

REVIEWS

R. HEGNAUER, Chemotaxonomie der Pflanzen. Eine Übersicht über die Verbreitung und die systematische Bedeutung der Pflanzenstoffe. Vol. 1. Thallophyten, Bryophyten, Pteridophyten und Gymnospermen — Birkhäuser Verlag, Basel und Stuttgart, 1962, 8°, 520 pp., 6 figures. Clothbound, DM 96.—.

An account of phytochemical substance has been provided by Wiesner's *Rohstoffe des Pflanzenreichs*, arranged by products, another account has been given by Karrer, compounds of established constitution arranged according to a chemical system. Though useful, none of these works, including also those of Czapek and Wehmer, aims, however, to use phytochemistry as an auxiliary branch of plant taxonomy.

It does seem necessary here to stress in a concise way the importance of the subject for taxonomy. All of us have used some coarse phytochemical characters, looked at characteristic glands and crystals, observed and used colours of dried leaves, tasted plants for bitter substances, sniffed at aromatic oils, and other secondary compounds. The use of these characters as arguments for taxonomic purpose has, however, been erratic and only been employed if very obvious and/or abundant. Everyone of us looked for refinement of the aspect. This is the principal aim of the present endeavour.

It is of course clear that a plant organism is built up of chemical substances primarily emanating from and directed by the genome and of changing composition during ontogenesis, executed by a large hierarchic array of 'tool- and other machines' of macromolecular size, as in a factory, 'working' in harmony with the laws of chemistry and physics. Physiology within the plant (that is under constant conditions, and exclusive of environmental influence) is therefore essentially biochemistry. The chemical substances employed and produced during the process are, for this reason, as valid an expression of the character of the genome as are the morphological, anatomical, and cytological characters. Consequently it is to be expected that there will be a certain degree of parallelism between chemical and morphological characters. There is no essential difference in goal between systematical physiology, chemotaxonomy, and systematical botany, each discipline in its own field judging or estimating the manifestation of the genome of taxa, and comparing them.

This has long been recognized in systematic botany; in the present century it has been approached, with not much technical success, though theoretically fully justified, on a finer scale with regard to proteins by Mez c.s. Refinement of organic chemical analysis is making nowadays great progress and this is a promising facet of botanical science.

Whether this renewed attack will yield many 'new' aspects towards systematic botany remains to be seen. Under the general view given above it is not likely that chemotaxonomy will 'shake' the major frame built up by the systematist, but will obviously sustain this system as have done other auxiliary disciplines such as palynology, embryology, karyology, wood anatomy, blastogeny, etc. in the past. Besides that this would in itself be a great gain, putting the whole frame on a firmer basis, phytochemistry may be excellent for providing clues for affinity of isolated genera and families of doubtful or disputed affinity. Most of these are probably phytochemically untouched and it would be beneficial if they are examined in future.

Chemotaxonomy may also be extremely helpful in implementing taxonomy on its frontier of microsystematics (sometimes erroneously called 'micro-evolution'), with races, forms, varieties, and clones, for which gross morphology (and at least herbarium taxonomy) proves insufficient for distinction and definition. In this section it can also serve a useful purpose in linking taxonomy to genetics.

In the brief introduction of the work under review there is unfortunately not much discussion about the **proportional value** which should be attributed to the occurrence of chemical substances, similarly as the botanist adheres generally more value to the structure of wood than to indument or leaf margin. This is for the botanist also a remarkable phenomenon, as **constancy** is both found in basic and so-called superficial characters: phyllotaxis in *Rubiaceae*, simple leaves in *Myrsinaceae*, brown shining hairs in *Sapotaceae*. It would also be interesting to know whether sometimes in phytochemical taxonomy basic constant characters show deficiency in exceptional cases, similarly as they do show in morphological characters: placentation in Composites (as communicated to me by Dr Norlindh), phyllotaxis in *Ilex*, superior ovary in *Gaertnera* and some species of *Mastixiodendron*, etc.

Also the botanist would like to know whether in phytochemical definition a similarity is found with taxonomical definition in constancy of **combinations** of characters on which we generally depend so much, as for example only the combination of decussate leaves, interpetiolar stipules, inferior ovary and connate corolla mark a *Rubiaceous* plant, although in exceptional cases one of the combination may fail to come up.

Also a cleaner exposition would appear desirable about the status of what the author called "Sekundäre Pflanzenstoffe" which are the showy substances we were already acquainted with: sinigrin and related glucosides in *Rhoadales*, essential oils in *Synandreae*, etc. which are generally accepted as by-products of metabolism.

The author emphasizes that good characters can also be found in the primary substances (carbohydrate-reserves, fatty oils, proteins) as we know already from a few cases (myrosine in *Rhoadales*, inulin in *Synandreae*, etc.).

A similarity is found indeed in the degree of clearness in which a character turns up (nicotine abundant or merely in traces), as is found in taxonomy (leaf crenation in *Elaeocarpus* may vary from manifest to almost absent).

Another similarity is certainly the phenomenon of parallel or convergent occurrence of the same substance in taxonomically unrelated groups (plumbagon, inulin).

A comprehensive work, like the present one, can of course only be undertaken by a scientist with a profound knowledge of phytochemistry, systematic plant anatomy, and a wide knowledge of plants, capable of making this important synthesis of this subject bordering on both chemistry and botany. The author, professor of pharmacognosy, and recently appointed professor of experimental plant taxonomy at Leyden University, has, I feel, made an original, really worthy attempt to analyze and synthesize present day knowledge.

Following a brief introduction describing the plan upon which the book is based, the second section lists various books of references under the plant components; the third section of the book treats the families systematically.

Under the cryptogamic phyla and the families of spermatophytes there are always three headings following a concise introduction viz (i) systematical subdivision, (ii) anatomical characters, (iii) chemical characters, in which components are discussed under the headings of: pigments, cell wall constituents, lipoids, carbohydrates, essential oils, polyphenolic substances including flavonoids and colouring matters, as well as mineral constituents and miscellaneous components, each treatment being concluded by the "Schlussbetrachtungen". The latter contain the phytochemical characteristic of the group and the correlation of phytochemistry and alpha taxonomy; this net outcome is of course the thing which plant taxonomy is waiting for.

The handling of this immense material yielded several difficulties, for instance the plant names on which the phytochemical data in literature rest could not be verified; many are taxonomically or nomenclaturally obsolete and only in obvious cases the author replaced them by modern names or added modern equivalents. Almost always, I am told, phytochemists unfortunately omit to keep supporting herbarium material. Another important point is that the overall picture must at present be unbalanced, because of the very uneven covering of the phytochemical research and fragmentary data on many groups which are very important taxonomically. For example *Ephedra* is only examined well with respect to 'basic' components, but of *Gnetum* and *Welwitschia* hardly anything is known phytochemically. The same can be said about *Psilotaceae*, *Isoetaceae*, *Selaginellaceae*, *Cyatheaceae*, etc. etc. The author clearly points out these deficiencies and the limited conclusions which can be drawn. In scanning the pages one gets the impression that an overall phytochemical survey of the plant kingdom is still in its infancy, intensive research having hitherto mostly been done on useful plants for certain sections of compounds. Addenda in this volume indicate the large amount of research which is going on, but my estimate is that it will take many decades before the overall picture can be summed up.

Still even now, it is most interesting to take notice of the general conclusions, e.g. that probably chlamydoperms are no true gymnosperms, but show more affinity with angiosperms, that taxads are close to conifers, that a breaking up of lichens would not be in agreement with phytochemistry, etc. etc. Few botanists will know that nicotine has been found in *Lycopodium*, *Equisetum*, *Sedum*, *Eliptia*, *Zinnia*, *Mucuna*, *Asclepias*, besides *Solanaceae*.

The discrepancy on the subject of the Lichenes is a crux between taxonomy and chemotaxonomy, as chemotaxonomy can certainly not undo the manifest distinction between *Ascomycetes* and *Basidiomycetes*, neither as the study of venation or palynology can blur the demarcation between Monocotyledons and Dicotyledons. The solution will probably be found in the occurrence of the lichenous substances, which appear largely to be produced by the fungi, in non-lichenized fungi of which the majority have as yet not been analyzed phytochemically.

If I may express a wish, it is that the author will give in some future volume a more full introduction on the evaluation of phytochemical data, which seems to be very desirable from the botanist's point of view.

The book is well indexed, the treatment thorough and systematic, printing and binding excellent. The complete work is planned in 5 volumes, the second one, containing the Monocotyledons, being in the press. A great acquisition to botany with which the author is warmly congratulated.

D. B. O. SAVILE, Collection and care of botanical specimens — Publication 113 of the Research Branch, Canada Department of Agriculture, 1962, 124 pp., illustrated. Bound, \$ 2.00.

It is true that often collecting- and herbarium-techniques can be improved as one is easily inclined to continue as usual and to see the routine already mastered as the best one there is. When reading an overall-picture of the techniques used by others you can contemplate this matter at your ease and have a try with something new without being obliged to admit you have been working uneconomically up till now.

This new publication gives a thorough inventory of the methods used at the Plant Research Institute at Ottawa. In the introduction is clearly stated that this booklet does not deal with problems peculiar to tropical regions, which should be noted by readers in these parts of the world.

Chapter 1, dealing with vascular plants, clearly describes collecting-methods in temperate, alpine, and arctic regions, and gives many useful hints which should be read by all regular collectors. Also the handling of the material after collection up to and including filing and shipment of duplicates is dealt with. It is here that we take the liberty to criticize some points. Although many items to be noted on the fieldlabels are mentioned, the illustrated example does not seem a good choice. The description of flowerparts is lacking and replaced by the general impression "flowers purple", a mistake made by too many collectors already. The other point of criticism concerns the mounting procedure. In this booklet sticking the plant with its whole surface, except for inflorescences etc., and reinforcing it afterwards with strips or plastic is recommended. This method prevents the scientific worker from examining both sides of the specimen and what he is allowed to see is decided by the mounter. Botanical specimens are objects to be worked with, not to be filed untouched in a museum!

This idea making the herbarium a museum instead of a practically arranged collection of material to be worked with also appears from the arrangement recommended according to some taxonomic system down to genera and even to sections and subsections. This makes filing as well as extracting specimens unnecessary complicated. And every new monograph implicates rearrangement of the herbarium. What is easier than the alphabet?

The chapters 2 and 4 give sound information on collecting and handling fungi and lichens down to filing in the herbarium. The one suggestion to be made is that when drying small fungi it is recommended to put them in fine-meshed wire-baskets instead of in open paper bags. Wire-baskets, each containing a separate collection, can be stacked in tiers, greatly economize the space available and do not obstruct the free circulation of heated air as paper bags would do. A remark seems appropriate with regard to the temperature inside the drier. If the heat is supplied by a kerosine lamp (and the exhaust fan cannot be used) the temperature should not exceed 50° C so as to prevent the fungi from boiling.

W. VINK.

Catalogus arborum, fruticum ac plantarum tam indigenarum, quam exoticarum, in horto Johannis Gerardi civis & chirurgi Londinensis nascentium. Londini, ex officina Arnoldi Hatfield, impensis Johannis Norton. 1599. — Facsimile reprint 1962 (limited ed.) by Wheldon & Wesley Ltd., Codicote near Hitchin, Herts., England & Verlag J. Cramer, Weinheim, Germany. Printed in Germany. Pref. (in Latin) + 22 pages.

This is the catalogue of native and exotic plants grown in the garden of Johannes Gerardus (John Gerarde), London. The plant names (scientific and corresponding English ones) are printed in two columns, those in Latin alphabetically. There are no descriptions, references or illustrations. A short postscript by Matthias de Lobel (Lobelius) giving his fiat to the catalogue is added. The present reprint is apparently that of the second edition of Gerardus' name list, the first ("ex officina Roberti Robinson") was issued in 1596.

R. C. BAKHUIZEN VAN DEN BRINK JR.

MILDRED ARCHER, Natural History Drawings in the India Office Library. London, Her Majesty's Stationery Office, 1962, ix + 116 pp., 25 plates. Clothbound, sh. 27/6.

The first impression is one of a beautifully executed book. The second impression is not so good, as the caption under the frontispiece asserts us that a "Black-naped oriole on a *Eugenia* (*Oriolus chinensis*)" is depicted, which might be true as for the bird, but the plant, which can never be a *Eugenia*, having no opposite leaves, is perfectly recognizable as *Flacourtia rukam* Zoll. & Mor. The third impression is better again, suggesting that we have one of the many fine pieces of scholarship on an uncommon subject, which only an Englishman seems able to produce.

"In 1801", the text begins, "the Directors of the Honourable East India Company founded a public depository at their House in Leadenhall Street, London, for the miscellaneous material which had been accumulating with them for some years. The depository consisted of a Museum (a 'Cabinet of Natural and Artificial Products') for specimens and objects, and a Library for manuscripts, books and drawings.

When the existence of this institution became known, quantities of natural history material began to arrive and the Company steadily built up a large collection of natural history drawings. . . . Through presentations of this type, the Company had accumulated by 1859 the finest collection in the country of both drawings and specimens relating to India and South East Asia. All specimens and many drawings were later transferred to other institutions, but the India Office Library (as the Company's Library has been called since 1858) retained a representative selection of the Company's natural history drawings." The 'other institution' where most of the botanical drawings went to, is the Kew Herbarium; of the 5,000 drawings that remained in the India Office, only a few hundred figured plants, the rest representing animals.

This book contains a catalogue of these drawings, and an extensive introduction, in which the activities of the persons who in some way or other contributed to the collection are explained. As this makes very readable matter and throws a new light on activities of persons already known for their achievements in other fields of natural history, we have every reason to welcome the book.

The first drawings of natural history objects from Malaysia that eventually found their way to England, were made in Napoleonic time, when British naturalists proceeded to the territories their troops had taken from the Dutch: Malacca, Penang, the Moluccas, and also Bencoolen and Java. Most of the names discussed are familiar to the botanist of Southeast Asia: Wellesley, governor general of Fort William near Calcutta, who acquired one of the richest collections of drawings, Lord Edward Clive, T. Hardwicke, B. Houghton Hodgson, Sir Stamford Raffles, W. Marsden, R. Parry, all of them amateurs. There is more to be told, of course, of the professional naturalists in the Company's service: W. Roxburgh, N. Wallich, J. F. Royle, B. Heyne, F. Buchanan-Hamilton, W. L. Gibbons, E. de Jonville (who introduced cinnamon in Ceylon), C. McKenzie, N. Wallich (why two entries on the same man in the same chapter?), J. McClelland, W. Griffith, T. Horsfield, G. Finlayson. When Wallich, Clelland, and Griffith made a tour in Assam in search for tea, "Wallich was ill and irritable. He had failed to take enough drying paper for the expedition and as a result Griffith developed a grudge against him. Griffith was new to North East India and after voraciously collecting plants found himself unable to dry them all. He even caught Wallich removing some of his specimens from the plant presses and substituting own." "It is personal friction of this kind which may have underlain the sharp differences of opinion concerning tea cultivation which later developed." So the picture which naturally deals mainly with the organization of the drawing, what results were obtained, and where the drawings went, is completed with looks beside.

A few lines would have been formulated differently by a professional botanist. On p. 25 it would be better to write that in 1895 J. D. Hooker published one hundred of the plates to which he added descriptions instead of suggesting that Hooker wrote "a book on Orchids", and on p. 104 in the bibliography erroneously 1905 is mentioned as the year of issue of the same work.

A professional botanist always spells a generic name with a capital letter (*ocimum americanum*, plate 15; *epidendrum*, p. 49; *glycine sinensis*, p. 60), and the epithet with a small letter (*Camellia Sinensis*, p. 41); he would have written *Phanera diphylla* under plate 13, or anyway *Bauhinia* instead of *Bauhinea*.

A professional botanist also thinks better of J. J. Bennett & Robert Brown's *Plantae Javanicae Rariores*, and he very unlikely will utter the words (p. 81) "unfortunately the working up of the botanical collections was entrusted to Robert Brown, and the only result of all Horsfield's botanical research was Brown and Bennett's (correctly Bennett and Brown) *Plantae Javanicae Rariores* (1838—1852)". There can be no doubt that Robert Brown was one of the greatest intellects among the botanists of all times, nor that it was he who set the standard for the work which was largely carried out by his friend and assistant Bennett and was published with his approval. In De Wit's opinion (*Flora Malesiana* I, 4: c. 1949) the book is "photographically as well as historically a classic." It is with some regret that we see it so much undervalued by Mrs. Archer, who in the bibliography on p. 107 inserted it under Horsfield, although Horsfield is only the author of the Geographical Preface and the Postscript in that book.

This is easy criticism and I wish to make it understood that these minor shortcomings were the only ones that I could find, and that these do not diminish my esteem for Mrs. Archer's book. Drawings, which are essential to bridge the gap between specimens and descriptions, form a much-neglected group. Descriptive biology would have made far better progress if not so many excellent drawings had remained unpublished and forgotten. Many splendid biological drawings have been piling up, from Ferdinand Bauer's unsurpassed pictures of Australian plants prepared in 1801—1805 (see *Endeavour*, January 1960) to Van Steenis's magnificent collection of Javanese mountain plants prepared in 1938 (see *Endeavour*, July 1962) without finding a possibility for publication. We are grateful to Mrs. Archer for the efforts she has taken to remind the public of this largely unexploited mine of knowledge, and for the excellent way she and the publisher presented her results.

M. JACOBS.