

ON THE GENUS *PUNCTATISPORITES* IBRAHIM, 1933

During the course of our palynological studies many a time such trilete spores as have been described or reported to be species of *Punctatisporites* Ibrahim by other palynologists have been met with. Often, it has proved extremely difficult for us to subscribe to the everwidening morphographic circumscription of this genus without any convincing morphological basis in support of such a taxonomic approach. Recently, BHARADWAJ AND SRIVASTAVA (1969) separated from it the characteristically spherical, mostly thick-exined with incipient to obvious differentiation of structure in it and trilete bearing miospores under *Callumispora*. This new genus is cosmopolitan and has been reported from various periods in the Upper Palaeozoic and the Mesozoic. It has also proved to be of stratigraphical value in the Gondwanalands, indicative of the Permo-Carboniferous and Permo-Triassic transitions.

Punctatisporites was created by IBRAHIM (1933). He included in it three species out of which, but for *P. punctatus*, which is now accepted as the genotype, the other two viz., *P. parvus* and *P. pallidus* were transferred to *Granulatisporites* and *Calamospora* respectively by POTONIÉ AND KREMP (1955). Meanwhile, SCHOPF, WILSON AND BENTALL (1944) emended *Punctatisporites* so as to include spores having laevigate to variously ornamented exine and, "originally nearly spherical or possibly broadly rounded triangular with slight shortening of axial dimension. When compressed the spores show no proximodistal orientation preference". However, POTONIÉ AND KREMP (1954) restricted this genus to miospores, circular or nearly circular with weak triangularity, smooth outline, sculptureless and structureless exine, or the structure seen as punctation, intrareticulation or intragranulation, probably also only local e.g. visibly punctate along the Y-rays. POTONIÉ AND KREMP (1955), also rediagnosed the genotype holding that the exine was intrapunctate in the species. They also photographically reproduced the holotype and one more specimen from the *stratum typicum* of the genotype. Besides the genotype, POTONIÉ AND KREMP (1955) described and illustrated three other species, all from the coal seams of the Ruhr. They also assigned to this genus seven other species described by KOSANKE (1950), LUBER (in LUBER & WALTZ, 1938) and IMGRUND (1952). In subsequent years, a large number of other species have been added to this genus by many palynologists from horizons as early as the Devonian to as late as Miocene. We wonder if there could be any taxon of vascular plants which could maintain constancy in its spore morphology through three geological eras defying the inevitable urge of evolution. Apparently the genus needs a critical scrutiny, to ascertain its true nature based upon the type and the other species included in it.

Among the six spores referable to four species of *Punctatisporites*, including its genotype, illustrated by POTONIÉ AND KREMP (1955, Pl. 11, Figs. 120-125) four are roundly triangular in polar view. Among the two remaining, one is the holotype of *P. obesus* (Loose) Pot. & Kr., which was originally assigned to *Laevigatisporites* by LOOSE (1934) and the other is assigned to *P. minutes* Kosanke (1950). All the roundly triangular spores show proximodistal orientation suggesting the probability of a polar axis shorter than the longer radial

axis. The spores illustrated in Figs. 121, 123 and 125, have thick exine. However, in the genoholotype (Fig. 122), the exine is thin and according to IBRAHIM (1933) bears distinct punctation with weakly rough outline. In view of the thinness of the exine which is also substantiated by the presence of folds, and the lowly irregular *extrema lineamenta* in the genoholotype, its exine does not seem to have been structured. Thus, *Punctatisporites* as represented in Westphalian B/C of Ruhr exhibits a morphographic association consisting of trilete mark, roundly triangular shape and lowly sculptured (finely punctate) exine without any structure. As opposed to this association, BHARADWAJ & SRIVASTAVA (1969) have instituted *Gallumispora* where the morphographic association is the trilete mark, circular (spherical) shape and structured, laevigate, exine. The main differences between the two genera lie in the shape of the flattened spore in polar view and exine structure *vis-a-vis* sculpture.

The triangular and the circular shapes have been considered normally to be worth generic differentiation by POTONIÉ & KREMP (1954, 1955). However, recently Bharadwaj (1974) has considered these characters to be of suprageneric significance. He distinguishes two main kinds of shapes in polar view among fossil spores viz., the triangular and the circular including the bilateral. Among the triangular shaped are also contained the roundly triangular ones. In the emendation of *Punctatisporites* by POTONIÉ & KREMP (1954) triangular spores with structured exine have been grouped with the genotype which as discussed above, has nonstructured thin exine in the holotype. In our opinion structured and non-structured exines are evolutionarily very much separated. Among the living pteridophyta, as far as known to us, the spore exines are nonstructured. The structure in spore exine seems to have developed first in the gymnosperms and there too at a level higher than the basal, because in the Whittlesynian pollen grains, structure is not seen in the exine. Thus, the triangular spores possessing structured exine, illustrated by POTONIÉ & KREMP (1955) for *Punctatisporites* Ibr., cannot be grouped with the genotype characterized by unstructured exine. Evidently these have to be found a place elsewhere and the diagnosis of *Punctatisporites* Ibr., is emended as follows:—

***Punctatisporites* Ibrahim 1933 emend.**

Genotype—*P. punctatus* Ibr.

Emended diagnosis Trilete bearing spores, amb triangular, exine finely punctate sculptured.

Comparison—*Leiotriletes* Naumova emend. Pot. & Kr. (1954) distinguishes with its sculptureless exine. *Granulatisporites* Ibr., *Converrucosisporites* Pot. & Kr., *Lophotriletes* Naum. emend Pot. & Kr. and *Microreticulatisporites* Knox emend Bharadwaj (1956), the other triangular spores with sculptured exine, differ in the nature of their exine ornamentation. Morphographically, *Punctatisporites* could be interpreted to come closest to *Microreticulatisporites* if the punctate sculpture is reckoned to be the ultimate reduction of reticulate sculpturing, causing the meshes to appear as puncta. However, this postulation can be confirmed or rejected only after a study of morphographical evolution in the triangular, microreticulate spores through the Upper Palaeozoic Era, is accomplished.

Affinities—The emended circumscription of *Punctatisporites* suggests these miospores to be filicinian. The diagnostic association of trilete tetrad mark and triangular shape is commonly known to be prevalent in fern spores. Among the fossil ferns, spores of *Oligocarpia* Goepf. (Potonié, 1962) compare closely with *Punctatisporites* as now emended.

REFERENCES

- BHARADWAJ, D. C. (1956). The spore genera from the Upper Carboniferous coals of the Saar and their value in stratigraphical studies. *Palaeobotanist*. **4**: 119-149.
- BHARADWAJ, D. C. (1974). On the classification of gymnospermous Sporae dispersae (in press).
- BHARADWAJ, D. C. & SRIVASTAVA, S. C. (1969). Some new miospores from Barakar Stage, Lower Gondwana India. *Palaeobotanist*. **17**(2): 220-229.
- IBRAHIM, A. C. (1933). Sporenformen des Aegirhorizonts des Ruhr-Reviers. Konrad Triltsch, Würzburg: 47.
- IMGRUND, R. (1960). Sporae dispersae des Kaipingbeckens, ihre palaeontologische und stratigraphische Bearbeitung in Hinblick auf eine Parallelisierung mit dem Ruhrkarbon und dem Pennsylvanian Von Illinois. *Geol. Jb.* **77**: 143-203.
- KOSANKE, R. M. (1950). Pennsylvanian spores of Illinois and their use in correlation. *Illinois. State Geol. Surv. Bull.* **74**: 1-128.
- LOOSE, F. (1934). Sporenformen aus dem Flöz Bismark des Ruhrgebietes. *Arb. Inst. Paläobot. Petrog. Brennsteine.* **4**: 126-164.
- LUBER, A. A. & WALTZ, J. E. (1938). Classification and stratigraphic value of some Carboniferous coal deposits in the U.S.S.R. *Trans. Centr. Geol. Prosp. Inst.* **105**: 1-45.
- POTONIE, R. (1962). Synopsis der Sporae in situ. *Beih. Geol. Jb.* **152**: 1-204.
- POTONIE, R. & KREMP, G. O. W. (1954). Die Gattungen der palaeozoischen Sporae dispersae und ihre Stratigraphie. *Geol. Jb.* **69**: 111-194.
- POTONIE, R. & KREMP, G. (1955). Die Sporae dispersae des Ruhrkarbons, usw. Pt 1. *Palaeontographica*. **98** (B): 1-136.
- SCHOPF, J. M., WILSON, L. R. & ROY BENTALL. (1944). An annotated synopsis of Paleozoic fossil spores and the identification of generic groups. *Illinois geol. Surv. Rep. Invest.* **91**: 7-72.

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