

ON TERMINOLOGY IN POLLEN AND SPORE MORPHOLOGY*

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THE following suggestions are issued as a result of discussions held at the Birbal Sahni Institute of Palaeobotany, Lucknow, in February and March, 1957. They represent the expression of a collective desire to establish terminological order, consistency, and simplification in pollen and spore morphology.

APERTURES

The apertures of the spores (pollen grains or spores according to the context) are either *long* (length/breadth ratio greater than 2) or *short* (length/breadth ratio 2 or less than 2). They are either *polar*, *zonal* (i.e. with their centre at the equator or at one or several lines parallel to the equator), or *global* (i.e. \pm uniformly spread over the surface). Long apertures are known as *colpi* (unfortunately not a very good term; "sulci" has older standing and would no doubt be better), short ones as *pori*. In coining simple terms the Greek prefix *cata-* (down, against) may indicate an aperture at the inner (proximal) pole, the prefix *ana-* (up) an aperture at the outer (distal) pole. A zonal arrangement of the apertures may be indicated by the prefix *zoni-*, a global arrangement by *pan-* (the prefix *peri-* may be misleading). Spores with long apertures are thus either *cata-*, *ana-*, *zoni-*, or *pancolpate*; spores with short apertures *cata-*, *ana-*, *zoni-*, or *panporate*. If the exact position of the aperture(s) is not known, the spores are simply referred to as *colpate* or *porate* (without prefixes). Spores without apertures are *inaperturate*. Spores with composite apertures are denoted by intercalating "or" (indicating the presence of an os, i.e. inner part of the aperture) between the prefix and the suffix. Thus zonicolpate spores with oriferous colpi are *zonicolporate*, while pancolpate spores are *pancolporate*. Spores with

a (polar) three-slit aperture are known as *trichotomocolpate*. Catacolpate spores should, in accordance with common practice, be referred to as 1-lete (*monolete*) or, if the "colpus" (*laesura*) is three-slit, 3-lete (*trilete*).

The terminology thus briefly outlined seems to be fairly natural, and at the same time, consistent from a morphological point of view. Thus monolete, trilete, and cataporate spores are found in mosses and ferns, anacolpate and anaporate pollen grains in gymnosperms and monocotyledons, zoni- and pan-aperturate pollen grains mainly in dicotyledonous plants. (N.B. The zonicolpate grains also comprise a not yet sufficiently studied type mainly confined to the monocotyledons and previously described as "sulcate".)












According to these suggestions, the following terms, among others, would be superfluous: hilate (= cataporate), sulcate (= anacolpate), ulcerate (= anaporate), rugate (= pancolpate), forate (= panporate), stephanocolpate (= zonicolpate in part), stephanoporate (= zoniporate in part), etc.

SPORODERM STRATIFICATION

(based on ordinary light microscopy)

The sporoderm consists of *perine* (in certain mosses and ferns only), *exine*, and *intine*. The exine comprises an inner, usually homogeneous layer (*nexine*), an outer layer (*sexine*) composed of more or less radial processes, and one or several layers (*tegillum*, plur. *tegilla*), lying more or less parallel to the general surface of the nexine. The processes, which may be classified according to their shape (*verrucae*, *gemmae*, *bacula*, *pila*, etc.), either extend from the nexine or from the outermost tegillum. In certain cases (*bacula*) they may have a root in the

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Faegri and Iversen 1950 Iversen and Tricell-Smith 1950	ERDTMAN 1952	POSITION OF APERTURES					Main subdivisions	
		POLAR (proximal)	POLAR (distal)	ZONAL	GLOBAL	UNKNOWN		
	monolete						monolete	Bryophytes Pteridophytes
	trilete						trilete	
	hilate						cataporate	
colpate p.p.	sulcate						anacolpate	Gymnosperms Monocotyledons
porate p.p.	ulcerate						anoporate	
colpate p.p. stephanocolpate	colpate						zonicolpate	Dicotyledons
porate p.p. stephanoporate	porate						zoniporate	
pericolpate	rugate						pancolpate	
periporate	forate						panporate	
colpate							colpate	
porate							porate	

nexine, protrude as *infrategillar* elements, penetrate (or, in certain cases by amalgamation apparently form) a tegillum, continue (if there are two tegilla) as *intertegillar* elements, penetrate the upper tegillum, and come to an end with a distal *suprategillar* part. Certain processes (*spinae*, *spinulae*) are generally borne on tegilla only. A tegillum may be defined as a layer (or layers) formed whenever two or more processes amalgamate or are united by the deposition of material upon and/or between their distal parts.

When a tegillum is present, the tegillum and everything connected with its outer surface is referred to as *ectosexine*, whereas the supporting bacula, or the layer that may be found in their place, are referred to as *endosexine*. Less important, at least at present, is the subdivision of the nexine into an outer, thicker, and less refracting part (*ectonexine*) and an inner, thinner, probably less resistant, more refracting part (*endonexine*). The last layer may be distinctly seen as an individual stratum, e.g. in *Epilobium* spp. and other oenotheraceous plants (cf. also recently published photomicrographs and electron micrographs). A redefinition of the terms ectexine (sexine) and endexine

(nexine) according to a non-morphological principle (staining properties), as suggested in the *Botanical Review*, 1956, should be rejected.

According to the areal extension of the tegilla (tegillum), the sexine is generally *striate*, *reticulate*, *tectate*, or *insulous* ("areolate"), i.e. forming *lirae*, *muri*, a *tectum*, or *insulae*, etc. *Lirae* have sometimes previously been referred to as "valla", plur. "vallae" (this should, however, be vallum, plur. valla, from the Latin for a wall). *Tectum*, as here suggested, indicates that the pollen grains are provided with a more or less unbroken tegillum.

SIZE

It does not seem advisable to suggest strict rules for calculations of the size. Whenever size figures are given it is, however, important to state which layers, etc., are included. The length of *spinae* and *spinulae* should, in accordance with common practice, be given separately. In other cases it generally seems preferable to use overall outer dimensions (i.e. to include *verrucae*, *gemmae*, *tegilla*, etc.). If, however, the tegillate parts of the sexine, or the processes in integillate grains, are

neither numerous nor very conspicuous, they had perhaps better not be included in the size-figures (a statement of how the measurements were made should be provided in any case).

The aperture classification, as here suggested, may, if advisable, serve as a basis for a classification of spores (fossil as well as recent) on a uniform basis (aperture characters). A master-key to pollen classes published in Copenhagen, in 1950, undoubtedly serves certain practical needs. If, however, consistency be strictly observed, several classes in that key cannot be unanimously accepted. Thus there may be transitions from a tetrad to a monad condition, from saccate ("vesiculate") spores to spores without sacci, etc. Furthermore, the class "dicolpate" may take pollen grains and spores of various origin and character, such as dicotyledons (e.g. certain Acanthaceae), monocotyledons (e.g. *Tigridia*, *Tofieldia*,

and certain palms) and even pteridosperms. A classification on a purely apertural basis, as here suggested, should probably prevent or at least diminish discrepancies of that kind.

It should be stressed, in conclusion, that the discussions at Lucknow did not aim at a system to serve special needs. In their routine work oil and coal geologists and others may like to have convenient pigeon-holes where the pollen grains and other spores could be placed. The discussions at Lucknow did not consider these lines. The paramount point, it was unanimously felt, was to provide a basis for a uniform terminology in pollen and spore morphology, a basis by means of which spore diagnoses could be provided in a lucid, easily understandable way, much like ordinary plant diagnoses. The contributors of the present note will welcome and appreciate any comments and suggestions.