of the Buitenzorg Gardens, penetrated into S. Celebes (1912-1914); plants of this collection have incidentally been described. H. A. B. BÜNNEMEIJER, Buitenzorg's professional collector (§ 97) made a big collection on Mt Bonthain. G. KJELLBERG, a Swedish botanist also assembled a large herbarium in southern Celebes (1929) while S. BLOEMBERGEN, of the Forestry Service, made in 1939 a trip to W. Central Celebes. P. J. EYMA secured possibly the most important collection of S. and Central Celebes plants during his expeditions far into the interior in 1937-38. The Ferns collected by KJELLBERG were elaborated by himself and CHRISTENSEN (6). BLOEMBERGEN wrote a general account of his trip (7) and an unpublished mimeographed report kept by the

Forestry Service; EYMA's collection was wilfully destroyed (8).

To be noted here is also a collection made by C. MONOD DE FROIDEVILLE, described by H. J. LAM *c.s.* (9).

VAN STEENIS, in his analysis of the mountain flora of Malaysia referred repeatedly to Celebean species (10).

F. K. M. STEUP, a Forestry Officer, worked several years in Celebes and wrote a number of papers on the forests of N. and Central Celebes, besides he composed some essays on the plant physiognomy of the island (11). These appeared in 'Tectona', the periodical edited at the Forestry Research Station at Buitenzorg since 1908; at the Station many valuable unpublished reports made by Forestry Officers in various parts of the Archipelago are preserved.

H. J. LAM is the author of a historical phytophagy of Celebes (12); in 1931 he gave an outline of the vegetation of the Minahassa (13).

References: (1) Meded. 's Lands Plantent. 19 (1898); Nat. Tijds. Ned. Ind. 61 (1901) 250-261; *ibid.* 63 (1903) 76-89, 90-99; Bull. Jard. Bot. Btzg III, 1 (1918) 1-30. (2) J. Linn. Soc. Bot. 15 (1877) 97-100. (3) Ann. Jard. Bot. Btzg 15 (1898) 73-186; also Basler Naturf. Ges. 11 (1895-1897). (4) *e.g.* Tropenpf. 5-7 (1901-1903) and Bot. Jahrb. 40 (1908) Beibl. 92, p. 1-19. (5) Kew Bull. (1896) 36-42. (6) Bot. Jahrb. 66 (1933) 39-70. (7) Tectona 33 (1940) 377-418. (8) Fl. Mal. Bull. no 4 (1948) 92. (9) Blumea 5 (1945) 554-599. (10) Bull. Jard. Bot. Btzg 14 (1936) 56-72. (11) Tectona 23-28 (1930-1935) *passim*, also Trop. Natuur 22-25 (1933-1936) *passim*. (12) Blumea 5 (1945) 600-640. (13) Trop. Natuur 20 (1931) 209-219.

104. Recent phytophagy of the Moluccas

Moluccan research was still stimulated by RUMPHIUS's research (§ 21) centuries later. The wish to establish the identity of the plants he had described, induced later scientists to investigate the flora of Amboina and neighbouring islands.

REINWARDT (§ 46), among his many commissions, was charged in particular to search for Rumphian plants. TEYSMANN and DE VRIESE, on their Moluccan trip (§§ 48, 53), assembled a large and important collection, to some extent again with a view to establish the identity of RUMPHIUS's species.

Among general collections is to be noted that of H. N. MOSELEY, on occasion of the 'Challenger' Expedition (1872-1876), who secured valuable specimens; these and some materials collected by J. G. F. RIEDEL and H. O. FORBES were examined or described by W. B. HEMSLEY (§ 49). Mantri JAHERI, of the Buitenzorg Gardens, who accompanied TREUB in 1888 to the Moluccas and in 1893 to the Aroe and Kei Islands, has to be remembered among the hardest explorers. BECCARI's collections (1874-1876) were partly described in *Malesia* (§ 78).

An outline of the search in the Moluccan fields during the 19th century was given by O. WARBURG

(1), who himself contributed both as a collector and as a phytographer (§ 78).

At the beginning of the 20th century, the quest for RUMPHIUS's plants was revived by BOERLAGE and SMITH; their trip ended in disaster (cf. § 68). Some ten years later C. B. ROBINSON made a new effort; he also met with death. MERRILL wrote some most valuable publications based on ROBINSON's data (cf. § 81).

The Talaud Archipelago was practically unknown (CH. HOSE had been there in 1895) when LAM (§ 99) made an expedition to these and the Sangi Islands in 1926. Some plant geographically significant species were brought home. A preliminary paper appeared in the proceedings of the 4th Neth. Ind. Congr. for Natural Sciences (1927), and a second paper (2) in 1932. In 1937 DOCTERS VAN LEEUWEN reported on the botanical results of his voyage to the Saleyer Islands (3).

V. M. A. BEGUIN collected 1919–1923 in the Moluccas (especially Halmahera) on behalf of the Museum for Economic Botany at Buitenzorg. G. A. L. DE HAAN, of the Forestry Service, assisted by ANGLING and NEDI of the Buitenzorg Gardens, made collections in Batjan, Obi, Talaud, Halmahera, and Morotai (1937–1938); their specimens wait, with so many others, to be considered in the future revisions of the *Flora Malesiana*.

A. RANT wrote an account of his trips to Ambon (4). L. J. TOXOPEUS, an entomologist, led an expedition into Boeroe (1921–1922). Now and then his specimens are referred to in literature; J. J. SMITH described his orchids (§ 96).

Mantri IBOET, of the Buitenzorg Gardens, went with the Danish Expedition of HJ. JENSEN to the Aroe and Kei Islands, and to Ambon in 1922. IBOET proved to be an outstanding collector.

P. BUWALDA, of the Forest Research Station, Buitenzorg, brought together a big and extremely valuable herbarium in the Moluccas (Ceram, Ambon), the Tanimbar and the Aroe Archipelago (1938). He was accompanied by AËT, of the Herbarium.

TEYSMANN made the first important Ceram collection in 1860. He published some account of the vegetation as apart of his narrative of his journey (cf. § 53). The island was investigated anew by L. M. R. and Mrs RUTTEN (1918); a very good herbarium was assembled by this mainly geological expedition. RUTTEN went also to Ambon. Part of the herbarium was made by KORNASI.

E. STRESEMANN, a Dresden zoologist, participated in the second Freiburgian Moluccas Expedition (1910–1912), on which the Malay Peninsula, Bali, Ceram, and Boeroe were visited. STRESEMANN secured a good collection of plants which allowed some first glimpses of the high mountain flora in the interior of Ceram. All these collections, however, were far surpassed by P. J. EYMA's Ceram herbarium (1938–39). His untimely death and, later on, the destruction of a part of his specimens, deprived the phytography of Ceram from a most satisfactory basis. A preliminary examination of his mountain specimens, however, has furnished a new and adequate picture of the characteristics of the Ceram vegetation in the higher parts.

SMITH described the Orchids of Ambon in 1905 and 1917, of Ceram in 1928, of Boeroe in 1928; the *Ericaceae* of the 'eastern Archipelago' in 1932 (cf. also § 96).

References: (1) Rumphius Gedenkboek (1902) 63–78. (2) Inter-Ocean 4 (1928) 195–201; Ind. Com. Wet. Ond. 6 (1932). (3) Blumea 2 (1937) 239–277. (4) Nat. Tijds. Ned. Ind. 94 (1934) 100–133.

105. *Recent phytography of the Lesser Sunda Islands*

Since the time when CLUSIUS described the first Bali specimen (§ 9), no essential change occurred in the progress of the phytography of the Lesser Sunda Islands. Till the present day, the knowledge of their flora increased according to the collections made at irregular intervals and when an opportunity of describing these specimens arose.

Timor has been privileged in that some authors attempted to deal with its flora as a whole; actually, however, these phytographers had only some fragmentary collections at their disposal. They were J. DECAISNE and J. B. SPANOGHE, the former by his *Herbarii Timorensis descriptio* (1), the latter by a *Prodromus florum timorensis* (2). SPANOGHE also made a list of all known species from Timor (3) and paid much attention to the work of ZIPELIUS (§ 50). The work of both authors is now entirely outdated.

The Koepang district of Timor was, in the course of time, comparatively closely investigated. Koepang was the regular port-of-call on the way from Java to New Guinea. TEYSMANN visited Timor in 1854 (§ 53). He made a large collection and wrote an account of his observations (4). H. O. FORBES, heading for New Guinea, stayed 5 months (1882–1883). In his *Wanderings* (5) only a list of his Timor plants is given; a more critical and descriptive study was published by the botanists A. B. RENDLE, E. G. BAKER, and Sp. MOORE in the 'Journal of Botany', Suppl. (1924–1926).

Mrs M. E. WALSH-HELD collected in the whole of Timor (1929); her large collection contains many valuable specimens.

Portuguese Timor has received less attention. A. O. DE CASTRO, a friend of TREUB's, wrote a book on his travels in the island and collected (c. 1909). J. G. ALFARO CARDOSO studied the forestry in recent years. Main collectors were CH. GAUDICHAUD (1818), FORBES (1883), F. NEWTON (1897), Mrs WALSH-HELD (1929), G. STEIN (1931–1932), E. MEIJER DREES (± 1946), and R. CINATTI (± 1946).

One or more of the other Lesser Sunda Islands were occasionally visited by plant collectors. In the 19th century, the most important was probably H. ZOLLINGER. He explored repeatedly Bali (1845, 1846, 1857), once Lombok (1846), and made in 1847 a 4-month trip into Soembawa (§ 54).

In the first half of the 20th century are to be noted the 'Sunda Expedition' of the 'Frankfurter Verein für Geographie und Statistik' (1910–1911) under J. ELBERT, who visited Lombok, Soembawa, Flores, and Wetar. H. HALLIER described part of the collections (§ 70).

R. E. P. MAIER, with SARIP of the Buitenzorg Herbarium, made a collection of plants in the west and central part of the island (1918). IBOER, another collector of the Herbarium, went with K. W. DAMMERMAN to Sumba (1925); the trip was chiefly for zoological purposes but a valuable set of plant specimens was secured (6).

In 1927, B. RENSCH and Mrs I. RENSCH travelled in Bali, Lombok, Soembawa, and Flores (7). This German zoological expedition, through the care of Mrs RENSCH, added to the phytography of the Lesser Sunda Islands by a fine herbarium. Mrs RENSCH examined and described the Ferns herself (8); the Phanerogams were partly elaborated by J. VON MALM (9).

C. N. A. DE VOOGD, in charge of the forests of the Lesser Sunda Islands (1933-1937) utilized the chance for making collections and observing the vegetation very well. His *Botanische Aanteekeningen* deal with all the major islands (10).

VAN STEENIS worked also in Bali (1936). He published his notes in two papers (11). He wrote on fossilized woods of Sumba and Sumbawa (12) in connexion with his plant geographical theories (§99).

O. JAAG, a Swiss lichenologist, collected in Bali, Flores, and Alor (1938), mainly Cryptogams but also a large amount of Phanerogams. Miss C. DU BOIS's collection was worked on by VAN STEENIS (13). She was an American ethnographer who made studies in Alor in 1938-1939.

S. BLOEMBERGEN, a Dutch systematist then in the employ of the Forestry Service, travelled in 1939 in the Lesser Sunda Islands. He explored especially the forests of Wetar (14).

A survey of the Ferns of the Lesser Sunda Islands was written by O. POSTHUMUS (§§ 100, 108) and published in 1943 (15); this was accompanied by an account of the botanical explorations of the islands more detailed than could be given here and from the pteridologist's point of view. The present survey only conveys some idea of the amount of material still waiting to be revised in the future instalments of *Flora Malesiana*.

References: (1) Ann. Mus. Hist. Nat. Paris 3 (1834) 345-501 (1835). (2) Linnaea 15 (1841) 161-208, 314-350, 476-480. (3) Hook. Comp. Bot. Mag. 1 (1836) 344-351. (4) Nat. Tijds. Ned. Ind. 14 (1856) 111-206. (5) FORBES, A Naturalist's Wanderings (1885) 415-488. (6) Trop. Natuur 15 (1926) 75-82; Nat. Tijds. Ned. Ind. 87 (1926) 27-122; Verh. Kon. Akad. Wet. Amsterdam, 2e sect., 33 (1930) 871-875. (7) RENSCH, Eine biologische Reise nach den Kleinen Sunda Inseln (1930). (8) Hedwigia 74 (1934) 224-256. (9) FEDDE, Rep. 34 (1934) 255-307. (10) Trop. Natuur 25-30 (1936-1941) *passim*. (11) *ibid.* 25 (1936) 158-159; *ibid.* 26 (1937) 69-78. (12) Chron. Nat. 103 (1947) 237-239. (13) Blumea 6 (1948) 247-262. (14) Tectona 33 (1940) 110-196. (15) Ann. Jard. Bot. Buitenzorg, hors série (2603 = 1943) 35-113.

106. Recent phytography of New Guinea

Javan phytography, chiefly by the efforts of a single phytographer of outstanding merit, and also

because of the easy accessibility of the wild flora from Buitenzorg, has shown most progress. Sumatra and certainly also Borneo being both decidedly less explored and the collections less studied, cannot dispose of a fund of literature comparable to that of Java. In the preceding paragraphs, it was demonstrated that, though the size and number of collections of the 'eastern archipelago', i.e. Celebes, the Moluccas, and the Lesser Sunda Islands, are more conducive to an advanced phytography than those of Borneo and Sumatra, the arrears in the elaboration of the materials are so large that their phytography is probably even more backward even if the comparatively poorer flora is taken into account. In the 20th century, the botany of New Guinea has roused a vivid interest with the result that New Guinean phytography is rapidly progressing.

The collections secured by expeditions or residents were eagerly expected and in the course of few years either consecutive series of articles or individual papers appeared; a splendidly executed periodical 'Nova Guinea' was entirely devoted to the natural history of this great island, a plant geographical outpost of the utmost significance, a vast area of land, harbouring many known, many unknown, autochthonous botanical marvels.

The phytography of New Guinea may be separated into three groups of contributions, though some explorers or authors have extended their work beyond the limits adopted here. Starting in the West of the island, the phytography of the Dutch territory is to be considered, secondly, that of the northeastern parts (largely from German sources) and finally that of the southeast, where chiefly British and Australian botanists worked. The political boundaries have caused that the three groups of phytographers paid often but little attention to what had been described over the border, but a few favourable exceptions exist. On the whole, however, the phytography of New Guinea was developed by a peaceful collaboration of many nations.

Some efforts were made to bring method into the rapid progress of New Guinean phytography ('Nova Guinea', LAUTERBACH's *Beiträge*) but the whole remained chaotic and there is no reason to expect much endeavour towards synthesis in a near future. Many thousands of specimens gathered on the frequent expeditions into various parts of the island wait study; here again, the *Flora Malesiana* may contribute decisively towards a co-ordinated knowledge of the New Guinean plant world.

(1) *Dutch West New Guinea*. C. L. BLUME (§ 47) chiefly in his *Rumphia* and F. A. W. MIQUEL (§ 48) in his *Annales* referred, in the 19th century, to West New Guinean plants (ZIPELIUS, § 50). TEYSMANN (§ 53) made a collection in 1871 and SCHEFFER (§ 55) wrote in the first volume of the Buitenzorg *Annales* an account of what had been achieved till that date (1876) including several new plant descriptions (1). BECCARI visited the island three times (1871, 1875, 1876) and explored in particular the Arfak Mountains and 'Vogelkop': the majority of his finds were described in *Malesia* (§ 78).



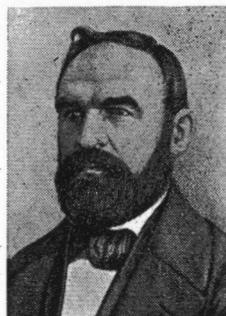
WHITE



WILLENOW



HUB. WINKLER



ZOLLINGER

O. WARBURG (§ 78) added to the phytography of western New Guinea and adjacent regions (2). VALETON gave, after TREUB and JAHERI's trips (1893, 1901, § 65) another enumeration (3).

With the aid of the 'Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën' (Society for the Advancement of the Natural Sciences in the Netherlands Colonies) and the 'Indisch Comité voor Wetenschappelijke Onderzoekingen' (Neth. Ind. Committee for Scientific Research)—both organizations had repeatedly supported botanical exploration in the Archipelago (Borneo)—a periodical began to appear in 1903, entitled 'Nova Guinea'. This was issued at irregular intervals and as separate reprints were distributed in advance of the official date of publication, many new names contained in it cause difficulties in matters of priority. On the other hand, 'Nova Guinea', sponsored by the Netherlands Government, is the most sumptuously edited periodical devoted to New Guinea in existence.

'Nova Guinea' was intended to receive work on the ethnography, geography, zoology, and botany of the island, based in particular on the results of the 20th century Dutch expeditions. Volumes 8 (1909–1914), 12 (1913–1917), 14 (1924–1932), and 18 (1926 →) so far have been occupied by phytography; they were edited by Dr A. A. PULLE. C. E. A. WICHMANN composed a detailed survey of the exploration of New Guinea in the first volume. He was also the leader of the expedition in which H. A. LORENTZ participated (1903). G. M. VERSTEEG accompanied the 2nd LORENTZ Expedition of 1907, and also the 2nd of A. FRANSSEN-HERDERSCHEE (1912–1913), in which PULLE took part. VERSTEEG and PULLE (later a Professor of Botany at Utrecht who specialized in the botany of Surinam) are among the foremost Dutch collectors.

To be noted are also the collections of J. W. R. KOCH, a physician and ethnographer who penetrated into SW. New Guinea in 1904–1905 on an expedition sponsored by the 'Koninklijk Nederlandsch Aardrijkskundig Genootschap', the large one of L. S. A. M. VON RÖMER (1909–1910, to S. New Guinea), of M. MOSZKOWSKY (a German, who travelled in the Mamberamo region, 1910–1911), of R. F. JANOWSKY (an Austrian, who collected in the same region, 1912–1914), and of K.

GJELLERUP (a Dane, who was accompanied by AJOEB of the Buitenzorg Gardens when he explored in Dutch N. New Guinea with the Dutch-German boundary commission, 1910–1911). The latter two collectors belonged with some others, e.g. W. K. H. FEUILLETAU DE BRUYN and A. CH. T. THOMSON, to the so-called exploration detachments (13).

English contributions to the phytography of Dutch New Guinea consisted e.g. of Miss L. S. GIBBS's valuable work on the Arfak Mountains (4), and RIDLEY's description (§ 88) of A. F. R. WOLLASTON's plants (5) collected on an expedition to the Carstensz Mountains; partly together with C. BODEN KLOSS (§ 101), WOLLASTON assembled a large herbarium (1910–1913) in South New Guinea.

A new Dutch expedition (1920–1921) to the Mamberamo River and the Wilhelmina Mountains was made by H. J. LAM (§§ 99, 104) who wrote extensive travel accounts (6); besides he studied New Guinean plant geography and added to its phytography (7). W. M. DOCTERS VAN LEEUWEN (§ 97) joined the Dutch American STIRLING expedition of 1926 and added considerably to the large collections he had made in other parts of the Archipelago. E. MEIER DREES accompanied L. J. BRASS on the 3rd ARCHBOLD Expedition of 1939 and again vast amounts of herbarium were preserved (8). E. MAYR, a German-American ornithologist collected in the Arfak Mountains and near Geelvink Bay (1928). P. J. EYMA (§§ 103, 111) extended his explorations to the Wissel Lakes (1939); the fate of his exemplary collections was mentioned before (§§ 103, 104). R. KANEHIRA and S. HATUSIMA made a fine collection on their trip into the interior (Geelvink Bay region) in 1940, which formed the material base of a series of articles (9). The Sorong area was explored by the Swedish S. BERGMAN expedition in 1948 (10). The Forestry Service had much exploratory work done on the forests e.g. in the region and islands of Geelvink Bay (L. J. VAN DIJK) and of McCluer Gulf (Z. SALVERDA); these two forest officers wrote each a report (11, 12). E. LUNDQUIST made collections in the swamp forests of the South (1941).

From these collections, and some not mentioned here, a variety of publications resulted appearing in more than a dozen periodicals. Among the

numerous phytographers who wrote in 'Nova Guinea', I select, rather arbitrarily, BECCARI (1909), A. ENGLER and K. KRAUSE (1910, 1912, 1924, 1927), H. HALLIER (1913, 1914), C. LAUTERBACH (1910-1912), A. A. PULLE (1910, 1912), TH. VALETON (1911); the Orchid descriptions of J. J. SMITH occupy considerable space in these volumes. Much phytography pertaining to New Guinea is also found in 'Blumea' and in the 'Bulletin of the Botanic Gardens, Buitenzorg'.

(2) *Northeast New Guinea*. The phytography of the northeastern, formerly German, part of New Guinea is probably most advanced.

A first *Flora von Kaiser Wilhelmsland* by K. SCHUMANN and U. M. HOLLRUNG was published in 1889; the former composed with C. LAUTERBACH *Die Flora der Deutschen Schutzgebiete in der Südsee* (1901) which was supplemented by *Nachträge* in 1905; this latter was the largest volume. To O. WARBURG's work I have referred before (§§ 78, 104, and this paragraph).

The flora of the Kaiserin Augusta Fluss (or Sepik River) was explored repeatedly. The largest collections were assembled by the Swiss C. L. LEDERMANN (1912-1913) who was the botanist of the German expedition to that region. Important material were also the specimens of U. M. HOLLRUNG (1885-1888), F. C. HELLWIG (1888-1889; Finisterre and Sattelberg Mountains), C. LAUTERBACH (1896-1899), G. BAMLER (1898-1899), F. R. R. SCHLECHTER (1901-1903, 1906-1910), G. PEEKEL (14), and CHR. KEYSER (1909-1919).

It was felt, that the flora of Kaiser Wilhelmsland, searched so industriously by many collectors, deserved a special medium of publication and so, in 1912, *Beiträge zur Flora Papuasiens* began to appear under the editorship of C. LAUTERBACH (later continued by L. DIELS, who elaborated many families); in 1942 the 26th instalment appeared. LAM compiled a list of the families elaborated till 1934 (15).

A special fund, the 'H. und E. HECKMANN-WENTZEL Stiftung' financed the majority of the explorations. A. ENGLER, in his 'Botanische Jahrbücher' undertook to publish the *Beiträge*. The limits of 'Papuasia' vary according to the author. Often (German) New Guinea is the centre, sometimes the adopted boundaries extend as far as Celebes to the West and the Solomons to the East.

The *Beiträge* contain more than a hundred of papers, several large, the majority brief. Quite a number are accompanied by geographical notes. Some of the phytographers collaborating in the series are: O. BECCARI (1914-1923), L. DIELS (1912-1940), A. ENGLER and K. KRAUSE (1912-1924), H. HARMS (1917-1942), E. IRMSCHER (1913), G. KÜENTHAL (1924, 1940), C. LAUTERBACH (1912-1929), FR. MARKGRAF (1924-1936), R. PILGER (1914-1939), R. SCHLECHTER (1912-1932), H. SLEUMER (1939-1942), TH. VALETON (1914-1927), HUB. WINKLER (1922). A comprehensive paper on the Pteridophytes appeared in 1921 by G. BRAUSE.

This survey of German sponsored phytography may be concluded by a reference to M. BURRET'S

outstanding work (16) on Palms *e.g.* *Neue Palmen aus Neu Guinea* (1933-1937). He wrote several papers on other groups *e.g.* on *Tiliaceae* and some contributions to the L. J. BRASS collections (17). R. SCHLECHTER titled his largest work *Die Orchidaceae von Deutsch Neu Guinea* (1912-1914); he is the describer of more than a thousand New Guinean Orchids, new to science. C. MEZ described New Guinean *Myrsinaceae* (18).

Contrary to the custom of the Manila Herbarium (§§ 85, 107) the German botanists have preferred to keep the whole of the collections from New Guinea under their care and distributed only rarely duplicates; frequently all materials have been kept at Berlin. The consequence is that with the destruction of the Berlin-Dahlem Herbarium in the latest European war (29) numerous typifying specimens are lost and that all available information for the present and for all time is their description. In deciding critical points, the type specimen may be, and often is, indispensable.

The annihilation of the Berlin collections means a blow to New Guinean phytography from which it will suffer a long time. It is fortunate that at Wrocław (Breslau) a certain amount of duplicates seems to have survived.

Finally, to be mentioned among recent collectors, is Mrs MARY STRONG CLEMENS who secured vast collections, chiefly of mountain plants 1935-1940 (*cf.* also § 102).

(3) *Southeast New Guinea*. British New Guinea, or the Territory of Papua, had been visited in the 19th century by H. O. FORBES whose plants were elaborated much later (*cf.* § 105). W. BOTTING HEMSLEY *c.s.* worked on the collections of A. GIULIANETTI (Mt Scratchley, *c.* 1896) and of A. L. ENGLISH, in the Kew Herbarium (19).

Sir W. MACGREGOR, Administrator of British New Guinea, searched the Owen Stanley Range in 1889. He stimulated collecting and furthered New Guinean phytography considerably by giving F. VON MUELLER all support he was able to (20). VON MUELLER'S descriptions of Papuan plants are scattered in a host of small articles, often in rare periodicals (*e.g.* 'the Victorian Naturalist' (21), 'WING'S Southern Science Record' (22), and 'Melbourne Chemist and Druggist'). His main work is, as regards Malaysian botany, *Descriptive Notes on Papuan Plants*, which was discussed previously (§ 64).

F. M. BAILEY continued VON MUELLER'S work after the latter's death (1896) and described several collections from Papua in the 'Annual Reports of Papua and British New Guinea' and especially in the 'Queensland Agricultural Journal' (vols 7-26) as *Contributions to the New Guinea Flora*.

BAILEY, the author of important works (§ 64) died in 1915; the phytography of New Guinea was then continued by C. T. WHITE, Government Botanist of Queensland, in the Melbourne Herbarium, assisted by W. D. FRANCIS and of recent years by S. T. BLAKE.

WHITE wrote *A Contribution to our knowledge of the Flora of Papua* (23) and on the ligneous

plants collected (1925–1926) by L. J. BRASS (24). Together with FRANCIS he described C. E. LANE-POOLE's specimens (25). BLAKE showed a preference for *Cyperaceae* and *Gramineae* (26).

LANE-POOLE wrote an important report, *The Forest Resources of the Territories of Papua and New Guinea* (1925). G. BURNETT's *Timber Trees of the Territory of Papua* was one of the earliest publications in this field (1908).

American participation in New Guinean plant description centres round the RICHARD ARCHBOLD Expeditions (1933–1934, 1936–1937, and 1938–1939, the Dutch-American Expedition).

These penetrated mostly into the interior of Papua (Owen Stanley Range, Fly River region; the 1938–1939 expedition reached the 'Snow' or Wilhelm Mountains in Dutch New Guinea). Leader of the botanical explorations was L. J. BRASS, who assembled New Guinean collections of unequalled size and quality. Some papers contain his observations (27).

The largest American publication dealing with New Guinean phytography is E. D. MERRILL and L. M. PERRY's *Plantae Papuanae Archboldianae*, based on BRASS's specimens (and also on the collections of some others, e.g. C. E. CARR, cf. §§ 94, 102).

This series began in 1939 in the 'Journal of the Arnold Arboretum' and, though the editors elaborated most families or groups personally, by the assistance of a number of American and other phytographers, proceeded rapidly. In 1949, the 18th and final instalment was published which included an index to the series. Additional papers, supplementary to the series though not titled as such, (many are indicated as *Botanical Results of the Archbold Expeditions*), and also based on BRASS's specimens, are contained in the same 'Journal'. I mention C. T. WHITE (*Myrtaceae*, 1942, 1947, 1948), L. DIELS (*Annonaceae* and *Menispermaceae*, 1939), M. BURRET (*Palmae*, 1939), H. UTTIEN (*Cyperaceae*, 1939), F. W. PENNELL (*Scrophulariaceae*, 1939–1943), V. S. SUMMERHAYES (*Ficus*, 1941) C. E. KOBUSKI (*Theaceae* and *Oleaceae*, 1940), and there are others.

A. C. SMITH wrote *Studies on Papuan plants* in 6 instalments in the 'Journal' (1941–1944). The

grasses were in particular studied by A. S. HITCHCOCK and A. CHASE (*Papuan Grasses*, 3 inst., 1936–1943) and by J. R. REEDER who made a thesis on the *Gramineae-Panicoideae of New Guinea* (1948). MERRILL and PERRY worked also on CLEMENS's plants (28).

References: (1) Ann. Jard. Bot. Btzg 1 (1876) 1–60, 178–187. (2) Bot. Jahrb. 13 (1891) 230–454; *ibid.* 16 (1892) 1–32; *ibid.* 18 (1894) 184–212. (3) Bull. Dép. Agric. Ind. néerl. 10 (1907); cf. also Fedde Rep. 5 (1908) 377–397. (4) GIBBS, Dutch N.W. New Guinea (1917). (5) Trans. Linn. Soc. London, Bot., ser. 2, 9 (1916) 1–269. (6) Nat. Tijds. Ned. Ind. 87 (1927) 110–180, 187–227, 252–324; *ibid.* 88 (1928) 67–140; *ibid.* 89 (1919) 193–288; Engl. transl. of series in Sargentia 5 (1945) 1–196. (7) Trop. Natuur 11 (1922) 38–45; *Teysmannia* 32 (1921) 289–326; *Blumea* 1 (1935) 115–159; KARSTEN & SCHENCK, Vegetationsbilder, Reihe 15, Heft 5–7, Taf. 25–42 (1924). (8) J. Arn. Arb. 22 (1941) 271–342. (9) Tokyo Bot. Mag. (1941–1943) *passim*; cf. Fl. Mal. Bull. no 2 (1947) 48–49. (10) *ibid.* no 5 (1949) 129. (11) L. J. VAN DIJK, Boschbedrijf en boschbeheer in de Residentie Molukken, in het byzonder in Noord-Nieuw-Guinea. Mimeogr. Report. 1940. (12) SALVERDA, Rapport van een orienteerende exploratie in Z.W. Nieuw Guinea, Dienst v/h Boschw. Ned. Ind., ill. mimeogr. rep. 1938. (13) Verslag v. d. Militaire Exploratie van Nederlandsch-Nieuw Guinea 1907–1915 (1920) 440 pp. photos, maps. (14) Fl. Mal. Bull. no 2 (1947) 44; *ibid.* no 5 (1949) 124. (15) *Blumea* 1 (1935) 115–159. (16) Notizbl. Bot. Gart. Mus. Berlin-Dahlem (1933–1937); cf. also *ibid.* 10 (1927–1930) 198–201; Fedde Rep. 24 (1928) 253–296. (17) J. Arn. Arb. 12 (1931) 264–268; *ibid.* 20 (1939) 187–212. (18) Bot. Arch. 1–2 (1922–1923) *passim*. (19) Kew Bull. (1899) 95–126. (20) Nature 42 (1889) 382–383. (21) Vict. Nat. (1884–1896) *passim*. (22) Wing's South. Sci. Rec. (1882–1887) *passim*. (23) Proc. Roy. Soc. Queensl. 34 (1922) 5–65. (24) J. Arn. Arb. 10 (1929) 197–274. (25) Proc. Roy. Soc. Queensl. 38 (1927) 225–261; *ibid.* 39 (1928) 61–70. (26) *Blumea*, Suppl. 3 (1946) 56–62; J. Arn. Arb. 28 (1947) 109–116, 207–229; *ibid.* 29 (1948) 90–102. (27) *ibid.* 22 (1941) 271–342. (28) *ibid.* 29 (1948) 152–168. (29) Kew Bull. (1949) 172–175.

MALAYSIAN PHYTOGRAPHY AT PRESENT

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107. *The present state of Malaysian phytography*

From the preceding paragraphs a general picture may be formed of the present state of Malaysian phytography. Therefore, some brief, as it were supplementary, notes will suffice here.

In the United States of America, the attention is mainly directed to New Guinea (§ 106) and the Philippines (§§ 80–85); some time is also devoted

to the study of the Sumatran flora (§ 101), and to that of Borneo (§ 102). The largest collections present in North America are of New Guinea and of the Philippines; after the destruction of the Manila Herbarium, the systematical research of the Philippine vegetation will have to rest very largely, for many years to come, on the materials preserved in the Herbaria of the United States. The foremost Herbaria in this respect are those of the Harvard

University (Arnold Herbarium, Gray Herbarium), the U.S. National Herbarium (Smithsonian Institution), and the Herbarium of the New York Botanical Garden. In the paragraphs cited above, several of the American phytographers now contributing to Malaysian phytochemistry are referred to. In addition I wish to add the name of L. O. WILLIAMS (1) who described recently *Orchids* and *Corsiaceae* collected on the 3rd ARCHBOLD Expedition.

In Great Britain, the largest collections of Malaysian plants are kept at Kew and in the British Museum Department of Botany. The majority of the publications on the subject are contained in the 'Kew Bulletin', the 'Journal of Botany', and the 'Journal of the Linnean Society of London (Botany)'. The interest paid to Malaysian botany is, of course, focused on the Malay Peninsula (§§ 86-94) and Borneo (§ 102); incidentally contributions to the phytochemistry of other parts of Malaysia appear (§§ 101, 104).

In the paragraphs just mentioned I have not yet made reference to E. NELMES, author of a key to Malaysian *Carex* (2).

In the Netherlands, the largest Malaysian collections rest in the Rijksherbarium at Leyden (MIQUEL's Herbarium (§ 48) mainly at Utrecht). At Leyden, Malaysian phytochemistry is a prominent subject of study (cf. §§ 99-106). S. J. VAN OOSTSTROOM (§ 10) prepared there his monograph of *Convulvulaceae* (3), Miss J. KOSTER her revision of part of the *Compositae* (4) and her Dutch edition of MERRILL's *Plant life of the Pacific World* (1949). In the Utrecht Herbarium were prepared a number of Doctor's theses. Recent ones are e.g. the monograph of the *Burmanniaceae* by F. P. JONKER (1938) and the revision of the *Melastomataceae* of the Malay Archipelago (5) by R. C. BAKHUIZEN VAN DEN BRINK Jr (§ 100). At Groningen P. BUWALDA, a pupil of DANSEUR's, wrote a revision of *Umbelliferae* (12), S. BLOEMBERGEN (§ 105) published on *Alangiaceae* (6), and J. WASSCHER on *Podocarpus* (13).

The periodicals 'Nova Guinea', 'Blumea', and the 'Receuil des travaux botaniques néerlandais' contain the major part of Malaysian phytochemistry.

In Germany, Malaysian plants were mainly described in the Herbarium at Berlin-Dahlem, and at the Hamburg Botanical Institute. Though New Guinea was preferably studied (§ 106), there was also a definite interest in the Bornean flora (§ 102), and in that of the 'eastern archipelago' (§§ 103-105). The periodicals to be remembered first are 'Botanische Jahrbücher', the Hamburger 'Mitteilungen', the 'Notizblatt' (Berlin-Dahlem), FEDDE's 'Repertorium', and the serial 'Das Pflanzenreich'. Not mentioned so far was W. DOMKE's work on *Thymeleaceae* (14).

Although it is to be feared that the loss of the Berlin Herbarium (§ 106) will reduce German contributions for some time to come, G. KÜKENTHAL's recent studies in *Rhynchosporoideae* ought not to pass unmentioned (7) nor H. SLEUMER's studies in *Ericaceae* (15) of New Guinea, in *Rhododendron* (16), and in *Vaccinioideae* (17).

In France the 'Muséum National d'Histoire Naturelle de Paris' keeps the largest Malaysian collections. Occasionally some addition to Malaysian phytochemistry comes from French sources apart from the valuable work done in respect to the phytochemistry of Indo-China. LECOMTE's 'Notulæ Systematicæ', and the 'Bulletin du Muséum' are to be noted. It is to be regretted that the French phytographers in recent years have had no facilities to participate to such an extent in the development of Malaysian plant description as French plant exploration would have justified. A number of articles on *Apocynaceae* (partly Malaysian) was published in rapid succession by M. PICHON (8).

Switzerland, in possession on the treasures of the DELESSERT Herbarium and the inheritance of the DECANDOLLE's, will remain a main source of materials and data. The collections are at Geneva in the 'Conservatoire et Jardin botaniques'. Incidental contributions appear, as a rule, in 'Candollea'.

In Italy, BECCARI's collections are preserved at Florence. Malaysian phytochemistry is rarely the subject of descriptive articles but, if so, usually in the 'Nuovo Giornale' and, possibly, in 'Webbia' (resumed in 1949).

In India, the Calcutta Herbarium, issuing the particularly beautiful 'Annals of the Calcutta Botanic Garden', produces the largest amount of work of interest to Malaysia. A second periodical of importance is the 'Journal of the Asiatic Society of Bengal'.

In Ceylon, Peradenya has not been able to maintain its former glory. The main periodical in our field is the 'Ceylon Journal of Science, Section A. Botany'.

In Australia the Herbaria at Brisbane, Sydney, and Melbourne contribute to Malaysian phytochemistry, chiefly to that of Papua. The position was generally outlined in § 106.

In China, contributions to Malaysian phytochemistry are found in 'Sunyatsenia', 'Sinensia', &c.; in Japan, in various botanical journals. Publishing authors are T. NAKAI (§§ 12, 111; (9)) S. HATUSIMA (§ 106; (10)) and J. OHWI (11).

References: (1) Bot. Mus. Leaf. Harv. Univ. 12 (1946) 149-172, 179-182. (2) Kew Bull. (1946) 5-29. (3) Blumea 3 (1938) 62-94; *ibid.* (1939) 267-371; *ibid.* (1940) 481-582; *ibid.* 5 (1943) 339-410; *ibid.* (1945) 689-691; J. Arn. Arb. 29 (1948) 414-418. (4) Blumea 4 (1941) 482-492. (5) Rec. trav. bot. néerl. 40 (1943) 1-391. (6) Blumea 1 (1935) 241-294; Bull. Jard. Bot. Btzg III, 16 (1939) 139-235. (7) Bot. Jahrb. 74 (1949) 375-509. (8) Mém. Mus. Nat. Hist. Natur. n.s. 24 (1948) 111-181; Bull. Mus. Hist. Natur. II, 19 (1947) 205-212, 294-301; *ibid.* 362-369, 409-410; *ibid.* II, 20 (1948) 190-197, 296-303, 381-382; Not. Syst. 13 (1948) 212-229, 230-254; Bull. Soc. Bot. France 94 (1947) 31-49; *ibid.* 95 (1948) 211-216. (9) Bull. Tokyo Sci. Mus. no 22 (1948) 1-43. (10) Tokyo Bot. Mag. (1941-1943) *passim*. (11) Bull. Tokyo Sci. Mus. no 18 (1947) 1-16. (12) Blumea 2 (1936) 119-220. (13) *ibid.* 4 (1941) 359-480. (14) Bibl. Bot. Heft 111 (1934). (15) Bot. Jahrb. 72 (1942) 207-269. (16) *ibid.* 71 (1941) 138-168. (17) *ibid.* p. 375-510.

108. *A note on recent descriptive studies of Malaysian Pteridophytes*

The phytophany of Malaysian Pteridophytes has received contributions from numerous botanists, whose chief occupation was the study of Phanerogams. Besides, some authors made Pteridophytes of Malaysia one of their chief subjects of research.

Among 19th century descriptions of Ferns were mentioned BLUME's work (his *Enumeratio* of 1827 and the 2nd volume of *Flora Javae*, cf. § 47), and DE VRIESE's monograph of *Marattiaceae* (§ 48). F. JUNGHUHN gave a list of publications on Javan cryptogams in his *Java* (1). VAN DEN BOSCH wrote on *Hymenophyllaceae* (1861), and there are considerable contributions in MIQUEL's *Annales* by G. METTENIUS (1863-1869) and M. KUHN (1869). BECCARI included in his *Malesia* a review of Ferns and *Lycopodiaceae* of Borneo and New Guinea (V. CESATI, 1886).

HOOKE's *Species Filicum* (1846-'64, with J. G. BAKER *Synopsis Filicum*, 1865, '68, 2nd ed. 1874) and J. G. BAKER's *Handbook of Fern Allies* (1887) are critical compilations which included all knowledge assembled so far.

RACIBORSKI (§ 71), CHRIST, VAN ALDERWERELT (§ 75), and COPELAND (§ 84) supplied by their work many valuable data to C. A. BACKER and O. POSTHUMUS when they were composing their excellent *Varenflora voor Java* (1939) which contained also the results of their many years of research into the Javan Ferns. They listed the most important literature. O. POSTHUMUS (§ 105, 110) is to be regarded as one of the leading pteridologists of Malaysia in the first half of the 20th century. Among his various papers I select *Malaysian Fern Studies I-III* (1). On occasion of his evaluation of the stem anatomy in *Polypodiaceae* (2), he added a useful bibliography.

A. H. G. ALSTON (§ 21) monographed *Selaginella* (3).

The reader is referred for further information to F. VERDOORN's *Manual of Pteridology* (1938), C. CHRISTENSEN's *Index Filicum* (1905-'34), and E. B. COPELAND's *Genera Filicum* (1947).

References: (1) Verh. Kon. Akad. Wet., sect. 2, 36 (1937) 1-67; *ibid.* 37 (1938) 1-35; Ann. Jard. Bot. Btzg, hors série (2603 = 1943) 35-113. (2) Rec. trav. bot. néerl. 33 (1936) 775-802. (3) Bull. Jard. Bot. Btzg III, 13 (1935) 432-442; *ibid.* 14 (1937) 175-186; 16 (1940) 343-350.

109. *Useful plants described*

The study on economic plants is older than that of taxonomy; it may be said that taxonomy received a main stimulus for its development from the necessities of defining the status, and of furnishing a means of recognition, when economic properties to be found in certain plants had to be recorded and made publicly available. With the emancipation of taxonomy, economic botanists were no longer required to occupy themselves with phytophany; a scientific name for the plant under discussion represented an efficient directive when its identity was to be established.

When dealing with the flora of a well-searched region, this practice proved to be satisfactory. Articles discussing the economic value of some species might be used to full advantage as long as the name of the plant under consideration could be, and was, given correctly. In regions of which the flora had been studied to a limited extent, no such direct approach was possible and the economic botanist of the present saw himself not infrequently obliged to describe his plants 'botanically', in order to make clear where his data were applicable or, otherwise, to call in the assistance of professional phytophany. The endeavour of the economic botanist to execute the required phytophany personally often fell short of its aim and, for example, much of the work of A. CHEVALIER on the economic plants of Indo-China (1) is practically useless as it will for ever remain uncertain which plant species was referred to. CHEVALIER failed, certainly not in all of his work but in some instances, to make his subjects recognizable. A far more serious case is that of CH. CREVOST and CH. LEMARIÉ who, dealing with the economic botany of the same region, supplied erroneous names (2).

Quite the opposite is demonstrated in J. J. OCHSE's books on vegetables and fruits *Fruits and Fruitculture in the Dutch East Indies* and *Vegetables in the Dutch East Indies* (§ 99). Here meticulous descriptions (by R. C. BAKHUIZEN VAN DEN BRINK Sr), and drawings, accompany the sections of the text dealing with practical uses. This method supplies the reader, in addition, instantly with the data to identify any edible plant he may meet with.

When discussing the phytophany of the 19th century, I have repeatedly pointed to economic botany, cf. HORSFIELD (§ 40), DE VRIESE (§ 48), HASSKARL (§ 53), BURCK (§ 67), KOORDERS (§§ 69, 73), GRESHOFF (§ 74), TSCHIRCH (§ 77), WARBURG (§ 78), BROWN (§ 83), RIDLEY (§§ 87, 88), BURKILL (§ 90), BACKER (§ 100), and in various other paragraphs.

The first effort to write a comprehensive work on all the economic plants in the Netherlands East Indies had been made by A. H. BISSCHOP GREVELINK in his *Planten van Nederlandsch-Indië bruikbaar voor handel, nijverheid en geneeskunde* (1883), which was followed by a *Nieuw Plantkundig woordenboek voor Nederlandsch-Indië* by F. S. A. DE CLERCQ (ed. M. GRESHOFF 1909, § 74).

A luxurious work on some useful or decorative plants in Java was made of 36 coloured plates, *Fleurs, fruits et feuillages choisis etc.* bij Mrs B. HOOLA VAN NOOTEN-DEN DOLDER (1864).

The main works on economic botany in Malaysia of the 20th century are at present W. H. BROWN's *Minor products* (§ 83), I. H. BURKILL's *Dictionary* (§ 90), J. J. OCHSE's books on fruits and vegetables mentioned above, and K. HEYNE's *De nuttige planten van Nederlandsch Indië*.

HEYNE was Head of the Museum for Economic Botany at Buitenzorg (1906-'27), an institution entirely built and maintained through his devotion. The exhaustive compilation of all data obtained previously was only a minor part of his work. Collectors travelled for years (H. A. Gus-

DORF 1913-'14, C. W. GRASHOFF 1915-'16, V. M. A. BEGUIN 1919-'23, also ACHMAD, BRUNIER, and DUMAS) on his behalf in the Archipelago assembling specimens alleged to be of economic importance; HEYNE himself had a small experimental garden near his office. The results were embodied in *De nuttige planten* (3).

HEYNE's texts lack the literary qualities of BURKILL's. His book is typographically less attractive, his articles have less direct appeal to the reader. On the other hand, HEYNE's sources were crude and unsifted; BURKILL, writing ten years later on the products of a much smaller area, with HEYNE's work at his disposal, had no mean advantage. Moreover, if HEYNE seems to have burdened his chapters now and then with too much detail, it may be advanced, that a surprisingly large amount of these details have proved to be useful, and having them arranged and available in one comprehensive work means that they are not forgotten, a fate that would inevitably await many facts now easily accessible in *De nuttige planten*. HEYNE's compilation is, in addition, critical and conclusions are advanced with caution. *De nuttige planten* will always remain an authoritative source and an excellent point of vantage when deciding on the direction of new research. A verbatim new edition is shortly to appear.

HEYNE was fortunate in having the voluntary assistance of some contemporaries. C. A. BACKER helped him with the identification of his specimens and wrote practically the chapter on the grasses; C. VAN OVEREEM assisted in the Cryptogams.

A valuable aid in identifying timber trees when only sterile material is available is F. H. ENDERT's *Geslachtstabellen voor Ned.-Indische Boomsoorten naar vegetatieve kenmerken* (1928).

I have mentioned before BACKER's work (§ 100) on the weeds of the sugarcane fields (vol. 7 of the *Handboek ten dienste van de Suikerrietcultuur*) and, in collaboration with D. F. VAN SLOOTEN, on the weeds of the tea plantations (cf. § 100).

The necessity of distinguishing among cultivated sugarcanes induced J. JESWIET c.s. (in particular assisted by BACKER), to draft meticulous descriptions of the varieties (4) accompanied by some general studies in *Saccharum*.

Here belongs also *De Oost-Indische Cultures* by K. W. VAN GORKOM (1884, new edition by H. C. PRINSEN GEERLIGS, 1917-1919). Mention has to be made of P. J. S. CRAMER's descriptive work (5) in the genus *Coffea* (1913) in connection with his investigation of the history of its introduction and its selection.

Horticulture was served by DAKKUS in his books on Orchids (cf. § 97) and more still by M. L. A. BRUGGEMAN in his *Sierboomen* (1938) and the charmingly illustrated *Indisch Tuinboek* (1939).

In the Netherlands, the study of Malaysian economic botany is largely centred in the 'Indisch Instituut' (formerly 'Koloniaal Museum', later 'Koloniaal Instituut') which issued a *Beschrijvende catalogus* and a large series of *Bulletins*.

References: (1) Bull. Écon. Indo-Chine, *passim*. (2) CREVOST & LEMARIÉ, Catalogue des produits de

l'Indo-Chine 5 vols (1917-1935) (3) HEYNE, *De nuttige planten van Ned. Ind.* 1st ed. (1913-1917), repr. vol. 1 (1922), 2nd ed. (1927). (4) Meded. Proefstat. Java Suikerind. vol. 6, pt 5, 8, 13 (1916), cntd *ibid.* Landbouwkundige serie (1917) nos 3, 8, 12, 17; *ibid.* (1918) 5; *ibid.* (1920) 4, 9; *ibid.* (1925) 12, 13; *ibid.* (1926) 16, 17; *ibid.* (1928) 19. (5) Meded. Dep. Landbouw 11 (1913).

110. Subjects not discussed

In this short history, I have advised repeatedly that no attempt could be made for an exhaustive study of any of the subjects under discussion. It seems advisable to point out at this moment that a considerable number of facts and events, influencing the course of development of Malaysian phytography, have not been touched on at all.

I mention, therefore, in passing the 'Nederlandsch-Indische Vereeniging tot Natuurbescherming', founded in 1912, mainly by the initiative of KOORDERS (§ 73) and DAMMERMAN (§ 105). The results of this Society for Nature Protection have been so considerable, and the opportunities so numerous, to investigate what would have disappeared without trace, had it not been for its interference, that phytography has benefited, and will continue to benefit, greatly. In 1918, the Society edited the first series of an *Album* which consisted of plates with accompanying text, somewhat in the style of KARSTEN and SCHENCK's *Vegetationsbilder*. In 1939 appeared *3 jaren Indisch Natuurleven*, a most informative, and beautifully illustrated, commemorative volume.

The scientific research of the protected areas is entrusted to the Buitenzorg Botanic Gardens; the organisation and management to the Forestry Service.

Another subject not discussed is palaeobotany, the phytography of extinct and fossilized plants. The reader will find a survey of the research done and a literature list in POSTHUMUS's (§§ 100, 108, 111) *On palaeobotanical investigations in the Dutch East Indies and adjacent regions* (1).

There are also the methods of collecting and of preserving specimens in the field, the methods of preserving, mounting, and arranging specimens in a herbarium, and the methods of labelling, either in the field or in the herbarium. The invention of the 'Wardian Case', by N. B. WARD, in 1836, which opened the possibility of bringing hundreds of species, hitherto untransportable, from the tropics into institutes where phytographers described them, might well have received some consideration. These, and many other points I cannot elaborate now but I wish that the reader should be aware that phytography is a basic science, an essential to all botany; that it is, therefore, connected with all branches of plant science.

References: (1) Bull. Jard. Bot. Btzg III, 10 (1929) 374-384.

111. The effects of the 2nd World War

The second World War has left a lasting imprint on Malaysian phytography. First of all, phytog-

raphers of standing and of promise met with an early death as one of its consequences. I refer here only to R. C. BAKHUIZEN VAN DEN BRINK SR (§§ 2, 99, 109), P. BUWALDA, who had roused high hopes by his revision of Malaysian *Umbelliferae* (1) and his forest explorations (§ 104), P. J. EYMA, the industrious collector and traveller in Celebes (1937), Ceram (1937–38) and New Guinea (1939), O. POSTHUMUS, a leader in the field of pteridology (§§ 100, 105, 108), and C. F. SYMINGTON, whose *Manual of Dipterocarps* (§ 92) testifies of his skill; they died in consequence of the war in Malaysia.

It is beyond the scope of this essay to mention the many able amateur-collectors who perished during this war in Malaysia or in continental Asia; their memories are kept living in the first volume of this work.

In the Netherlands, *Flora Malesiana* lost its prominent cyperologist H. UTTIEN and its most prominent promoter B. H. DANSER who had agreed to share the editorship of this work. In Germany, the death of L. DIELS prematurely finished the career of, possibly, the ablest authority on the New Guinean flora.

The material losses were heavy, both in Europe and in Malaysia. Irreparable damage was done to the huge Berlin-Dahlem collections (3) resulting in the loss of many numerous type specimens (§ 106); less severe losses were inflicted to the Vienna and British Museum collections. In Malaysia, losses were serious at Sandakan (§ 101), Sarawak (§ 102) and at Kuala Lumpur (§ 92). The destruction of the Mar'ia Herbarium is a heavy blow to phytography (§§ 81, 85); fortunately the wise policy of a generous distribution of duplicates had been long adopted by MERRILL, and the labour to assemble the big Philippine collections has not been in vain. Nevertheless, a number of type specimens is irretrievably lost. In the aftermath of the war some damage was done at Buitenzorg resulting in the loss (2) of some very valuable East Malaysian collections of EYMA's (§ 103, 104, 106).

In addition, the progress of phytography halted in many centres during the war years, partly through the absence of scientists for reasons of war, and partly because the issue of botanical journals was almost completely discontinued. In Germany, the Netherlands, and in the United States work on the Malaysian flora was continued, however (*cf.* §§ 99–106).

References: (1) BUWALDA, *The Umbelliferae* of

the Netherlands Indies (1925). (2) *Fl. Mal. Bull.* no 5 (1949) 130–131. (3) *Kew Bull.* (1949) 172–175.

112. *Conclusions and prospects*

The account in the preceding pages has made it clear, I believe, that Malaysian plant description is contained in a mass of literature, from standard works which may be consulted at every botanical institute to small notes hidden in the few remaining copies of rare periodicals. Only an exhaustive bibliography can give satisfactory and detailed information concerning the work done in its entirety. A book of that nature is urgently required.

A practical conclusion, which may be derived even from this short history, is that the majority of the phytographical studies have been local, *i.e.* the flora or plant groups were described only as occurring in a limited area or in one island. Malaysia is essentially a homogeneous well-defined plant geographical region; phytographical research ought, first of all, to be directed towards revisions of *taxa* in the whole of Malaysia.

VAN STEENIS has demonstrated that in the progress of phytography in the tropics—which culminates in the issue of a general Flora—a clearly marked and fixed sequence of stages can be observed. Malaysian phytography, he found to have entered the 5th stage *viz* the composition of a critical general Flora (*Vakbl. Biol.* 29 (1949) 27).

For Java a local Flora is at present in course of publication (§ 100) and at Singapore a new local Flora of the Malay Peninsula is planned (*cf.* § 88). These local Floras will prove to be of great use and to advance phytography considerably. Nevertheless, they are historically and scientifically premature (belonging to stage 6!) and they will inevitably suffer from shortcomings avoidable when a general Flora of the whole of Malaysia could have been made to a guide and a source of information.

Our present *Flora Malesiana* is the brightest hope of future Malaysian phytography. Many have joined in its writing; work is done in the main, and in many of the smaller, Herbaria of the world and there is whole-hearted support and enthusiastic international co-operation.

The profound change in the Government of Malaysia will affect phytography, let us hope, not unfavourably. The words of JOANNIS COMMELIJN (1701) may conclude this survey of the history of Malaysian phytography:

“Het blijft echter zeker, dat deeze Wetenschap, gelijk alle andere, nu meerder dan minder heeft gebloeit, na dat de toestand der heerschappijen en neigingen der Opper machten dezelve begonstigen.”

Acknowledgments. I am greatly indebted to Dr C. G. G. J. VAN STEENIS who spared neither his criticism nor his constructive help, much to the betterment of my work. He supplied me with the portraits from his iconotheca. Mr E. J. H. CORNER read the text. Dr E. D. MERRILL sent the photo-

(transl.) “It is certain, however, that this Science, like all Sciences, flourished sometimes more and sometimes less, all in accordance with the inclination of Rulers and the Favour of Government.”

graph of the Manila Herbarium, Mr R. E. HOLTUM that of Singapore. I wish to thank also the Staffs of the Buitenzorg and the Leyden Libraries who assisted me in all respects and walked cheerfully many miles in search of desired samples of phytography.

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