A CLASSIFICATION FOR SPORAE DISPERSAE

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ABSTRACT

A new moropholographic classification for the fossil, dispersed spores of higher cryptogams and phanerogams has been proposed. The categories are mutually exclusive. Each is based upon presence or absence of an obvious characteristic, chosen in view of its greater prevalence in the sporae dispersae surmised to be belonging to a Group, Class, Subclass etc., of plants, as apparent from our knowledge of the *in situ* spores from fructifications. Within the ultimate suprageneric categories, the constituents represent presumed evolutionary sequences of morphographic organizations and characters, as far as possible.

INTRODUCTION

Spores and pollen grains abound dispersed in the sedimentary rocks of the Palaeozoic, Mesozoic and Cenozoic eras. They include representations of all classes of plants as surmised from their similarity with the descriptions of the *in situ* spores recovered out of fructifications (POTONIE, 1962). They reveal varied morphographical characteristics and in different combinations of them. Thus, spores and pollen grains bearing functional, vestigial or undetectable haptotypic features, sacci—one, two, three and more or none, striations—few to many or none, sulci or colpi—one to many or none and the occurrence of sulculus, ulcus, porus and porocolpus besides the variations in exine sculpture and structure, are to be found. This multiplicity of morphographic features, presents obvious difficulties in any effort to classify the sporae dispersae specially with regard to the comparative importance which may be attached to each morphographic feature met within them.

Till today, a good number of fossil fructifications with their spores have been described. They have provided us the basic understanding about the nature of spore organisations in different classes of plants. Moreover, the sporae dispersae, organizationally close to these, described from older or younger strata, tend to reveal the evolutionary variations, which the different morphographic characters must have acquired in geological time. This knowledge was utilized for the classification of gymnospermous sporae dispersae by me in 1971 (BHARADWAJ, 1974) and the same scheme extending to the spores of higher cryptogams and angiosperms is presented here.

The Approach

It is mostly agreed that an ideal classification of biological entities is one which reproduces phylogeny or natural relationships as nearly as possible. The same holds true for a classification of sporae dispersae limited of course, by the extent of the insufficiency in our knowledge about their morphology.

In the classification of biological entities, genus is the unit. The genera need to be grouped together on the basis of their morphographic characters, into suprageneric categories of different rank and these in turn to make up the classification. Hence, it is from amongst the morphographic features characterizing the genera that some are to be selected for defining the suprageneric categories. However, the most important aspect is how to pick any

one out of the many morphographical characters, considering the same to be the most significant for a particular level in the classification. As the sporae dispersae are plant remains, for their morphological or natural classification their division and subdivisions at the higher level have to follow a pattern similar to those for plant kingdom as far as possible based upon morphographic features which are exclusively characteristic of the major plant groups or classes. To select the morphographic features for subdivisions at lower level, the method adopted by me (Bharadwaj, 1974) for gymnospermous sporae dispersae, wherein the oldest organizations have been traced through their apparently connected modifications in successively younger strata making up the morphographical evolutionary sequences, has been useful. This method revealed the feature which remained unaffected and thus, which could be of value as the basis for subdivision.

Plant kingdom is primarily divided into Phanerogams and Cryptogams. Among the pollen grains of the former, the differentiation of a *tenuitas* and the presence of a structured endosexine in the exine, are exclusive as compared to the cryptogamic spores, notwithstanding some gymnospermous pollen grains (cf. *Heterotheca—Benson*, *Potoniea* Zeiller, *Dolerotheca* Halle and *Cycadocephalus* Nathorst and the like—Potonie, 1962) which lack these characteristics and in some others at least one of these is absent, obviously due to their primitivity.

Among the higher cryptogams, almost all lycopsid spores are characterized by arcuate exinal connectives or the *curvaturae* between the ends of trilete rays or the monolete mark. These connectives are thin, thick, low, high, simple or modified and variously subequatorial in position. As apparent from the stratigraphical distribution of these features the thin, low and simple curvaturae are primitive and the others are advanced.

Among the non-lycopsid spores of higher cryptogams, most of the sphenopsid spores are spherical but for some bilateral ones. In the former, the primitive organization lacks the advanced, functional operculum. The filicinian spores are triangular, spherical or bilateral and bryophytic spores are triangular or circular.

Among phanerogams the *sulcus* (incl. *ulcus* and *sulculus* as its modifications) is present on one or both the polar faces in most of gymnosperms and some primitive angiosperms. In most of the angiosperms, the *colpus* which runs across the equator and between the polar faces with its various modifications and the simple or complex *porus* located on the equator or close to it, are characteristic.

The above mentioned morphographic characteristics, being diagnostic of major groups of plants, have been considered here as most suitable to provide the basic criteria for the division and subdivision of *Sporites* H. Pot., which as defined here includes all originally, sexually productive, spores dispersed in sedimentary strata. This treatment presents a serious digression from the hitherto persued approach in the classifications proposed by Ibrahim (1933), Naumova (1937), Potonie and Kremp (1954) and Rueda-Gaxiola (1969). Instead of separating spores from pollen grains on a theoretical consideration, the absence or presence of tenuitas has been found to do almost the same morphographically. For the subdivision of the nontenuitate spores, criteria characteristic of the different classes of higher cryptogams have been used rather than the uniformly prevalent trilete or monolete haptotypic features. On the other hand, for the tenuitate pollen grains, the variations in the shape and position of the tenuitas, being evolutionary manifestations, have provided the basis for separating gymnospermous sporae dispersae from the angiospermous ones whereas characters like saccus and rugula, appearing separately in different classes, have been used as suprageneric categories of much lower rank than that done by the earlier systematists.

The classification proposed here is entirely a new approach. Its frame-work is based upon

easily understood morphographic characters valued with reference to their evolutionary status and the phylogeny of the plants whose sporae dispersae bore them. At the very high level, the categories include spores or pollen grains of a number of classes. However, in the next lower levels such features as characterize most of a class have been employed to separate them from others as far as feasible. In the ultimate suprageneric categories, the constituent genera normally represent one, morphographic, evolutionary chain, linked by one constant characteristic. Summing up the approach, the following considerations have influenced the newly proposed classification:

(1) Tenuitas is the most significant morphographic character of the phanerogamic pollen grains separating them from all cryptogamic spores.

(2) Among the tenuitas, the ill-defined sulcus is considered primitive as compared to a defined sulcus which may be borne distally or proximally (primitive). A fossate sulcus is presumed to be more primitive than ulcate condition which is considered an advanced modification of a distal fossate sulcus. A sulculus is supposed to have given rise to pori or colpi as two independent derivations. A porocolpus is considered to be an advancement from a colpus.

(3) The whole haptotypic impression wheresoever distinctive, has been relied upon. Trilete, monolete and alete nature, persistently employed so far by all the spore systematists as a major character of higher level distinction, has been abandoned.

(4) The triangular and circular shapes in polar view have been held important whereas sculpture has not been found worthy for suprageneric categorization and thus, abandoned.

(5) In vesiculation or cavatism, the number of sacci held to be a characteristic of major importance by earlier systematists has been abandoned and instead of it the presence or the shape of the saccus has been held significant but at a much lower level. Likewise, the presence of striations has been much degraded.

(6) Alete spores and nontenuitate, alete pollen grains have not been given special categorization because, if belonging to higher cryptogams or phanerogams, they are presumed to be so due to reduction in the manifestation of germinal feature. Hence, they have been grouped along with the otherwise similar forms. So also is the treatment for the tetradic forms. However, cases which defy all morphographic means to find a place in the system proposed below are supposed to be listed under *incertae sedis*.

In the classification given below, the names of all the suprageneric categories are latin derivatives.

THE CLASSIFICATION

Anteturma *Sporites* H. Potonie 1893 emend. Bharadwaj 1974. All originally sexually productive spores and pollen grains dispersed in geological strata with or without a tetrad mark or tenuitas.

Subanteturma **Atenuitati** Bharadwaj, 1974

All sporae dispersae with or without a tetrad mark and lacking illdefined or defined tenuitas such as sulcus, sulculus, ulcus, porus, colpus or porocolpus and all their modifications.

Turma **Curvaturati** Bharadwaj, 1974

All sporae dispersae bearing subequatorially on the proximal face, arcuate structures connecting the ends of the tetrad mark completely or incompletely.

Subturma **Acingulati** Bharadwaj, 1974

All sporae dispersae where arcuate structures are either in the form of low ridges or are vertically raised.

Infrasubturma **Agulati** Bharadwaj, 1974

All sporae dispersae where the apex of trilete rays is low.

Typical examples: *Retusotriletes* (Naum., 1953) Richardson, 1965
Grassispora Bharad., 1957
Laevigatisporites Ibrahim, 1933
Cystosporites Schopf, 1938

Infrasubturma **Gulati** Bharadwaj, 1957

Typical example : *Lagenicula* (B. & K.) Pot. & Kremp, 1954
Capulisporites Potonie, 1956

Subturma **Cingulati** Pot. & Klaus, 1954 emend. Bharad., 1974

All sporae dispersae where the curvaturae are flattened forming narrow to wide flange.

Infrasubturma **Nonexinaugeri** Bharadwaj, 1974

All sporae dispersae where sexine shows no tendency of separation from nexine.

Typical examples: *Lycospora* S. W. & B., 1944
Bentzisporites Pot. & Kr., 1954
Triangulatisporites Pot. & Kr., 1954
Reticulatisporites Ibr., 1933 em. Neeves, 1964

Infrasubturma **Exinaugeri** Bharadwaj, 1974

All sporae dispersae where sexine separates from the nexine subequatorially on the proximal face extending on to distal face partially to wholly.

Typical examples: *Endosporites* Wilson & Coe, 1940
Spencerisporites Chaloner, 1951
Aratrisporites Leschik, 1955 em. Klaus, 1960

Turma **Noncurvaturati** Bharadwaj, 1974

All noncurvaturate, atenuitate sporae dispersae.

Subturma **Triquetri** Bharadwaj, 1974

All such sporae dispersae which exhibit a triangular shape in polar view.

Infrasubturma **Abalti** Bharadwaj, 1974

Triangular sporae dispersae lacking an equatorial girdle.

Infraturma **Brevipolaxi** Bharadwaj, 1974

Triangular sporae dispersae having a polar axis shorter than the equatorial axis.

Typical examples: *Leiotriletes* (Naum.) Pot. & Kr., 1954
Granulatisporites Ibr., 1933 em. Pot. & Kr., 1954
Indospora Bharadwaj, 1962

Infraturma **Longipolaxi** Bharadwaj, 1974

Triangular sporae dispersae with a polar axis longer than the equatorial axis.

Typical examples: *Microbaculispora* Bharadwaj, 1962
Dictyophyllidites Couper, 1958
Cicatricosisporites Pot. & Gell., 1933

Infrasubturma **Balti** Bharadwaj, 1974

Triangular sporae dispersae with a continuous equatorial girdle of crassiexine, frilly exine, saccus or scutulum etc., or a discontinuous one at the angles or between the angles.

Infraturma **Nonintermitteri** Bharadwaj, 1974

Triangular sporae dispersae with a continuous ± equatorial girdle.

Subinfraturma **Apseudosacciti** Bharadwaj, 1974

Triangular sporae dispersae where the ± equatorial girdle is not cavate.

Typical examples: *Craspedispora* Allen, 1965
Simozonotriletes (Naum., 1937) Pot. & Kr., 1954
Gallisporites Butterw. & Williams, 1958
Asbeckiasporites v. d. Brelie, 1964

Subinfraturma **Pseudosacciti** Bharadwaj, 1974

Triangular sporae dispersae where the ± equatorial girdle is cavate.

Typical examples: *Calyptosporites* Richardson, 1960 em. Richardson, 1962
Auroraspora H. S. & M., 1955 em. Richardson, 1960
Pseudowilsonia T-Lantz, 1960

Infraturma **Intermitteri** Bharadwaj, 1974

Triangular sporae dispersae with a discontinuous equatorial girdle.

Subinfraturma **Angulati** Bharadwaj, 1974

Exinous growth restricted to angles.

Typical example: *Triquitrites* Wils. & Coe, 1940 em. Pot. & Kr., 1954

Subinfraturma **Nonangulati** Bharadwaj, 1974

Exinous growth discontinued at the angles.

Typical examples: *Reinschospora* S. W. & B., 1944
Alatisporites Ibr., 1933
Dulhuntispora Pot., 1956

Subturma **Nontriquetri** Bharadwaj, 1974

Noncurvaturate and nontriangular sporae dispersae.

Infrasubturma **Nonstructurati** Bharadwaj, 1974

Sporae dispersae having unstructured or intectate exine among nontenuitate, noncurvaturate and nontriangular organizations.

Infraturma **Sphaerae** Bharadwaj, 1974

All nontenuitate, noncurvaturate sporae dispersae with intectate exine and spherical shape i.e. all axes are equal.

Subinfraturma **Operculati** Bharadwaj, 1974

All such spherical sporae dispersae where a discoid part of spore wall around the proximal pole is differentially marked out.

Typical examples: *Calamospora* S. W. & B., 1944
Vestispora Wils. & Hoffmeister, 1956 em. Bharad. 1957
Foveolatisporites Bharad., 1956

Subinfraturma **Nonoperculati** Bharadwaj, 1974

All spherical sporae dispersae in which a discoid part or spore wall around the proximal pole is not differentially marked out.

Typical examples: *Pteroretis* Felix & Parks-Burbridge, 1961
Convolutispora H. S. & M., 1955
Cyclogranisporites Pot. & Kr., 1954
Verrucosisporites Ibr., em. Smith, 1971

Infraturma **Nonsphaerae** Bharadwaj, 1974

All nontenuitate, noncurvaturate, intectate sporae dispersae which are not spherical i.e. only two or none of the axes are equal.

Subinfraturma **Circuli** Bharadwaj, 1974

All sporae dispersae which are circular or subcircular in polar view but are not spherical.

Infrasubinfraturma **Leti** Bharadwaj, 1974

All circular or subcircular, nontenuitate, intectate and noncurvaturate sporae dispersae having a trilete suture proximally.

Typical examples: *Rhabdosporites* Richardson, 1960
Aculeispores Artuez, 1957

Infrasubinfraturma **Aleti** Bharadwaj, 1974

All circular or subcircular, nontenuitate, intectate and noncurvaturate sporae dispersae without any suture proximally.

Typical examples: *Hoegisporis* Cookson, 1961
Zonaletes (Luber 1935) Staplin, 1960

Subinfraturma **Acirculi** Bharadwaj, 1974

All sporae dispersae bilateral in polar view.

Infrasubinfraturma **Agibberi** Bharadwaj, 1974

Bilateral sporae dispersae in which the distal face is not humped.

Typical examples: *Laevigatosporites* Ibr., 1933
Verrucososporites (Knox, 1950) Pot. & Kremp, 1954
Striatosporites Bharadwaj, 1954
Peromonolites (Erdtm., 1947) Couper, 1953

Infrasubinfraturma **Gibberi** Bharadwaj, 1974

Bilateral sporae dispersae having humped distal face.

Typical examples: *Schopfipollenites* Pot. & Kr., 1954
Praecolpatites Bharad. & Srivastava, 1969
Ephedripites Bolkhovitina, 1953 em. Krutzsch, 1961.

Infrasubturma **Structurati** Bharadwaj, 1974

Sporae dispersae having structured or tectate exine among nontenuitate, noncurvaturate and nontriangular organizations.

Infraturma **Globi** Bharadwaj, 1974

All sporae dispersae with spherical body.

Subinfraturma **Cavati** Bharadwaj, 1974

Spherical sporae dispersae developing a saccus.

Typical examples: *Remysporites* Butterworth & Williams, 1958
Wilsonites (Kosanke) Kos., 1959
Nuskoisporites Pot. & Klaus, 1954
Densipollenites Bharadwaj, 1962

Subinfraturma **Acavati** Bharadwaj, 1974

Spherical sporae dispersae without a saccus.

Typical examples: *Callumispora* Bharadwaj & Srivastava, 1969
Stenozonitriletes Naumova, 1937

Infraturma **Nonglobi** Bharadwaj, 1974

All sporae dispersae with triangular or subspherical body.

Typical examples: *Schulzospora* Kosanke, 1950.
Florinites S. W. & B., 1944
Guthoerlisporites Bharadwaj, 1954

Subanteturma **Tenuitati** Bharadwaj, 1974

All sporae dispersae which possess due to thinning of the exinal layers such tenuitas as sulcus, sulculus, ulcus, colpus, porocolpus or porus and their modifications.

Turma **Sulcati** Bharadwaj, 1974

All sporae dispersae which show a sulcus, sulculus or ulcus.

Subturma **Polaesulcati** Bharadwaj, 1974

All sporae dispersae where a tenuitas or sulcus occurs either at the proximal pole, the distal pole, both poles or both polar faces.

Infrasubturma **Nondefiniri** Bharadwaj, 1974

All sporae dispersae where an ill-defined tenuitas occurs proximally or distally.

Infraturma **Distarae** Bharadwaj, 1974

All polaesulcate sporae dispersae where the tenuitas is distal and ill-defined in extent.

Subinfraturma **Bilaterae** Bharadwaj, 1974

The pollen body is bilateral.

Infrasubinfraturma **Corugati** Infrasubinfraturma nov.

Diagnosis—Exine of spore body etched with linear grooves.

Typical examples: *Vittatina* Luber, 1940 ex Samoilovich, 1953 em. Jansonius, 1962
Weylandites Bharadwaj & Sriv., 1969

Infrasubinfraturma **Noncorugati** Infrasubinfraturma nov.

Diagnosis—Exine of spore body nonetched.

Typical examples: *Vesicaspora* Schemel em. Wils. & Venkatacha., 1963
Labiisporites Leschik, 1955
Klausipollenites Jansonius, 1962

Subinfraturma **Nonbilaterae** Bharadwaj, 1974

The pollen body is nonbilateral.

Typical examples: *Alpernipollenites* Danze & Laveine, 1962
Parasaccites Bharadwaj & Tiwari, 1964
Stellapollenites Lele, 1965
Triangulopsis Doering, 1961
Applanopsis Doering, 1961

Infraturma **Nondistarae** Bharadwaj, 1974

All sporae dispersae with a proximal, ill-defined tenuitas.

Typical examples: *Parasporites* Schopf, 1938
Jugasporites Klaus, 1963

Infrasubturma—**Definiri** Bharadwaj, 1974

All polaesulcate sporae dispersae where the sulcus is of a defined shape.

Infraturma **Fossati** Bharadwaj, 1974

All sporae dispersae where a sulcus is biradial.

Subinfraturma **Taeniati** Bharadwaj, 1974

All sporae dispersae where the sulcus has thickened exinal bands as its edges or lips.

Infrasubinfraturma **Proximi** Bharadwaj, 1974

All sporae dispersae where the sulcus occurs on the proximal face only or on both faces.

1. *Adistalae*—Sulcus on proximal face only.

Typical examples: *Sahnisporites* Bharad., 1954
Lueckisporites Pot. & Klaus, 1954
Scutasporites Klaus, 1963

2. *Distalae*—Sulcus on both polar faces.

Typical examples: *Crucisaccites* Lele & Maithy, 1964
Guttulapollenites Goubin, 1965 em. Venkatachala, Goubin & Kar, 1967
Lunatisporites Lesch., 1955 em. Bharadwaj, 1974

Infrasubinfraturma **Aproximi** Bharadwaj, 1974

All sporae dispersae where the sulcus occurs on the distal face only.

1. *Poroidae*—Bharadwaj, 1974—Distal sulcus as two, subequatorial, oval to circular, tenuitas.

Typical examples: *Gigantosporites* Klaus, 1963
Ovalipollis Krutzsch, 1955 em. Bharadwaj, 1974

2. *Aporoidae* Bharadwaj, 1974—Distally two to many sulci between the taeniae.

Typical examples: *Aumancisporites* Alpern, 1959
Costapollenites Tschudy & Kosanke, 1966
Hamiapollenites Wilson, 1962 em. Tschudy & Kosanke, 1966

Subinfraturma **Ataeniati** Bharadwaj, 1974

All sporae dispersae where exinal bands do not form sulcus edges.

Infrasubinfraturma **Longiquataxi** Bharadwaj, 1974

All sporae dispersae where the sulci or sulcus lies along the longer equatorial axis of the body.

1. **Rugulati** Bharadwaj, 1974

Sporae dispersae with striate exine.

Typical examples: *Kosankeisporites* Bharadwaj, 1956 em. Bharadwaj, 1974
Striatites Pant, 1955 em. Bharadwaj, 1962
Decussatisporites Leschik, 1955 em. Jansonius, 1962
Welwitschipollenites Bharadwaj, 1974

2. **Arugulati** Bharadwaj, 1974

Sporae dispersae with nonstriate exine.

2.1. **Monosulcati** Bharadwaj, 1944

All sporae dispersae having one vertical sulcus distally.

Typical examples: *Ginkgocycadophytus* Samoilovich, 1953
Marsupipollenites Balme & Hennelly, 1956 em. Pocock & Jansonius, 1969
Cycadopites (Wodehouse, 1933) ex. Wilson & Webster, 1946

2.2. **Amonosulcati** Bharadwaj, 1974

All sporae dispersae having more than one sulcus distributed on polar faces.

Typical examples: *Pretricolpipollenites* Danze-Corsin & Laviene, 1964
Eucommidites Erdtman, 1946 em. Hughes, 1961
Pocockipites Bharadwaj, 1974

Infrasubinfraturma **Breviquataxi** Bharadwaj, 1972

All sporae dispersae where the sulcus lies along the shorter equatorial axis.

Typical examples: *Potonieisporites* Bhard., 1954 em. Bharad., 1964
Parvisaccites Couper, 1958
Scheuringipollenites Tiwari, 1974
Pityosporites Seward, 1914
Platysaccus Naumova, 1937 em. Potonie & Klaus, 1954
Podocarpidites Cookson, 1947 em. Potonie, 1958

Willipollis Bharad., 1974
Alisporites Daugherty., 1941
Cedripites Wodehouse, 1933
Abiespollenites Thiergart in Raatz, 1937 em. Potonie, 1958

Infraturma **Afossati** Bharadwaj, 1974

All polaesulcate sporae dispersae bearing an ulcus.

Subinfraturma **Circumsulcati** Bharadwaj, 1974

All ulcate sporae dispersae also bearing a sulculus.

Infrasubinfraturma **Asegmentati** Bharadwaj, 1974

Sulculus undivided.

Typical examples: *Circulina* Malawkina, 1949
Duplicisporites Lesch., 1955 em. Scheuring, 1970
Praecirculina Klaus, 1960 em. Scheuring, 1970
Granuloperculatipollis Venk. & Goczan, 1964

Infrasubinfraturma **Segmentati**—Bharadwaj, 1974

Sulculus segmented.

Typical example: *Penetetrapites* Hedlund & Norris, 1968

Subinfraturma **Acircumsulcati** Bharadwaj, 1974

All ulcate sporae dispersae lacking a sulculus.

Infrasubinfraturma **Ligulati** Bharadwaj, 1974

All sporae dispersae with an invaginated ulcus.

Typical examples: *Sequoiapollenites* Thiergart, 1937
Araucariacites Cookson, 1947

Infrasubinfraturma **Aligulati** Bharadwaj, 1974

All sporae dispersae with an ulcus and without a sulculus.

Typical examples: *Classopollis* Pflug, 1953 em. Pocock & Jansonius, 1961
Classoidites Amerson, 1965
Monoporopollenites (Meyer, 1956) Pot., 1960
Execipollenites Balme, 1957

Subturma **Nonpolaesulcati** Bharadwaj, 1974

All such sporae dispersae where no sulcus lies at the pole.

Infrasubturma **Orbiculati** Bharadwaj, 1974

All sporae dispersae having a ring sulculus.

Infraturma **Proximisulculati** Bharadwaj, 1974

Sporae dispersae having sulculus or its rudiments on proximal face.

Typical examples: *Illinites* Kosanke, 1950 (Klaus, 1964)
Complexisporites Jizba, 1962
Infernopollenites Scheuring, 1970

Infraturma **Approximisulculati** Bharadwaj, 1974.

All spores having sulculus on distal face.

Typical examples: *Barakarites* Bharad. & Tiwari, 1964
Fossapollenites Scheuring, 1970
Camerosporites Leschik, 1955 em. Scheuring, 1970
Schizosporis Cookson & Dettmann, 1959

Infrasubturma **Nonorbiculati** Bharadwaj, 1974

All sporae dispersae with the sulculus restricted and modified into pores.

Typical examples: *Cricotriporites* Leidelmeyer, 1966
Intertrioculates Thiergart & Frantz, 1961
Tripunctisporis Krutzsch, 1966

Turma **Nonsulcati** Bharadwaj, 1974

All sporae dispersae which bear colpus, porocolpus or porus, and their modifications.

Subturma **Colpati** Bharadwaj, 1974

All sporae dispersae which bear one colpus or more.

Infrasubturma **Aporocolpati** Bharadwaj, 1974

All sporae dispersae which have simple colpi.

Infraturma **Apolaeconecti** Bharadwaj, 1974

Diagnosis—All sporae dispersae where colpi are not connected to each other at or around the poles.

Typical examples: *Dicolpopollis* Pflanzl, 1956 em. Potonie, 1966
Tricolpites (Erdtman, 1947), Couper, 1953 em Potonie, 1960
Pemphixipollenites Stover, 1963
Fustispollenites Tschudy & Pakiser, 1967
Rugaepollis Engelhardt, 1966

Infraturma **Polaeconecti** Bharadwaj, 1974

Diagnosis—All sporae dispersae where colpi are connected to each other at or around the poles or extend over the poles.

Typical examples: *Syndemicolpites* v. Hoeken-Klikenberg, 1964
Trichotomosulcites (Erdtman, 1945) Couper, 1953
Liliacidites Couper, 1953

Infrasubturma **Porocolpati** Bharadwaj, 1974

Diagnosis—All sporae dispersae which bear the porocolpus.

Infarturma **Anguli** Bharadwaj, 1974

Colporate sporae dispersae with angular equator.

Typical examples: *Araliaceoipollenites* Pot., 1951
Cupanieidites Cookson & Pike, 1954
Nyssapollenites Thiergart, 1937
Symplocoipollenites Pot., 1951

Infraturma **Nonanguli** Bharadwaj, 1974

All colporate sporae dispersae with circular equator.

Typical examples: *Retimonocolporites* Rueda-Gaxiola, 1967
Polycolporopollenites Kedves, 1965
Hexaporotricolpites Boltenhagen, 1967

Subturma **Noncolpati** Bharadwaj, 1974

All sporae dispersae which bear one porus or pori.

Infrasubturma **Nonequatorialis** Bharadwaj, 1974

Location of porus or pori not confined to the equator.

Infraturma **Unipolaris** Bharadwaj, 1974

Triangular sporae dispersae with porus or pori confined to one polar face only.

Typical examples: *Victorisporis* Belsky *et al.*, 1965
Andreisporis Belsky *et al.*, 1965

Infraturma **Bipolaris** Bharadwaj, 1974

Circular sporae dispersae with porus or pori present on both polar faces.

Typical examples: *Alexandriapollis* Krutzsch, 1966
Chenopodiopollis Krutzsch, 1966

Infrasubturma **Equatorialis** Bharadwaj, 1974

Porus or pori located along the equator only.

Infraturma **Triangulares** Bharadwaj, 1974

Triangular, porate sporae dispersae.

Typical examples: *Hungaropollis* Goczan, 1964
Carpinipites Srivastava, 1966

Infraturma **Nontriangulares** Bharadwaj, 1974

Nontriangular, porate sporae dispersae.

Typical examples: *Annutriporites* Guzman, 1967
Australopollis Krutzsch, 1966
Diporites v. d. Hammen, 1954
Psilodiporites Varma & Rawat, 1963
Betulaepollenites Pot., 1934
Verrutriporites Muller, 1968
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