

## A MONOCOTYLEDONOUS INFLORESCENCE FROM THE DECCAN INTERTRAPPEAN BEDS OF INDIA

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### ABSTRACT

A monocotyledonous inflorescence, *Monocotylostrobos bracteatus* gen. et sp. nov. is described from the Deccan Intertrappean beds of Mohgaon Kalan, Chhindwara District, Madhya Pradesh. Although the exact affinities of the inflorescence could not be ascertained, close relationship with the families Palmae and Liliaceae is indicated.

*Key-words* — Monocotyledonous inflorescence, *Monocotylostrobos*, Palmae, Liliaceae, Deccan Intertrappean beds, Palaeocene-Eocene (India).

### सारांश

भारत के दक्खिन अन्तर्द्वीपी संस्तरों से एक एकबीजपत्रीय पुष्पक्रम — राजेन्द्र नाथ लखनपाल, उत्तम प्रकाश एवं मोहन बलवंत बांडे

मध्य प्रदेश के छिदवाड़ा जनपद में मोहगाँव कलाँ के दक्खिन अन्तर्द्वीपी संस्तरों से एक एकबीजपत्रीय पुष्पक्रम — मोनोकोटिलोस्ट्रोबस ब्रेक्टियेटस नव प्रजाति व जाति — का वर्णन किया गया है। यद्यपि पुष्पक्रम की वास्तविक सजातीयतायें तो निश्चित नहीं की जा सकीं, परन्तु पाल्मी एवं लिलिएसी कुलों से इसका घनिष्ठ सम्बन्ध प्रदर्शित किया गया है।

### INTRODUCTION

**I**N a short note published a few years ago (Lakhanpal *et al.*, 1975) we had reported the occurrence of an angiospermous inflorescence from the Deccan Intertrappean beds of Mohgaon Kalan, Madhya Pradesh. It was then stated that a detailed description would be published when more specimens of this interesting fossil became available. On further scanning, we have found three more specimens which have furnished sufficient information forming the basis of the present communication.

All the specimens were exposed in the longitudinal plane and none was complete. The largest of them measures about 3.5 cm in length. As the material was fragmentary and limited, the specimens were studied serially by grinding the surface and taking photographs from different regions. Ultimately, wherever considered desirable, thin longitudinal sections were prepared from each specimen.

### DESCRIPTION

*General Features* — The inflorescence is a branched racemose spikelet with sessile flowers arranged spirally on the axis. They are in acropetal succession (Pl. 1, fig. 4; Pl. 2, fig. 8; Text-fig. 1) with those in the apical region still immature. A significant feature is the presence of a conspicuous bract below each flower (Pl. 1, fig. 4; Pl. 2, fig. 6; Text-figs 1, 3). At places the axis shows well-preserved anatomical details. It is made up of thin-walled cells of irregular shape (Text-fig. 2) with vascular traces going to the bract and the flowers (Text-fig. 3).

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

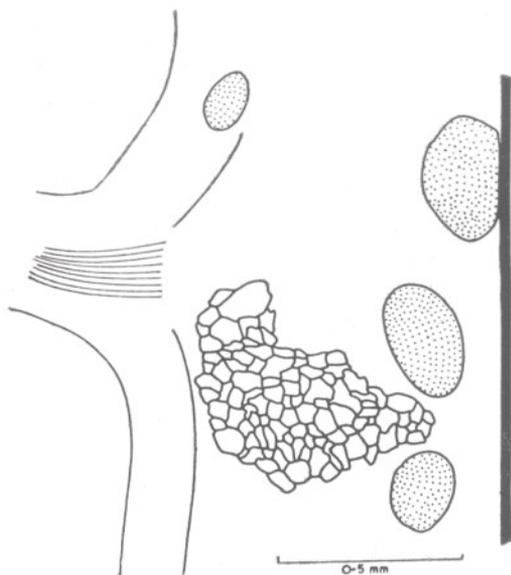
*Bract* — The bract subtending each flower is a persistent structure like the perianth and is present even in the mature flowers. It is about 3-5 mm in length and 1 mm in thickness, narrowing towards the apex



TEXT-FIG. 1—*Monocotylorobus bracteatus*—Inflorescence in vertical longitudinal section showing main axis with sessile, bracteate flowers arranged in acropetal succession.

(Pl. 2, fig. 6; Text-fig. 1). Anatomically it is well differentiated. In a vertical section, a single layered epidermis consisting of a row of horizontally elongated cells is seen on the adaxial side of the bract. Below the epidermis, there are 2-3 successive rows of fibrovascular bundles (Text-fig. 4). Each fibrovascular bundle consists of a round vascular part surrounded below by a broad fibrous sclerenchymatous sheath made up of thick-walled polygonal cells. The cells of the vascular part are polygonal, thin-walled, in which some protoxylem elements with annular or spiral thickenings can be seen. The area of the fibrous part is slightly more than that of the vascular.

The ground tissue of the bract is made up of thin-walled, oval, irregular or rod-shaped cells (Text-fig. 4). The abaxial part of the bract is badly preserved due to which it is not possible to study its details.



TEXT-FIG. 2—*Monocotylorobus bracteatus*—Main axis in vertical section showing vascular bundles and traces going to the bract.

*Perianth*—The perianth is hypogynous, persistent and made up of whorls of similar perianth lobes. The number of lobes in each whorl as well as the total number of whorls could not be ascertained as no cross section of the flower was available. However, at one place where the flower is exposed in an oblique longitudinal section, three perianth whorls seem to be present as indicated by three distinct midribs with well-developed fibrovascular bundles at the middle part of each lobe (Pl. 2, fig. 7; Text-fig. 5). The cellular details of the perianth lobes are well-preserved. The oblique longitudinal section reveals an epidermal layer of squarish to vertically elongated cells with wavy outline on the outer side and a layer of horizontally elongated cells on its inner side (Text-fig. 6). However, there is no such distinction between these two layers in the young perianth lobes (Pl. 1, fig. 5). Well-developed fibrovascular and fibrous bundles are quite common and crowded near the midrib region of the perianth lobes but they are somewhat diffuse and less frequent in the region away from the midrib (Pl. 2, fig. 7; Text-fig. 5). The



TEXT-FIG. 3 — *Monocotylostrobus bracteatus* — Inflorescence in vertical longitudinal section showing bracteate flowers and the vascular supply of the bract and perianth lobes.

ground tissue of the perianth is made up of thin-walled, compact cells of variable shape and size without intercellular spaces (Text-fig. 6).

*Androecium* — Neither stamens nor their remnants were observed in any of the flowers studied. This most probably indicates the unisexual nature of the flowers.

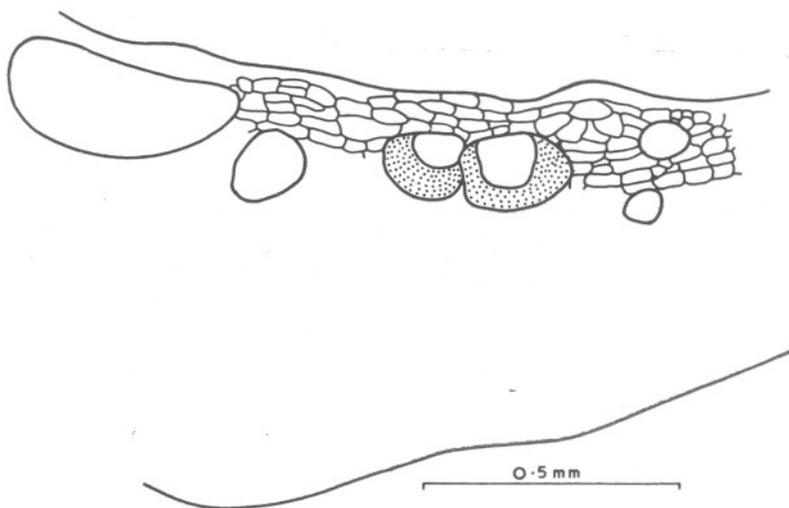
*Gynaecium* — The gynaecium seems to be tricarpeal, of the three carpels only two being seen in the longitudinal section (Pl. 2, fig. 9; Text-fig. 7), syncarpous with a superior ovary (Text-fig. 7). A common style with a broad base and a pointed apex was seen in one of the flowers (Pl. 2, fig. 9; Text-fig. 7). The number and position of

ovules in each locule could not be found out.

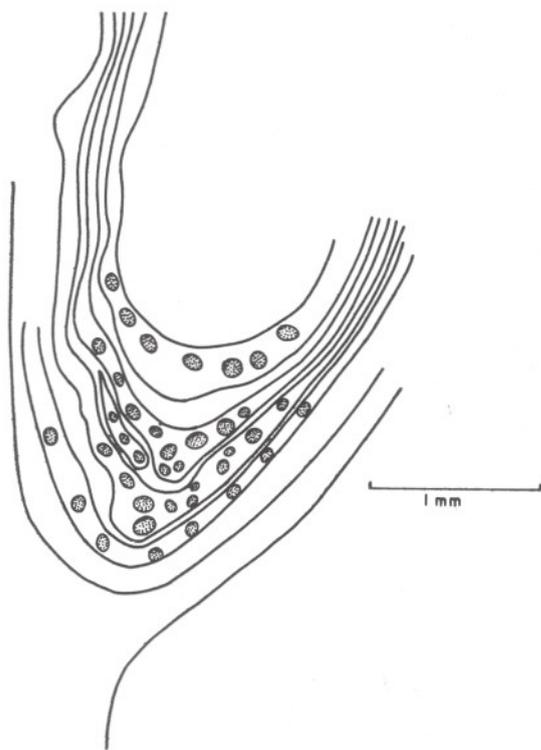
#### DISCUSSION

The presence of collateral and closed vascular bundles in the bract as well as in the perianth lobes of the flowers indicates that the inflorescence belongs to the monocotyledons. The other characters of diagnostic value are (a) racemose inflorescence with sessile flowers arranged in acropetal succession, (b) well-developed bract subtending each flower, (c) perianth lobes arranged in probably three whorls, and (d) a syncarpous, superior ovary.

Of all the families of monocots listed by Hutchinson (1959), there are 24 in which a syncarpous, superior ovary is present. Amongst these a racemose inflorescence is present in Bromeliaceae, Liliaceae, Pontederiaceae, Smilacaceae, Philesiaceae, Araceae, Agavaceae, Palmae, Pandanaceae, Haemodoraceae, Centrolepidaceae and Restionaceae. Further, a well-developed bract subtending each flower is present in the families Bromeliaceae, Centrolepidaceae, Restionaceae, Liliaceae and Palmae. However, in Centrolepidaceae the perianth is totally absent and in Bromeliaceae the perianth is made up of two dissimilar whorls whereas in the present inflorescence the flowers appear to possess 3 similar whorls of perianth. In Restionaceae also the perianth is in two series made up of 3-6 glume-like scarious or hyaline segments. However, in the fossil under discussion the perianth lobes appear to be quite thick with well-developed vascular tissue. Liliaceae is a big family with about 250 genera (Willis, 1973) and shows a variety of characters. Practically all the morphological characters of this petrified inflorescence, viz., its racemose nature with flowers subtended by bracts, well-developed perianth lobes arranged in similar whorls, and a tricarpeal, syncarpous, superior ovary can be found in various tribes of this family. But the fossil inflorescence shows well-developed fibrous and fibrovascular tissue suggesting a woody nature which is not expected in the floral axes of the members of Liliaceae. Moreover, in Liliaceae the perianth is made up of two similar whorls while in the fossil inflorescence it appears to be made up of three whorls.

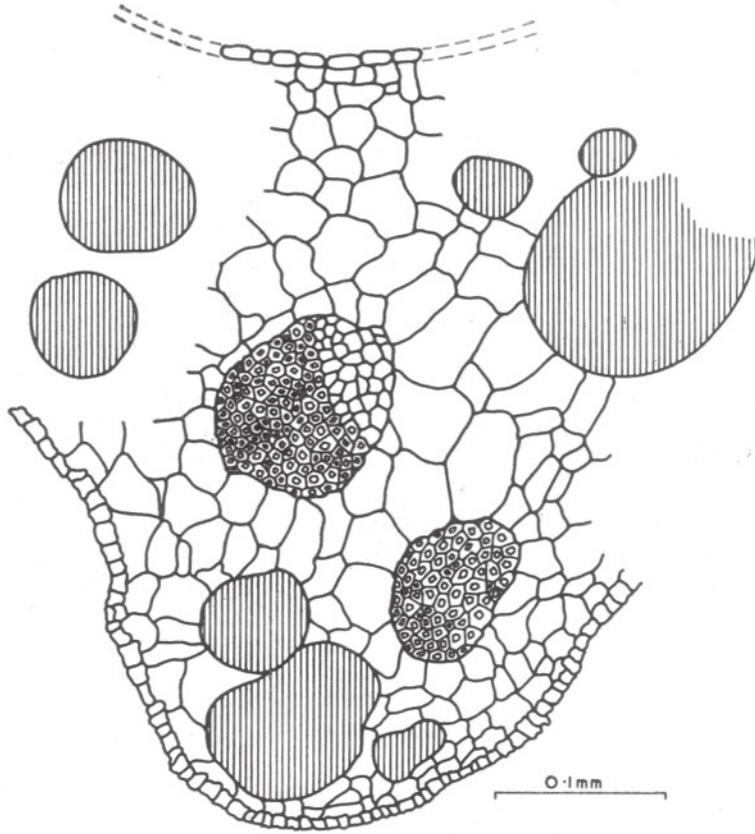


TEXT-FIG. 4 — *Monocotylostrobus bracteatus* — Bract in vertical section showing collateral and closed fibrovascular bundles.



TEXT-FIG. 5 — *Monocotylostrobus bracteatus* — A flower in oblique vertical section showing three perianth lobes.

Presence of a palm inflorescence in the Deccan Intertrappean beds of India is not at all unexpected as practically all the vegetative parts of palms as well as their fruits are abundantly known from these beds. Palm inflorescence and flower have been described in detail by Corner (1966). A palm inflorescence with unisexual and bracteate flowers is somewhat sturdy and quite commonly found in panicles or spikes and a small portion of this can be closely compared with the present fossil. The presence of well-developed fibrous and fibrovascular bundles in perianth and bracts in the fossil also strongly supports this possibility. However, the number of perianth whorls in each flower and the number of perianth lobes in each whorl in the fossil are characters which must be considered before assigning it to any modern family. Unfortunately, in the present state of our knowledge, it does not seem possible as the flowers could not be studied in cross-section. Unless this is done, the affinities of the present fossil remain an open question. For the present it is being described under a newly proposed form genus *Monocotylostrobus*, indicating its being a monocotyledonous inflorescence. The specific name *M. bracteatus* emphasizes the occurrence of prominent bracts.



TEXT-FIG. 6 — *Monocotylostrobus bracteatus* — A perianth lobe in longitudinal section showing fibrous and fibrovascular bundles, thin-walled cells of the ground tissue and upper and lower epidermis.

#### GENERIC DIAGNOSIS

##### *Monocotylostrobus* gen. nov.

Monocotyledonous inflorescence which cannot be assigned to any family.

*Genotype* — *Monocotylostrobus bracteatus* sp. nov.

#### SPECIFIC DIAGNOSIS

*Monocotylostrobus bracteatus* sp. nov.

A branched, racemose spikelet with sessile flowers arranged spirally on the axis in acropetal succession. *Flowers* 3-5 mm in length and 1.5-3 mm in diameter, sessile, bracteate, hypogynous and probably uni-

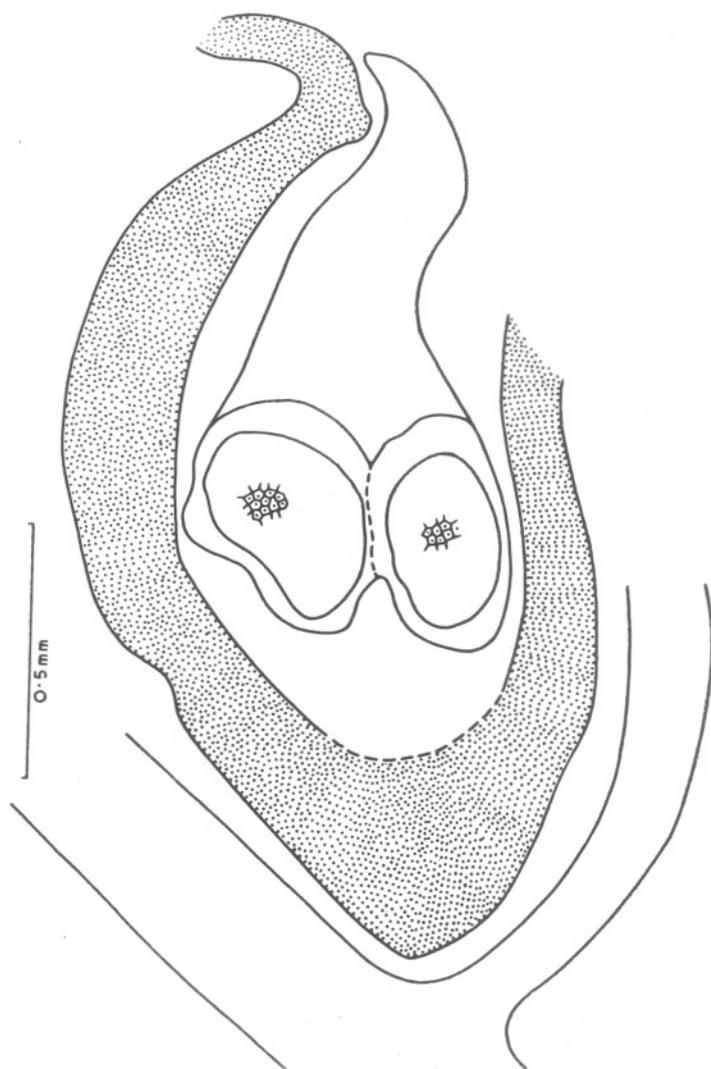
sexual. *Bract* well-developed below each flower, 3-5 mm in length and 1 mm in thickness; 2-3 successive rows of collateral and closed fibrovascular bundles present on the adaxial side of the bract. *Perianth* hypogynous, persistent, made up probably of three whorls of similar lobes; well-developed fibrous and fibrovascular bundles similar to those of bract present. *Androeium* not observed. *Gynaecium* probably tricarpellary, syncarpous, superior, style probably one.

*Holotype* — B.S.I.P. Museum slide no. 6267.

*Paratypes* — B.S.I.P. Museum slide nos. 6268, 6269 and 6270.

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

*Horizon* — Palaeocene-Eocene.



TEXT-FIG. 7 — *Monocotylostrobus bracteatus* — A flower in oblique vertical section showing two carpels cut vertically and a single style.

#### ACKNOWLEDGEMENTS

We are grateful to Prof. T. S. Mahabale and Prof. V. Puri for enlightened discussions and helpful suggestions regarding possible

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## EXPLANATION OF PLATES

## PLATE 1

*Monocotylostrobus bracteatus*

1. Inflorescence in reflected light.  $\times 1.5$ .
2. Another specimen in reflected light.  $\times 2$ .
3. Third specimen slightly enlarged, also in reflected light.  $\times 5$ .
4. Inflorescence in vertical longitudinal section showing main axis with sessile, bracteate flowers arranged in acropetal succession.  $\times 8$ . B.S.I.P. slide no. 6267.
5. A young perianth lobe in longitudinal section showing fibrous bundles.  $\times 100$ . B.S.I.P. slide no. 6267.

## PLATE 2

*Monocotylostrobus bracteatus*

6. A mature flower in oblique longitudinal section with a well-developed bract.  $\times 16$ . B.S.I.P. slide no. 6267.
7. Base of the flower in oblique longitudinal section showing three perianth lobes with well-developed fibrous and fibrovascular bundles.  $\times 60$ . B.S.I.P. slide no. 6268.
8. Inflorescence in longitudinal section with flowers arranged in acropetal succession.  $\times 11$ . slide no. 6269.
9. Inflorescence in longitudinal section with a flower at the top showing two carpels and single style.  $\times 9$ . C-carpel, S-style. B.S.I.P. slide no. 6270.

