

Observations on some Tertiary zonisulcate pollen grains

H. P. Singh & S. K. M. Tripathi

ABSTRACT

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A morphological study of the genus *Assamialetes* has been carried out and its generic diagnosis has been emended. Various taxonomic changes, through which *Proxapertites* and *Assamialetes* have undergone, have also been discussed. Further, in order to understand these genera, a comparative study of the allied taxa has also been done.

Key-words—Palynology, Zonisulcate pollen, *Assamialetes*, *Proxapertites*, Tertiary (India).

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सारांश

कुछ तृतीयक युगीन पट्टपरिखीय परागकणों पर प्रेक्षण

हरीपाल सिंह एवं सूर्यकान्त मणि त्रिपाठी

असमिआलिटीज़ प्रजाति का विस्तृत आकारिकीय अध्ययन किया गया है तथा इसके प्रजातीय निदान में भी संशोधन किया गया है। इसके अतिरिक्त इस शोध-पत्र में प्रोक्सापर्टाइटिस एवं असमिआलिटीज़ में अभी तक किये गये विभिन्न वर्गीकरणिक परिवर्तन भी विवेचित किये गए हैं। इन दोनों प्रजातियों को स्पष्टताय समझने के लिए घनिष्ठ रूप से सम्बद्ध वर्गकों का तुलनात्मक अध्ययन भी प्रस्तुत किया गया है।

INTRODUCTION

A PERUSAL of the published literature shows that the Tertiary sediments of the Indian subcontinent contain a variety of zonisulcate pollen grains. Various authors described these pollen grains under different genera, viz., *Potamogetonaceapites* Biswas (1962), *Microreticulatipites* Baksi (1962), *Weylandipollis* Takahashi (1964), *Nymphaeoiipollis* Venkatachala & Kar (1969), *Assamialetes* Singh (1975) and *Proxapertites* van der Hammen (1956). Subsequently, Singh (1975) while attempting to streamline the taxonomy of zonisulcate pollen grains emended the diagnosis of *Proxapertites* and grouped *Potamogetonaceapites*, *Microreticulatipites*, *Weylandipollis* and *Nymphaeoiipollis* under it.

The genus *Proxapertites* was proposed by van der Hammen (1956 pl. 1, fig. 5) with the following diagnosis: "Pollen grains with big and wide aperture at the proximal side of the grain (remnants of an extremely thin exine layer can be found sometimes in the aperture). Grains of this type are sometimes found still in dyads (or sometimes in tetrads, etc.)". In the description van der Hammen (1956) mentioned that the exine is microfoveolate.

Muller (1968) regarded the dyads of the genus *Proxapertites* as zonisulcate pollen grains having a tendency to split into two slightly unequal parts. Potonié (1970) stated that these pollen grains consist of two discs, jointed by a rim in such a manner that a fine groove runs around the periphery.

Singh (1975, p. 101) regarded these pollen grains as zonisulcate and emended the diagnosis of the genus *Proxapertites* as follows: "Pollen grains circular to subcircular in shape, zonisulcate, sulcus \pm parallel to the margin, resulting into breaking of the pollen into two \pm equal halves. Size range $20-70 \times 25-50 \mu$. Exine tectate, variable in ornamentation and sculpture generally ranging from punctate, psilate, granulose or microfoveolate and reticulate."

Singh (1975) also transferred *Schizosporis assamicus* Sah & Dutta (1966) and *Schizosporis crassimurus* Sah & Dutta (1966) to *Proxapertites*. The genus *Schizosporis* was instituted by Cookson and Dettmann (1959) with the following characters: "Miospores medium to large, with an equatorial line or furrow along which a separation into two approximately equal parts takes place."

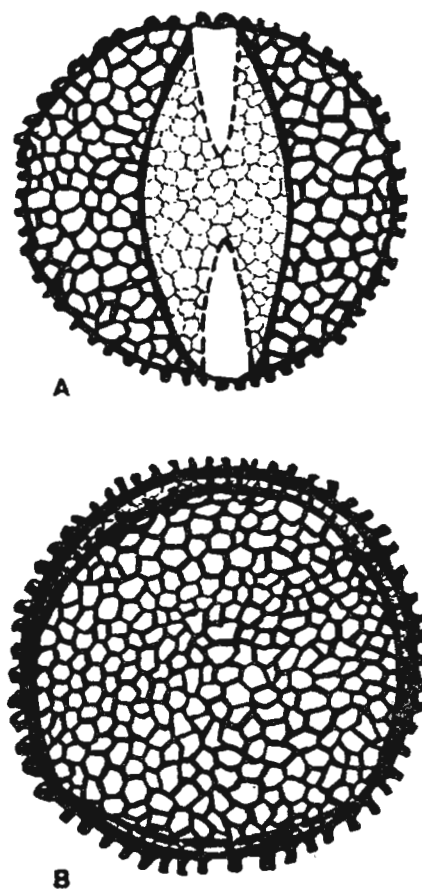
Cookson and Dettmann (1959) recognized four species in this genus, viz., *Schizosporis reticulatus*, *S. rugulatus*, *S. spriggi* and *S. parvus*. All these forms are nontectate and vary in size from 78-135 μm and thus do not fall in the circumscription of the genus *Proxapertites*. However, the transfer of *Schizosporis assamicus* into the genus *Proxapertites* by Singh (1975) is justified as in this case the exine is tectate. The taxonomic status of *Schizosporis crassimurus* has been discussed in the later part of the text.

Sah and Dutta (1966, pl. 1, figs 16, 17) instituted a genus *Retialetes* for nonaperturate and coarsely reticulate pollen grains. Later, it was found that Staplin (1960, pl. 6, figs 2, 3) had already published a genus having the same name for the spores which are alete, reticulate, ellipsoidal in outline and have fine grooves arranged parallel to the longer axis. To overcome this difficulty Singh (1975, p. 103) instituted another genus *Assamialetes* to accommodate the forms previously described under *Retialetes*.

Singh (1975, p. 103) diagnosed the genus *Assamialetes* as a nonaperturate form but while describing *Assamialetes* sp. (Singh, 1977) he regarded it as zonisulcate, thus contradicting the diagnosis of the genus of which he himself is the author. The present authors recently examined a large number of reticulate pollen grains from the Palaeocene-Eocene sediments of Jowai-Sonapur Road Section, Jaintia Hills, Meghalaya. Examination of specimens of *Assamialetes emendatus* reveals that these specimens are separated halves of a single zonisulcate pollen grain. This fact is clear as the type specimen of *Assamialetes emendatus* exhibits reticulations only on a single surface. So the present authors believe that the type species of the genus *Assamialetes*, viz., *A. emendatus* (Sah & Dutta) Singh (1975) is based on the split half part of a single zonisulcate pollen grain. This fact has been confirmed by the examination of specimens illustrated here (Pl. 1, figs 2, 9) showing two partially separated discs of *Assamialetes*.

From the present study it appears that the sulcus is very long and covers the pollen grain at equator, almost all along its perimeter. With such an organization two discs of a single pollen grain will get separated off very easily. A split half part can be confused as a nonaperturate pollen. Therefore, the diagnosis of the genus *Assamialetes* has been emended and dealt with in the latter part of the text.

The morphological resemblance between *Longapertites* Hoeken Klinkenberg (1964) and *Assamialetes* Singh (1975) appears to be superficial although both are tectate, reticulate and possess single, long aperture. The sulcus in *Assamialetes* is longer than that in *Longapertites* providing a weak union between the two halves in the former. This may be one of the reasons that in *Assamialetes* it is extremely rare to get the



Text-figure 1—*Assamialetes emendatus*, A. equatorial view, and B. lateral view.

two halves attached to each other. In addition to this, *Assamialetes* is more or less circular in shape, whereas *Longapertites* is ovoidal with lateral ends unequally broad. In *Assamialetes* the reticulate pattern is not made up of baculae as in the case of *Longapertites*. These basic differences preclude a close resemblance between *Assamialetes* and *Longapertites*.

Van Hoeken Klinkenberg (1964) did not give diagnosis of the genus *Longapertites*. The variation of shape was also not mentioned and only two photographs of a single specimen were given. On this scanty available information it is difficult to clearly understand the morphography of *Longapertites*.

SYSTEMATIC DESCRIPTION

Recently, detailed palynostratigraphic studies have been carried out on the Palaeocene-Eocene sediments exposed along the Jowai-Sonapur Road, Jaintia Hills, Meghalaya. The sediments yielded a rich and diversified palynoflora. The Palaeocene sediments are rich in having zonisulcate pollen grains. In this palynoflora the zonisulcate pollen grains are represented by

Proxapertites and *Assamialetes*. The geological map and lithological information about the area has already been published by Saxena and Tripathi (1982). The morphological observations on these pollen grains are given below.

Genus—*Proxapertites* van der Hammen emend. Singh, 1975

Type species—*Proxapertites operculatus* van der Hammen, 1956

Proxapertites assamicus (Sah & Dutta) Singh, 1975
Pl. 1, figs 9, 11, 12, 13, 14

Description—Subcircular to oval, $45.60 \times 39.54 \mu\text{m}$ in size, zonisulcate. Zonisulcus distinct, running almost parallel to the equator. Exine $1.5\text{--}2 \mu\text{m}$ thick, tectate, sexine as thick as nexine, faintly structured to microfoveolate.

Previous records—Palaeocene of Cherra Formation, Meghalaya (Dutta & Sah, 1970); Lower Eocene of Tura Formation, Meghalaya (Sah & Singh, 1974); and Palaeocene of Mikir Formation, Assam (Mehrotra & Sah, 1982).

Occurrence—Lower-Middle part of Therria Formation (Palaeocene), Meghalaya.

Affinity—Zonisulcate pollen grains are found in some members of the family Liliaceae and Nymphaeaceae.

Genus—*Assamialetes* Singh, 1975 emend.

Type species—*Assamialetes emendatus* Singh, 1975 emend.

Emended Generic Diagnosis—Pollen grains mostly subcircular; zonisulcate, zonisulcus distinct, long along the equator; exine finely to coarsely reticulate, muri raised or flat.

Assamialetes emendatus Singh, 1975 emend.
Pl. 1, figs 1, 2, 5, 10, 15

Holotype—Pl. 1, fig. 16; Sah and Dutta, 1966.

Type Locality—India, Maukma; South Shillong Plateau, Assam; Lower Eocene.

Emended Diagnosis—Pollen grains subcircular to slightly ovoidal in shape, $57\text{--}95 \mu\text{m}$ in size; zonisulcate, zonisulcus distinct; exine $2\text{--}4 \mu\text{m}$ thick, distinctly reticulate.

Description—Pollen grains mostly subcircular, rarely slightly ovoidal in shape, $57\text{--}95 \mu\text{m}$ in size, zonisulcate. Zonisulcus distinct, covering almost full perimeter of the pollen grain at the equator. Pollen grains having a tendency of splitting into two disc-like halves, suggesting a weak union between them. Exine $2\text{--}4 \mu\text{m}$ thick, reticulate, lumen $3\text{--}13 \mu\text{m}$ wide, muri $2\text{--}2.5 \mu\text{m}$ thick and $2.5 \mu\text{m}$ high.

Previous records—Palaeocene-Lower Eocene of Cherra Formation, Meghalaya (Sah & Dutta, 1966); Palaeocene of Tura Formation, Meghalaya (Sah & Singh, 1974) and Palaeocene of Mikir Formation, Assam (Mehrotra & Sah, 1982).

Occurrence—Lower and upper part of Therria Formation (Palaeocene), Meghalaya.

Affinity—Morphologically *Assamialetes emendatus* is comparable to the pollen grains found in some members of the family Nelumbonaceae like *Nelumbo nucifera*. In the pollen grains of *Nelumbo nucifera* the exine is not very coarsely reticulate.

Assamialetes crassimurus comb. nov.
Pl. 1, figs 3, 4, 6, 7, 8

1966 *Schizosporis crassimurus* Sah & Dutta, pl. 1, figs 18, 19. *Palaebotanist* 15 (1-2) : 72-86.

Holotype—Sah & Dutta, 1966, pl. 1, fig. 19.

Diagnosis—As published by Sah and Dutta, 1966.

Remarks—Singh (1975) transferred *Schizosporis crassimurus* Sah & Dutta (1966) to the genus *Proxapertites* and emended the generic diagnosis of the latter. Singh (1975) in fact emended the diagnosis of *Proxapertites* to accommodate zonisulcate pollen grains having variable morphological characters such as pollen grains ranging from $20\text{--}70 \mu\text{m}$ in size and possessing psilate, punctate, granulose, microfoveolate and reticulate type of exine ornamentations. The present authors do not agree with this treatment for the reason that the morphological limits of *Proxapertites* have been

PLATE 1

(All photomicrographs are enlarged ca $\times 750$)

1,2,5,10 & 15. *Assamialetes emendatus* Singh, 1975 emend.; B.S.I.P. slide nos. 7038, 7028, 7038, 7035 and 7032; coordinates 90.10×20.9 , 79.2×11.0 , 90.10×20.9 , 112.2×11.7 and 104.8×20.9 respectively.

3,4,6,7 & 8. *Assamialetes crassimurus* Sah & Dutta, 1966 comb. nov.; B.S.I.P. slide nos. 7036, 7036, 7028, 7028 and 7028; coordinates :

100.8×7.7 , 100.8×7.7 , 77.5×5.3 , 115.10×19.5 and 115.10×19.5 respectively.

9,11,12,13 & 14. *Proxapertites assamicus* van der Hammen emend. Singh, 1975; B.S.I.P. slide nos. 7028, 7031, 7031, 7030 and 7030; coordinates : 109.9×14.6 , 109.10×24.8 , 109.10×24.8 , 97.7×3.2 and 97.7×3.2 respectively.

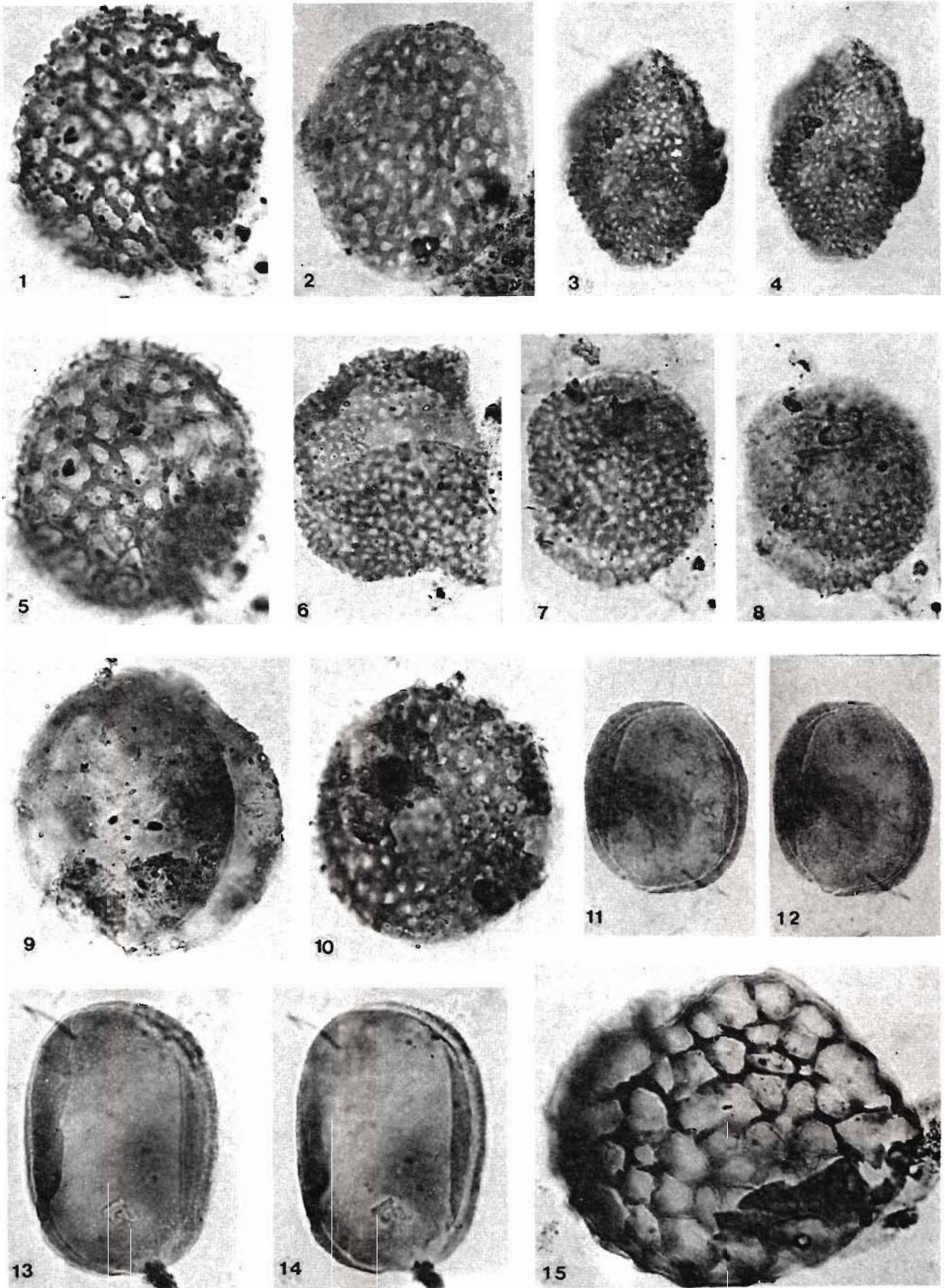


PLATE 1

enlarged more than necessary. It is proposed here that zonisulcate pollen with psilate to microfoveolate ornamentation should be grouped under the genus *Proxapertites*, whereas those with distinctly reticulate to coarsely reticulate ornamentation should be kept under the genus *Assamialetes*, the diagnosis of which has been emended earlier in the text.

Since the forms described as *Schizosporis crassimurus* are zonisulcate and the exine ornamentation in it is reticulate, they have been transferred to the genus *Assamialetes*.

Discussion—The stratigraphical importance of zonisulcate pollen grains in the Palaeocene and Lower Eocene sediments is established by the works of Sah and Dutta (1966), Dutta and Sah (1970), Sah and Singh (1974) and Mehrotra and Sah (1982). The genus *Assamialetes* identifies a palynological zone in the Lower Palaeocene sequence of Tura Formation, Meghalaya (Sah & Singh, 1974), Cherra Formation, Meghalaya (Sah & Dutta, 1974), and Mikir Formation, Assam (Mehrotra & Sah, 1982). It is based on the percentage frequency of this particular genus. The frequency counts made by various authors have obviously been established by counting only half part of a single specimen. Therefore, it is essential to reduce the frequency of this genus to half for all practical purposes. In all the above mentioned palynozones the prominence of *Assamialetes* is because of its dominance over other genera in this particular palynozone. But with the result of the present study, it may lose its validity.

CONCLUSION

The fossil pollen grains of *Assamialetes*, diagnosed as nonaperturate, have been found to be zonisulcate. They possess a long zonisulcus covering almost full perimeter of the pollen grain providing a weak union between the two halves of the exine. This results in breakage of the grain into two more or less equal parts. Each separated half of the pollen grain was confused to be representing a nonaperturate pollen by the previous

workers, a mistaken notion which has been convincingly removed in the present paper.

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