

ON SOME CONIFER REMAINS FROM BANSA, SOUTH REWA GONDWANA BASIN

SUKH-DEV & M. N. BOSE

Birbal Sahni Institute of Palaeobotany, Lucknow

ABSTRACT

Leafy twigs of *Brachyphyllum bansaensis* n. sp., *B. eikaiostomum* n. sp., *B. suryanarayanai* n. sp. and *Marwaria latifolia* (Feistmantel) n. comb. are described here from the Lower Cretaceous of Bansa, South Rewa Gondwana Basin. *Marwaria* is a new genus, based on the specimen originally described by Feistmantel (1882) as *Araucarites latifolius*. Cone-scales of *Araucarites fibrosa* n. sp. and *Araucarites macropterus* Feistmantel have also been described.

INTRODUCTION

FROM Bansa, Madhya Pradesh, three species of *Pagiophyllum* have already been described by us (Bose & Sukh-Dev, 1972). *Brachyphyllum bansaensis*, *B. eikaiostomum*, *B. suryanarayanai*, *Marwaria latifolia*, *Araucarites fibrosa* and *A. macropterus* Feistmantel are now described. Except *Araucarites macropterus* all the new species are based on cuticular features.

DESCRIPTION

Genus *Brachyphyllum* Brongniart

Brachyphyllum bansaensis n. sp.

Pl. 1, Figs. 1-3; Text-fig. 1A-F

Diagnosis — Twigs irregularly branched. Branches 3-4 mm. wide, straight or slightly curved. Leaves spirally arranged, ovate, typically measuring 4×2.5 mm. (range 2.4×1.5-2.5 mm.), slightly longer than the rhomboidal leaf-base cushion, directed forward or sideways. Margin entire; occasionally with a microscopic frill in parts. Apex acute. Lower side keeled.

Leaves amphistomatic. Cuticle about 6 μ thick. Upper surface: stomata fewer as compared to lower surface, present near margins in single, short files, leaving a wide central non-stomatic area. Each file consisting of 3-7 stomata. Stomata mostly transversely orientated, some obliquely or longitudinally placed. Guard cells sunken. Subsidiary cells 4-6, mostly 4 or 5, slightly

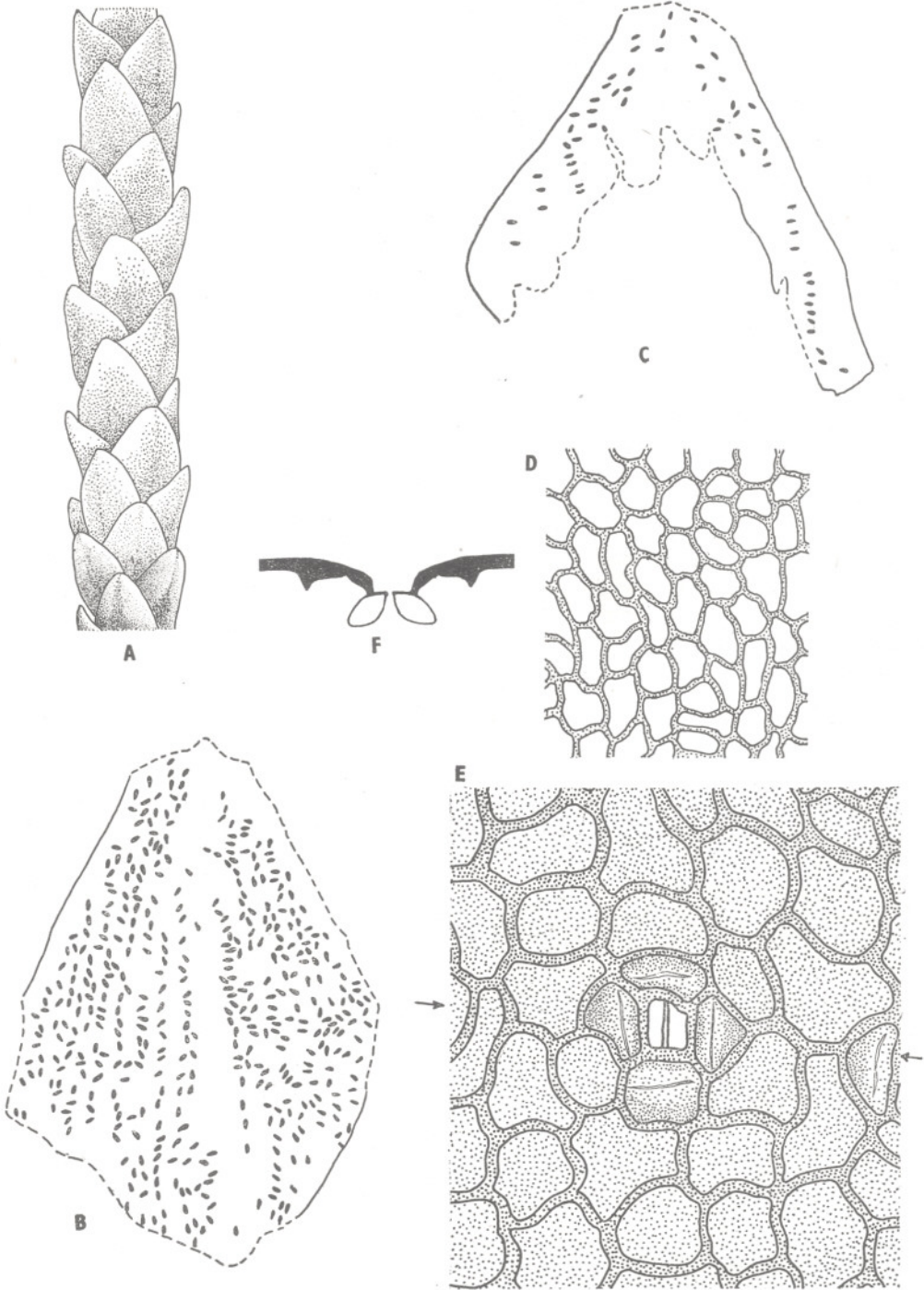
sunken; surface wall more cutinized than epidermal cells and possessing a prominent thin slit. Epidermal cells polygonal; lateral and end walls moderately thick and almost straight, at places slightly wavy; some cells show a longitudinal or transverse slit. Lower surface: epidermal cells mostly like cells of upper side but with lateral and end walls sometimes pitted or slightly undulate. Epidermal cells between stomata and stomatal files polygonal, a few rectangular, more or less serially arranged. Stomata present over entire surface, arranged in single, short to long files, some irregularly placed; separated by 2-3 (sometimes 5) cells; longitudinally or transversely orientated, a few obliquely placed. Subsidiary cells 4-6, mostly 4 or 5, slightly sunken; surface wall more thickened than that of the ordinary epidermal cells and showing a prominent thin slit. Guard cells sunken, thinly cutinized. Aperture narrow and slit-like. A few stomata with an incomplete ring of encircling cells. Trichomes absent. Hypodermis present on both surfaces.

Holotype — No. 29989 of the Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Marwar Ghat about $\frac{3}{4}$ km. N.E. of Bansa.

Horizon and Age — Jabalpur Series; Lower Cretaceous.

Comparison and Discussion — The twigs of *Brachyphyllum bansaensis* are somewhat similar to the twigs of *B. mamillare* Brongniart and *B. scalbiensis* Kendall (1947). Both, like *B. bansaensis*, are amphistomatic. But in *B. mamillare* stomata are occasionally absent from the upper surface. The distribution of stomata on the upper surface is more regular in *B. scalbiensis* than in *B. bansaensis*. In the former the stomata are arranged in well-marked longitudinal rows. In *B. bansaensis* the upper surface is more reduced with a few stomata placed in ill-defined files. In *B. bansaensis* the stomata are mostly transversely or longitudinally orientated while in *B. scalbiensis* they are irregularly orientated. From *B.*



TEXT-FIG. 1

tropidimorphum Wesley (1956) *B. bansaensis* can readily be distinguished by the distribution of the stomata which in the former species occur over the entire upper surface.

Systematic Position — In the form of the leaves and the stomatal distribution *B. bansaensis* resembles somewhat *Dacrydium colensoi*. However, in *D. colensoi* the leaves appear more keeled, the stomata comparatively less crowded on the lower surface and the subsidiary cells less cutinized towards their inner side. In *Dacrydium kirkii*, as in *B. bansaensis*, the stomata are fewer on the upper surface but on the lower surface they occur densely in two broad marginal bands and unlike *B. bansaensis* are mostly longitudinally placed. Though *B. bansaensis* shows some resemblances with certain species of *Dacrydium*, its systematic position is not yet certain and we prefer to keep it under the form-genus *Brachyphyllum*.

Brachyphyllum eikaiostomum n. sp.

Pl. 1, Figs. 4-7; Pl. 2, Fig. 16; Text-fig. 2A,F

Diagnosis — Leafy twigs straight, stiff, 2-4.5 mm. wide. Leaves small, rhomboidal, typically 2.5 × 4 mm., arranged spirally and closely placed, appressed, not keeled and projecting. Leaf-base slightly concealed by adjacent leaves. Longer diagonal of leaf transverse to stem. Attachment area rhomboidal. Upper surface of leaf much reduced, slightly convex. Leaf tip directed forward and overlapping the basal portion of the leaf in front. Margin with a microscopic frill. Apex acute, obtuse or rounded.

Leaf amphistomatic. Lower cuticle 4 to 9 μ thick in folds, upper slightly thinner. Stomata irregularly distributed over entire lower surface, excepting the apical and sometimes the central portion, usually widely spaced, never forming longitudinal rows, sometimes 2 or 3 stomata occurring in contact. Stomata on upper surface few. On both surfaces stomata mostly obliquely, sometimes

transversely or longitudinally orientated. Stomatal apparatus oval or circular. Subsidiary cells slightly sunken, 4 to 7, mostly 5 or 4; inner surface wall less thickened than epidermal cells, often showing one or two slits. Polar and lateral subsidiary cells not distinguishable. Outer anticlinal wall of subsidiary cells slightly raised above general level of the epidermis. Bottom of stomatal pit oval. Guard cells slightly sunken, with aperture and surface wall thinly cutinized. Ring of encircling cells not always complete.

Epidermal cells on both surfaces polygonal, isodiametric, irregularly packed. Anticlinal walls prominent, commonly interrupted by pits or not clear, 1.5-5.5 μ thick, straight, sometimes undulate. Periclinal walls frequently marked with a longitudinal slit, sometimes slit may be dividing. Marginal frill one cell thick, 21-117 μ broad; frill cells usually narrower, their free ends rounded or obtuse.

Holotype — No. 30030 of the Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Marwar Ghat about $\frac{3}{4}$ km. N.E. of Bansa.

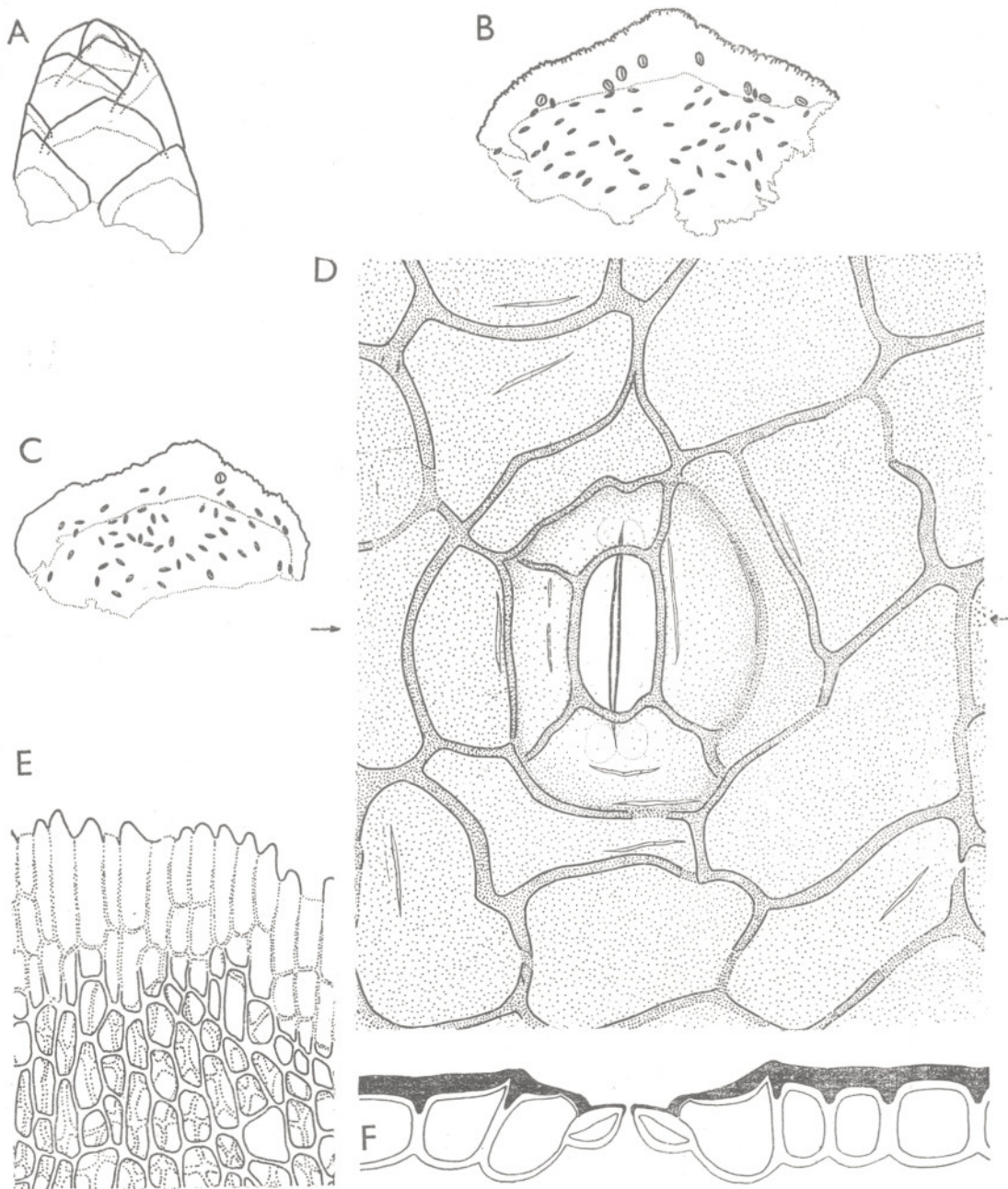
Horizon and Age — Jabalpur Series; Lower Cretaceous.

Comparison and Discussion — *Brachyphyllum eikaiostomum* looks like *Brachyphyllum rhombicum* (Feistm.) Sahni (1928) described from the same flora. From Marwar Ghat we have another new species of *Brachyphyllum* (not described in this paper) which also resembles *B. rhombicum* in external features. But unfortunately the cuticle of the original specimens of *B. rhombicum* is unknown and therefore none of the Marwar species can be identified with it.

B. expansum (Sternb.) var. *indica* Sahni (1928) agrees with *B. eikaiostomum* in the presence of stomata on both the surfaces and in stomatal structure. In both the stomata are irregularly distributed, but in *B. expansum* var. *indica* the leaf tip is microscopically thick and pointed and there

←

TEXT-FIG. 1 — *Brachyphyllum bansaensis* n. sp.: A, specimen no. 29989, × 5. B, lower cuticle, showing orientation and distribution of stomata, slide no. 4428 (from specimen no. 29989), × 20. C, upper cuticle, showing orientation and distribution of stomata, slide no. 4428 (from specimen no. 29989), × 20. D, epidermal cells of upper cuticle, slide no. 4428 (from specimen no. 29989), × 250. E, stoma and epidermal cells, slide no. 4428 (from specimen no. 29989), × 500. F, reconstructed transverse section of stoma of Fig. E along the line denoted by arrows.



TEXT-FIG. 2—*Brachyphyllum eikaiostomum* n. sp.: A, $\times 10$. B, C, leaves showing cuticle of both the surfaces and distribution of stomata. Short thick lines enclosed in a ring represent the stomata of the upper surface, the unenclosed ones denote lower surface, slide nos. 5-2, 4428A, $\times 20$. D, stoma and epidermal cells, slide no. 4428A, $\times 800$. E, apical portion of a leaf showing both surfaces and a marginal frill, slide no. 5-2. F, reconstructed transverse section of stoma of Fig. D along the line denoted by arrows.

is no marginal flange. Moreover, the leaves in this variety are smaller and elongate. *B. expansum* var. *indica* appears to need a new specific name because Kendall (1949) has shown that *B. expansum* (Sternb.) Seward with its papillate stomata is a different species.

B. eikaiostomum looks similar to several other species of *Brachyphyllum* but in all these the cuticular characters differ. *B. mamillare* (Kendall, 1947) resembles *B. eikaiostomum* in having an apical marginal frill but its stomata are arranged in longitudinal rows. *B. crucis* Kendall (1949) has a frilled margin near the apex and scattered stomata towards the leaf-base, but these stomata are papillate. *B. expansum* (Sternb.) Seward (Kendall, 1949) has a frilled margin and papillate stomata arranged in longitudinal rows. *B. kendallianum* Wesley (1956) agrees with *B. eikaiostomum* in its subsidiary cells but differs in having the stomata placed in longitudinal rows and in the absence of marginal frill. *B. appropinquatum* Wesley (1956) agrees in its often scattered stomata but these have papillate subsidiary cells; there is also no marginal frill in this species.

Systematic Position — *Brachyphyllum eikaiostomum* shows some resemblances in its gross features with *Dacrydium biforme* (Hook.) Pilg., *D. colensoi* Hook. and *Athrotaxis cupressoides* Don. In all these the leaves have a marginal flange. But while in *D. colensoi* the stomata are irregularly scattered in *D. biforme* and *A. cupressoides* they are placed in bands though in the latter species the stomata sometimes become scattered at the leaf-base. In *D. biforme* the epidermal cells are pitted, but the subsidiary cells are thickly cutinized. The walls are not pitted in *D. colensoi* and the subsidiary cells are more thickly cutinized in their outer portion than the inner. In the other species of *Dacrydium*, viz. *D. cupressinum* Sol., *D. elatum* (Roxb.) Wall., *D. intermedium* Kirk and *D. kirkii* F. Muell. the subsidiary cells are either sunken or at level with the general surface, but, in contrast to *B. eikaiostomum*, the inner portion of their subsidiary cells is always at a higher level than the outer portion.

In conclusion, while *B. eikaiostomum* does have a few characters in common with some species of *Dacrydium*, its systematic position remains uncertain.

Brachyphyllum suryanarayanai n. sp.

Pl. 2, Figs. 11, 14, 18; Pl. 3, Fig. 25; Text-fig. 3A-H

Diagnosis — Main twig 5 mm. wide; branches 2.5-4.0 mm. wide, arising irregularly at angle of 25-45°. Leaves persistent, more or less rhomboidal, typically 4×2 mm., borne spirally. Most of lower surface exposed but base concealed; upper surface small, somewhat concave. Leaf rounded in section, not keeled, with a rhomboidal area of attachment. Leaf apex obtusely pointed, projecting outwards and forwards at an angle of about 45° to the stem. Margin entire, occasionally with a microscopic frill in parts.

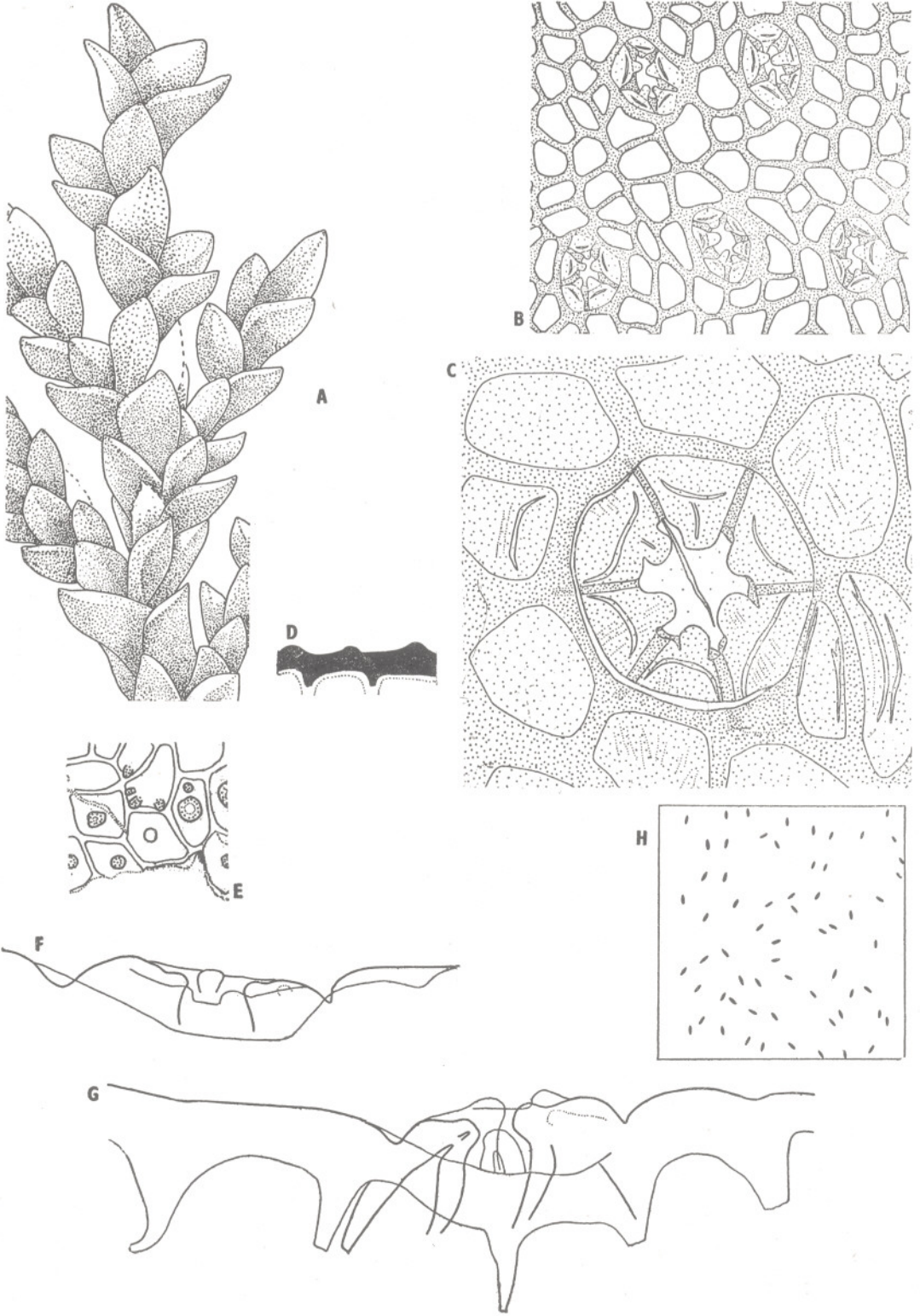
Cuticle about 8-13 μ (in folds) thick; upper cuticle slightly thinner than lower. Stomata irregularly distributed on both surfaces, not in rows, widely or closely spaced, occasionally with subsidiary cells in contact. Stomata longitudinally or obliquely placed, a few transverse. Stomatal apparatus oval or circular, typically 61×49 μ . Guard cells deeply sunken, thinly cutinized.

Subsidiary cells 4-5, sometimes 6 or 7, slightly sunken, as thickly cutinized as epidermal cells and possessing a thin strip placed parallel to their inner margin and separating an inner from an outer thick area. All subsidiary cells alike, polar ones unspecialized. Subsidiary cells sharply separated from encircling cells by a deep, narrow groove. Surface of subsidiary cells strongly convex showing faint radial striations. Stomatal pit angular. Subsidiary cells provided with a papilla overhanging the stomatal pit; some or all papillae occasionally absent. Papillae 3-9 (-12) μ long, with rounded ends, sometimes faintly striated. Papillae sometimes crowded over stomatal pit even concealing it. Encircling cells similar to other epidermal cells, not raised, their outer margins not forming a definite ring.

Epidermal cells similar on both surfaces, polygonal, often isodiametric, tending to form longitudinal rows or irregularly packed. Anticlinal walls very thick, 3-11 μ , straight. Periclinal walls smooth or slightly mottled, sometimes with fine striations and one or more thin strips. Epidermal cells at leaf-base papillate.

Holotype — No. 30662 of the Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — About $\frac{3}{4}$ km. N.N.W. of Bansa.



TEXT-FIG. 3

Horizon and Age — Jabalpur Series; Lower Cretaceous.

Comparison and Discussion — *Brachyphyllum suryanarayanaii* agrees rather closely in its stomata with *B. expansum* (Sternberg) Seward (Kendall, 1949), *B. appropinquatum* Wesley (1956) and *B. praetermissum* Wesley (1956). In all these species the stomatal apparatus is rounded, the subsidiary cells have strong papillae and are marked off from the encircling cells by a deep groove. But there are differences also. The leaves of *B. suryanarayanaii* are rather more divergent than the leaves in the other species. *B. expansum* differs from the Bansa species in its longitudinal rows of stomata, a hypodermis and frilled margin. The leaves of *B. appropinquatum* show very little exposed upper surface; also the periclinal wall of the subsidiary cells is here less cutinized than the epidermal cells and they also lack thin strips. In *B. praetermissum* stomata are present only on the lower surface. Moreover, in this species the anticlinal walls of the epidermal cells are comparatively thinner and both the subsidiary and epidermal cells lack thin strips and striations.

Systematic Position — *Brachyphyllum suryanarayanaii* rather closely resembles in its shoots and leaves *Athrotaxis cupressoides* Don and *Dacrydium colensoi* Hook. It also resembles *Glyptostrobus* Endl. but the two are very different in cuticular structure. *A. cupressoides* differs from *B. suryanarayanaii* in having leaves with scarious and toothed margin. But *D. colensoi* is like *B. suryanarayanaii* in this respect. *D. colensoi* also resembles in having a similar type of stomatal distribution. In the papillate basal cells of its leaves *B. suryanarayanaii* is like *A. cupressoides* but not *D. colensoi*.

In stomatal structure *B. suryanarayanaii* is more like *D. colensoi* and a few other species of *Dacrydium* than *Athrotaxis*. Both *B. suryanarayanaii* and *Dacrydium* share

the feature of a deep groove round the subsidiary cells while this is absent in *Athrotaxis*. Like *B. suryanarayanaii* *D. biforme* has thin strips in the subsidiary cells and some of the epidermal cells, though in other species of *Dacrydium* such strips are feeble or lacking.

In conclusion, *B. suryanarayanaii* shows more features in common with *Dacrydium* than with *Athrotaxis*, but clearly much more evidence is needed before this species can be placed in the Podocarpaceae.

Genus *Marwaria* n. gen.

Diagnosis — Twigs bearing simple leaves. Leaves sessile, spirally borne, narrowing towards base and apex. Venation simple, parallel. Leaves amphistomatic. Stomata haplocheilic. Subsidiary cells 4-6, surface wall thickened.

Type Species — *Marwaria latifolia* (Feistmantel) Sukh-Dev & Bose.

Marwaria latifolia (Feistmantel) n. comb.

Pl. 3, Figs. 19-24; Text-fig. 4A, B

1882 — *Araucarites (Araucaria) latifolius* Feistmantel, p. 45, Pl. 2, Fig. 6.

1920 — *Araucarites latifolius* Feist.: Seward & Sahni, p. 35, Pl. 2, Fig. 27.

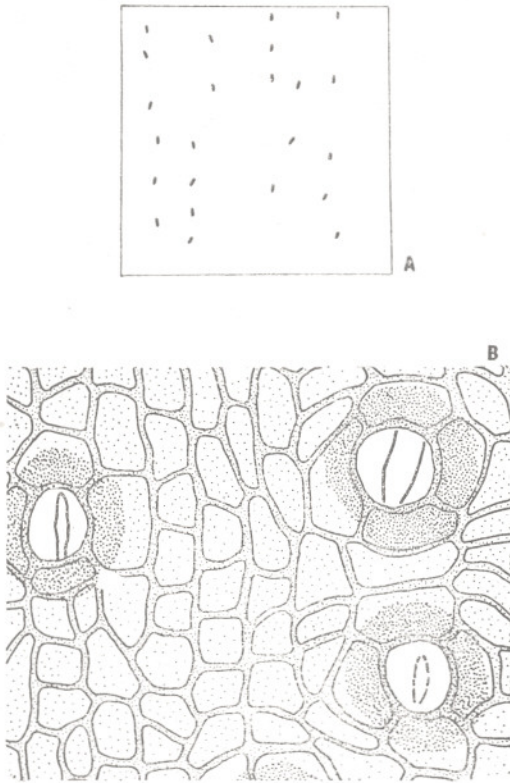
1928 — *Araucarites latifolius* Fst.: Sahni, p. 31.

Diagnosis — Twigs bearing spirally arranged leaves. Leaves typically 14 × 5 mm. (available range 11-15 × 3.5-5 mm.), elliptic-lanceolate; attached by a narrow base, lower basal margin sometimes slightly decurrent; apex pointed or bluntly rounded. Veins simple, parallel, obscure towards apex. Lamina apparently thick and coriaceous.

Cuticle thick, of almost same thickness on both sides. Leaves amphistomatic with fewer stomata on upper surface. Stomata on upper surface confined to leaf-base, irregularly distributed, distant, sometimes two stomata may be lying close. Epidermal

←

TEXT-FIG. 3 — *Brachyphyllum suryanarayanaii* n. sp.: A, specimen no. 30662, × 5. B, lower cuticle, slide no. 4431 (from specimen no. 30227), × 250. C, stoma and epidermal cells. Note the deep groove on the left round the subsidiary cells, slide no. 4431 (from specimen no. 30227), × 800. D, papillate cells in side view, slide no. 4434, × 250. E, basal papillate cells of lower surface, slide no. 4434, × 250. F, G, two stomata in side view, slide no. 4431 (from specimen no. 30227), × 800. H, orientation and distribution of stomata in 1 sq. mm. of the lower surface, slide no. 4435 (from specimen no. 30227).



TEXT-FIG. 4 — *Marvaria latifolia* (Feistmantel) n. comb.: A, showing orientation and distribution of stomata in 1 sq. mm. of lower cuticle, slide no. 4436 (from specimen no. 30152). B, lower cuticle, slide no. 4437 (from specimen no. 30152), $\times 250$.

cells serially arranged, $22-66 \times 15-35 \mu$, rectangular, rarely polygonal, anticlinal walls about 3μ thick, almost straight and fairly well marked, periclinal wall unspecialized.

Stomata on the lower surface placed generally in single rows, distant, a few lying outside rows, sunken, longitudinally orientated, sometimes slightly oblique, rarely transverse. Subsidiary cells mostly 4 (2+2), rarely 5, forming a ring, surface more cutinized than in epidermal cells. Stomatal pit oval or circular. Guard cells thinly cutinized, sunken. Aperture narrow, oval or elliptic. Encircling cells like epidermal cells. Epidermal cells outside stomatal rows rectangular, squarish or polygonal, anticlinal walls more or less straight, periclinal wall smooth. Epidermal cells between stomata polygonal, broader than their length. Trichomes absent.

Holotype — No. 5/386 of the Geological Survey of India, Calcutta. (Feistmantel 1882, Pl. 2, Fig. 6; same here Pl. 3, Fig. 20).

Locality — Bansa.

Horizon and Age — Jabalpur Series; Lower Cretaceous.

Comparison and Discussion — In gross features *Marvaria latifolia* somewhat resembles *Araucaria crassifolia* Corda described by Kräusel (1922) and *A. toucasi* Saporta (1879). But the cuticle of *A. crassifolia* differs considerably from that of *M. latifolia*. In *A. crassifolia* the stomata are mostly transversely orientated, but in *M. latifolia* they are mostly longitudinally orientated. In *M. latifolia* there are mostly 4 subsidiary cells, whereas in *A. crassifolia* they are mostly 6. The cuticular structure of *A. toucasi* is not known. In external form the leaves of *Pagiophyllum peregrinum* (?) (L. & H.) described by Walkom (1919) from ?Briton Shaft may also be compared with *M. latifolia*. The leaves in *P. peregrinum* (?) (L. & H.) are more distantly placed than *M. latifolia*. Among the fossil forms, *Araucaria balcombensis* Selling (1950) from Balcombe Bay, Australia, comes close to *M. latifolia*. In both the leaves are amphistomatic, the stomatal rows are quite distant from one another and inside the rows stomata are longitudinally orientated. In *A. balcombensis* the subsidiary cells are 4-6 in number, whereas in *M. latifolia* they are mostly 4, rarely 5. In both the stomatal opening resembles in shape. However, the leaves of *A. balcombensis* are larger and have, unlike the leaves of *M. latifolia*, a large number of stomata on the upper surface which are obliquely or transversely placed.

Among the recent species of *Araucaria*, *M. latifolia* comes closest in general form and size of leaf to *Araucaria biramulata* Buchholz and *Araucaria muelleri* Br. & Gr. But the cuticle of *A. biramulata* is quite different from that of *M. latifolia*. The stomata in *A. biramulata* are arranged on both the surfaces of the leaf in close longitudinal rows, and the stomata are mostly transversely orientated. Also the anticlinal walls of the epidermal cells in this species are pitted or sinuous. *A. muelleri* has also mostly transversely orientated stomata but the stomatal rows are here distant as in *M. latifolia*. The epidermal cells in *A. muelleri* are markedly sinuous walled.

Genus *Araucarites* Presl*Araucarites fibrosa* n. sp.

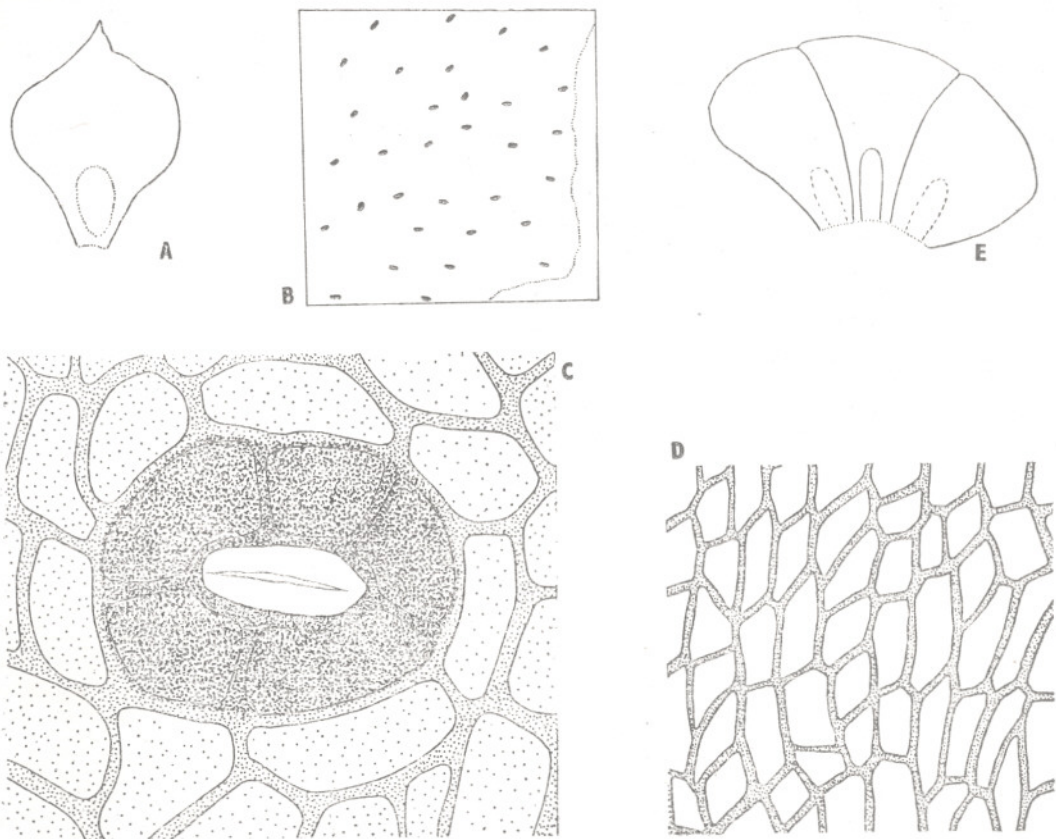
Pl. 2, Figs. 12, 13, 15, 17; Text-fig. 5A-D

1877 — *Araucarites macropterus* Feistmantel (*partim*), p. 24, Pl. 8, Fig. 10.1928 — *Araucarites macropterus* Fst.: Sahni (*partim*), p. 33, Pl. 6, Fig. 76.

Diagnosis — Detached cone-scales with a single adaxially placed obovoid seed. Cone-scale broadly deltoid, narrowing proximally and with a broad distal end, prolonged into a short narrow tip. Base truncate. Cone-scale $2.8-6 \times 2.6-4.4$ cm.; seed $1.2-1.7$ cm. long and $0.5-0.9$ cm. broad. Veins prominent, numerous, almost parallel, branching from two basal veins, which run parallel on each side of the basal part of cone-scale.

Veins sometimes bifurcated. (Ligule doubtful.)

Cuticle of scale with stomata present only on lower surface. Upper cuticle slightly thinner than lower; cells rectangular or squarish, sometimes polygonal, serially arranged, anticlinal walls straight, periclinal wall unspecialized. On lower cuticle stomata abundant, irregularly distributed, mostly transversely or obliquely placed, rarely longitudinal. Stomatal apparatus oval or circular. Subsidiary cells 4-6, mostly 5, rather more heavily cutinized than epidermal cells. Encircling cells not clearly marked. Guard cells slightly sunken, forming a slit-like aperture. Epidermal cells polygonal, rectangular or squarish, irregularly distributed, anticlinal walls straight,



TEXT-FIG. 5 — *Araucarites fibrosa* n. sp. (A-D); *Araucarites macropterus* Feistmantel (E): A, specimen no. 30585, $\times \frac{1}{2}$. B, lower cuticle showing orientation and distribution of stomata in 1 sq. mm., slide no. 4432 (from specimen no. 29992). C, stoma and epidermal cells, slide no. 4432 (from specimen no. 29992), $\times 500$. D, upper cuticle, slide no. 4432 (from specimen no. 29992), $\times 250$. E, *Araucarites macropterus*, specimen no. 30383, $\times 1$.

periclinal wall unspecialized. (Seed cuticle not known.)

Holotype — No. 30377 of the Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — About $\frac{1}{2}$ km. N.N.W. of Bansa.

Horizon and Age — Jabalpur Series; Lower Cretaceous.

Comparison and Discussion — The present specimens resemble *Araucarites macropterus sensu* Feistmantel (1877, Pl. 8, Fig. 10, reproduced by Sahni, 1928, Pl. 6, Fig. 76) in shape and more or less in size. But unlike Feistmantel's specimen the veins in *A. fibrosa* join the two principle veins which are running on two sides of the base and also the seed of *A. fibrosa* is comparatively smaller in size. The cuticle of *A. fibrosa* differs from that of *Araucaria cutchensis* (Feistmantel) Pant & Srivastava (1968) in having the stomata confined to the lower side, irregularly distributed and mostly transversely orientated. *A. cutchensis* is amphistomatic, the stomata are placed in rows and are commonly longitudinally orientated.

Araucarites macropterus Feistmantel

Pl. 1, Figs. 8-10; Text-fig. 5E

- 1877 — *Araucarites macropterus* Feistmantel (*partim*), p. 24, Pl. 8, Fig. 9.
 1879 — *Araucarites macropterus* Fstm.: Feistmantel, p. 28, Pl. 14, Figs. 13, 14; Pl. 16, Fig. 11.
 1882 — *Araucarites macropterus* Fstm.: Feistmantel, p. 45, Pl. 3, Fig. 18.
 1920 — *Araucarites macropterus* Feist.: Seward & Sahni, p. 34, Pl. 6, Fig. 65.
 1928 — *Araucarites macropterus* Fst.: Sahni (*partim*), p. 33.

Emended Diagnosis — Cone-scale deltoid, narrow towards base and broader, membranaceous upwards, $1.8-3.5 \times 1.6-3.4$ cm., bearing adaxially a small oval seed. Proximal end of cone-scale truncate; distal end rounded, sometimes with a small pointed apex. (Ligule not observed.)

Holotype — Specimen no. 4/584 of the Geological Survey of India, Calcutta (Feistmantel, 1877, Pl. 8, Fig. 9; same here Pl. 1, Fig. 10).

Locality — Holotype — Gollapalle, East Coast Gondwana.

Horizon and Age — Holotype — Rajmahal Stage, U. Jurassic.

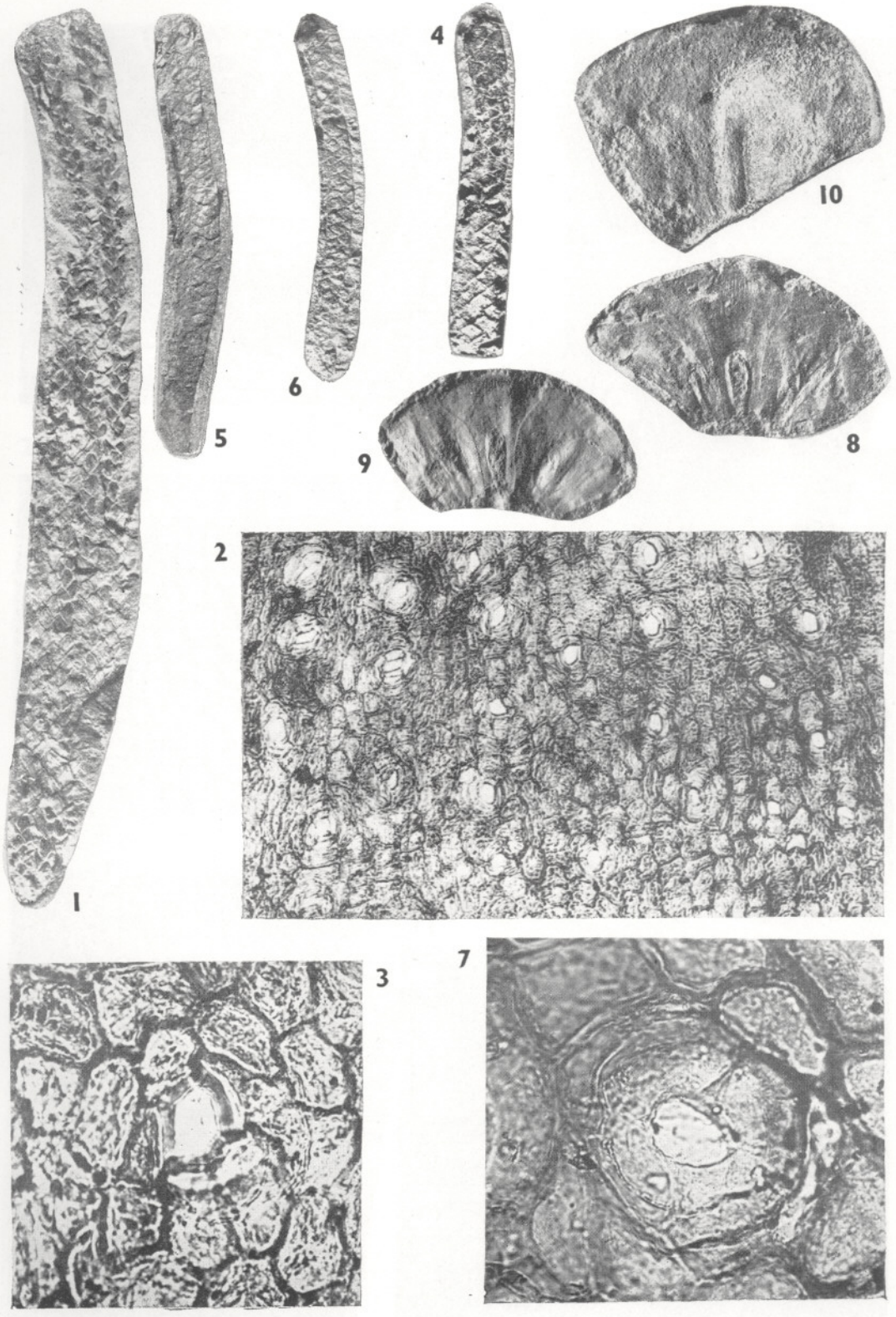
Discussion — Feistmantel (1877) instituted *Araucarites macropterus* on some specimens of fossil cone-scales (Pl. 8, Figs. 9-12) from Gollapalle, East Coast. Under this species he had included two or three different species. Out of these, the one figured in Pl. 8, Fig. 9 (here reproduced in Pl. 1, Fig. 10) is similar to some of the specimens collected from Bansa and nearby localities. For all these we have adopted the name *Araucarites macropterus*. Outside India somewhat similar specimen has been figured by Seward (1903, Pl. 6, Fig. 6) from Cape Colony as *Araucarites rogersi*.

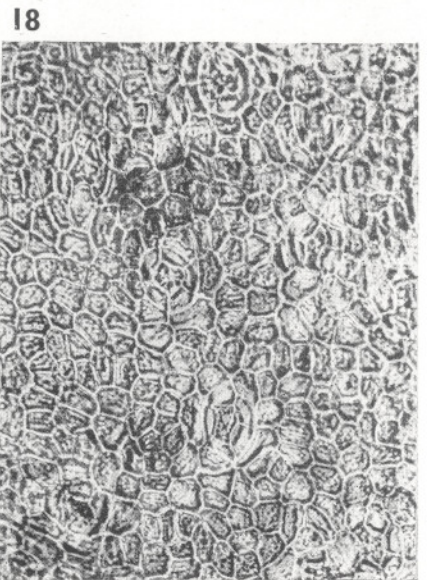
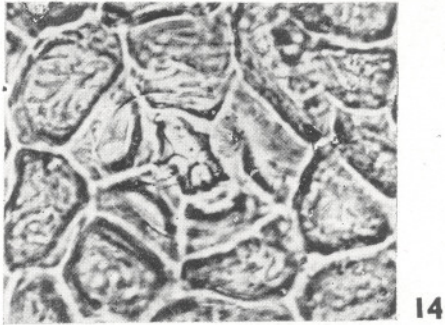
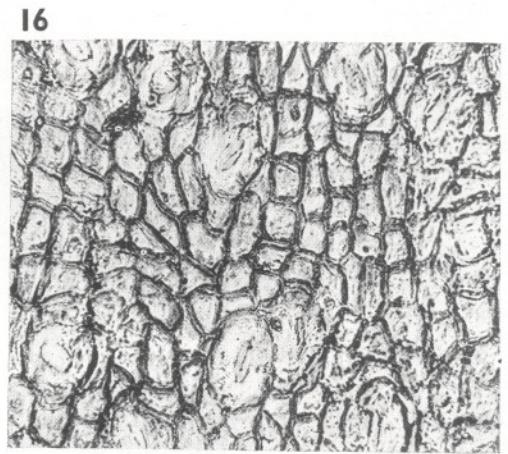
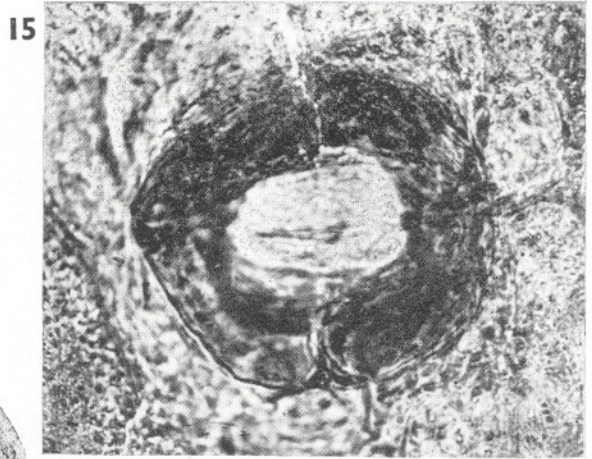
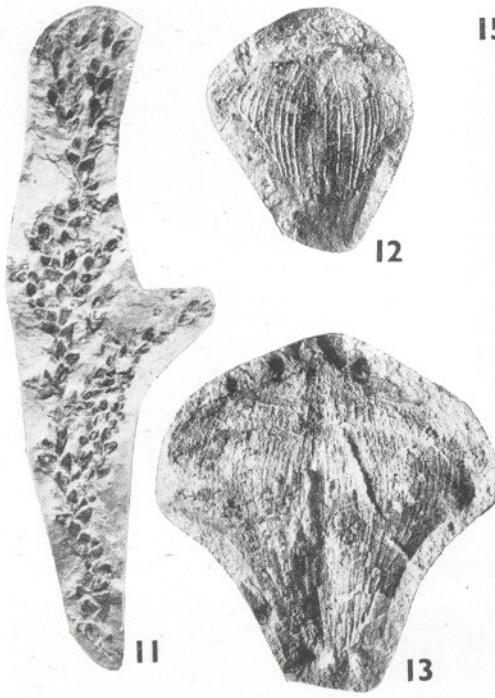
ACKNOWLEDGEMENTS

A part of the research work published here was completed at the Botany Department of the Reading University, England under the kind guidance of Professor. T. M. Harris to whom the authors are most grateful.

REFERENCES

- BOSE, M. N. & SUKH-DEV (1972). Three new species of *Pagiophyllum* from Bansa, Madhya Pradesh, India. *Geophytology*, **1** (2): 116-122.
 FEISTMANTEL, O. (1877). Jurassic (Liassic) flora of the Rajmahal Group from Golapili (near Ellore), South Godavari district. *Mem. geol. Surv. India Palaeont. indica*, **1** (3): 163-190.
 Idem (1882). Fossil flora of the South Rewah Gondwana Basin. *Ibid.* **4** (1): 1-52.
 KENDALL, M. W. (1947). On five species of *Brachyphyllum* from the Jurassic of Yorkshire and Wiltshire. *Ann. Mag. nat. Hist. Ser.* **11**, **14**: 225-251.
 Idem (1949). On *Brachyphyllum expansum* (Seward) Seward, and its cone. *Ibid.* *Ser.* **12**, **2**: 308-320.
 KRÄUSEL, R. (1922). Beiträge zur Kenntnis der Kreideflora. 1. Über einige Kreidepflanzen von Swalmen (Niederlande). *Meded. Rijks geol. Dienst, Ser. A*, **2**: 1-40.
 PANT, D. D. & SRIVASTAVA, G. K. (1968). On the cuticular structure of *Araucaria* (*Araucarites*) *cutchensis* (Feistmantel) Comb. nov. from the Jabalpur Series, India. *J. Linn. Soc. (Bot.)*, **61** (384): 201-206.
 SAHNI, B. (1928). Revisions of Indian fossil plants: Part 1 — Coniferales (a. Impressions and In crustations). *Mem. geol. Surv. India Palaeont. indica*, (N.S.), **11**: 1-49.
 SAPORTA, C. DE (1879). Le Monde des plantes avant L'apparition de L'homme. *Paris*.
 SELLING, O. H. (1950). Some Tertiary plants



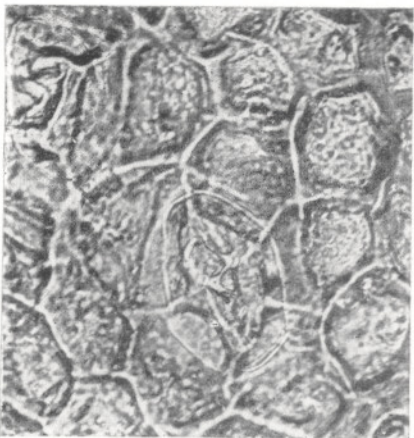




19



21



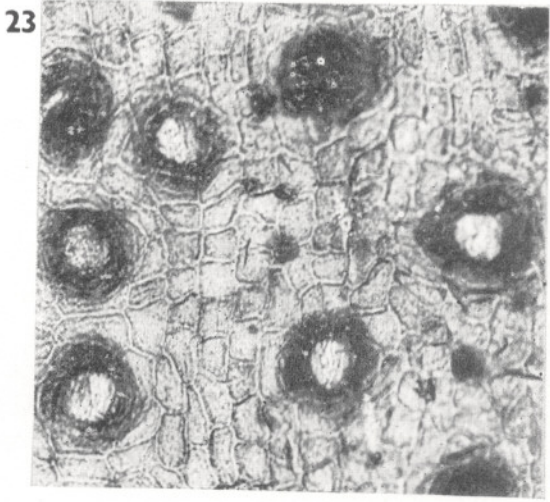
25



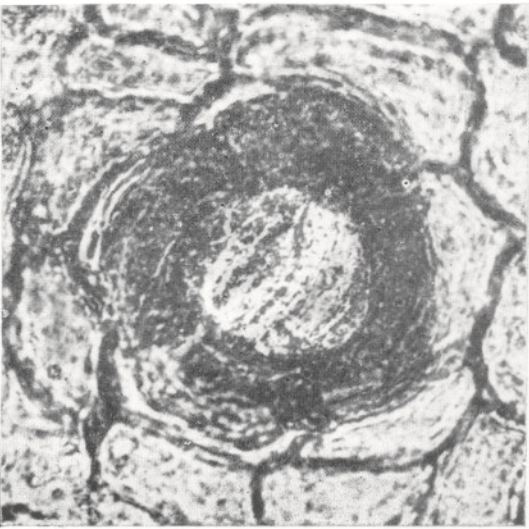
20



22



23



24

- from Australia. *Svensk bot. Tidskr.* **44** (4): 551-560.
- SEWARD, A. C. (1903). Fossil floras of Cape Colony. *Ann. S. Afr. Mus.* **4** (1): 1-122.
- SEWARD, A. C. & SAHNI, B. (1920). Indian Gondwana Plants: A Revision. *Mem. geol. Surv. India Palaeont. indica* (N.S.), **7** (1): 1-41.
- SINGH, G. (1957). *Araucarites nipaniensis* sp. nov.—A female Araucarian cone-scale from the Rajmahal Series. *Palaeobotanist*, **5** (2): 64-65.
- WALKOM, A. B. (1919). Mesozoic Floras of Queensland. Parts 3 and 4. The Floras of the Burrum and Styx River Series. *Qd. geol. Surv. Publ.* **263**: 1-62.
- WESLEY, A. (1956). Contributions to the knowledge of the flora of the Grey Limestones of Veneto: Part I. *Memorie Ist. geol. miner. Univ. Padova*, **19**: 1-68.

EXPLANATION OF PLATES

PLATE 1

1. *Brachyphyllum bansaensis* n. sp. No. 29989, holotype, $\times 1$.
2. *B. bansaensis*, lower cuticle. Sl. No. 4428 (from specimen no. 29989), $\times 150$.
3. *B. bansaensis*, a stoma magnified. Sl. No. 4429 (from specimen no. 29989, $\times 500$).
4. *Brachyphyllum eikaiostomum* n. sp. No. 30030, holotype, $\times 1$.
5. *B. eikaiostomum*, No. 30033, $\times 1$.
6. *B. eikaiostomum*. No. 35016, $\times 1$.
7. *B. eikaiostomum*, a stoma magnified. Sl. No. 4430 (from specimen no. 30269), $\times 500$.
8. *Araucarites macropterus* Feistmantel, No. 30438, $\times 1$.
9. *A. macropterus*, No. 35017, $\times 1$.
10. *A. macropterus*, No. 4/584 (G.S.I., Calcutta), holotype, $\times 1$.

PLATE 2

11. *Brachyphyllum suryanarayanai* n. sp. No. 30662, holotype, $\times 1$.
12. *Araucarites fibrosa* n. sp. No. 30377, holotype, $\times 1$.
13. *A. fibrosa*, No. 30483, $\times 1$.

14. *Brachyphyllum suryanarayanai*, a stoma magnified. Sl. No. 4431 (from specimen no. 30227), $\times 500$.
15. *Araucarites fibrosa*, a stoma magnified. Sl. No. 4432 (from specimen no. 29992), $\times 500$.
16. *Brachyphyllum eikaiostomum*, lower cuticle. Sl. No. 4430 (from specimen no. 30269), $\times 150$.
17. *Araucarites fibrosa*, lower cuticle. Sl. No. 4432 (from specimen no. 29992), $\times 150$.
18. *Brachyphyllum suryanarayanai*, lower cuticle. Sl. No. 4431 (from specimen no. 30227), $\times 150$.

PLATE 3

19. *Marwaria latifolia* (Feistmental) n. comb. No. 30152, $\times 1$.
20. *M. latifolia*, No. 5/386 (G.S.I., Calcutta), holotype, $\times 1$.
21. *M. latifolia*, No. 30683, $\times 1$.
22. *M. latifolia*, No. 35018, $\times 1$.
23. *M. latifolia*, lower cuticle. Sl. No. 4433 (from specimen no. 30152), $\times 150$.
24. *M. latifolia*, a stoma magnified. Sl. No. 4433 (from specimen no. 30152), $\times 500$.
25. *Brachyphyllum suryanarayanai*, two stomata magnified. Sl. no. 4431 (from specimen no. 30227), $\times 500$.