

LELESTROBUS: A NEW MICROSPORANGIATE ORGAN FROM THE TRIASSIC OF NIDPUR, INDIA

SHYAM C. SRIVASTAVA

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

ABSTRACT

Lelestrombus pennatus gen. et sp. nov. is a compact strobilus having spirally arranged quill-like microsporophylls. Each microsporophyll is composed of an expanded base bearing abaxially inserted sporangium, and an attenuated distal portion. A sporangium is ovoid in shape and contains nonstriate-bisaccate pollen grains. This has close affinity to Coniferales.

Key-words — *Lelestrombus*, Strobilus, Microsporophyll, Coniferales, Triassic (India).

सारांश

भारत में निदपुर के त्रिअसंधी कल्प से एक नवीन लघुबीजाणुधानिक अणवयव . लेलेस्ट्रोबस - श्याम चन्द्र श्रीवास्तव

लेलेस्ट्रोबस पैन्नेटस नव वंश व नव जाति सपिलाकार विन्यस्त पंख-सदृश लघुबीजाणुपुष्पों से युक्त एक संहत शंकु है। प्रत्येक लघुबीजाणुपुष्प का फेला हुआ आधारीय भाग अपाक्ष की ओर प्रविष्ट एक बीजाणुधानी को जन्म देता है तथा इसका दूसरा सिरा कम संकीर्ण है। लघुबीजाणुधानी आकार में अंडाकार है तथा इसमें अरेखित-द्विकोणीय परागकण मिलते हैं। यह कोनिफेरैल्स से घनिष्ठ सजातीयता प्रदर्शित करता है।

INTRODUCTION

SINCE a compressed cone (*Conites* sp.) from the Indian Triassic was first recorded by Srivastava (1971) from the *Dicroidium*-bearing bed of Nidpur, several pollen producing organs, namely, *Nidistrobis* Bose & Srivastava, 1973; *P. nidpurensis* Srivastava, 1974; *Pteruchus indicus* Pant & Basu, 1973; *Bosea* Srivastava, 1975; *Rugatheca* Pant & Basu, 1977; and *Nidpuria* Pant & Basu, 1979 have been discovered and described.

A few more fructifications, viz., *Satsangia* Srivastava & Maheshwari, 1973; *Chakrea* Srivastava, 1976; *Pteruchus thomasi*; and *P. gopadensis* Pant & Basu, 1979 have also been reported but these have not yielded any pollen grains.

This paper records an additional strobilus bearing quill-like microsporophylls.

Lelestrombus gen. nov.

Diagnosis — Strobilus consisting of spirally arranged quill-like sessile microsporophylls

having broad expanded base with an attenuated distal portion. Sporophyll base with an abaxially inserted median sporangium, sporangium oblong-ovoid, accentuated by flap or wing-like structure. Sporophyll cuticle differentiated into non-stomatic and stomatic sides, thinner surface bearing a few longitudinally oriented stomata, marked in tapering part of sporophyll. Sporangial wall thin, composed of smooth rectangular-polygonal cells; pollen grains bisaccate, non-striate.

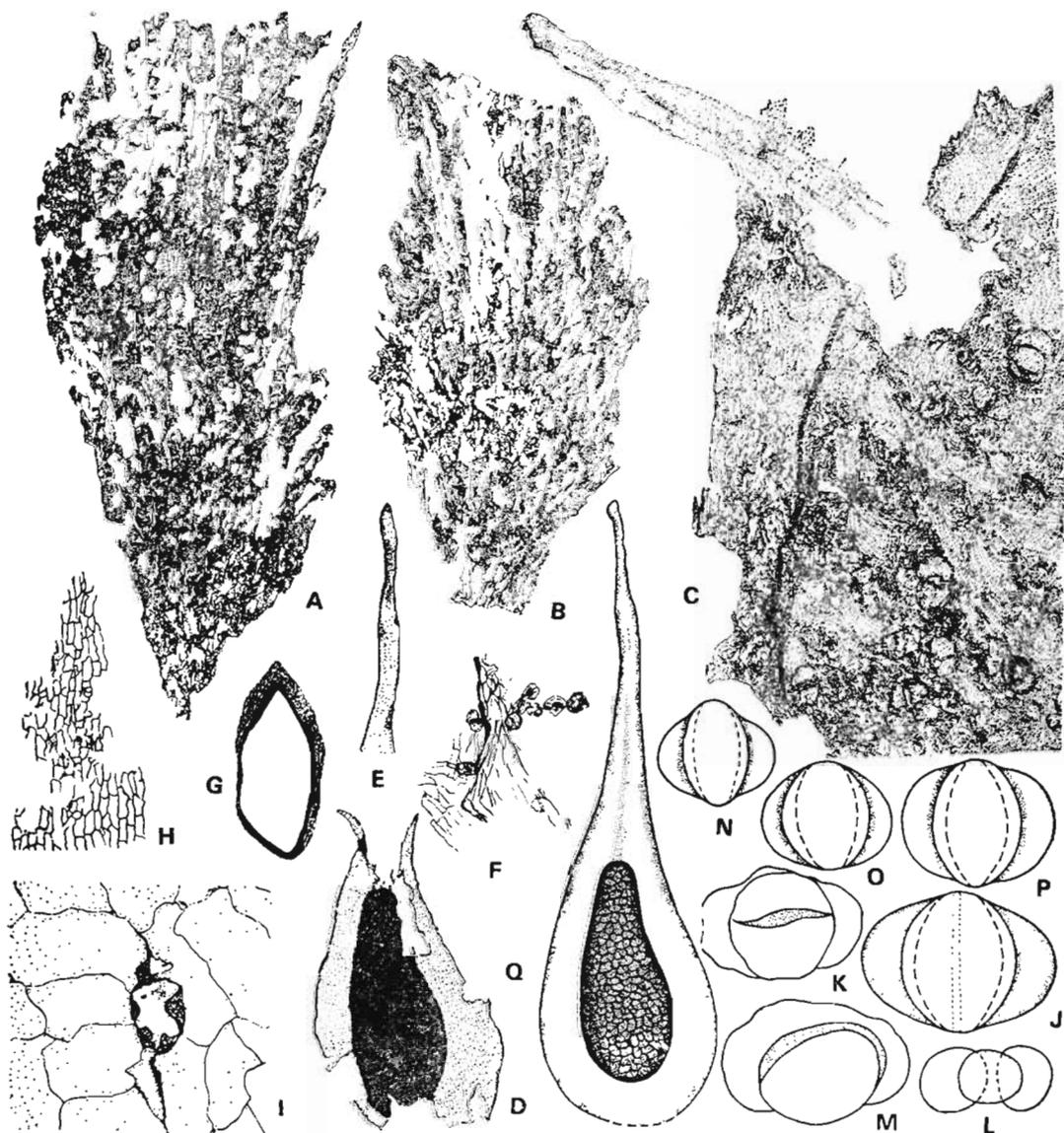
Type Species — *Lelestrombus pennatus* sp. nov.

Derivation of Name — After late Dr K. M. Lele.

Lelestrombus pennatus gen. et sp. nov.

Pl. 1, figs 1-16; Text-figs 1A-Q

Diagnosis — Detached strobilus, 1.5 cm long, consisting of spirally arranged sessile microsporophylls, microsporophylls abaxially with an inserted oblong-ovoid sporangium accentuated by flap or wing-



TEXT-FIG. 1 — *Lelestrobis pennatus* gen. et sp. nov. — A, a microstrobilus showing spirally arranged microsporophylls with its attenuated distal portion, Holotype no. 35469, $\times 4$; B, counterpart of Holotype no. 35469, $\times 4$; C, a broken microsporophyll showing a part of sporangium containing pollen grains associated with attenuated distal portion in broken state, slide no. 6598/35469, $\times 40$. D-E, an approximately complete microsporophyll exhibiting conspicuously midpart broken, but expanded basal portion bearing abaxial sporangium with a few pollen grains and attenuated distal portion preserved respectively, slide nos. 6600/35469, $\times 20$, 6598/35469, $\times 20$; F, a part of sporangium with both surfaces associated with pollen grains, slide no. 6599/35469, $\times 50$; G, an empty sporangium where the entire pollen mass is shed off, slide no. 6598/35469, $\times 20$. H, non-stomatic surface showing serially arranged epidermal cells, slide no. 6601/35469, $\times 75$; I, thinner surface showing a single stoma with feebly developed papillae projecting over stomatal pit, slide no. 6598/35469, $\times 500$. J, a typical nonstriate, bilateral, disaccate grain showing zone of saccus attachment associated with vertically oblong-ovoid c.b. distally saccus free area (where sexine not free from intexine) bearing linear diffused sulcus-like area (tenuitas) in the centre, slide no. 6599/35469 ca. $\times 400$; K-M, varied forms of pollen grains respectively showing: K—central body with horizontal or two parallel folds, L—one pollen diploxytonoid with circular central body in distal focus, M—a pollen grain in monosaccoid condition, slide no. 6599/35469 ca. $\times 500$; N-P, showing variation in saccus attachment, slide no. 6599/35469 ca. $\times 500$; Q, a diagrammatic restoration of a microsporophyll.

like structure. Sporophyll cuticle differentiated into stomatic and non-stomatic surfaces, non-stomatic surface slightly thicker composed of serially arranged rectangular-narrower, occasionally polygonal cells, cell walls usually straight, at places end-walls oblique, surface generally smooth; stomatic surface thinner bearing a few stomata, usually marked in tapering part of sporophyll, cells generally polygonal, cell walls extremely thin, at times inconspicuous, lateral-walls straight, end-walls usually oblique, at places straight, surface smooth or unsculptured, stomata orientated longitudinally, mostly marked only by thinly cutinized, feebly developed papillae projecting over the inner stomatal pit, subsidiary cells 5, stomatal aperture indistinct. Sporangial-wall membranous, cells elongated-rectangular or polygonal, cell-walls thin, at times not clearly distinct, surface smooth. Pollen grains non-striate, bisaccate, haploxylonoid, size range 60-70 × 50-60 μm with a well defined vertically oval-rounded central body measuring 36-48 μm in size, finely intrapunctate-infrareticulate in structure, sacci small 8-12 μm wide, sacci proximally attached on equator and distally inclined to cover 1/6 part of central body, distal zone of saccus attachment clearly marked but without any fold or ridge, distal saccus free area 14-25 μm wide, vertically oblong-ovoid showing the presence of a linear tenuitas or diffused sulcus-like area in the centre, sacci mediumly or finely intrareticulate, less than 1 μm wide muri, 10-24 μm laterally apart.

Holotype — No. 35489 of the Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Gopad River near Nidpur, Sidhi District, Madhya Pradesh.

Age — Triassic.

Remarks — Only one detached specimen with a slightly imperfect base has been found. The sporophylls are so closely clasped that only a small sporophyll with its apical broken end could be separated with difficulty. Even in doing so the pollen grains were shed in water. However, in other preparations the tapering part of sporophyll attached with sporangium could be detected and the reconstruction of microsporophyll given in Text-fig. 1Q has been based on all the preparations.

The position and attachment of sacci in the pollen grains are variable. Mostly the

sacci are crescentic and smaller than the central body; but in a few specimens they are equal to the central body. Sacci are usually continuous laterally round the central body and sometimes there are notches at the meeting points. Occasional diploxylonoid pollen grains with circular central body have also been marked. One or two folds have also been observed on proximal surface of some monosaccoid grains. These grains are variants of the same general type. Variation in pollen grains is known in some coniferous cones (Grauvogel-Stamm, 1969, 1972, 1973, 1976) as well as in other fossil plant groups.

Such type of dispersed pollen grains have earlier been recorded from the Nidpur shale as a variable form of *Alisporites indicus* Bharadwaj & Srivastava, 1969.

COMPARISON AND DISCUSSION

In general, *Lelestrombus pennatus* is a compact strobilus bearing abaxial sporangia with nonstriate-bisaccate pollen grains. These characters are suggestive of its relationship with Coniferales. In having quill-like microsporophylls, *L. pennatus* seemingly approaches the genus *Isoetes* but it is clearly different because of the aforesaid characters.

Lebachia piniformis described by Florin (1938-45) differs in having two microsporangia on each sporophyll and monosaccate pollen grains with balloon-like sacci completely surrounding the central body except at distal pole.

Lelestrombus pennatus markedly differs from the extant conifers in its microsporophylls exhibiting only a single sporangium abaxially inserted in the basal region while in the latter the microsporophylls bear two to many, fused or free sporangia.

Because of a single sporangium *Lelestrombus pennatus* probably represents an early phase in the evolutionary history of conifers.

ACKNOWLEDGEMENTS

Grateful appreciations are expressed to Dr Sukh Dev for critically going through the manuscript and to Dr R. S. Tiwari for his useful discussions dealing with the morphology of pollen grains.

REFERENCES

- BHARADWAJ, D. C. & SRIVASTAVA, SHYAM C. (1969). A Triassic mioflora from India. *Palaeontographica*, **125B**: 119-149.
- BOSE, M. N. & SRIVASTAVA, SHYAM C. (1973a). *Nidistrobus* gen. nov. a pollen-bearing fructification from the Lower Triassic of Gopad River Valley, Nidpur. *Geophytology*, **2** (2): 211-212.
- BOSE, M. N. & SRIVASTAVA, SHYAM C. (1973b). Some micro- and megastrobili from the Lower Triassic of Gopad River Valley, Nidpur. *Geophytology*, **3** (1): 69-80.
- FLORIN, R. (1938-45). Die Koniferen des Obercarbons und der untern Perms I-VIII. *Palaeontographica*, **85B**: 1-729.
- GRAUVOGEL-STAMM, LEA (1969). Nouveaux D'organes reproducteurs males de coniferes du gres a *Voltzia* (Trias Inferieur) Des Vosges. *Bull. Serv. geol. Als. Lorr.*, **22** (2): 93-120.
- GRAUVOGEL-STAMM, LEA (1972). Revision de cones males du "Keuper Inferieur" du Worcestershire (Angleterre) attribues a *Masculostrobos willsi* Townrow Comparaison avec des especes Voisines du Buntsandstein superieur des vosges (France). *Palaeontographica*, **140B**: 1-26.
- GRAUVOGEL-STAMM, LEA (1973). *Masculostrobos acuminatus* nom. nov. un nouvel organe reproducteur male de Gymnospermae du gres a *Voltzia* (Trias inferieur) des Vosges (France). *Geobios.*, **6** (2): 101-113.
- GRAUVOGEL-STAMM, LEA (1978). La flore du Gres a *Voltzia* (Buntsandstein Superior) des Vosges du Nord (France)— Morphologie Anatomie Interpretation, Phylogenie et Palaeontographie. *Sci. Geol. Mem.*, **50**: 1-225.
- PANT, D. D. & BASU, N. (1973). *Pteruchus indicus* sp. nov. from the Triassic of Nidpur, India. *Palaeontographica*, **144B**: 11-24.
- PANT, D. D. & BASU, N. (1977). On some seeds, synangia and scales from the Triassic of Nidpur, India. *Palaeontographica*, **163B**: 162-178.
- PANT, D. D. & BASU, N. (1979). Some further remains of fructifications from the Triassic of Nidpur, India. *Palaeontographica*, **168B**: 129-146.
- SRIVASTAVA, SHYAM C. (1971). Some gymnospermic remains from the Triassic of Nidpur, Siddhi District, Madhya Pradesh. *Palaeobotanist*, **18** (3): 280-296.
- SRIVASTAVA, SHYAM C. (1974). Pteridospermic remains from the Triassic of Nidpur, Madhya Pradesh, India. *Geophytology*, **4** (1): 54-59.
- SRIVASTAVA, SHYAM C. (1975). A new microsporangiate fructification from the Triassic of Nidpur, India. *Palaeobotanist*, **22** (1): 19-22.
- SRIVASTAVA, SHYAM C. (1976). Some macroplant fossils from the Triassic rocks of Nidpur, India. *Palaeobotanist*, **23** (1): 44-48.
- SRIVASTAVA, SHYAM C. & MAHESHWARI, H. K. (1973). *Satsangia*, a new plant organ from the Triassic of Nidpur, Madhya Pradesh. *Geophytology*, **3** (2): 222-226.

EXPLANATION OF PLATE

Lelestrobos pennatus gen. et sp. nov.

- Holotype: BSIP specimen no. 35469. × nat.
- Counterpart of the holotype. × nat.
- Holotype showing spirally clasped microsporophylls. × 6.
- Holotype (counterpart). × 4.
- A part of microsporophyll showing a portion of sporangium containing pollen grains associated with a broken attenuated distal portion. BSIP slide no. 6598/35469. × 40.
- A broken microsporophyll showing an embedded abaxial sporangium placed in middle of expanded basal part. BSIP slide no. 6600/35469. × 40.
- An under macerated incomplete sporangium filled with pollen grains. BSIP slide no 6599/35469. × 100.
- An empty sporangium from which the pollen have been shed off. BSIP slide no 6598/35469. × 40.
- Spirally clasped microsporophylls. BSIP slide no. 6597/35469. × 100.
- 10,12. Pollen grains retrieved from a sporangium. BSIP slide no 6599/35469. × 200.
- A dissected sporangium with liberated pollen grains adhering to its thin cuticle. BSIP slide no. 6599/35469. × 100.
14. Non-stomatic thicker surface. BSIP slide no. 6601/35469. × 150.



PLATE 1