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# Further observations on the structure and affinities of *Monocotylotrobus bracteatus* Lakhnupal, Prakash & Bande from the Deccan Intertrappean beds of India

M. B. Bande

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Based on some more specimens recovered from the Deccan Intertrappean chert of Mohgaonkalan, the fossil inflorescence—*Monocotylotrobus bracteatus* Lakhnupal, Prakash & Bande 1982 has been restudied. Many new characters have been observed and added to its diagnosis given earlier. On the basis of new observations a reconstruction of the inflorescence has been attempted and the affinities reassessed.

**Key-words**—Monocotyledons, Inflorescence, Deccan Intertrappean beds, India.

*M.B. Bande, Birbal Sabni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India.*

## सारांश

भारत के दक्खिन अन्तर्द्वीपी संस्तरो से प्राप्त मोनोकोटाइलोस्ट्रोबस ब्रेक्टिएटस लखनपाल, प्रकाश व बाँडे की संरचना एव सजातीयताओं पर और प्रेक्षण

माहहन बलवंत बाँडे

माहगाव कला के दक्खिन अन्तर्द्वीपी रामसंकाशमों से प्राप्त कुछ आर प्रादर्शों के अध्ययन के आधार पर *मोनोकोटाइलोस्ट्रोबस ब्रेक्टिएटस* लखनपाल, प्रकाश व बाँडे 1982 नामक अशिमत पुष्पक्रम का पुनः अध्ययन किया गया है। इन प्रादर्शों में कई नये लक्षण प्रेक्षण किये गये हैं तथा पूर्व वर्णित निदान में इनका समायाजन किया गया है। नये प्रेक्षणों के आधार पर उक्त अशिमत पुष्पक्रम की पुनर्रचना का भी प्रयास किया गया है तथा सजातीयतायें पुनर्निर्धारित की गई हैं।

MORE than fifteen years back, a fossil inflorescence *Monocotylotrobus bracteatus* was described from the Deccan Intertrappean chert of Mohgaon Kalan, Chhindwara District, Madhya Pradesh (22° 1' N : 79°11'30" E), first in the form of a short note (Lakhnupal *et al.*, 1975) and later in detail (Lakhnupal *et al.*, 1982). As all the specimens recovered at that time from the chert material were exposed in the longitudinal plane only, some of the important characters, e.g., the number of vertical rows of flowers around the main axis and number of perianth whorls in each flower, could not be ascertained. Because of the incomplete description, a reconstruction of this interesting fossil could also not be attempted. Recently, a few more specimens of the above fossil were recovered from the Mohgaon Kalan chert. Two of them were exposed in a longitudinal plane, and two in an oblique transverse plane. In all, eleven thin sections from this material were prepared.

A collective study of these slides revealed many new features, not recorded earlier and it was, therefore, deemed necessary to redescribe the inflorescence in the light of new observations. Based on this study an attempt has been made to reconstruct this interesting fossil.

## DESCRIPTION

***Monocotylotrobus bracteatus* Lakhnupal,  
Prakash & Bande 1982**

Incomplete racemose inflorescence, base not known, maximum length about 3.5 to 4 cm (Pl. 2, fig. 1; Text-fig. 2), flowers sessile, arranged spirally on the axis in acropetal succession, each flower subtended by a well-developed distinct bract. An oblique transverse section revealed that the main axis is surrounded by about 9-10 vertical rows of flowers (Pl. 1, fig. 1; Text-fig. 1). The maximum diameter of the inflorescence in an oblique transverse section is 1.5-2 cm. The *main axis*, as seen

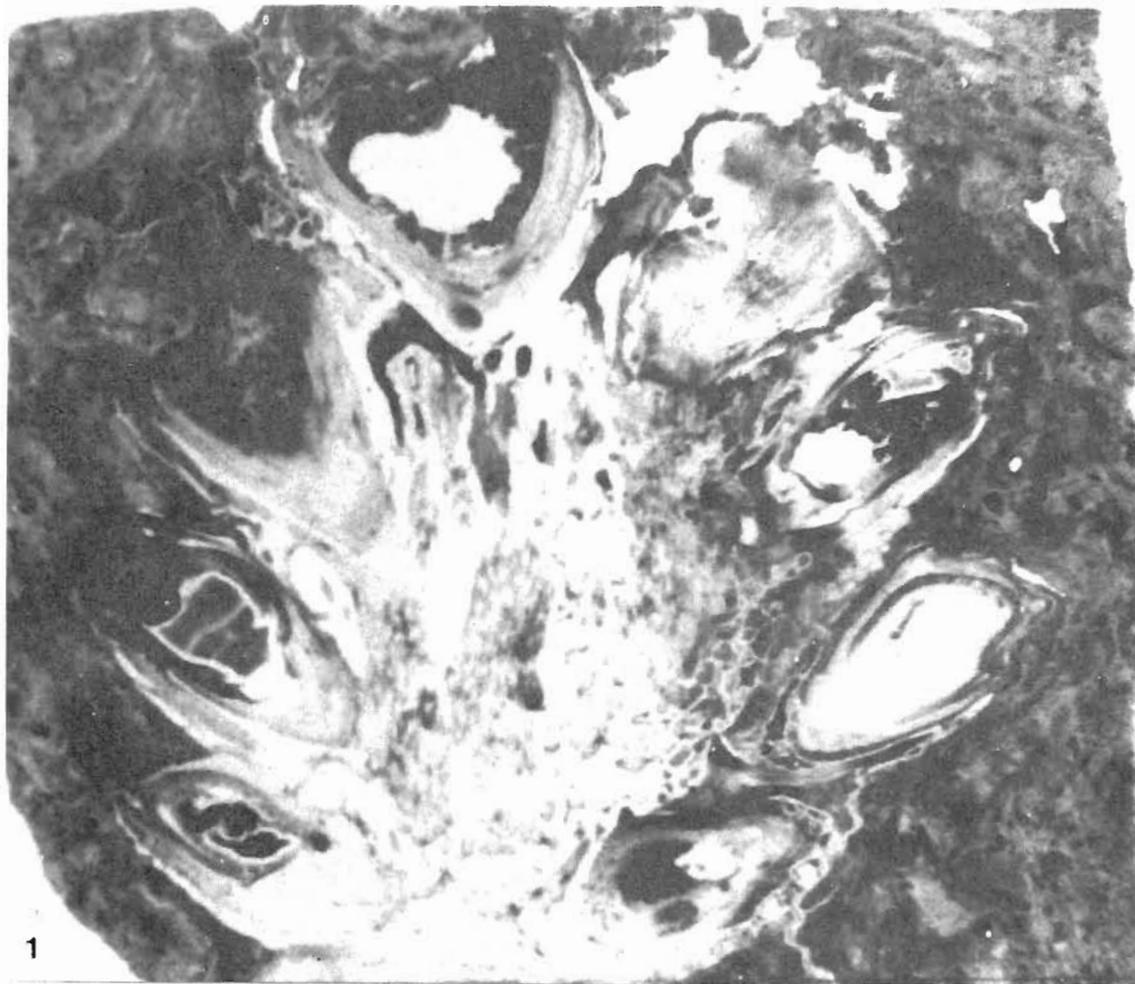


PLATE 1



**Text-figure 1**—*Monocotylostrobus bracteatus*: Inflorescence in an oblique transverse section showing main axis surrounded by flowers. x 6.5.

in an oblique transverse section, is made up of thin-walled cells of irregular shape with fibrous and ?fibrovascular bundles distributed in the ground tissue. The bundles are about 350  $\mu\text{m}$  in diameter and circular to orbicular in shape (Pl. 2, fig. 4).

*Flowers*—The flowers are small, 3.5 to 5 mm in length and 1.5 to 3 mm in diameter, sessile, bracteate, hypogynous and probably unisexual (Pl. 1, fig. 4; Pl. 2, fig. 1; Text-fig. 1).

*Bract*—The bract subtending each flower is persistent, about 3.5 mm in length and 1 mm in thickness, narrowing towards the apex. It consists of a single layered epidermis made up of horizontally elongated cells on the adaxial side of the bract followed by 2-3 successive rows of fibrovascular bundles. The ground tissue is made up of thin-walled, oval, irregular or rod-shaped cells. Because of bad preservation, anatomical details of the abaxial half of the bract could not be studied by Lakhanpal *et al.* (1982). In the present

material, at one place where the flower is exposed in a transverse plane, the abaxial half of the bract could be studied. It consists of a row of well-developed fibrous bundles, distributed in the ground tissue (Pl. 2, fig. 2) indicating that the bract is a sturdy structure with well-developed mechanical tissue. The cellular details of the epidermis on the abaxial side could not be studied due to bad preservation.

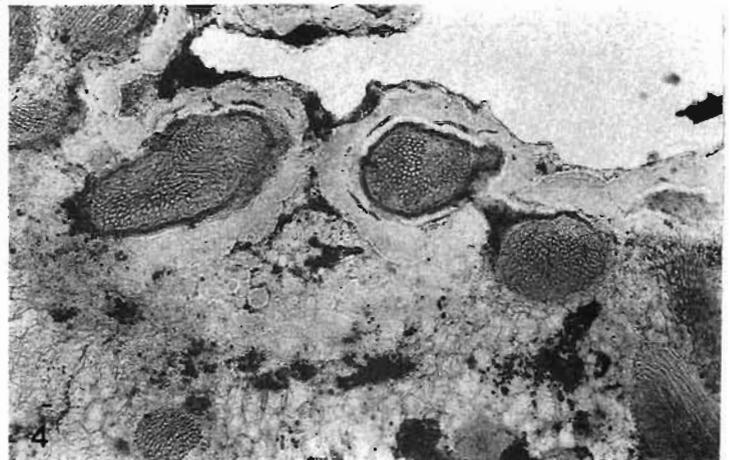
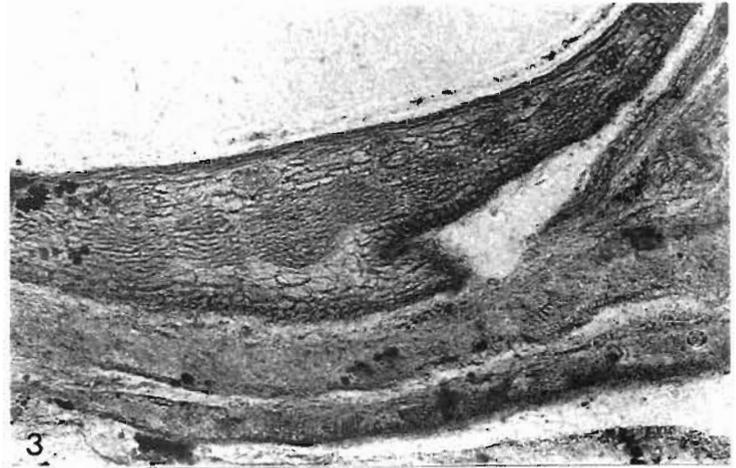
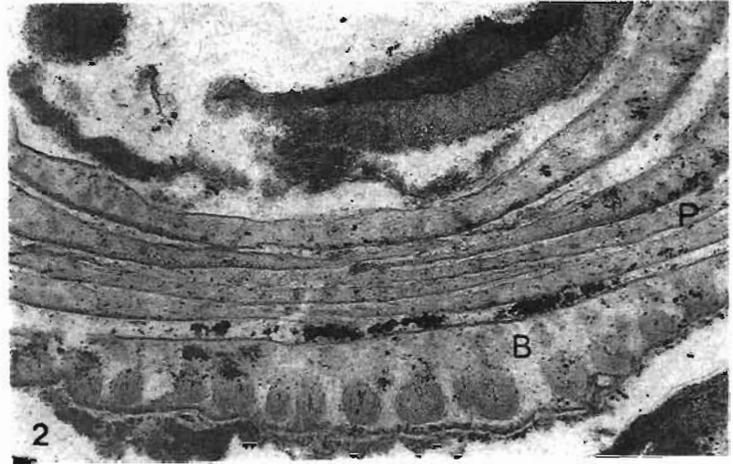
*Perianth*—The perianth is hypogynous, persistent and made up of whorls of similar perianth lobes. At more than one place, in a transverse section of the flower, 6 similar perianth lobes arranged in imbricate aestivation could be seen (Pl. 1, figs 2, 3). However, whether the perianth consists of two or three whorls of perianth lobes is that character which still could not be ascertained. The anatomical details of the perianth are as described by Lakhanpal *et al.* (1982).

*Androecium*—In accordance with the observations made by the earlier workers, in this material also, neither

## PLATE 1

### *Monocotylostrobus bracteatus*

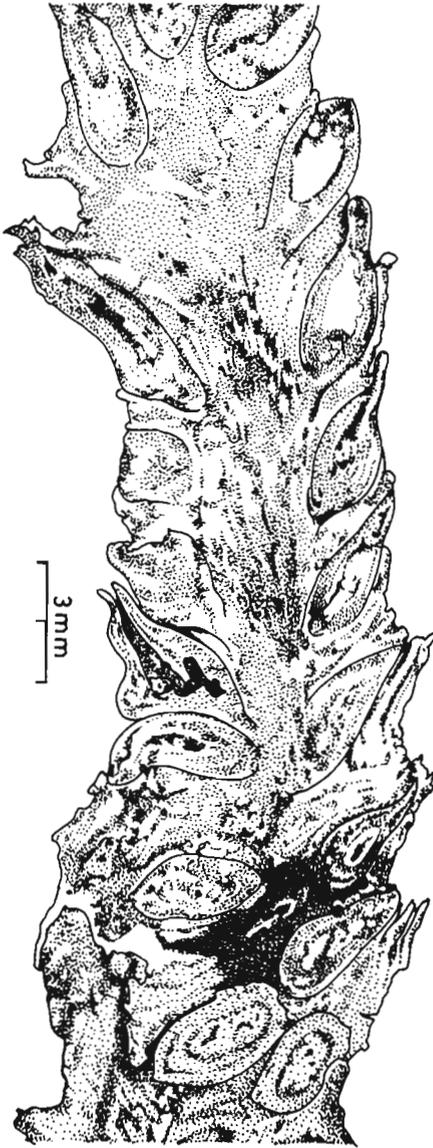
1. An oblique transverse section of inflorescence showing 8 (9) flowers arranged around the main axis. x 6.5. B.S.I.P Slide no. 10881.
2. A single flower with the subtending bract in transverse section showing six perianth lobes, x 12. B.S.I.P Slide no. 10882.
3. Another flower in transverse section, x 12. B.S.I.P. Slide no. 10883.
4. A single flower in longitudinal section showing an elongated style with a flattened stigma, x 12. B.S.I.P. Slide no. 10884.



## PLATE 2

*Monocotylostrobus bracteatus*

- 1 Vertical longitudinal section of the inflorescence showing bracteate, sessile flowers attached on both the sides of the main axis, x 7.5. B.S.I.P. Slide no. 10885.
- 2 Transverse section of a flower magnified to show the perianth lobes (P) and the subtending bract (B) with well-developed vascular bundles. x 60 B.S.I.P. Slide no. 10882
- 3 Cellular details of perianth lobe showing parenchymatous ground tissue and well-developed vascular bundles, x 90. B.S.I.P. Slide no. 10883.
- 4 Main axis in an oblique transverse section showing parenchymatous ground tissue and typical monocotyledonous vascular bundles, x 60 B.S.I.P. Slide no. 10881



**Text-figure 2**—*Monocotylostrobus bracteatus*: A vertical longitudinal section of the inflorescence showing bracteate, sessile flowers attached on both the sides of the main axis, x 6.5.

stamens nor their remnants could be seen which further supports the view that the flowers are most probably unisexual.

**Gynoecium**—The gynoecium is tricarpeal, syncarpous with a superior ovary. The style was described earlier as with a broad base and pointed apex. However,

in the present material at one place, a long style (about 2 mm) with a flattened stigma can be seen clearly (Pl. 1, fig. 4).

**?Thalamus**—In one of the slides where a flower is exposed in a transverse plane, the perianth whorl is followed by a structure occupying the central cavity which could be interpreted as the thalamus (Pl. 3, figs 2-3). In cross section it consists of an unicellular layer of dark coloured, vertically elongated cells towards the outer side followed by a thick multicellular layer made of thin-walled parenchymatous cells with closely spaced—almost a continuous ring of well-developed fibrous bundles (Pl. 3, fig. 3). This layer is followed by an amalgamated mass of thin-walled cells in which at places a few pollen grains are present (Pl. 3, figs 4-7).

**Pollen**—The pollen grains are oval in shape in the equatorial view, monocolpate, a single colpus running almost 3/4th length of the grain visible; 30  $\mu$ m in polar diameter, 24  $\mu$ m in equatorial diameter; exine finely reticulate (Pl. 3, figs 5, 6, 7).

**?Embryo**—At one place an oblique section of the flower shows an elongated structure made up of thin-walled in the central cavity of the flower (Pl. 3, fig. 1). This could be interpreted as embryo (in that case this particular flower should be termed as a fruit and not as flower). However, no other details of the seed wall or endosperm, etc. are visible. The attachment of this possible embryo is adaxial.

**Affinities**—Presence of distinct collateral and close vascular bundles in the main axis, bract and perianth lobes indicates that the inflorescence belongs to the monocotyledons. Taking into account the other important morphological features, such as (a) racemose inflorescence with sessile flowers arranged in acropetal succession, (b) well-developed bract subtending each flower, and (c) a tricarpeal syncarpous, superior ovary, Laxmanpal *et al.* (1982) had broadly suggested the affinities of this inflorescence with the families Bromeliaceae, Centrolepidaceae, Restionaceae, Liliaceae and Palmae. Further, considering the presence of a well-developed perianth it may belong to either Liliaceae or Arecaceae. A number of morphological diagnostic characters such as the number of flower rows around the main axis and number of lobes in the perianth were not available earlier for ascertaining

### PLATE 3



1. Transverse section of a single flower (fruit) showing perianth lobes and ?embryo, x 12. B.S.I.P. Slide no. 10884.
2. Inflorescence in oblique transverse section showing main axis and 9 rows of flowers, x 7.5. B.S.I.P. Slide no. 10886.
3. A portion of one of the flowers (fig. 2 F) magnified to show perianth (P) with well-developed vascular bundles and a portion of ?thalamus (T) showing a continuous row of vascular bundles, x 60. B.S.I.P. Slide no. 10886.
4. A portion of the central part of ?thalamus enlarged to show pollen grains (PO), x 370. B.S.I.P. Slide no. 10886.
- 5-7. Pollen grains in different focii, x 900. B.S.I.P. Slide no. 10886.

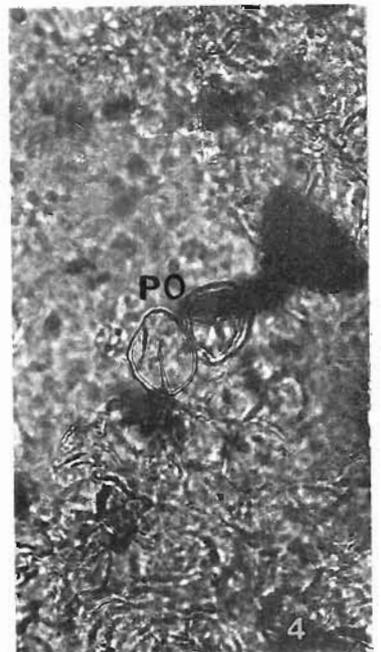
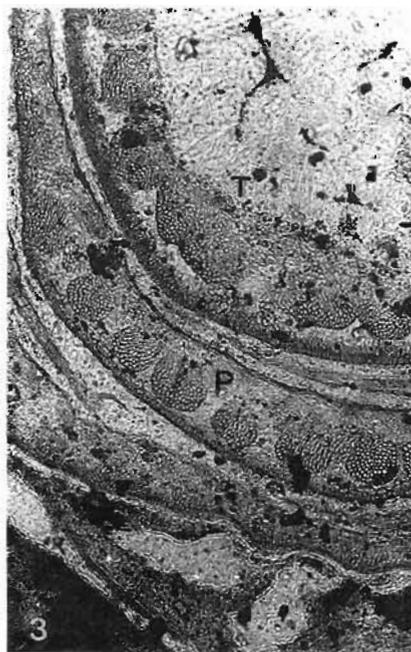
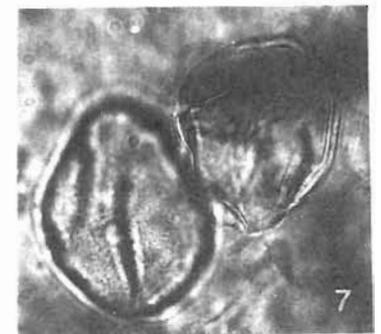
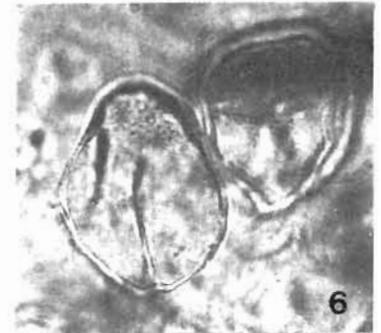
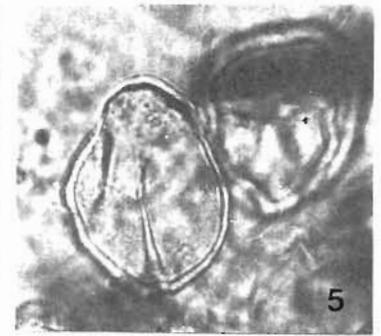
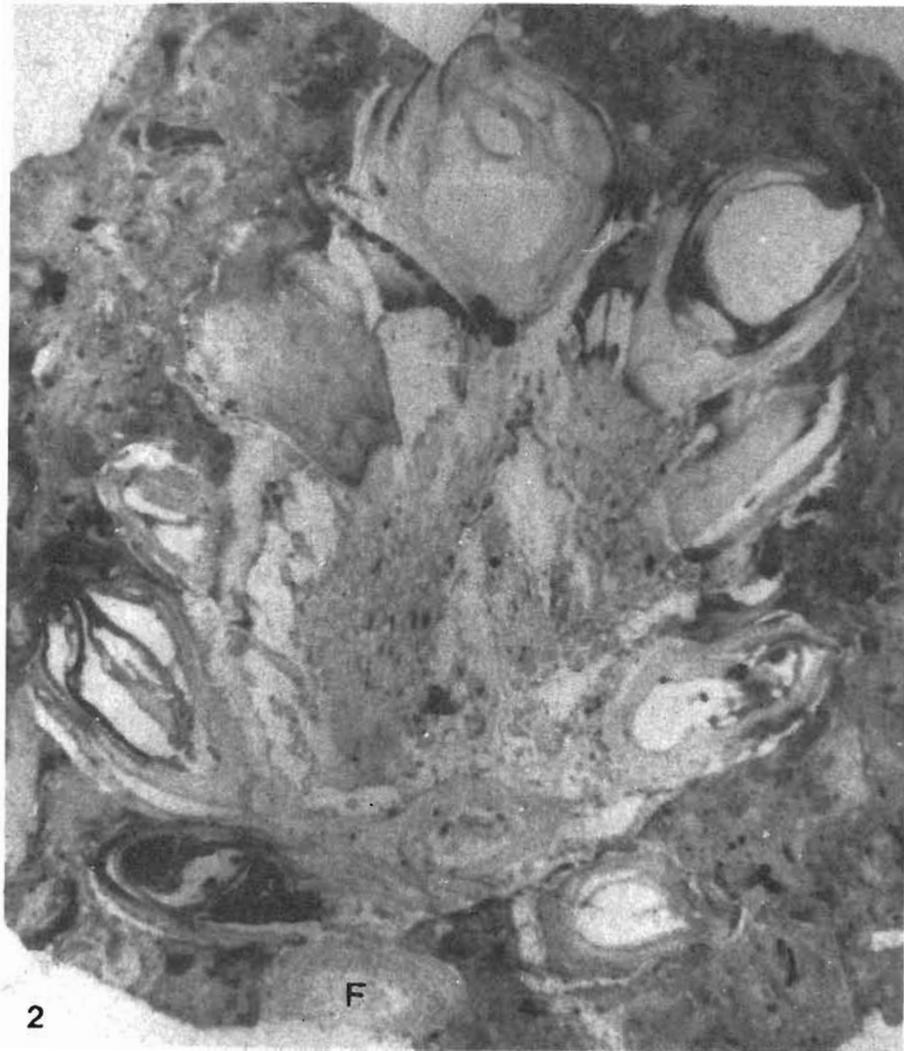
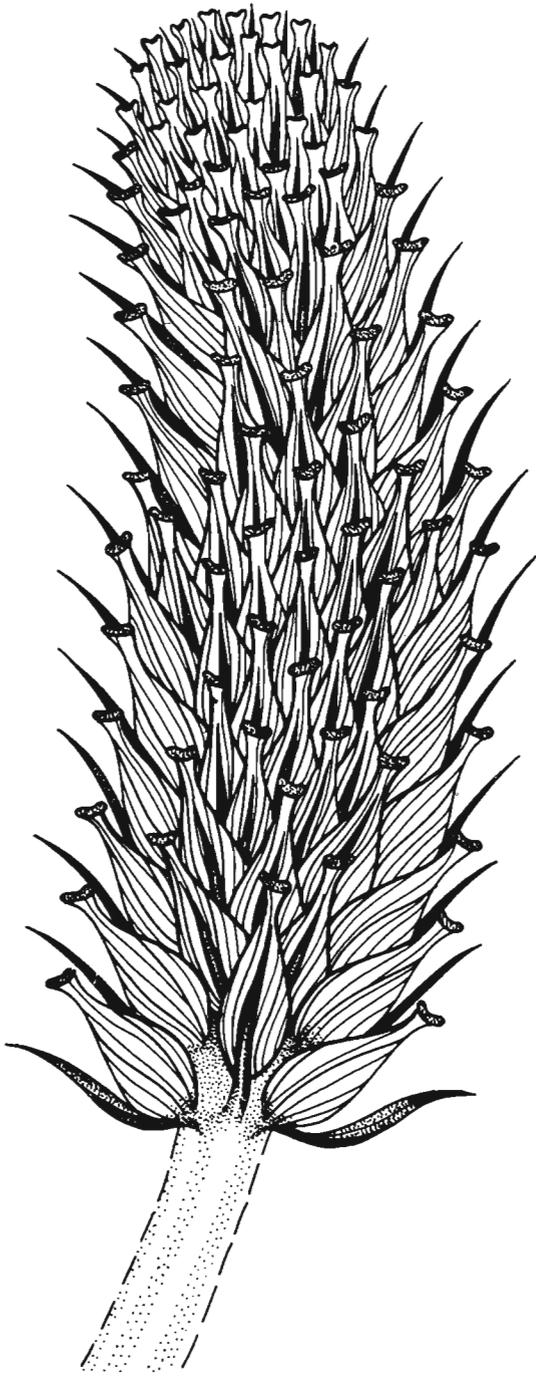


PLATE 3



**Text-figure 3**—*Monocotylostrobus bracteatus*: Reconstruction of the inflorescence (semi-diagrammatic).

the affinities of this inflorescence. From the present study, it is clear that there are 9-10 vertical rows of flowers, around the main axis and the perianth is made up of six similar lobes. A few more details, like the style with a flattened stigma and monocolpate pollen grains inside one of the flowers have been added to the already given diagnostic feature of the inflorescence.

A study of the morphological characters of the families Liliaceae and Arecaceae enlisted by Hutchinson (1959) reveals that most of the diagnostic features of the present inflorescence are found in both these families. In addition to the common characters mentioned by Lakhanpal *et al.* (1982), as in the above two families, in the fossil also the perianth consists of six lobes. However, uncertainty regarding the number of perianth whorls in the present fossil inflorescence restricts its assignment to either Liliaceae or Arecaceae. Leaving aside this particular feature, presence of a long style with a flattened stigma indicates its affinity with Liliaceae. At the same time presence of well-developed fibrous bundles in all parts of the inflorescence, indicating a sturdy nature, suggests the possibility of its belonging to Arecaceae.

The structure of the pollen grains is also indicative of its affinities with these two families as similar type of pollen grains are known to occur in the members of Liliaceae and Palmae (now Arecaceae—Erdtman, 1972). However, the evidence of pollen grains should be accepted with some caution. Although the pollen grains in the fossil have been observed lying on the probable thalamus of one of the flowers, in the total absence of stamens or their remnants in the fossil, the possibility of their getting deposited inside the flower from some other plant also can not be ruled out.

Considering all the points together, it can be summed up that although the fossil inflorescence shows maximum resemblance with Liliaceae and Arecaceae, it still eludes the attempts to assign it to any particular family.

#### EXTENDED SPECIFIC DIAGNOSIS

*Monocotylostrobus bracteatus* Lakhanpal, Prakash & Bande  
1982

Incomplete inflorescence about 3.5-4 cm in length and 1.5-2 cm in diameter. A branched racemose spikelet with sessile flowers arranged spirally in 9-10 vertical rows around the main axis in acropetal succession. *Main axis* made up of thin-walled ground tissue with well-developed collateral and closed fibrous/fibrovascular bundles. *Flowers* 3-5 mm in length and 1.5-3 mm in diameter, sessile, bracteate, hypogynous and probably unisexual. *Bract* well-developed below each flower, 3-5 mm in length and 1 mm in thickness, rows of collateral and closed fibrovascular/fibrous bundles distributed in the ground tissue on both adaxial and abaxial side of the bract. *Perianth* hypogynous, persistent, made up of six similar lobes with imbricate aestivation, arranged probably in three whorls, well-developed fibrous and fibrovascular bundles similar to those of bract present in the perianth lobes. *Androecium* not observed. *Gynoecium* probably tricarpellary,

syncarpus, superior; style long, with a flattened stigma. ?*Thalamus* seen in one of the flowers, made up of thin-walled ground tissue and an almost continuous ring of well-developed fibrous bundles. ?*Embryo* seen at once place, made up of thin-walled cells, attachment adaxial. *Pollen grains* seen at one place lying in the probable thalamus tissue, oval in shape in the equatorial view, monocolpate, 30  $\mu\text{m}$  in polar diameter, 24  $\mu\text{m}$  in equatorial diameter; exine finely reticulate.

*Specimens*—B.S.I.P. Slide nos. 10881-10886.

*Locality*—Mohgaon Kalan, Chhindwara District, Madhya Pradesh.

*Horizon*—Deccan Intertrappean beds.

*Age*—Early Tertiary.

#### ACKNOWLEDGEMENTS

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