

BOOK REVIEWS

P. MAHESHWARI (ed.), *Recent Advances in the Embryology of Angiosperms*. International Society of Plant Morphologists, University of Delhi 1963, X + 444 pp. and two indexes (authors and subjects, 23 pp.), with numerous illustrations.

This book supplements MAHESHWARI's "Introduction to the Embryology of Angiosperms" which was published in 1950 by the McGraw Hill Book Company, Inc., New York, Toronto, London. The present volume was printed in India and published by the wellknown Society mentioned above. The two volumes resemble one another very much in size, print, way of illustration, and references after each chapter. Together they form the most—and perhaps the only—complete and comprehensive source of knowledge on the embryology of Angiosperms. A third volume on the embryology of Gymnosperms and lower vascular plants would no doubt be warmly welcomed by all who are interested in homologies in all *Cormophyta*.

Differences between the two books are that the former (in this review referred to as M. '50) was written under the sole responsibility of Prof. MAHESHWARI, whereas the present one has been composed by the joint efforts of no less than fourteen authors, of whom seven are Indian, two French, two American, one English, one Italian, and one German. This measure was evidently necessary, and, indeed, most effective in view of the tremendous specialization and, consequently, the enormous literature on the subject of the last fifteen years. Accordingly, the embryology of Angiosperms has been considered from several points of view. It has greatly contributed to as well as been assisted by many fields of Botany. While M. '50 is what it claimed to be, an "introduction", the present book is "meant for those who have already gained some familiarity in this field" (Preface). The plan of the book in general follows that of M. '50, but some chapters have been given new titles or their contents have been rearranged, and some new ones were added.

The History and present status of Angiosperm (the Contents say: Plant) embryology is a short chapter, written by P. MAHESHWARI, briefly relating the older publications on the subject, which were more circumstantially treated in M. '50. The "Imperial Institute of the Netherlands" (obviously the Royal Netherlands Academy of Sciences is meant here, p. 2) is here mentioned to have announced a prize contest (1850) to solve the controversy between SCHLEIDEN and SCHACHT. The latter was given the award though he supported SCHLEIDEN's erroneous views on account of false observations: the problem of the origin of the embryo, either from the pollen tube or from the ovule had, in the mean time, already been correctly solved by HOFMEISTER (1849).

In the other chapters the following subjects have been treated and in this order, by the authors mentioned between brackets: male gametophyte (K. STEFFEN), ovule (R. N. KAPIL & I. K. VASIL), female gametophyte (B. M. JOHRI), fertilization (K. STEFFEN), endosperm (R. N. CHOPRA & R. C. SACHAR), embryo (P. CRÉTÉ), apomixis (E. BATTAGLIA), polyembryony (P. MAHESHWARI & R. C. SACHAR), artificial culture of embryos (MARY E. SANDERS & NANCY KENT ZIEBUR), control of fertilization and embryo development (N. S. RANGASWAMY), plant embryos as reaction systems (C. W. WARDLAW), fruit development (J. P. NITSCH), embryology

and taxonomy (B. M. JOHRI). As will be elucidated underneath, in my opinion another chapter should have been added, dealing with embryology from the viewpoint of comparative morphology of homologous structures and of the phylogeny of these structures. Considerations of this kind are now either omitted or scattered over various chapters.

As it is, the book touches upon life cycles, anatomy of sporangia, taxonomy, physiology, cytology, genetics, tissue and organ culture, and metabolism processes. It is exciting reading, even for a non-experimentalist, about the very intricate processes involved, to ponder about the relative autonomy, and at the same time flexibility of both organs and functions, about what has already been found out about the biochemistry of cells and functions and about mutual influences in the fields of nutrition and metabolism. It inspires admiration for the very minute techniques necessary to succeed in culturing excised, newly fertilised ovules up to the formation of viable seeds, and influencing their dormancy periods. Modern techniques reach far: separate anthers can be cultured, artificial parthenogenesis from vegetative cells has become possible. The mysterious behaviour of certain nuclei, notably in the embryosac, regarding repeated fusions and/or divisions and some other phenomena suggest deeper-rooted processes yet unknown. Impressive is also the minute research on tracing ^{14}C contents from nutritive solutions in ovules and embryosacs. And there are numerous other instances which have a bearing on some other branch of botany, well worth being studied by those interested. It is, indeed, a mysterious world full of interconnected activities of many kinds.

The style of the book is clear, though rather concise, but the references are exceedingly numerous, including many Indian, Russian, and Japanese. I found some twelve to fifteen Dutch authors quoted. I missed only a few which I happened to be familiar with, though it may be that I did not come across them on account of some suspected inefficiencies of the author's index. Among them are WARMING's treatise on the vascularisation of ovules (1913), ECKARDT's papers of 1937 (*Nova Acta Leop. N.F.* 5) and 1957 (*Neue Hefte z. Morphol.* 3), and RIJVEN's doctoral thesis on the *Capsella* embryo (Utrecht 1952, *Acta Bot. Neerl.* 1). Being mainly based on forms and functions observed or experimentally checked, the book makes the impression of a high degree of trustworthiness, leaving the choice between several hypotheses and theories briefly indicated to the readers' discretion. Accordingly, the descriptive or rather comparative point of view is in general more or less intentionally neglected. There is a very good and simple reason for this: the material available hardly allows a trustworthy survey of more than a limited taxial area. Of several families not a single representative has been investigated embryologically, of larger families only a small proportion of genera is known in this respect and the same is true for species within genera. Now that embryology has entered into a stage of experimentation and microphysiological and microbiological research, surely fascinating fields which have attracted a great many workers, there may be some danger that the descriptive investigation will be shifted to a background position. Just as taxonomy based on morphology has, in the past been greatly assisted by (wood)anatomy, teratology, genetics, palynology, ecology, biochemistry and even physiology, it cannot do without embryological evidence, both morphological and physiological. I wish, therefore, to stress the absolute necessity to extend this type of work as widely as possible. Chalazogamy (TREUB 1891) and porogamy may have lost their original taxonomic value, they

certainly remain important characters. The same is undoubtedly true for the many varieties in the embryology, described in this book, but also for such characters as the duration of the periods between pollination and fertilization, the relative longevity of pollen, the number of integuments, the vascularisation of ovules, nucelli, and integuments.

From the evidence now available it seems impossible to conclude whether double fertilization is a uniform differential character of Angiosperms. Whereas PORSCH's hypothesis on the origin of the majority of Angiosperm embryosacs (the *Polygonum* type) is still attractive, it seems more than questionable whether it holds for the remaining twelve types recognized. JOHN's derivation (p. 97-99) of these from the *Polygonum* type or its earliest stages is undoubtedly prejudiced. Equally prejudiced and utterly unacceptable are remarks like that (p. 47) which state that vascularized ovules are found both in "primitive" and in "advanced" families, as long as there is no unequivocal opinion about what these terms mean. It is quite obvious but too often overlooked that also the organs involved in Angiosperm embryology, like all others generally, must have resulted from developments from remote ancestors (Pteridophytes?). It may well be that embryosacs with numerous 'antipodal' nuclei (up to 200!) should rather be derived from some ancient megagametophyte with many vegetative prothallium cells. As I have repeatedly stressed, nowadays structures should not necessarily be explained by comparative ontogeny only. As it is, there is no conclusive evidence that the Angiosperm embryosac has a monotypic origin.

More or less the same is true regarding the presence of endosperm. As far as known, only three families have been reported to fail in developing endosperm viz *Podostemonaceae*, *Orchidaceae*, and *Trapa*, but perhaps there are more of these and particularly here there is a chance of some evidence from Palaeobotany. Another matter is whether 'no endosperm' is due to reduction (advanced) or is a 'primitive' character. The systematic distribution of the various types of endosperm seems to be better known than of those of the embryosac. Its correlation with the traditional taxa is often high, especially regarding genera. Still, the embryogenic classification which CRÉTÉ borrowed from SOUÈGES comprising six "megarchetypes" and sixteen "groups", contains many serious discrepancies from the viewpoint of classical taxonomy, many of which are hardly to explain but by assuming that the latter has been thoroughly beside the mark, which does not seem likely. Such discrepancies are for instance found in "heterogeneous families" like the *Papilionaceae*. Other examples are that *Levenhookia* (*Stylidiaceae*) should be placed near *Hypericum*, *Myosurus* near the *Cucurbitaceae*, *Capsella* near the *Personales*, *Plantago*, *Callitriche*, and *Buddleia*. *Cuscuta* shows even two different types within the genus.

Considerations of this kind are found in two places, first in CRÉTÉ's chapter on the embryo (pp. 196-215), and secondly in JOHN's chapter on embryology and taxonomy (pp. 396-438). As a matter of fact there are also several examples of embryological evidence which confirm earlier ones based on morphology. Like in the latter, there is, here too, a general trend to sever somewhat aberrant taxa of lower rank, e.g. genera from families and families from their order, and raise their rank so as to stipulate their relative independence. Some of them are: *Lilaea* belongs to the *Juncaginaceae*, *Butomus* constitutes a separate family near the *Alismataceae*, the *Lemnaceae* are actually closest to *Araceae*, the *Santalaceae* are related to the *Olcaceae* (including the *Octoknemataceae*), the *Viscoideae* should be raised to family rank near the *Loranthaceae*, *Pæonia* constitutes a separate family closer to the

Magnoliales than to the *Ranales*, *Peganum* belongs to the *Zygophyllaceae* rather than to the *Rutaceae*, the *Limnanthaceae* are to be given ordinal rank (*Limnanthales*), not being associated with either *Sapindales* or *Geraniales*, the *Stackhousiaceae* are to be amalgamated with the *Celastraceae*, the *Bombacaceae* are closer to the *Elaeocarpaceae*, *Tiliaceae*, and *Sterculiaceae* than to the *Malvaceae*, the *Actinidiaceae* belong to the *Theales* rather than to the *Dilleniales*, the *Alangiaceae* closer to the *Araliales* (*Umbelliflorae*) than to the *Myrtales*, *Trapa* is to be considered the representative of a separate family and so does *Menyanthes*, *Gunnera* and *Hippuris* are to be taken out of the *Haloragaceae* (as *Hippuridaceae*?), *Nelsonioideae* remain in the *Acanthaceae* and are not to be transferred to the *Scrophulariaceae*, *Sphenoclea* and *Pentaphragma* certainly belong to the *Campanulaceae* and show no relationship to other families.

Regarding the following taxa of doubtful position embryology cannot offer any constructive evidence: *Limeum* (*Phytolaccaceae*?), *Parnassia* (*Droseraceae*? *Portulacaceae*?), *Saxifragaceae*?, separate family?, *Balanites* (*Zygophyllaceae*?), *Cneoraceae* (*Parietales*? *Ranales*?, *Magnoliales*?, *Dilleniales*? etc.?), *Nyctanthes* (*Oleaceae*? *Verbenaceae*?).

Since some dubious points root in various possible interpretations (cf. the controversy regarding 'primitive' and 'advanced') of organs, both in the fields of macro- and micromorphology, there is an urgent need to broadly study the taxonomic and phylogenetical value of many structures, notably the aril and the integuments. VAN DER PIJL (quoted on p. 49) even asserts that the presence of an aril is of no phylogenetical significance! I doubt whether this could be said of any organ or structure. Each of them is the result of a mostly very long series of predecessors and the facts that their ancestry so far remains obscure and that no distinct function can be attributed to them does not mean that there is no ancestry at all. I would, therefore, strongly advocate that plant morphologists, interested in phylogeny tackle such problems and study them from all possible aspects. These would also involve the number of integuments and the significance of their ontological origin (reduction, splitting, fusion of primordia, etc., p. 45) and that of a double nucellus (*Opuntia*, p. 43; dichotomy?), and also that of the position of stamens and ovules in the flower.

There are also some minor incompatibilities, such as between the titles of the introductory chapters on history in the Contents (p. VII) and above the chapter concerned (p. 1), the plural of taxon written both as taxa and as taxons. The system of continuous numbering of the illustrations in M. '50 has been abandoned and replaced by a system of numbering according to the number of the chapters; this would, in my opinion, make only some sense if the latter are also mentioned at the top of each page. Another minor point is that in borrowing a picture from an older publication the legends are not always been taken over in full. The Subject and Plant Index (in M. '50: Subject Index) contains mostly plant names; for those of organs, processes, notions, etc., one has often to consult M. '50. The number of typographical errors is negligible and the book generally worthily matches its predecessor.

WILHELM TROLL. Die Infloreszenzen. Typologie und Stellung im Aufbau des Vegetationskörpers. 4 Teile. Band I. Deskriptive Morphologie der Infloreszenzen; Typologie der Infloreszenzen, mit 553 Abbildungen im Text, 615 Seiten; Gustav Fischer Verlag, Jena. DM 112.50.

The inflorescence forms one of the most difficult subjects of Angiosperm morphology, and a work on this topic by the man who may be regarded as the most prominent investigator in the field of Angiosperm morphology will doubtless be received with great interest. The reader who takes the trouble to study this voluminous work, will certainly not feel disappointed. It is a most thorough and at the same time very original study, illustrated by excellent photographs, drawings and diagrams, which deserves a place in every botanical library.

The first volume, which now lies before us, consists of two parts, viz. a descriptive "morphology" of the inflorescence, and a "typology", whereas the three volumes which will be published later, will deal with "monotelic synflorescences" (the meaning of this and the following terms will be explained hereafter), "polytelic synflorescences", the derivation of the polytelic synflorescence from the monotelic one, proliferating synflorescences, the synflorescences of the Umbelliferae and Compositae, the flowering shoots of the ligneous plants, and the inflorescences of the Monocotyledones.

In studying this work one should bear in mind that the subtitle is "Typologie und Stellung in Aufbau des Vegetationskörpers", i.e. typology (this is the term used by Troll for what other botanists usually call morphology; the term "morphology" itself is used by him in the sense of phytography) of the inflorescence and the position it occupies in the plan according to which the plant is constructed, for it is especially to the latter point that a large part of the work is devoted.

Before entering into details it is of importance to draw the attention to the fact that Troll uses the term "floreescence" for every uninterrupted series of flowers or groups of flowers (partial florescences). Such a series of flowers or groups of flowers is found at the end of a shoot, and if this shoot is the main one, the florescence is designated as the main or primary one. A "synflorescence" consists of such a main or primary florescence with its "basal internode" and a number of lateral ones, for which Troll uses the term "coflorescences". These coflorescences are found at the end of "paracladia", i.e. shoots arising from the axil of the leaves immediately preceding the basal internode of the main florescence. The part of the main shoot from which the paracladia arise, is called by him the "supplementing zone" (Bereicherungszone). The basal part of the paracladia may, apart from the basal internode of the coflorescence, consist of one or more other ones, and from the axil of the leaves on the latter some more coflorescences may arise. The purely vegetative zone below the synflorescence is called the "inhibited zone" (Hemmungszone).

This concept of the synflorescence with its coflorescences centred around a main florescence is apparently based on the assumption that the main florescence is always produced by the main shoot. In the herbaceous plants which are discussed in this volume, this may indeed be regarded as a general rule. However, when applied to woody plants this concept will of necessity lead to difficulties; the latter appear to be especially serious in the case of cauliflory. This problem is not discussed in the present volume, but it will doubtless receive due consideration in the part dealing with the flowering shoots of woody plants.

Another point which deserves our attention is that the term "bract" is used by Troll for every leaf which subtends a flower or a group of flowers; whether such leaves differ in shape, colour or size from the leaves which subtend buds developing into vegetative shoots, is therefore irrelevant. This makes it possible to regard an uninterrupted series of "axillary" flowers such as is found in *Veronica hederifolia*, as a "florescence". In the case of this species the subtending leaves differ slightly from those found in the preceding, purely vegetative zone, viz. by the shortness of their petiole, but even this difference is not indispensable, for in several rosette plants the leaves by which the flowers are subtended, are entirely indistinguishable from the other ones. In a case like that of *Veronica hederifolia* this interpretation is obviously advantageous, for it enables us to regard the whole series of axillary flowers as a raceme, i.e. as an inflorescence of the kind found in most of the related species. However, it might have been desirable to draw attention to the fact that the presence of a bud which may grow out to a vegetative shoot, may be of more importance for the distinction between vegetative leaves and "bracts" than the presence of a flower in the axil of the latter, for this flower may be lacking, so e.g. in the spikes of the *Blepharis* species; these spikes are provided with four pairs of bracts but with one flower only which arises from the axil of one of the bracts belonging to the uppermost pair (see the reviewer's remarks on this inflorescence in his paper on "the Acantheae of the Malesian area" in Proc. Koninkl. Nederl. Akademie v. Wetensch., Amsterdam, Ser. C: 1955 58: 168). However, as such sterile bracts play an important part in the capitula of the Compositae, where they form the involucre, we may expect that this problem will be discussed in the part dealing with the inflorescences of this family.

The difficulties caused to the interpretation of the florescences by the shifting of the flowers either on the bracts ("recaulescence") or on the internode above the bract ("concaulescence") are amply discussed. These "metatopic" shiftings are described by Troll in the terms of the classical morphology, viz. as the result of a fusion (concrecence or coalescence) between the axillary shoot and the subtending leaf (recaulescence) or between the axillary shoot and the internode above the subtending leaf (concaulescence). The reviewer's criticism of the use of this rather mystic terminology (the possibility of a true concrecence may obviously be excluded) in the essay on morphology of his work on "The various aspects of biology" (North-Holland Publishing Company, Amsterdam, 1961) and his plea in favour of the interpretation of these phenomena by the aid of intercalary growth zones (l.c. pp. 131-134) has apparently escaped the author's attention.

Of paramount importance is Troll's main division of the synflorescences. The time-hallowed division in a cymose and a racemose type is regarded by him as of secondary importance only. Instead he distinguishes them into "monotelic" and "polytelic" ones. In the monotelic synflorescence the main florescence always ends in a flower, and in the polytelic one this terminal flower is always lacking. Moreover, in the monotelic synflorescence the coflorescences are always cymose, i.e. either dichasial or monochasial, whereas in the polytelic one they may be of the cymose as well as of the racemose type.

That this new division of the synflorescences is of great importance, follows from the fact that these two types are characteristic for taxonomic groups of comparatively high rank. The author demonstrates this with several examples.

It is regrettable that the author did not draw the attention to another noteworthy peculiarity of the monotelic inflorescence, viz. that it is found only in taxa in

which the flowers are actinomorphic, a coincidence which is easily comprehensible as "one can hardly expect that an erect, radially symmetric shoot will end in a zygomorphic flower" (see p. 108 of the reviewer's paper on "the Acantheae of the Malesian area", which was quoted above).

However, all in all this is a most informative volume, and all morphologists will without doubt eagerly look forward to the publication of the remaining parts.

C. E. B. BREMEKAMP

ALAN BROOK, *The living Plant*. Edinburgh University Publications: Science and Mathematics Texts 6. Edinburgh University Press, 1964, IX + 529 pp.

"Botany, to many people, implies little more than the collecting and naming of flowers. For this reason it has become the Cinderella of school curricula; and even in some universities it is often regarded as a 'soft option' ". This is a quotation from the foreword of the book under review and it explains why Edinburgh University Press invited the author "to write an introductory text-book of botany which would be more comprehensive in detail and more radical in conception than the generality of such books". From the cover of the book we learn that the book is intended for "higher grades and first year college courses" and that it attempts "to free the study of botany from much of the ossifying drudgery of the systematic approach still favoured by many outworn curricula". It seems that the book is a reaction against outdated and old-fashioned educational programmes in the field of botany. In the author's opinion the consequences of such programming can be seen every day; the distance between pupils and students on the one hand and living nature on the other has grown considerably. He writes therefore a text-book on "The Living Plant"—the choice of the title being quite deliberate.

The author has approached his subject under six headings: (1) the growth and development of flowering plants; (2) cell differentiation and the internal structure of plants; (3) plant nutrition; (4) plant metabolism; (5) reproduction, heredity, evolution; (6) the plant kingdom. All these aspects of plant life have been brought together in less than 500 pages in a book of almost luxurious pattern. It is illuminated with 300 figures, a large proportion of them original and drawn by the author himself. Furthermore, he has a very pleasant and exact way of writing; wherever you open the book you are attracted by the simple manner in which he presents and connects his facts. He has a very clear style of writing.

The book breathes a fresh spirit and may be recommended to all who have to teach or study botany *on the level of this book*. Here, however, we arrive at the crucial point, for in our opinion this level is rather low. Undoubtedly this is the consequence of the author's attempt to deal with every aspect of the living plant in a book limited to less than 500 pages text. His fear of losing sight of the living plant has kept him from giving too many details and from dealing with many searching problems. To give some examples: in the chapter on catabolism and respiration the reader will find only one chemical formula, that of pyruvic acid; in that on mineral nutrition the trace elements are only incidentally mentioned; the subject of heredity is dealt with in nine odd pages.

The broad framework of the book, however, does not imply that the author has not paid attention to modern aspects of botany. On the contrary: in the

chapter on the products of plant metabolism we find a good photograph of KENDREW's myoglobin model; in that on viruses there is a photograph of a partially degraded particle of tobacco mosaic virus, and so on. But on the other hand, the whole chapter on viruses takes, besides the figures, only four pages.

Enough has been said to make it clear that this book can be used for first year college courses only in countries where botanical (and no less chemical) teaching at the high schools does not furnish an adequate basis for a more profound study of the living plant. But even so it does not give enough. Nowadays it is impossible to study botany without a profound and thorough knowledge of physics and chemistry. The fear that the student may lose sight of what is going on in the field can never be an excuse for dropping the basic disciplines to a larger or smaller extent even from an introductory text-book. It can only be overcome by a curriculum that is fully adapted to modern biology and, last but not least, by the teacher's love to nature, with which he has to inspire his students—difficult though that may be.

L. W. KUILMAN

C. BARNARD, *Grasses and Grasslands*. Macmillan & Co, London 1964, 270 pages, 80 illustrations, 50 sh.

This book, written by a group of 15 Australian research officers of the C.S.I.R.O., offers a most comprehensive survey of the subject. After an introduction, presenting a "picture of the historic development of grasses and grasslands in relation to the animals, including man, which feed upon them", nine chapters follow dealing with the different phases of the biology of grasses: botanical classification, geography, morphology and anatomy, biology of germination, quantitative analysis of growth, relationships between growth and environmental conditions, reproductive mechanisms, cytogenetics and selection methods for species improvement. The following four chapters deal with the plant communities of grassland, their evolution and distribution, nutrition, utilization, and soil conservation. All chapters are written by different authors, specialists in their respective fields, each chapter is followed by a list of references, mostly of Australian, English and American authors.

Grassland-research in Australia exists for just over thirty years. Although in principle the book offers a world-wide view of the subject, every author has in mind the specific Australian conditions and questions, and tries to relate his—sometimes rather theoretical—subject to the practical problems. Emerges a most interesting picture of ranging and grassland-research under desert and steppe conditions on almost virgin soil. The major successes have been in the field of species introduction and improvement (e.g. *Trifolium subterraneum* and *Phalaris tuberosa* from the Mediterranean region), and on nutritional questions. As nitrogen fertilizers in most cases do not give paying results, stress is laid on propagating legumes with superphosphate, and fertilizing with minor elements, of which several wide-spread deficiencies have been established. The major problems now lie with the grazing management in relation to soil conservation. Management in order to obtain the highest production tends to lead to pastures dominated by annual species, resulting in severe deterioration of the soil during periods of drought, which occur once in 5 to 10 years. A highly controversial point in this case is the question of rotational grazing, which in the northern hemisphere is widely

practised in order to increase productivity of the pastures. Under Australian circumstances, however, rotational grazing appears to be more harmful to the vegetation than continuous grazing (which is the usual practice), as was shown by recent field-experiments. These experiments are sharply criticised by A. B. Costin in his chapter on soil conservation, continuous grazing being more liable to expose bare soil during stress periods. Costin also wants maximum cover standards of the soil for every range and grassland management in anticipation of deteriorating conditions, so that minimum cover conditions are maintained under any circumstance. Although the question of rotational grazing is discussed at length, no mention is made of the use of this system for weed control, in spite of the fact that pastures dominated by thistles or cape-weed (no Latin names given in this case), are mentioned. The question remains whether this would be practical under Australian conditions.

The book is very interesting and useful for everyone concerned with grasses or grasslands in dry, subtropical and tropical conditions, especially for those, who want to introduce or breed new species and varieties, as well as for fertilizing problems under extensive grazing conditions. The book is well-printed, beautifully bound, while the photographs, figures and tables are clear.

E. M. EISMA-DONKER

E. REINDERS (red.) en R. PRAKKEN, *Leerboek der Plantkunde, omfattende in- en uitwendige morfologie en voortplanting der vaatplanten, afstammings-hypothesen, karyologie*. 5de druk van KONINGSBERGER-REINDERS, *Leerboek der Algemene Plantkunde I. Scheltema & Holkema N.V.*, Amsterdam, 1964, 19^x en 748 blz. (incl. 18 blz. lit. lijsten, 30 blz. bladwijzer, en 4 blz. aanvullingen en 699 figuren. Prijs (geb.) f 59.—.

Mij is reeds eerder de taak te beurt gevallen dit leerboek te bespreken, nl. de 2de druk van 1949 (Vakbl. v. Biol. 29, nr 10, pp. 189-191, 1949). Ik heb mij bij die gelegenheid een aantal opmerkingen veroorloofd over punten, die naar mijn mening verbetering behoeften. Voorzover ik heb kunnen nagaan, is met enkelen daarvan in de nieuwe, 5de druk, rekening gehouden, maar in ieder geval meen ik niet op die punten te moeten terugkomen, waarbij dat niet het geval is. Trouwens, zij deden geen afbreuk aan de grote kwaliteiten van dit boek, dat, als elk werk van karakter, zo duidelijk het stempel draagt van de persoonlijkheid van zijn redacteur. Ik vind het nog altijd een monumentaal werk, dat in zijn laatste druk wederom aan waarde gewonnen heeft. De beide auteurs beschikken over een heldere en duidelijke betoogtrant en de door ieder bewerkte delen sluiten op zodanige wijze bij elkaar aan, dat men nauwelijks bemerkt, dat er twee schrijvers aan het woord zijn. Over de door PRAKKEN geschreven gedeelten (cytologie s.a., parthenogenese, en apogamie) kan ik mij geen deskundig oordeel aanmatigen, maar op een leek op deze gebieden als ik, maken zijn hoofdstukken een uiterst frisse en gedegen indruk en de recente modernisering heeft dit deel van het werk nog aanzienlijk verbeterd.

Op minder glad ijs gevoel ik mij t.a.v. de door REINDERS bewerkte hoofdstukken, met name die over de morfologie en de afstammingsleer. Bespreking van die onderdelen zal dus de hoofdschotel van deze recensie zijn. Ik wil dan allereerst

refereren aan wat de schrijver in zijn „Voorbericht” (blz. 8^x) heeft opgemerkt n.a.v. mijn kritiek op de splitsing van de morfologie in twee, niet opeenvolgende delen, nl. de „Vergelijkende vormbeschouwing van Vaatplanten” (hst. 4) en het „Overzicht van de morfologie van Vaatplanten” (hst. 6), gescheiden door hst. 5 „Afstammingshypothesen”. In zijn voorbericht stelt de schrijver dat het hem onmogelijk is gebleken te voldoen aan mijn wens, de twee delen der morfologie tot één te doen samensmelten, zonder het boek „als leerboek volstrekt onbruikbaar te maken”. Ik heb niet gepoogd, de proef te herhalen, maar het komt mij onwaarschijnlijk voor, dat zij niet uitvoerbaar zou blijken, met goed resultaat wel te verstaan. Het soms meer dan 200 bladzijden uit elkaar liggen van behandeling van eenzelfde onderwerp is uitermate hinderlijk voor wie over dat onderwerp iets wil naslaan. Wellicht is deze splitsing in twee „ronden” een overblijfsel uit REINDERS' leraarsjaren, en dat wederom een gevolg van de biologische hiaat in de klassen 3 en 4 van het gymnasium. Een kleine verschuiving van hst. 6 onmiddellijk na hst. 4 zou het onlogische van de splitsing terstond in het oog hebben doen springen. Van de twee genoemde hoofdstukken is het laatstgenoemde naar mijn gevoel het interessantste. Hier worden „de problemen” behandeld, zij het in niet erg moderne vorm (ik kom hierop terug). Daardoor is hoofdstuk 6 een tamelijk dorre, grotendeels terminologische opsomming geworden, een soort geïllustreerd PULLE-compendium, waarvan weinig of geen inspiratie uitgaat, de eigenlijke „klassieke” morfologie, waardoor het in wezen nauwelijks verschilt van PAX' overigens uitstekende „Allgemeine Morphologie der Pflanzen” (1890).

Merkwaardigerwijze is t.a.v. de cytologie in wijdere zin een dergelijke splijting toegepast. De cytologische inleiding (door REINDERS) is zelfs diametraal gesteld tegenover de karyologie (van PRAKKEN), helemaal aan het eind. Het was m.i. logischer geweest bij de indeling der stof te gaan van klein naar groot, dus in de volgorde: Cytologie (inclusief de karyologie), Anatomie, Histologie, Morfologie (of Organografie) met achtereenvolgens inleiding tot de problematiek, diverse groepen, vergelijkende vormleer met beschouwingen over plastieken en theorieën over homologieën, mede op grond van palaeobotanische gegevens, en ten slotte speciale vormleer (uitmondend in die) der Angiospermen. Als afzonderlijke hoofdstukken hadden dan de voortplanting en de evolutieleer het boek kunnen besluiten. Ik neem wel aan, dat de redacteur goede gronden voor zijn afwijkende keuze heeft gehad, maar ik ben van mening, dat die eerder gebaseerd waren op didactische methoden, door REINDERS bij het V.H.M.O. opgedaan dan op wetenschappelijke logica. Ik heb in dit verband REINDERS' „Didactica Botanices” nog eens grondig nagelezen. In dit merkwaardige, verrassend openhartige boekje (Wolters, Groningen, 1954), dat een soort botanische autobiografie is, ontvouwt de auteur zijn didactisch credo, bekent hij zijn aanvankelijk falen o.m. als gevolg van zijn opleiding bij de enigszins dogmatische Prof. MOLL, en vermeldt hij niet zonder voldoening zijn uiteindelijk zegevieren met de door hem ontwikkelde, inderdaad originele en waarschijnlijk zeer effectieve onderwijsmethode. Reeds in zijn vroegste leraarsjaren werd hij geboeid door de problemen, die ons worden voorgelegd door sommige monochasiale bloeiwijzen (REINDERS zegt hardnekkig: bloemgestellen) en door de vertakkingswijze en de ontwikkeling van zekere bolgewassen. In zijn Wageningse tijd kwamen daar nog enige onderwerpen bij. De eindproducten van zijn levenslang peinen over hoe jongeren deze ingewikkelde morfologische structuren met blijvend resultaat duidelijk te maken onder geraffineerd aankweken van zelfkritiek, vindt men in zijn leerboek terug. Nauwkeurig waar-

nemen en onbarmhartige zelfkritiek zijn de pijlers van REINDERS' denkwereld en het lijkt wel of zijn geest na zijn jeugdige omzwaai op het gebied der didaktiek aan ontvankelijkheid voor nieuwere denkbeelden heeft ingeboet.

Als deze voorstelling van zaken enige waarheid bevat — maar ik geef toe, het is niet meer dan een persoonlijke veronderstelling — is zij er wellicht ook de oorzaak van, dat op de genoemde onderwerpen wel wat veel nadruk is komen te liggen; het gaat in deze passages haast op een handboek lijken; en daaraan ook is misschien de neiging te wijten (REINDERS zal waarschijnlijk liever zeggen: te danken), om op het gebied van hypothesen de grens der waarschijnlijkheid zo nauw te trekken. Wellicht daardoor is hij geneigd de deductieve methode zo ver van zich te werpen, hoewel moet worden erkend, dat hij de laatstgenoemde, niet zonder tegenzin, naar het mij voorkomt, een zeker bestaansrecht toekent. Hoe kan het ook anders? Immers, bij de ontwikkeling der wetenschap zijn de twee methoden, de inductieve en de deductieve, steeds hand in hand gegaan en beide zijn waardevol en onmisbaar gebleken, de eerste voor de idiobiologische, de laatste voor de symbiologische onderdelen der biologie. Zekerheid is in de historische aspecten der biologie zelden te krijgen. Het gaat er veeleer om hoever men kan gaan met het aanvaarden van waarschijnlijkheden en in hoeverre men die aan anderen durft voor te houden. Men leze in dit verband eens bepaalde passages uit DARWIN's levenswijze autobiografie, bezorgd door zijn kleindochter NORA BARLOW (Collins, Londen, 1958) bv. op de bladzijden 130, 138-9, 158, 160, en 162. Naar mijn mening had REINDERS bij sommige veronderstelde, vooralsnog hypothetische mogelijkheden op het gebied van homologieën wel wat meer vertrouwen mogen stellen in de kritische zin van zijn lezers. T.a.v. zekere homologiseringsen zegt REINDERS (p. 418): „fylogenetici zijn in deze dingen doorgaans gauwer tevreden”. Ik vermoed, dat hij eigenlijk bedoelt: minder kritisch, of oppervlakkiger. Nogmaals: lees DARWIN, die toch wel door niemand van oppervlakkigheid zal worden beticht, maar die niettemin, bij inductie begonnen, hier en daar met deductie is geëindigd.

Natuurlijk aanvaardt REINDERS een aantal „afleidingen” die van ouds als zodanig worden aangenomen. Ik noem als voorbeelden de op grond van HOFMEISTER's werk herkende lijn die door de generatiewisseling van de Cormofyten loopt en de afleiding van de laminale aanhechting van varensporangia van de marginale (BOWER) (p. 314). Maar zodra hij stuit op een hiaat in een reeks, of ook op nogal evidente uiteenlopingen van meningen, wordt REINDERS „schichtig”, het is dan alsof hij niet meer op eigen oordeel durft te vertrouwen; hij breekt dan liever de lijn af en, wat erger is, hij vindt het zelfs overbodig, mogelijkheden van de een of andere voortzetting aan te duiden en een conclusie aan zijn lezers over te laten. Dit is bijv. het geval met de mogelijke afleiding van de embryozak van de Angiospermen. De oude theorie van PORSCH is, voorzover ik kan nagaan, niet genoemd, ook is hij niet in de literatuurlijst aangehaald en HOFMEISTER's fraaie afleiding met zijn latere voortzetting, wordt na de „Gymnospermen” abrupt afgebroken. Voorzeker ligt hier een hiaat, dat evenwel niet onoverbrugbaar lijkt wanneer men beschikt over een vollediger overzicht van de voornaamste embryozaktypen, afgebeeld op fig. 371, p. 309. Bekijkt men het volledige stel, zoals bijv. afgebeeld in MAHESWARI's „Recent advances . . .” 1963 (besproken in dit tijdschrift, Vol. 14, No. 2), dan komen naast de theorie van PORSCH nog diverse andere mogelijkheden te voorschijn, die toch wel aan de gebruikers van REINDERS' boek hadden mogen worden voorgelegd. Ook zou hij dan wellicht tot de slotsom zijn gekomen, dat

men niet kan zeggen, dat de embryozak van de Angiospermen geen (homologa van) vegetatieve prothalliumcellen zou bevatten (er zijn tot 200 „antipodal nuceli” gevonden!).

Een ander voorbeeld is te vinden in ZIMMERMANN's teloomtheorie (ik heb me erover verbaasd, dat REINDERS die geen hypothese noemt), die hij niet zonder achterdocht noemt en waarvan hij bepaalde consequenties niet durft aanvaarden, bijv. t.a.v. de vertakking (bladnervatuur), okselstandige assen als zittende dichotomieën, primair en secundair sympodium, enz.). Men mag niet van REINDERS verlangen, dat hij met betrekking hiertoe partij kiest, of tot een eigen standpunt besluit, maar wel, dat hij zijn lezers in staat stelt van zekere geopperde conclusies kennis te nemen.

Een en ander kan er de oorzaak van zijn, dat het boek wel een uiterst gedegen, maar tevens een wat ouderwetse indruk maakt. In die richting wijst ook het feit, dat REINDERS bijv. de Pteridofyten, de Gymnospermen (vgl. p. 357), en de Monocotylen nog steeds als natuurlijke taxa beschouwt, dat uitsluitend de strobilus-theorie (euanthium) wordt aangehangen, dat derhalve alle stengelaanhangselen, voorzover geen trichomen of emergenties, fyllomen moesten worden, ook de sporangioforen der Angiospermen. De mogelijkheid, dat laatstgenoemde wel eens assen zouden kunnen zijn, wordt niet eens genoemd (vgl. p. 275, 448), hoewel deze denkbeelden al meer dan 120 jaar oud zijn (PAYER wordt niet genoemd), zij het, dat zij nooit een wijde vlucht hebben kunnen nemen.

Moderne velden van onderzoek als de embryologie en de morfogenese worden slechts summier of nauwelijks behandeld. MAHESHWARI's „Introduction” van 1950 wordt onder de literatuur niet aangehaald. Evenmin is er iets gezegd over de mogelijke betekenis van het vaatbundelverloop in bloemen en wordt PURI's samenvattende artikel hierover niet aangehaald, maar misschien vond REINDERS, dat dit onderwerp eerder in het komende deel over de Bijzondere Plantkunde thuishoort.

Voor mij persoonlijk zijn de hoofdstukken 4 en 6, resp. de „dynamische” morfologie en de evolutieeler verreweg de mooiste, gaaf, bezielde, ja men zou zeggen met ingehouden hartstocht geschreven. Juist door die ingehouden hartstocht is REINDERS zo precies in zijn, vaak enigszins eigendommelijke, woordkeus. Doordat men voelt, dat elke gedachte en elk woord zijn gewikt en gewogen, maakt het boek allereerst de indruk van onwrikbare betrouwbaarheid. Dit is zeker zijn grootste sieraad met betrekking tot de verwachte lezerskring.

De zowel aan de schrijvers als aan de referent goedgunstige lezer dezer regelen gelieve intussen te bedenken, dat de hierboven neergeschreven opmerkingen grotendeels een gevolg zijn van de blijkbaar geheel verschillende denkwerelden van REINDERS en mij. Ik ben er mij wel van bewust, dat ik niet kan tippen aan de uiterste precisie en de enorme feitenkennis van onze grootste levende morfoloog. Aan de andere kant kan ik met de beste wil de morfologie niet anders zien dan als een moment-opname van een dynamisch proces. Hoe dit zij, REINDERS heeft met dit boek een monument voor zich opgericht, dat nog generaties van botanici zullen blijven gebruiken en bewonderen. Het is mij een voorrecht, hem daarvoor hulde te betuigen.

De uitvoering van het werk is perfect en ook uitgever en drukker zij daarvoor hulde gebracht. Het gladde papier laat de fraaie illustraties uitstekend uitkomen, maar de keerzijde van deze medaille is dat men het nauwelijks met potlood kan beschrijven. Wel had ik gaarne wat meer voorbeelden van tropische planten gezien.

Ik heb van de redacteur begrepen, dat hij van mening is een eventuele 6e druk niet meer zelf te kunnen verzorgen. Het boek verdient zonder twijfel voortzetting. Onder mijn berusting bevinden zich nog een aantal aantekeningen, die daartoe van nut zouden kunnen zijn; ik wil er slechts één noemen: de uit oudere werken overgenomen, verouderde figuur van *Lepidocarpon* (fig. 442, p. 377) worde vervangen door een nieuwe, die minder misleidend is. Ik stel die aantekeningen desgewenst gaarne aan een volgende redacteur ter beschikking.

H. J. LAM

HEUKELS-VAN OOSTSTROOM, *Flora van Nederland*, fifteenth edition by S. J. VAN OOSTSTROOM, published by P. Noordhoff N.V. Groningen, 1962, 892 pages, 1038 illustrations, D.fl. 11.50.

This fifteenth edition of the principal Dutch flora differs only in minor respects from the previous edition, but since the latter was never reviewed in this journal, this occasion may well be used to draw the attention of non-Dutch botanists to this flora which represents the continuation of a long tradition. The Dutch botanist HENDRIK HEUKELS (1854–1936) published his first "Schoolflora voor Nederland" in the year 1883. The present book is the modern version of one of his later flora's called the "Geïllustreerde Schoolflora voor Nederland" of which the first edition appeared in 1900. The fourteenth and fifteenth editions of this illustrated school-flora were revised to such an extent by Dr S. J. VAN OOSTSTROOM of the Rijks-herbarium, Leiden, that the change of title to "Flora van Nederland" was fully warranted. The last two editions represent in fact an entirely rewritten flora which might well have been published under van Ooststroom's name alone. The traditional link with one of the most noteworthy Dutch floristic botanists, however, has been preserved in the full title: "Heukels-van Ooststroom, Flora van Nederland".

This flora is the main source of reference for the spermatophytic flora of the Netherlands, since the more elaborate *Flora Neerlandica* has not yet been completed. The *Flora van Nederland* serves this purpose well: there are many references to critical and local literature and the taxonomy is kept well up-to-date by incorporating in each edition the main new taxonomic discoveries or opinions. On the whole this is done in a praiseworthy conservative way: not every latter-day split is automatically accepted: the circumscription of the taxa certainly reflects the taxonomic opinions of the author of the flora himself. It is therefore understandable that a reviewer will always find some decision to disagree with, such as in this instance the continued acceptance of *Endymion non-scriptus* (L.) Garcke as a member of the genus *Scilla*. On the other hand the acceptance of generic splits in the grasses sometimes tends to lead to an instability which may be somewhat confusing for the great majority of student and non-professional users of the book. An example of such a split is that of *Agropyron*, *Elytrigia* and *Roegneria*. *Roegneria canina* was split off from *Agropyron* in the fourteenth edition and still is so in the fifteenth; however, in the subsequently published edition of the shortened version of this flora, the so-called *Beknopte School- en Excursieflora* (ed. 11 of 1963), the species is shifted to *Elytrigia*. *Agropyron repens* and other *Agropyron* species, on the other hand, are shifted to *Elytrigia* in the fifteenth edition. On the whole one should be extremely reluctant

to make such shifts in a flora like this: the instability of botanical nomenclature is often criticized, but here its reasons lie purely with changing taxonomic opinions; changes which ought to be incorporated only when fully warranted.

The nomenclature, however, is in general well taken care of and is based on a thorough knowledge of the literature. The synonyms cited are almost exclusively those found in other publications on the Dutch flora.

Intraspecific taxa are described only occasionally and then very briefly. The flora is not intended to be really critical: this is left to the more elaborate *Flora Neerlandica*.

Short indications of habitats are given, followed by a code designation of the plant communities in which the species may generally be expected. This code indication is based on a decidedly out-of-date system of phytosociological associations (from 1946) which is shortly recapitulated in the book. This is certainly not the fault of the author of the flora: he has no other complete up-to-date review of the Dutch plant communities. The continuation of this outdated system, however, in our most important every-day flora, compares unfavorably with the well-balanced and fully modern ecological descriptions given for the taxa in the later instalments of the *Flora Neerlandica*. Dutch ecologists might perhaps do something to improve this very undesirable situation.

In conclusion it should be said that this flora is so thoroughly composed and contains such a vast amount of information, that its consultation is highly recommended to all those concerned in any way with the European flora.

F. A. STAFLEU

FLORA EUROPAEA. Volume 1, Lycopodiaceae to Platanaceae, edited by T. G. Tutin, V. H. Heywood, N. A. Burges, D. H. Valentine, S. M. Walters, D. A. Webb, with the assistance of P. W. Ball & A. O. Chater. Cambridge, University Press, 1964, XXXII + 464 pp., 5 kaarten. Prijs 84 sh.

Deze in de Engelse taal geschreven flora, waarvan het eerste deel thans voor ons ligt, is de eerste flora die geheel Europa zal omvatten. Terecht wijst het voorwoord op het merkwaardige feit, dat Europa, het werelddeel waar toch de basis gelegd is voor de wetenschappelijke botanische taxonomie en welks systematici zich sedert vele jaren hebben bezig gehouden met het bewerken van flora's van andere continenten, zelf geen algemene flora bezit. Weliswaar bestaan er vele honderden flora's van een regionaal karakter, geen enkele bestrijkt echter het gehele werelddeel.

De Flora Europaea zal een viertal forse delen omvatten en het ligt in de bedoeling van de redactie, deze in de kortst mogelijke tijd gereed te maken. Het in de titel genoemde „Editorial Committee”, dat met Prof. T. G. Tutin (Leicester) als voorzitter en Dr. V. H. Heywood (Liverpool) als secretaris de leiding heeft en zich gesteund weet door een „Organizing Committee” stelt zich voor dat de nog te verschijnen delen in ongeveer 8 jaar gereed zullen zijn. Deze „committees” worden bijgestaan door een aantal „Advisory Editors”, terwijl in de meeste Europese landen 1 of soms meer „Regional Advisers”, in totaal ruim 30, hun medewerking verlenen. Al deze redactieleden en adviseurs krijgen de manuscripten der bewerkte groepen in gestencilde vorm in handen en kunnen hun op- en aanmerkingen hierop aan de redactie kenbaar maken. Een groots opgezet team-work dus.

Het eerste deel van de Flora bevat de Pteridophyta, de Gymnospermae en een aantal families van de Angiospermae-Dicotyledones, deze laatste in de volgorde van het systeem van Engler en wel de Salicaceae tot en met de Platanaceae. De lijst van auteurs die hebben bijgedragen aan de totstandkoming van dit eerste deel omvat niet minder dan 51 namen, grotendeels van Europese, doch ook van enkele buiten-Europese botanici.

De in de flora voorkomende beschrijvingen van families, geslachten en soorten zijn over het algemeen beknopt gehouden. Bij de beschrijving van verwante soorten is vooral gestreefd naar het opstellen van goede met elkaar vergelijkbare diagnoses. Ook de determinatietabellen voor de geslachten en soorten zijn beknopt; ze zijn daardoor zeer overzichtelijk en, voor zover ik heb kunnen nagaan, goed bruikbaar. In het algemeen is in deze tabellen geen gebruik gemaakt van kenmerken, die moeilijk zijn waar te nemen, ook al zijn deze vaak van systematisch belang. Voorts bevat dit eerste deel reeds een uitvoerige sleutel tot alle erin behandelde en de meeste nog te behandelen families. Een volledige tabel voor de families zal in deel 4 worden opgenomen.

Wat betreft het gebied dat de flora bestrijkt, moge worden opgemerkt, dat dit Europa oostelijk tot de Oeral en de Kaspische Zee omvat; de Kaukasus is jammer genoeg niet erin verwerkt. Zuidelijk loopt de grens door de Middellandse Zee, waarvan de meeste eilanden zijn opgenomen, echter niet Cyprus en enige kleine eilanden voor de kust van Aziatisch Turkije. In het westen en noorden is ook aan de flora's van de Azoren, de Fär Öer, IJsland, Jan Mayen, het Bereneiland en Spitsbergen aandacht besteed.

De nomenclatuur is voor zover ik zie geheel „bij”. Dit betekent dat hier en daar namen worden gebruikt, die in de meeste lokale Europese flora's nog geen ingang hebben gevonden, doch daar zeker in zullen moeten worden opgenomen. Synoniemen zijn in de tekst vermeld voor zover ze betrekking hebben op namen die in de grote Europese flora's (de „basic floras”) gebruikt worden, nl. in die van Coste voor Frankrijk, Hayek voor het Balkan Schiereiland, Hegi voor Midden-Europa, Hylander voor Skandinavië, Komarov c.s. voor de U.S.S.R. en Willkomm en Lange voor Spanje. Verdere synoniemen, hoewel vanzelfsprekend niet alle, zijn echter wel in de index opgenomen.

Bij iedere soort is een overzicht gegeven van de verspreiding binnen Europa; vaak zijn bij de geslachten literatuur-gegevens toegevoegd; oecologische bijzonderheden zijn zeer schaars. Wat infraspecifiche taxa betreft zijn meestal alleen subspecies opgenomen; taxa van lagere rang, die het boek aanzienlijk in omvang zouden doen toenemen — en waarschijnlijk in bruikbaarheid zouden doen afnemen — zijn gelukkig vrijwel steeds weggelaten. De flora is dus wat dit betreft niet te vergelijken met Ascherson und Graebners Synopsis, die zeker niet in de laatste plaats door zijn al te grote uitvoerigheid een vroegtijdige dood is gestorven.

Bastaarden zijn hier en daar vermeld, doch alleen als ze vast voorkomen of op andere wijze in een gebied een belangrijke rol spelen. Toevallige adventieven zijn niet opgenomen, wel die, welke in bepaalde landen duidelijk ingeburgerd zijn.

Het is zonder meer duidelijk, dat de opzet van deze grote Flora langdurig en goed overdacht is. Ook ziet het boek er typografisch uitstekend verzorgd uit en is het gedrukt op prima papier. De afmetingen (28 × 21 cm) der pagina's zijn van dien aard, dat ze heel wat tekst kunnen bevatten, zodat de delen niet onhandelbaar dik worden. Misschien zullen sommigen het betreuren dat het boek geen afbeeldingen bevat — zelf vind ik dit geen onoverkomelijk bezwaar. Misschien hadden hier en

daar de beschrijvingen iets uitvoeriger kunnen zijn. Maar ook dit is een punt van ondergeschikt belang.

Al met al een flora, die in brede kring aandacht verdient en zonder twijfel uitvoerig zal worden gebruikt zowel door de vakman als door de amateur.

S. J. VAN OOSTSTROOM

B. A. RUBIN and YE. V. ARTSIKHOVSKAYA. *Biochemistry and Physiology of Plant Immunity*. Published by Izdatel stvo Akademii Nauk SSSR Moscow 1960; translated from the Russian: "Biokhimiya i Fiziologiya Immuniteta Rastenii" by Helen Wareing. Translation edited by Ellis Griffith, lecturer in Agricultural Botany, University College of Wales, Aberystwyth. Pergamon Press; 1963; 358 pages; £5.—.

In their preface to the original edition the purpose of the authors is made clear: 'to summarize the results of numerous investigations in the field of biochemistry and physiology of plant immunity'. There is a separate section on the results obtained by the authors themselves at the "Biochemistry Laboratory of Plant Immunity at the Bakh Biochemical Institute of the Academy of Sciences of the USSR".

In a foreword to the English version, the authors express their hope that the book in the translated form will contribute to further experimental research in the field of plant immunity, as the circle of readers will be considerably extended.

The book is divided into four chapters: 1. The evolution of parasitism; 2. Biochemistry and physiology of the heterotrophic micro-organisms; 3. Biochemistry and physiology of the diseased plant, and 4. Plant immunity. Moreover there are 54 pages of references divided into literature published in the USSR and publications which appeared elsewhere. There are about 250 articles written in Russian the titles of which are given in English. Many of these articles are hardly ever cited in phytopathological literature published in the western world. It makes the reader long to get a more thorough knowledge of the experiments and techniques used at the Russian institutes and he may regret the difficulties he encounters when he tries to obtain a paper he wants to study.

On the one hand the content of the book is more restricted than the title would suggest: virus research is hardly mentioned and problems concerning acquired immunity in this field are not discussed. On the other hand the book has a much wider scope than one would suppose. It provides the reader with information on such topics as symbiosis and the interaction of one plant species on diseases of another.

In the chapter on heterotrophic micro-organisms attention is given to the formation of enzymes and toxic substances such as antibiotics or wilt inducing toxins, to nutrient requirements and to the various pathways of respiration.

In the third chapter, dealing with the plant after it has become infected, spore germination and the process of infection are discussed, followed by a survey of the changes in physico-chemical properties and metabolism. Attention is given to the influence of toxic substances released by the parasite, and to the changes in permeability, in photosynthetic activity and in carbohydrate-metabolism. The possible pathways of respiration are amply reviewed as an introduction to the fourth

chapter on plant immunity, which occupies the greater part of the book. After having passed through a wide field of information on the influence of environmental conditions on the degree of resistance, one is confronted with the authors' main line of research: "the desire to connect plant resistance with the chemical composition of the higher plant before it encountered the parasite". It is obvious that the resistance provided by morphological characteristics is considered exceptional. Resistance may be due to a deficiency in the plant of substances essential for the nutrition of the parasite or to the presence of compounds toxic to the pathogen.

Much attention is given to protein and carbohydrate metabolism and the presence of vitamins in relation to resistance. Physiologically active substances, such as alkaloids or phenolic compounds, so called "phytoncides", already present before infection, may provide the plant with an active resistance. If such substances are produced after an infection, the plant may obtain acquired immunity. Although a number of experiments are mentioned dealing with successful artificial immunisation, the authors' opinion is that this method of conferring resistance has little future in plant breeding. Much more important is the search for natural immunity, the ability of the plant to develop protection after infection "which depends on inherited characteristics and which changes during the course of plant development and as a result of the environment". The last 100 pages of the book are dedicated to this subject and again oxidative processes are emphasized in accordance with the theory of the academician Bakh, "the founder of the concept of the mechanism of slow biological oxidation". That facts already mentioned in former chapters are repeated seems unavoidable although the field is enlarged.

However if anyone thinks, that the authors have provided us with an elaborate, though rather dull review of literature, he is mistaken. The discussions which cement the descriptive parts together, confer on the book a lively character. As soon as a plant is attacked by a parasite its metabolism changes and it has to be considered a new organism in which the processes deviate from the course they take in a healthy plant. Thus far the reader may agree with the dynamic outlook but in other respect he may be highly critical when it concerns the authors' neo-Lamarckian views. The concept of adaptation and evolution of parasitism can be traced through all chapters. Against this "basic law" the results of all experiments are interpreted, thus conforming to the opinion prevalent in the authors' country "that the evolution of parasitism took place, and is continuing to take place, by means of a transition from a saprophytic method of nutrition, by way of facultative parasitism to the true, or obligate, parasitism". They do not deny that the reverse may also have occurred: autotrophic organisms may have lost their independent way of life and may have become parasites. This conception means, however, a loss of characters originally present and therefore it does not conform to the idea that only new characters arise by mutual adaptability. A high degree of plasticity is especially inherent in fungi. They may form adaptive enzymes under the influence of environmental conditions. On the other hand the host plant also changes. It develops systems of defence when in interaction with a parasite, which has a "moulding role". Thus a "progressive relationship" is built up during a long period of co-existence, leading to the highest form—obligate parasitism. E. Köhler's opinion, that true immunity is characterized by the absence of any relationship between the plant and the parasite, is rejected, probably as being too static. According to the authors, immunity does not have this strict implication but it has to be considered an extreme non-susceptibility, which, depending on the

continuous changes in the external environment, may switch over to susceptibility. It is astonishing that the authors, who appear to be well informed of the world literature, do not even mention the terms chromosome or gene, not to speak of Flor's gene-for gene theory, according to which the complementary genetic systems of the host plant and the parasite may react specifically. The discovery of the Mendelian laws and the development of genetics over the last century seem to have escaped their attention!

Their illustrations of the neo-Lamarckian views are far from convincing. What can one say of the experiments on wheat rust, which adapted itself to previously completely resistant varieties of wheat if the rust was sub-inoculated on intermediate varieties, which acted as bridging hosts? And what can one think of the example found in *Alternaria tenuis*, a collective species with forms of different pathogenicity. Some forms are saprophytic, others are capable of attacking *Leguminosae*. It is supposed that this species is involved in the process of evolution towards parasitism "with the evolution of its physiological properties overtaking the evolution of morphological characters". Though the reader may not agree with the theories postulated, the book is worth studying. It brings a great many papers to the notice of the western world and, moreover, the often amazing interpretation of the experimental results confronts us with a way of thinking common to a great number of phytopathologists.

The English translation seems to be excellent.

L. C. P. KERLING

Dr. W. NULTSCH, Allgemeine Botanik. Kurzes Lehrbuch für Mediziner und Naturwissenschaftler. Georg Thieme Verlag, Stuttgart, 1964. XII, 372 blz., 199 fig. DM 9.80.

Dit boek verschilt in twee opzichten van de gebruikelijke Duitse leerboeken; het is in de eerste plaats werkelijk kort en van een handig (zak-) formaat en dan zet het geen eerbiedwaardige traditie voort, maar is nieuw opgezet. Dit gaf de gelegenheid ook onderwerpen die pas in de laatste jaren in het centrum van de belangstelling zijn gekomen geheel in de stof te verwerken en de auteur heeft die kans goed gebruikt.

In het eerste hoofdstuk wordt ruime aandacht aan de chemische samenstelling van de plant besteed, als uitgangspunt voor een bespreking van achtereenvolgens de structuur van het protoplasma, de cytologie, de histologie en de overige delen van de morfologie. Hier sluit logisch de fysiologie van opname en transport van stoffen op aan, gevolgd door de behandeling van anä- en katabolisme, het stikstofmetabolisme en de heterotrofe levenswijze.

Na de voortplanting, met grote aandacht voor de generatiewisseling, is plaats gevonden voor een zeer beknopte, moderne, genetica, terwijl groei, ontwikkeling en bewegingen de laatste hoofdstukken vullen, gevolgd door een zeer nuttig overzicht van de systematische indeling van de planten.

Gegeven de zeer beperkte omvang van het boek verbaast men zich telkens over de veelheid van gegevens die er in goed assimileerbare vorm, ondersteund door duidelijke figuren, in zijn verwerkt.

H. P. BOTTELIER

LUCIE KOFLER, *Croissance et développement des plantes*. Publ. Gauthier-Villars, Paris, 1963, 234 p. 121 text figures. Price 24 francs, (5 dollars).

This book is intended as a text book for students for the teachers certificate in biology in France. It consists of three parts. Part I: "Description of growth phenomena", with chapters on Kinetics of growth; Anatomy of growing tissues; Differentiation, senescence and rejuvenescence of cells; Growth rhythms; Correlation; Wound tissue, formation of buds and roots in mature tissue, polarity; Formative effects of external conditions. Part II: "Auxins and other growth substances", contains 7 chapters on auxin and one chapter dealing with other growth substances. Part III: "Special problems of growth and development", with chapters on Plant tumours, Dormancy of seeds and inhibitors of germination; Dormancy of buds; Induction of flowering; Hormones and reproduction in lower plants; and a short chapter on the techniques of environmental control.

The short list of literature at the end of the book is limited to text books on plant physiology and on books and reviews of special aspects of growth. In the text, however, the author, who is professor at the university of Grenoble, mentions the results and hypotheses of a great number of research workers, without citing the original articles. I think this is justified in a textbook which is intended for first and second years' students.

What makes this book an excellent textbook is the well-equilibrated treatment of its subject. Owing to the impressive results of biochemistry, the physiologist of these days is liable to forget that growth and development are essentially changes of the visible form and structure of an organism, and that without a thorough knowledge of form and structure biochemistry is of little avail for the understanding of growth. Evidently, the author is well aware of this danger, for she devotes a relatively large part of her book to the description of morphological and morphogenetical phenomena. Several of these have been chosen from the practice of horticulture: in the chapter on correlation one finds a drawing of different forms of pear trees obtained by pruning, in the chapter on polarity a drawing of different methods of grafting, in the chapter on dormancy drawings of a potato plant and of the germination of potato tubers.

On the other hand, the chemistry and mode of action of auxins have received a far more extensive treatment than is customary in textbooks for first and second years' students.

Textbooks usually are adapted to the educational system of the country in which they have been written and they are not likely to be used by students in other countries. Nevertheless, anyone who is concerned with the teaching of plant physiology at university or high school level, and who can read French, will find this a most stimulating book.

M. H. VAN RAALTE

P. J. MALONE and A. E. MUSKETT, *Seed-Borne Fungi. Description of 77 Fungus Species. Handbook on Seed Health Testing, Series 4(1)*. The International Seed Testing Association Wageningen (Holland) 1964, Proc. Int. Seed Test. Ass. Vol. 29 (1964), no 2, 384 pp.

As is stated by the authors, it is more than two hundred years ago since Tillet (1755) established that *Tilletia caries* (DC.) Tul. on wheat is seed-borne. Now there

is hardly any cultivated crop where at least one seed-borne fungus is known, pathogenic or non-pathogenic. In respect to germination and purity, standardisation of seed testing methods has been attained through the International Seed Testing Association, but there is less agreement on the matter of testing seed for the presence of pathogenic organisms. As a consequence, misunderstandings are inevitable.

In this handbook, different techniques for the determination of seed-borne fungi, from flax and oat-seeds mostly, are described, as they are used in Northern Ireland during the last 15 years. The methods are developed according to two principles, viz. the method must give an accurate assessment of the percentage of seeds contaminated with the parasite in a viable condition, and the method must be carried out rapidly.

For 77 fungus species, both pathogenic and non-pathogenic, an isolation technique is given, together with a description of the colony development of the fungus, growing from contaminated seeds on moist filterpaper, as well as on 2 % malt-extract agar. The incubation-temperature is not mentioned, but probably this is 22° C. With every description, the literature is discussed and there are three or more excellent photographs of the colonies and of the imperfect and perfect stages of the fungus (if present).

Together with the good descriptions and the cited literature, this book is of importance not only for seed testing laboratories but also for phytopathologists and mycologists.

K. VERHOEFF