

Typhophyllites ganeshii gen. et sp. nov., a monocotyledonous leaf from the Deccan Intertrappean Beds of Mohgaonkalan, Chhindwara District, Madhya Pradesh, India

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ABSTRACT

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The fossil leaf specimen, exposed in two pieces of black chert, was collected from the Deccan Intertrappean Beds (Latest Cretaceous) of Mohgaonkalan, Chhindwara District, Madhya Pradesh. The leaf is monocotyledonous with air cavities present in a single row. The mesophyll tissue is undifferentiated. The vascular bundles are of two types, i.e. sub-epidermal and vascular bundles in partition wall. The vascular bundles are conjoint, collateral and oval. Each vascular bundle has a single metaxylem element. On the basis of above characters, the fossil leaf shows close resemblance with the genus *Typha* of family Typhaceae.

Key-words: *Typhophyllites ganeshii* gen. et sp. nov., monocotyledonous leaf, Deccan Intertrappean Beds, Mohgaonkalan, Madhya Pradesh, India.

INTRODUCTION

Mohgaonkalan, an intertrappean fossiliferous locality, lies at a distance of 6 km from Chaurai, in Chhindwara District, Madhya Pradesh. A number of monocotyledonous remains are known from this locality, e.g. *Cyclanthodendron sahnii* (Rode) Sahni & Surange, *Musocaulon indicum* Jain, *Cyperaceoxylon intertrappeum* Chitaley & Patil, *Cannaites intertrappea* Trivedi & Verma, *Aerophyllites intertrappea* Chitaley and Patil, *Festucophyllites intertrappeaense* Patil & Singh, *Elymus deccanensis* Patil & Singh, *Crinum eocenum* Patil & Upadhye, *Culmites deccanensis* Paradkar and *Heliconiaites mohgaonensis* Trivedi & Verma.

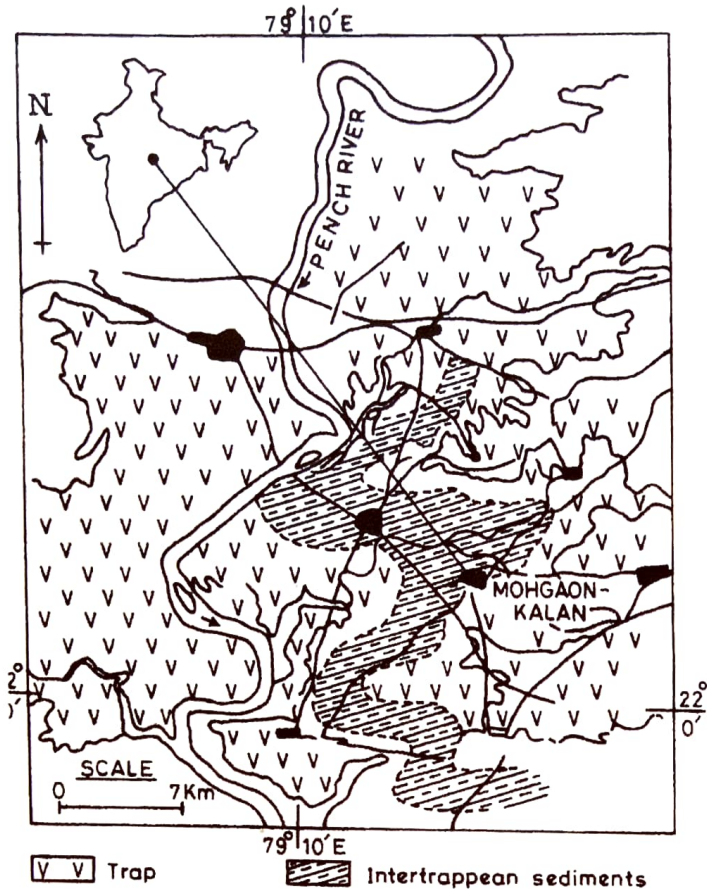
MATERIAL AND METHOD

The present fossil specimen was collected from the Deccan Intertrappean Beds of Mohgaonkalan, Chhindwara District, Madhya Pradesh (Text-figure 1). It was exposed in two pieces of black chert. The specimen was cut into thin sections and permanent slides were prepared for studying the anatomical details.

DESCRIPTION

Genus: *Typhophyllites* P. S. Kokate, E. V. Upadhye & G. V. Patil, gen. nov.

Type species: *Typhophyllites ganeshii* P. S. Kokate, E. V. Upadhye & G. V. Patil, gen. et sp. nov.



Text-figure 1. Map showing location of Mohgaonkalan, Chhindwara District, Madhya Pradesh.

Diagnosis: Monocotyledonous leaf, semicircular to triangular in outline, air cavities in single row, mesophyll tissue undifferentiated, vascular bundles of two types, sub-epidermal and vascular bundles in partition walls, vascular bundles conjoint, collateral and oval, each vascular bundle with single metaxylem element.

Etymology: The generic name is after the extant genus *Typha* of family Typhaceae.

***Typhophyllites ganeshii* P. S. Kokate, E. V. Upadhye & G. V. Patil, gen. et sp. nov.**

Diagnosis: Fossil leaf 7 mm in width and 2 mm in thickness, leaf semicircular to triangular in outline, air cavities in single row, largest air cavity 1.4 x 0.518 mm

and smallest air cavity 333 x 259 μm in size, sub-epidermal vascular bundles ten in number measuring 185 x 111 μm in size while vascular bundles in partition wall 481 x 148 μm in size. Vascular bundles show sclerenchymatous sheath on both sides, single metaxylem element measuring 49 x 38 μm in size. Protoxylem not seen, phloem tissue not well preserved.

Description: The present fossil leaf specimen is observed in two different chert pieces. In transverse section, the specimen shows width 7 mm and thickness 2 mm in the middle part. The leaf seems to be aquatic monocotyledonous. The leaf is broad in the middle region and tapers towards margin (Plate 1, figure 1, Text-figure 2A). It appears somewhat semi-circular in outline in transverse section. In transverse section, a row of air cavities is clearly seen. Air cavities are six in number and arranged exactly in the middle part of leaf in cross section. The adaxial epidermis is single layered. Cells of epidermis are smaller in size and thin walled. Presence of stomata is not very clear. Hypodermal layer is not distinct in abaxial region. Abaxial epidermis is also of thin walled small parenchymatous cells. Abaxial epidermal region is not continuous as adaxial epidermis. The abaxial hypodermal region consists of patches of sclerenchymatous tissue alternating with some parenchymatous tissue (Plate 1, figure 3, Text-figure 2B).

Mesophyll tissue comprises only parenchymatous cells. The parenchymatous cells are circular and isodiametric in nature. The parenchyma is thin walled and compactly arranged measuring 44 x 33 μm in size (Plate 1, figure 7, Text-figure 2D). In this mesophyll tissue, six large elliptical air cavities are present. Their size decreases from middle broader part towards the marginal part (Plate 1, figure 1, Text-figure 2A). The largest air cavity measures 1.4 mm x 518 μm in size while smallest air

Plate 1

1, 3-5, 7. *Typhophyllites ganeshii* gen. et sp. nov. 2, 6. *Typha* sp. 1. T.S. of leaf showing semi-circular outline and air cavities, x10. 2. T.S. of leaf of *Typha* sp., x20. 3. T.S. of leaf showing vascular bundles in partition wall, x40. 4. T.S. of leaf showing air cavity and partition wall vascular bundle, large air cavities and sub-epidermal vascular bundles, x20. 7. Magnified vascular bundles showing xylem elements, x400.

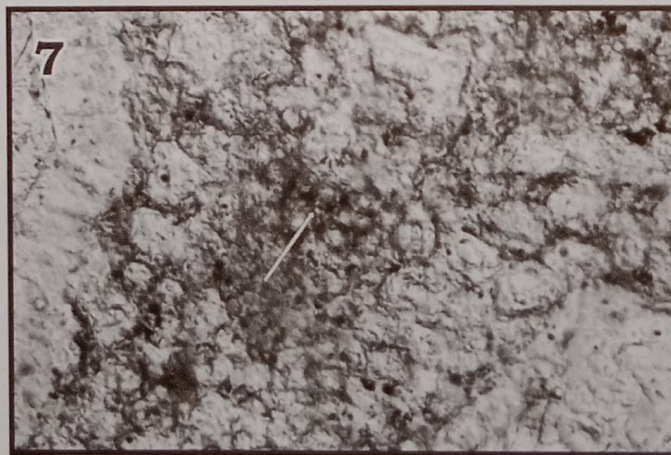
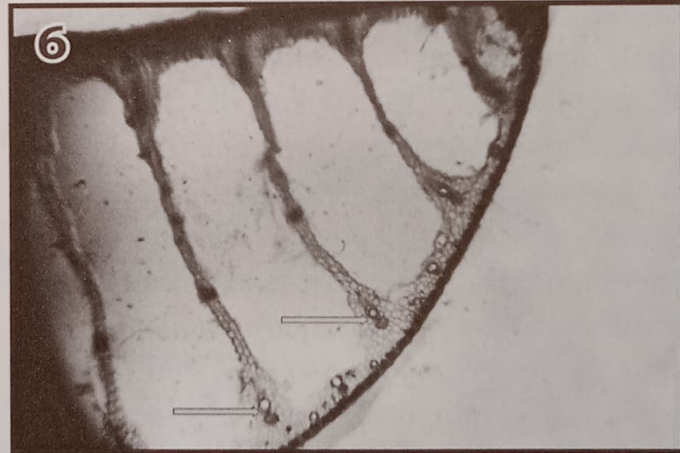
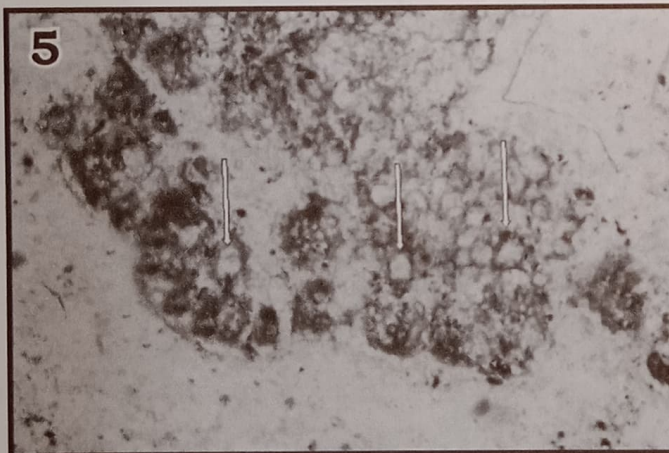
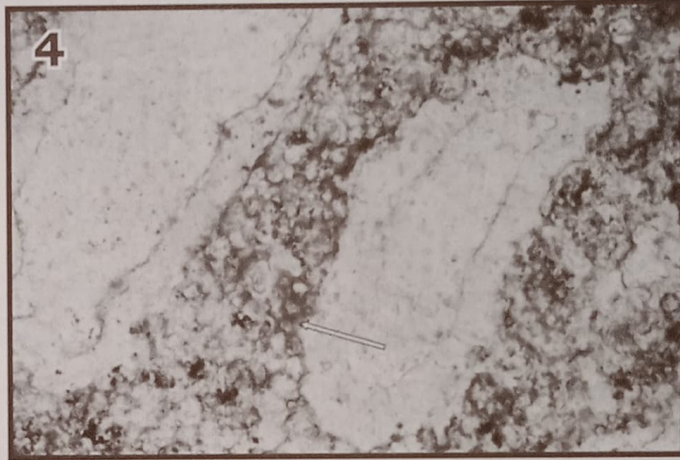
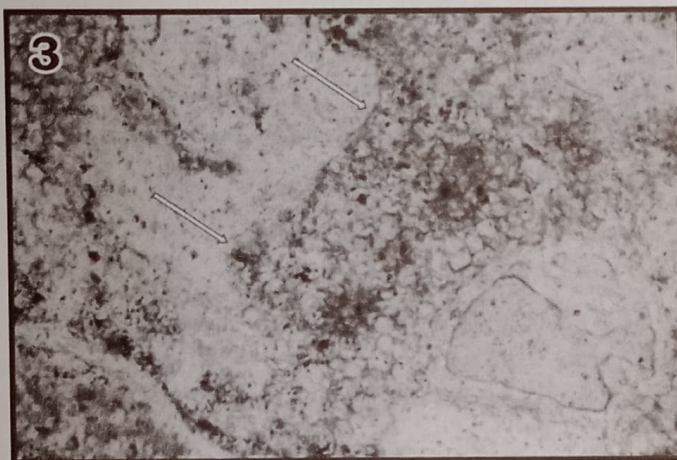
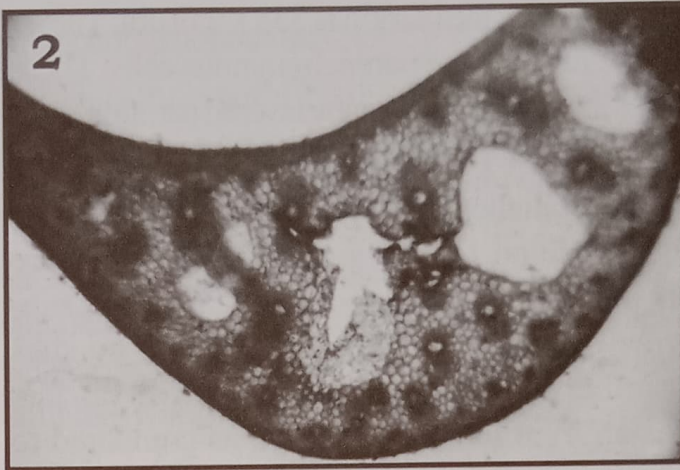
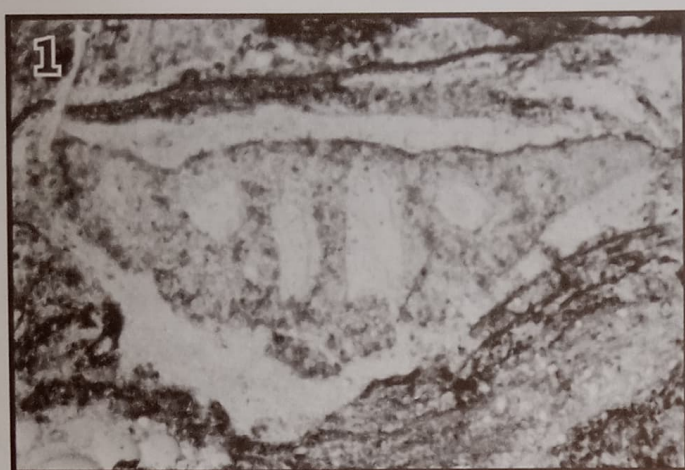
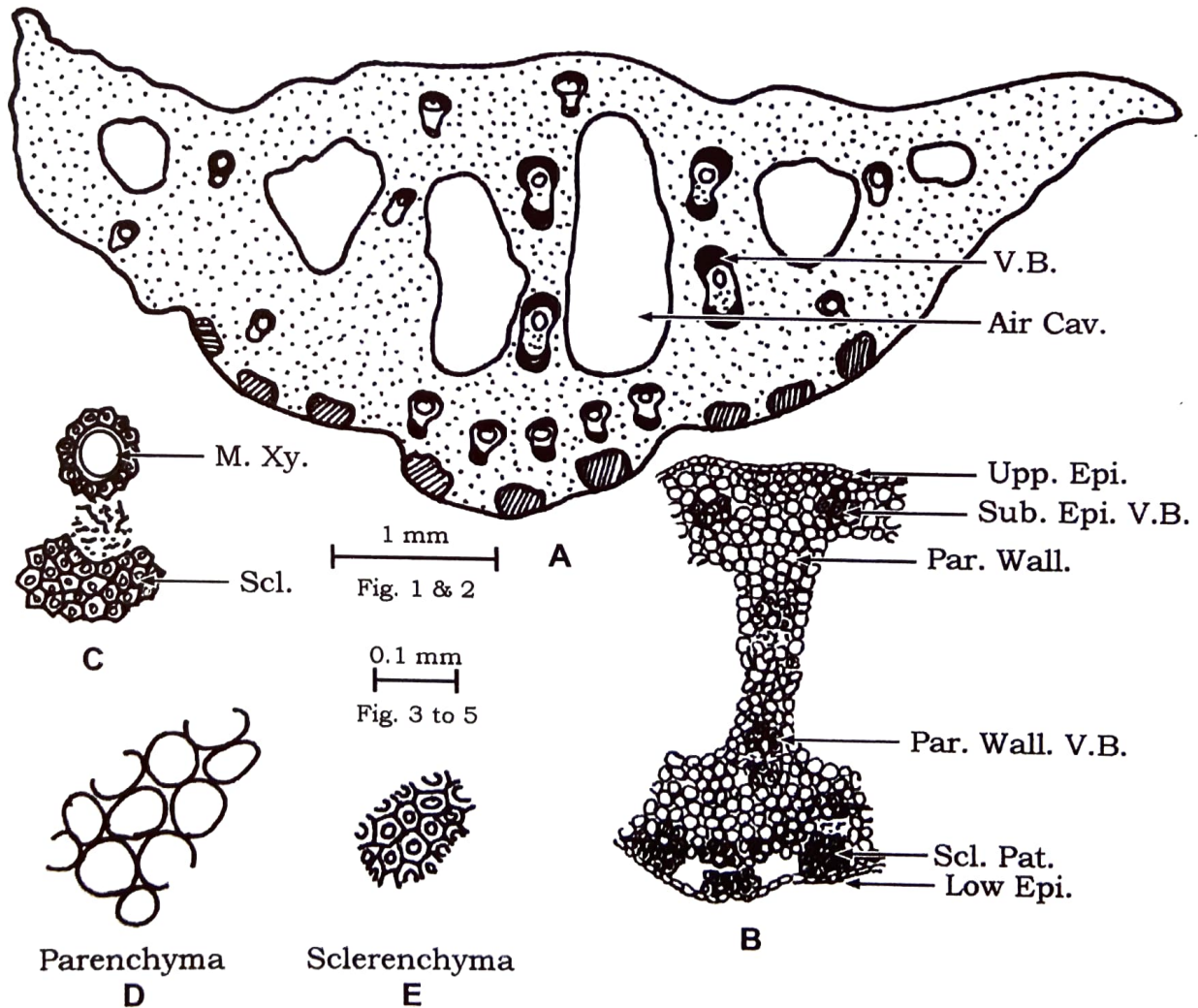


Plate 1

cavity present near the margin is $333 \times 259 \mu\text{m}$. The air cavities are lined by the parenchymatous cells. These air cavities are separated by many layered partition walls (Plate 1, figures 3-4, Text-figure 2B).

Vascular bundles are divided into two types on the basis of its position, i.e. the vascular bundles which are present just below the epidermal layer are sub-epidermal vascular bundles and vascular bundles present in the partition wall. The sub-epidermal vascular bundles are rare in adaxial region as compared to abaxial region. In the present specimen, the total number of sub-epidermal vascular bundle on both the adaxial and abaxial sides are ten. While vascular bundles in the partition wall are seven in number (Plate 1, figures 3, 5, Text-figure 2B).

Each vascular bundle is conjoint and collateral, nearly oval and varies in size from $185 \times 111 \mu\text{m}$ to $481 \times 148 \mu\text{m}$. It shows sclerenchymatous sheath on both sides of vascular bundles. In partition wall of air cavities, two vascular bundles are present. These vascular bundles are larger in size than sub-epidermal vascular bundles (Plate 1, figures 4-5, Text-figures 2B-C). Each vascular bundle consists of single metaxylem element measuring $49 \times 38 \mu\text{m}$ in size while protoxylem elements are not seen. Below the xylem, phloem is present in the form of crushed tissue (Plate 1, figure 7, Text-figure 2C). The sclerenchymatous patches are very prominent towards epidermal region in sub-epidermal vascular bundles.



Text-figure 2. *Typhophyllites ganeshii* gen. et sp. nov. A. Diagrammatic sketch of T.S. of leaf showing air cavities (Air Cav.) and vascular bundles (V. Bs.). B. Cellular details of part of T.S. of leaf showing sub-epidermal (Sub. Epi V.B.) and partition wall vascular bundles (Par. Wall V.B.). C. Magnified vascular bundle (V.B.) showing cellular details. D. Parenchymatous cells of Mesophyll. E. Sclerenchymatous tissue of hypodermal region.

Holotype: MOH/PSK/MONOCOT LEAF-III, Department of Botany, Shri Shivaji College of Arts, Commerce and Science, Akola, India.

Locality: Mohgaonkalan, Chhindwara District, Madhya Pradesh, India.

Horizon and age: Deccan Intertrappean Series, Early Tertiary.

Etymology: The specific epithet is after Lord Ganesh.

DISCUSSION AND COMPARISON

The present fossil specimen shows characters like air cavities in the mesophyll tissue, sclerenchymatous patches in the abaxial hypodermal region, sub-epidermal and partition wall vascular bundles and sclerenchymatous sheath around vascular bundle.

The above characters suggest its identity with monocotyledons which are aquatic or amphibious. As the present fossil specimen is semi-circular in outline and shows presence of sclerenchymatous patches in hypodermal region alternating with parenchyma, more similarities are seen with amphibious members. In order to establish its identity, freshly cut sections of amphibious member *Typha* sp. of family Typhaceae were studied for comparison (Plate 1, figures 2, 6).

The present fossil specimen resembles anatomically with leaf of living plant of *Typha*. Similarities are seen in the semicircular shape, large air cavities, two types of vascular bundles, i.e. sub-epidermal and partition wall vascular bundles, and sclerenchymatous patches in hypodermal region. The vascular bundles in both the cases are oval and with sclerenchymatous sheath. The present fossil specimen shows vascular bundles which are characteristics of parallel veined leaves of *Typha*. However, the differences are seen in not having thick cuticle and mesophyll tissue with palisade layer. The present specimen shows mingling characters of hydrophyte and xerophyte.

Comparison with fossil leaves: When present fossil specimen is compared with already reported fossil leaves, it shows close resemblance with the hydrophytic

monocotyledonous leaves.

The present fossil resembles with leaf of *Cyclanthodendron sahnii* Sahni & Surange 1953, *Musocaulon indicum* Jain 1964 and *Cannaites intertrappea* Trivedi & Verma 1971 in having air cavities while differs in not having fibrous and dumbbell shaped Scitamian type of vascular bundles. This suggests that the present fossil specimen does not show affinities with Scitaminae.

The present fossil specimen also resembles *Festucophyllites intertrappeaense* and *Elymus deccanensis* (Patil & Singh 1984) in having air cavities in mesophyll tissue, but differs in arrangement of vascular bundles, fibrous cells as mechanical tissue and presence of bulbiform large cells in the intercostals region and pair of small cells in costal region which are typical characteristics of festucoid type of Gramineae. As these characters are not observed in the present fossil specimen, it might be from other monocotyledons.

Aerophyllites intertrappea Chitale & Patil 1970 shows close resemblance in size, shape and presence of sclerenchymatous patches around xylem and phloem. In both the cases, air cavities are present in mesophyll tissue. In *Aerophyllites intertrappea*, air cavities are small and many in number and are present in scattered manner while in present fossil specimen they are definite in number, large and elliptical in shape. The partition wall, present between two air cavities, has two vascular bundles in the middle broader portion. It also differs in not having hypodermis as in case of *Aerophyllites intertrappea*. *Typha* has also been reported from the Lower Karewa sediments (Pleistocene) of Kashmir, with *Sparganium* and *Trapa* fruits (Puri 1951).

The present fossil specimen, described as *Typhophyllites ganeshii*, is different from all the reported fossil leaves of aquatic monocotyledons. However, it shows close resemblance with the extant genus *Typha* of family Typhaceae and therefore can be placed in the same family.

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