VII. GOOD HEALTH TO THE DIPTEROCARPS!

The Paris Round Table Conference

According to rough estimate, in these years one quarter of the hardwood in the international timber market comes from Dipterocarpaceae: keruing, meranti are the best-known names. It was a good idea to convene a conference for a review of the available knowledge on this family, which is best represented in Malesia with 380 species. Most of them occur in Borneo, Malaya, Sumatra and the Philippines, in that order.

About 35 botanists – too few of them from the region itself – attended the 3-day session, on 14, 15, and 16 June 1977. Organizer was Mme. Géma M a u r y of Brunoy near Paris, whose work in Malaya on seedlings of the family was mentioned on *pages 2565-2566* of the Flora Malesiana Bulletin. Host was Professor J. F. L e r o y, Director of the Paris Herbarium. (In his speech he spoke of the Dipterocarpaceae as a kind of Drosophila of tropical forestry. A nice feat of French originality!). Professor Jean D o r s t, general Director of the Paris biological museums, opened the conference and later treated the participants to champagne. (His name in Dutch would mean 'thirst').

The frequent mention of the name C.F. Symington (1905-1943) testifies to the importance of his Foresters' Manual of Dipterocarps (1943, recently reprinted, see Taxon 25: 629. 1976), which deals with the species of Malaya. To this importance contributed Symington's collaboration with H.E. Desch, a wood anatomist, and the attention he paid to the living trees. In the opinion of Dr. J. D. B r a z i e r, wood technologist of the Princes Risborough Laboratory, England, this resulted in a great advantage for SE. Asia on the timber market. Symington's confinement to Malaya was overcome largely by Dr. P. S. A s h t o n, who could study the family in Borneo, its richest centre of development. The fact of this richness led botanists like E.D. Merrill and F.W. Foxworthy to regard West Malesia as the original centre of distribution, too. This view has been changed in recent years, and was changed further by the botanists present at the Conference.

With regard to Wood anatomy, discussed by Mr. J. D. B r a z i e r, the general classification adopted by Desch still stands, although the commercial classification of the Red Meranti Shoreas does not entirely cover the taxonomic one. In the whole of Shorea, 4 anatomical types can be distinguished, in Hopea 2. There is a problem in Pentacme (by Ashton included in Shorea) where 2 types are discerned not matched by gross morphology. The resin canals in the secondary wood are a fairly unique feature of the Asian Dipterocarps; they occur either in groups, or solitary like in Cotylelobium, the latter character is considered primitive.

Bark morphology was explained by Dr. T. C. W h i t m o r e of Oxford. A pupil of E.J.H. Corner (who in The Wayside Trees of Malaya, p. 11-12 brought up the subject), he refreshed the audience's memory of his several papers (e.g. *pages 1017-1019*). Three kinds of expansion mechanisms have been developed to deal with the stress in the bark of a growing tree; thus c. 10, 40, or 70% of the strain can be absorbed; at a certain diameter the differences show up in an inverse degree of fissuring, or of flaking if rhytidome develops. In Dipterocarpaceae, Corner and Whitmore find 5 bark types in common, to which Whitmore added 2 (dippled and scrolled bark, described by Corner from other families, do not occur in D.). The 7 bark types distinguished by Whitmore have a taxonomic relevance, according to Dr. Ashton, and Whitmore saw promise in the highly diverse barks of Eugenia as well.

Professor F. H a l l é of Montpellier went into tree architecture, for which he acknowledged the assistance of Dr. F. S. P. N g of Kepong. He distinguished 3 'models': Rauh, Massart, and Roux, all of them rather monopodial and rhythmically branched (anyway the young trees on his slides); they differ in being orthotropic or plagiotropic, and the number of branches per layer or storey. As he told it, the larger trees 'reiterate' the branching of the smaller-sized species while they extend their crown horizontally. The latter would coincide with buttress development, but his theory which sounded convincing was nevertheless challenged by several veteran field workers.

Seed structure and germination are replete with differences and characters, as Mme. Géma M a u r y of Brunoy asserted on the strength of an almost unending series of facts. The pericarp can be soft or hard, trilobate or circular on equatorial section, the sepals at a certain stage imbricate (primitive) or valvate. She suggested a grouping of genera under 'Imbricatoids' and 'Valvatoids' supported by embryo position and epidermis details. With the aid of a mathematician of Brunoy, J. F. Ponge (almost a Monge ?) she had built a model of correlations; it playfully suggested the new skyline of Paris. Such an elaboration easily tempts an author to propose a one-discipline system; Mme. Maury is still wrestling with the temptation. So seemed to be Dr. N. P a r a m e s w a r a n of Hamburg, who on anatomical grounds made several strong statements.

Chromosome and embryological observations were reviewed by Dr. Kwiton J o n g of Aberdeen and Miss A. K a u r (Mrs. Dalbir Singh) of Kuala Lumpur. Counts of chromosomes are available from c. 60 species or 12% of the total; none yet in Cotylelobium, Parashorea, and Upuna. Yet highly interesting things have already been found: diploids, triploids, and tetraploids occur in some Asian members of the family; in the

disputed genus Neobalanocarpus not all chromosomes are paired; Shorea ovalis is tetraploid and tends to produce twin seedlings. The basic subdivision into groups of genera with x = 11 and x = 7 stands; other numbers such as x = 10 and x = 6 remain unconfirmed. Hopea poses exciting problems: one of them is the occurrence of triploidy in H. latifolia (2n = 3 x = 21), which is thought to be agamospermous but further work is required to clarify its breeding system. Dipterocarp chromosomes are remarkably small, and stable in number (like in Fagaceae, Lauraceae) compared with e.g. Meliaceae, Sapindaceae.

Dr. W. M e ij e r of Lexington, Kentucky, made a plea for concerted study in the genus Dipterocarpus, the genus best known for its natural hybrids (e.g. D. confertus x stellatus from N. Borneo). There are not too many species, 32 in Malaya 3 endemic, 50 in Borneo 12 endemic, 12 in the Philippines 2 endemic, all too closely related to maintain a subdivision of the genus. Other disciplines may provide a clue to subdivision and phylogeny.

A rare botanical sensation* was the show, by Dr. B. M a g u i r e of New York, of 3 collections of Pakaraimaea, the new genus of Guyana in the Neo-tropics (now published in Taxon 26: 341-385. 1977). It is only known in flower, and forms a subfamily of its own, beside the Monotoideae in Africa and the Dipterocarpoideae in Indo-Malesia. On the scan photographs already made by Mr. J. M u l l e r of Leiden, the pollen grains have a regular meshwork as found in many families, and show no trace of the tilioid structure of Monotes and some E. Asian Dipterocarps. Mr. Muller also discussed pollen size: the larger grains in Dipterocarpus (60-90 μ vs. 20-45 μ in other genera) he attributed to better nutrition in these few-flowered, thick-stalked inflorescences. Grain size might be related to compatibility.

Fossils were disappointing, first because neither Dr. N. Awasthi of Lucknow, nor Professor E. Boureau of Paris had shown up, second because supposed records in Europe had faded upon critical examination.

Chemistry (triterpenes, sesquiterpenes present, monoterpenes and alkaloids absent) was entertainingly explained by Professor G. O u r i s s o n of Strasbourg who, alas, has stopped working on the family. The valuable resin is by him regarded as a dead track in plant metabolism, a useless by-product for the tree. Chemically, Monotes seems an alien in the family, owing to absence of the above terpenes.

* A second botanical sensation may be the observation by Dr. A.J. Kostermans, that Pakaraimaea is nothing but a Tiliacea, closely related to Schoutenia or even congeneric with it. His manuscript was sent to Taxon in February 1978.

In the discussion on affinity, the Ochnaceae (brought in because of the African genus Lophira) lost on all counts to the Malvales, especially Tiliaceae, notwithstanding the storied rays common in that order which were, however, offset by the stellate indumentum. Guttiferae and Burseraceae are out on chemical grounds. Ashton, in the wake of 19th century authors, advocated relationship with the Sarcolaenaceae which has 8 genera and some 33 species all confined to Madagascar (Fl. Madag. fam. 126); but this family (better known as Chlaenaceae) in turn is placed by some authors near the Ochnaceae and by others in the Malvales.

Speaking of phylogeny Dr. P. S. A s h t o n of Aberdeen (who did much of the speaking throughout), asserted that the African-Madagascar genera Monotes and Marquesia (with dehiscent fruits) now have the company of Pakaraimaea in their relative primitivity. In view of occurrence in Madagascar, Seychelles, Ceylon and S. Deccan, the origin of the family seems to be Gondwanaland, and it is surmised that from Africa-Madagascar a stock of Dipterocarps, radiating in one direction to the Neotropics where Pakaraimaea survives, and in the other direction via the Deccan which then was on its way to Asia was ferried to Burma, thence to make their way to Malesia where, after always having lived under seasonal conditions, they now found their humid ecological niche and exploded into their present diversity. The oldest pollen found in Borneo are Oligocene. It was not made clear whether the Dipterocarps in the seasonal climates of SE. Asia (a few dozens of species) are to be looked upon as more primitive or more specialized than the species of the everwet Malesian rain forests.

Certainly the dispersal possibilities are small; a correlation between tree height and length of the fruit wings hardly changes this. Ashton found the barrier effect of rivers in the ancient Sunda system still reflected in present distribution discontinuities (map in Lowe-McConnell, ed., Speciation in Tropical Environments p. 184. 1969), like in Sarawak where the Batang Lupar, now a small river, still shows up on the map as a formidable barrier.

Evolution seems to be most intensively at work in Shorea and Hopea, and to a lesser degree in Vatica; it is there that the taxonomic problems occur. At the species level, there are no quarrels, although some species are polymorphic and well worth investigating in the field, to learn more about background and significance of the variation. Ashton has compiled a list of such species. The uneasiness lies in the no man's land between the genus and the species, although an occasional redefinition at (sub)generic level may be in order, mainly on the evidence of seed and germination, supplied by Mme. Géma M a u r y of Brunoy/Paris.

The hot spots thus identified by her are a close association of Doona and Pentacme under Shorea sect. Anthoshorea, a dissociation of Shorea sect. Pachycarpa and Rubroshorea, and a higher rank to the Synaptea-group, at one level with the Upuna and Vatica group, all under the valvate part of the family. (For comparison, see Ashton's paper, Gard. Bull. 20: 229-284. 1963.) Balanocarpus may remain a sore spot in the system. According to Dr. N. P a r a m e s w a r a n, the original species are very different. The type species (in S. India) is a Hopea; the Malayan species, which stands apart, has therefore been accommodated in a new genus Neobalanocarpus by Ashton, due for publication in the future. We remember its cytogenetic irregularity; the seed characters are suggestive of Shorea sect. Mutica.

On dispersal and regeneration very little was said, and not much on ecology in relation to altitude either. The mentioning of mass flowering triggered off a mass scepticism, but also some interesting observations, e.g. that mass flowering may occur in a swamp forest but not simultaneously on the surrounding dryland, that so-called mass flowering may entail part of the individuals at a time only, and that (following P.F. Burgess) the trigger is most likely to be identified by micro-climate study in situ. If combined (as Jong pointed out) with an examination of flower morphogenesis, more interesting facts may become known. D.H. Janzen's theory about the survival value of mass flowering (see *p. 2626-2627*) was hardly discussed.

Conservation had been purposely left out, because it is too big a subject to be squeezed in. Yet the arrival of Dr. W. L. C h e w of IUCN, Morges, aroused curiosity, and we were not disappointed. He told the meeting that IUCN/WWF intends to set in motion a Dipterocarp conservation program. To that purpose, a task force is to be set up, with assistance from UNEP (United Nations Environmental Program). The task force will consist of botanists of Dipterocarp countries, as leader was mentioned Dr. Ashton, as adviser Dr. Meijer. In 1-2 years a program is to be drawn up; then other agencies must step in or take over. Also Agathis and other commercial taxa may be included. "Hear hear!" the audience murmured.

Finally, problems were identified and a look into the future taken. Ashton asserted that at Aberdeen many unpublished data are waiting to be computerized. They come from well-identified plots in Malaya where the trees are measured every 5 years, and are available for consultation, now also in metric system. In Aberdeen a student, Mr. H. Baillie, is working out data on species-soil relations, and Mr. C h a n, also present at the meeting, is working on quantitative mortality in all stages from inflorescence development to seed germination. An entomology student, Mr. S. Appanah, is en-

gaged on all aspects of pollination biology. Among the subjects for further scrutiny, Hopea and most Shorea sections come high on the list (sect. Richetia is relatively well-known). The cytological status of Dipterocarpus is still uncertain, and of course we want to know more of Monotes, Marquesia, Pakaraimaea, and in Indo-Malesia of the smaller genera: Cotylelobium, Parashorea, Upuna, and Vateriopsis. Also the taxa in Ceylon are in urgent need of study to see if they are indeed the links postulated, and because they are acutely endangered by exploitation. Phytochemical work there is done by Dr. S u l t a n b a w a. In general, collecting for such work is encouraged, provided that good herbarium specimens are taken as vouchers. One kilogram of fresh bark is a good rule of the thumb, and an equivalent of 5 herbarium sheets of leaves, air-dried and not treated with alcohol. For rare species, both Dr. Ashton and Mme. Maury have shopping lists. Collectors should look for stipules, for differences in leaves on juvenile, sterile, and fertile branches, and take a good supply of mature buds for pollen. For architecture observations, Hallé recommended photographs and analytical sketches of tree 3-5 m high, and collections or orthotropic and plagiotropic shoots. Buttress observations are to be made on older trees. For the collection of buds for cytological studies Jong will be happy to supply full instructions. Those lucky enough to find fresh ripe seeds should pick out those which are already germinating, to airmail them from a suitable place. Before dispatch, keep them with you, in damp charcoal, then send them under passenger conditions — cold and low pressure in the hold will kill them — and notify the addressee by cable with the flight number and consignment number.

To sum up: the meeting was held at a fortunate time. The taxonomic basis built by Heim, Foxworthy, Symington, Van Slooten, Ashton and others on steadily expanding material, is now complete to a degree where problems can — and have been — fruitfully identified for other disciplines. Some specialists in such fields are available and interested, if not quite enough. Especially in ecology, more workers are needed. It is easily noted that, through forestry, economy has great benefits to reap from anatomy, bark morphology, chemistry, cytogenetics, palynology, taxonomy, tree architecture, and others, particularly if they interact in concert, and if the governments do not allow their Dipterocarp resources to be sold out for ever.

For all these reasons there will be much to do for an International working Group on Dipterocarpaceae. It was decided to establish such a working group under a caretaker secretariat in the hands of Messrs. J. Muller (correspondence) and M. Jacobs (circulars), c/o Rijksherbarium, Schelpenkade 6,

Leiden, Netherlands. As members qualify those persons who are interested in any aspect of the family. Members are requested to communicate news to the secretariat, and to order extra reprints of their Dipterocarp publications for fellow-members

The desire for a second meeting was generally felt; mid-1979 seems a good time to aim at (by then, the IUCN task force must have drawn up the action program). By all means, such a meeting should be held in a Dipterocarp country.

A brief declaration was adopted. It urges governments in Dipterocarp countries to promote a) conservation of their Dipterocarp resources, b) research, c) education.

After the meeting, an excursion was made to Fontainebleau, enlivened by a lunch which lasted for 2½ hours. On that event, Drs. Kostermans and Vidal delighted the company with an old French song, adapted for the occasion to contain the words that became the title of this paper: A la santé des Diptérocarpacées! And this was certainly a good conclusion.

Rijksherbarium, Leiden M. Jacobs

Meanwhile, prospects for a Second Meeting have been discussed, and it turned out that the best possibilities are to be expected from a combination with the 5th International Symposium of Tropical Ecology (INTECOL), to be held at Kuala Lumpur, 16-21 April 1979. In the general circular already sent out, 1 June 1978 has been indicated as the deadline for applications. Contact Professor J. I. F u r t a d o, Zoology, University of Malaya, Pantai Valley, Kuala Lumpur, Malaysia.

P.S. It looks that a part of the Mémoires du Museum d'Histoire Naturelle will be published to contain all the papers of the Symposium. For this, contact Mme. Géma Maury, Phanérogamie, 16 Rue Buffon, Paris, France.