The Palaeobotanist, **30**(1): 63-67, 1982.

SCLEROSPERMA-TYPE POLLEN GRAINS FROM THE NEYVELI LIGNITE OF INDIA

M. B. BANDE & K. AMBWANI

Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India

ABSTRACT

Pollen grains similar to those of African palm, *Sclerosperma manii* Wendl., have been described from the Neyveli lignite. The occurrence of this African palm in the Early to Middle Tertiary of India is significant from the view point of palaeoclimate of the Indian subcontinent and the palaeogeographical distribution of *Sclerosperma*.

Key-words — *Sclerosperma*, African palm, Monocot pollen, Neyveli Lignite (India).

सारांश

भारत के निवेली लगुडांगार से स्कलेरोस्पर्मा-सदृश परागकण – मोहन बलवंत बाँडे एवं कृष्ण अम्बवानी

निवेली लगुडांगार से अफ्रीकी ताड़, स्क्लेरोस्पर्मा मैनाई वैंडलैंड, के अनुरूप परागकणों का वर्णन किया गया है। प्रारम्भिक से मध्य तृतीयक युग में इस अफ्रीकी ताड़ की उपस्थिति भारतीय उपमहाद्वीप की पुराजलवायु एवं स्क्लेरोस्पर्मा के पुराभौगोलिक वितरण की दृष्टि से उल्लेखनीय है।

INTRODUCTION

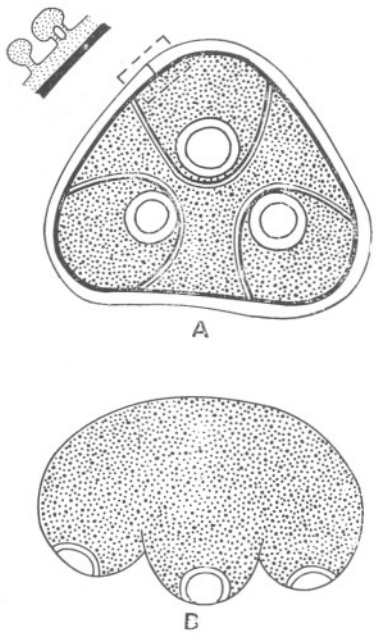
TERTIARY palynology constitutes an important part of Palaeobotany. It is from the Tertiary onwards that the vegetation started acquiring its present-day structure. Our knowledge regarding past vegetation, palaeoclimate and palaeogeography is far from complete without a clear understanding of the vegetation pattern of this period. Although a lot of morphotaxonomic work has been done on the Tertiary megafossils of India and their affinities traced to modern taxa, the microfossils which constitute an important constituent of the Indian Tertiary flora have been mostly studied and classified only artificially for stratigraphic purposes. The authors are well aware of the problems, one has to face in tracing the affinities of fossil spores and pollen to the modern genera and species, the main difficulty being lack of a detailed knowledge of the morphology of modern pollen and spores. However, it is emphasized that sincere attempts should be made in this direction whenever the related information is available for comparison. With this idea in mind, pollen grains showing affinities with the extant genus *Ctenolophon* (Ctenolophonaceae) have been recently described from the Neyveli lignite of India (Ambwani, Bande & Prakash, 1981) and in this paper the pollen grains closely comparable with those of African palm, *Sclerosperma manii* Wendl., are described. Earlier work on this lignite deposit has yielded a rich assemblage of pollen and spores belonging to angiosperms and pteridophytes (Rao, 1955; Thiergart & Frantz, 1963; Ramanujam, 1966, 1966-67; Navale, 1967; Deb, 1972).

FAMILY—PALMAE

Pollen grains cf. *Sclerosperma manii* Wendl.

Pl. 1, figs 1-6; Text-fig. 1

Description — Pollen grains heteropolar, radiosymmetrical, triangular to subcircular in polar view, convexo-concave and give the appearance of a tripod-like structure in lateral view due to the presence of three exinous projections, one at each angle on the convex side (this particular character is very clear in unmounted grains), size



TEXT-FIG. 1 — **A**, pollen grain in polar view; **B**, pollen grain in lateral view showing three exinous projections with submarginal pores (not to the scale).

31-50 μm in diameter in polar view, interpolar distance 30-36 μm. Pollen grains triporate, one pore at each angle, pores submarginal, each pore situated on an exinous projection on the convex side, ±6 μm wide, circular in shape, pores surrounded by a smooth ring-like thickening. The exinous projections are only on the convex side and become superimposed on the three angles of the grain when mounted under a cover glass. Exine 2-3 μm thick; sexine reticulate, reticulum uneven, brochi ±2 μm thick, baculae with small tegilla, simple or compound, tegillum smooth, nexine thinner than sexine, smooth.

Comparison — The above morphological characters of the pollen grains indicate their close affinities with those of *Sclerosperma manii* of Palmae. Pollen morphology of *Sclerosperma manii* has been described in detail by Erdtman and Singh (1957, pp. 217-220, fig. 24) and Thanikaimoni (1970, p. 69, pl. 9, figs 147-154). The fossil pollen grains show a very close structural similarity with the pollen grains of *S. manii* in their shape, size, nature and orientation of the apertures as well as the exine ornamentation. Pollen grains of the modern species and those under discussion are about 40 μm in diameter, triangular to rounded in shape, triporate, pores submarginal, in one hemisphere only, situated on the exinous projections on the convex side and the exine reticulate.

From the Tertiary of India pollen grains showing similar morphological characters have previously been described as *Dorreenipites* from the Tura Formation of Assam by Biswas (1962) and from the Middle to Upper Eocene of Bengal by Baksi (1972). Ramanujam (1966) described similar grains under the generic name *Trilatiporites* from the Neyveli lignite and placed them under four different species. Later on Venkatachala and Kar (1969) and Sah and Kar (1970) described two more species of *Trilatiporites* Ramanujam from the Laki Series of Kachchh. Recently, Ramanujam and Rao (1977) have reported one species of *Trilatiporites* from the Warkalli lignite deposits of South India. According to Deb, Baksi and Ghosh (1973, p. 28), "the grains described from Tura and Neyveli assemblages under two separate genera are morphologically same, i.e. anisopolar pollen, triporate, rounded to rounded triangular amb, pores surrounded by a thicker rim, prominent thickening of the exine at the base of the pores —, pores prominently non-equatorial, situated all in one hemisphere, thick exine, columellae distinct, surface mostly microreticulate and also granular, eq. diam. 29-48 μm." From these characters it is obvious that the pollen grains so far described under *Dorreenipites* and *Trilatiporites* as well as the grains described in this paper are of the same morphological type. However, as the purpose of this study is to know the botanical affinity of these fossil grains, they are described here without assigning them to any of the above two genera. Moreover, as it is also not desirable to assign the fossil pollen grains to a living genus, there being always some minor morphological differences, the present grains have been described simply as the pollen grains cf. *Sclerosperma*. Further studies on the variations in the pollen morphology in *Sclerosperma manii* and on the pollen grains described under *Dorreenipites* and *Trilatiporites* are necessary to resolve the problems of synonymy and speciation in these two genera.

DISCUSSION

The modern species, *Sclerosperma manii* Wendl., with which the pollen grains described here show a very close similarity, is a slender palm growing in swampy places on the river banks in tropical West Africa (Thiselton-Dyer, 1902, p. 100). While Willis (1973) mentions this genus with 2-3 species restricted to West Africa; Thiselton-Dyer (1902) considers this genus as monotypic with only one species, *Sclerosperma manii* Wendl., endemic to tropical West Africa. The occurrence of this African genus in the Neyveli lignite of India raises a number of interesting points. As discussed earlier, besides Neyveli such type of pollen grains are known from the Laki Series of Kachchh, Tura Formation in Assam, the Eocene of Bengal and the Warkalli lignite deposits of Kerala. The age of the Laki Series and the Tura Formation is accepted as Lower Eocene and Palaeocene to Eocene respectively and that of Warkalli lignite as Miocene. But there appears to be a controversy regarding the age of the Neyveli lignite. This issue has been discussed in detail by Deb, Baksi and Ghosh (1973) and although the age of the Neyveli lignite is usually considered as Miocene, however, these authors have suggested an Eocene age for this lignite on the basis of its palynological assemblage. Without going into the details of merits and demerits of these two different viewpoints it can be said that the presence of *Sclerosperma*-type of pollen grains in the various Early to Middle Tertiary localities of India carries special significance. If the age of the Neyveli lignite is considered to be Eocene, then it appears that during the Palaeogene of India the genus *Sclerosperma* was widely distributed throughout the Indian Subcontinent which is clear from its occurrence in the wide spread localities like Kachchh in the West, Assam and Bengal in northeast and east, and Neyveli in the south. On the other hand if the age of the Neyveli lignite is considered as Miocene, then the present finding along with the record of *Trilatiporites* in the Warkalli extends the upper limit of this genus at least up to Miocene in India before its extinction from this area. Nevertheless it is interesting to note that the modern species *Ctenolophon engleri*, pollen grains comparable to which have recently been described from Neyveli lignite by Ambwani, Bande and Prakash (1981), is also a species confined to tropical West Africa. The present finding thus strongly indicates the presence of at least some common genera in India and tropical West Africa during Early to Middle Tertiary period. It can also be deduced that by the Palaeogene although the west coast of India had separated from the east coast of Africa (Dietz & Holden, 1973, p. 827), the Indian subcontinent was situated almost in the same latitudes as the tropical West Africa. Both these regions thus might have enjoyed a similar climate permitting the growth of common genera on two widely separated lands. The extinction of these forms from the Indian subcontinent in the later part of Tertiary might be attributed to changes in the climate of this region resulting from the northward drift of India.

Locality — Neyveli, South Arcot District, Tamil Nadu.

Specimen — Birbal Sahni Institute of Palaeobotany Museum slide nos. 6048, 6049 and 6050.

ACKNOWLEDGEMENTS

The authors wish to express their sincere thanks to Dr G. Thanikaimoni and Dr Sunirmal Chanda for their suggestions during the identification of this material. They are also thankful to Dr U. Prakash for going through the manuscript.

REFERENCES

AMBWANI, K., BANDE, M. B. & PRAKASH, U. (1981). Pollen grains of *Ctenolophonodites* from the Neyveli lignites of South India. *Palaeobotanist*, **27** (1): 100-106.

BAKSI, S. K. (1972). On the palynological biostratigraphy of Bengal Basin, pp. 188-206 in A. K. Ghosh *et al.* (eds)— *Seminar on Palaeopalynology and Indian Stratigraphy, Calcutta.*

BISWAS, B. (1962). Stratigraphy of the Mahadeo, Langpar, Cherra and Tura formations, Assam, India. *Bull. geol. Min. Metall. Soc. India*, **25**: 1-48.

DEB, U. (1972). Some pollen grains from the Neyveli Lignite, pp. 220-228 in A. K. Ghosh *et al.* (eds)— *Seminar on Palaeopalynology and Indian Stratigraphy, Calcutta.*

DEB, U., BAKSI, S. K. & GHOSH, A. K. (1973). On the age of the Neyveli Lignite — A palynological approach. *J. geol. Min. Metall. Soc. India*, **45** (1): 23-38.

DIETZ, R. S. & HOLDEN, J. C. (1973). The breakup of Pangaea in: *Scientific American Resource Library Readings in the Earth Sciences*, **3**: 820-832.

ERDTMAN, G. & SINGH, G. (1957). On the pollen morphology of *Sclerosperma manii*. *Bull. Jard. Bot. Brux.*, **27**: 217-220.

NAVALE, G. K. B. (1962). Pollen and spores from Neyveli lignite, South India. *Palaeobotanist*, **10**: 87-90.

RAMANUJAM, C. G. K. (1966). Palynology of the Miocene lignite from South Arcot District, Madras, India. *Pollen Spores*, **8** (1): 149-203.

RAMANUJAM, C. G. K. (1966-67). Pteridophytic spores from the Miocene lignite of South Arcot District, Madras. *Palynol. Bull.*, **2** & **3**: 29-40.

RAMANUJAM, C. G. K. & RAO, K. P. (1977). A palynological approach to the study of Warkalli deposits of Kerala in South India. *Geophytology*, **7** (2): 160-164.

RAO, A. R. (1955). Some observations on pollen found in Indian Tertiary lignites. *Palaeobotanist*, **4**: 57-59.

SAH, S. C. D. & KAR, R. K. (1970). Palynology of the Laki sediments in Kutch-3. Pollen from the bore-holes around Jhulrai, Baranda and Panandhro. *Palaeobotanist*, **18** (2): 127-142.

THANIKAIMONI, G. (1970). Les Palmiers-Palynologie et Systematique *Inst. Fr. Pondicherry, Trav. Sect. Sci. Tech.*, **11**: 1-286.

THIERGART, F. & FRANTZ, U. (1963). Some spores and pollen grains from the Tertiary brown coal of Neyveli. *Palaeobotanist*, **11**: 43-45.

THISELTON-DYER, W. T. (1902). *Flora of Tropical Africa*, **8**. Ashford, Kent.

VENKATACHALA, B. S. & KAR, R. K. (1969). Palynology of the Tertiary sediments in Kutch. 1. Spores and pollen from bore-hole no. 14. *Palaeobotanist*, **17** (2): 157-178.

WILLIS, J. C. (1973). *A Dictionary of the Flowering Plants and Ferns*. Revised edition by H. K. Airy Shaw, Cambridge.

EXPLANATION OF PLATE

(Figs 1-6. Pollen grains cf. *Sclerosperma manii*. × 1500)

1-3. Pollen grain in polar view at different focii showing reticulate exine pattern and the exinous projections with pores. B.S.I.P. slide no. 6048.

4-6. Pollen grains in polar view showing variations in size and shape. 4. B.S.I.P. slide no. 6048. 5. B.S.I.P. slide no. 6050. 6. B.S.I.P. slide no. 6049.

PLATE 1