MEETINGS OF THE ROYAL BOTANICAL SOCIETY OF THE NETHERLANDS

POLLEN SYMPOSIUM ON OCTOBER 30, 1971

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Pollen morphology and evolution

The factors which have governed pollen evolution are inadequately known, although phylogenetic schemes showing the derivation of pollen types, and statements concerning the taxonomic value of pollen characters are common in the literature. WODEHOUSE (1935) first attempted a comprehensive review of pollen evolution. He emphasized the close relation between size, mode of pollination, and structural differentiation of the exine and discussed functional aspects.

Size may be related to chromosome number (polyploids often have larger grains with more apertures), pollination ecology (wind-dispersed grains are small, insect-dispersed ones large or small), size of flowers (Fouquieraceae), or length of style (*Glandularia*, Verbenaceae).

Sticky, strongly sculptured pollen is characteristic for most insect pollinated flowers, but small, smooth and dry pollen occurs in *Viola*, *Galanthus* and *Pedicularis* and is here related to the peculiar pollination mechanism of these flowers.

Compound pollen grains are often found in flowers possessing a large number of ovules (Orchidaceae, certain Annonaceae).

The protective function of the exine is a further source of diversity. Especially volume-accommodating structures (harmomegathi in the sense of Wodehouse) have evolved in great variety. Specialized apertures having the functions of pollen tube exit and places of enzyme exchange with the stigmatic surface are often combined with such structures.

A few examples may illustrate these general principles.

Evolution of conifer pollen appears related to fertilization mechanism and stigmatic structure. An evolutionary trend towards loss of airsacs, postulated on the basis of recent conifers, has been observed in time sequence in the Permo-Triassic *Lueckisporites* complex (VISSCHER).

In Umbelliferae trends towards increase in size and structural differentiation of the exine and change in shape are correlated with trends from annual to perennial, undivided to divided leaves and from small, smooth to large, spinose fruits (CERCEAU-LARRIVAL 1967).

In *Waltheria* (Sterculiaceae) a parallel evolutionary development from few equatorial apertures to many regularly distributed ones has taken place in two groups of species, characterized, respectively, by echinate and reticulate sculpture. In both groups the exine shows a trend towards increased complexity. No correlation with the taxonomic subdivision of the genus appears possible, but the geographic distribution pattern of the various pollen types elucidates the history of the genus (KÖHLER 1971).

In *Caltha leptosepala* populations with tricolpate pollen were separated during the last glacial period from populations with a higher number of apertures. In the present zone of contact mixed populations are found (SMIT & PUNT 1969).

A tendency towards increase in aperture number, often coupled with a change from equatorial to peridispersed position, occurs in more dicotyledonous taxa (e.g. Convolvulaceae). Increased germinating efficiency may have been among the causative factors.

In the genus *Sonneratia* (Sonneratiaceae) apertures are uniform, but the exine structure is highly variable, which can be related to increased harmomegathic efficiency. Recent populations of *S. alba* have yielded 21 pollen subtypes, with various degrees of abortion. The geographic distribution of these subtypes reflects dispersal over a geographically broken area. The fossil record shows the largest and most complex *S. alba* pollen type to be the youngest, while an ancestral type occurs in the Oligo-Miocene (MULLER 1969).

It is evident that the relation between form and function should be central in the study of pollen grains, as it is in other branches of biology. A pollen ecology is needed before pollen

morphology can be transformed into pollen evolution, and only then will taxonomy reap the full benefit of the palynologist's efforts.

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MEETING OF THE SECTION FOR PLANT TAXONOMY AND GEOGRAPHY ON APRIL 17, 1971

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Delimitation of the genera and wood anatomy in the Celastraceae (Hippocrateaceae).

The taxonomic position of both *Celastraceae* and *Hippocrateaceae* was briefly discussed. In spite of my conviction that in their recent treatments both Ding Hou and N. K. B. Robson rightly consider the *Hippocrateaceae* as part of the *Celastraceae*, they are here still treated as separate entities.

By the structure of their wood two distinct groups stand out in the *Hippocrateaceae*. These correspond with *Hippocratea* s.lat., including the genus *Campylostemon*, and with *Salacia* s.lat., the species with peculiar capsular fruits consisting of 3 mericarps and winged seeds, and the species with drupaceous fruits and non-winged seeds, respectively.

The differences in wood structure between *Hippocratea* (and *Campylostemon*) and *Salacia* consist in wide rays versus uniseriate rays and in the occurrence of scattered septate fibres among the fibre tracheids versus banded septate fibres resembling parenchyma (a feature also often present in genera of the *Celastraceae*).

Most of the *Hippocrateaceae* are lianas with abnormal secondary growth, either by intrusion of the phloem of the bark into the woody cylinder or by included phloem, the latter, as seen in cross section, present as isolated strands or as concentric rings. It turned out that the presence or absence and the distribution of the included phloem do not give a clue to taxonomic relationship. E.g. in the genus *Cheiloclinium*, well characterized by the features of the disk, normal wood as well as wood with included phloem occurring as strands or as regular rings may be found.

Of the various taxa in both groups recognized by most modern authors, only two, both belonging to *Hippocratea* s.lat., show distinctive anatomical characters (*Prionostemma* with silica in the ray cells; *Hippocratea volubilis* L. with short triangular intrusions of the bark into the wood).

Genera like *Kokoona* and *Lophopetalum*, which as far as morphological characters are concerned can be considered as intermediates between *Hippocrateaceae* and *Celastraceae*, in their anatomy do not resemble *Hippocratea* nor *Salacia*.

A. M. W. MENNEGA (in press): A survey of the wood anatomy of the New World Hippocrateaceae, in Prof. Chowdhury Commemoration Volume, Tata McGraw-Hill, New Delhi.