

Full Length Article

A Report on Monocot Leaf from the Deccan Intertrappean Beds of Mohgaonkalan, (MP) India

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ABSTRACT

The present petrified monocot leaf is described from rich fossiliferous locality, Mohgaonkalan, M. P., India. Fossil leaf specimen is semi-circular in outline. The leaf is monocotyledonous; air cavities are present in single row. The mesophyll tissue undifferentiated. The vascular bundles are present below upper and above lower epidermis in partition wall. The vascular bundles are conjoint, collateral and oval in shape. Each vascular bundle consists of single metaxylem element and protoxylem elements, phloem tissue not well preserved. On the basis of above characters and after comparing with other already reported fossil monocotyledonous leaves and living genera, it shows close resemblance with the leaf of *Potamogeton* sps. from family Potamogetonaceae so named as *Potamogetonophyllites gen et nov.*

Keywords: Angiosperm, Deccan, Intertrappean, Leaf, Monocot, *Potamogetonophyllites*.

INTRODUCTION

Mohgaonkalan is a fossiliferous locality in the Chhindwara district having Intertrappean beds. (22°1' N; 79°11' E). There are many monocotyledonous leaves reported so far from the Deccan Intertrappean beds of India. Some leaves are reported from the same locality are leaf of *Cyclanthodendron sahnii* (Sahni and Surange, 1953); *Musocaulon indicum* (Jain, 1963); *Cannaites intertrappea* (Trivedi and Verma, 1971a); *Aerophyllites intertrappea* (Chitaley and Patil, 1970); *Festucophyllites intertrappeanense* and *Elymus deccanensis* (Patil and Singh, 1977), *Culmites deccanensis* (Paradkar, 1975); *Heliconiastes mohgaonsis* (Trivedi and Verma, 1972) leaf of *Cypercooxylon intertrappeum* (Chitaley and Patel, 1970), *Carexophyllum mohgaonse* (Bhowal and Sheikh, 2003); *Thalasiophyllum mahabalei* (Kokate, 2010) *Hydrocharitaceaphyllum patili* (Narkhede and Nandeshwer, 2011) and *Typhophyllites ganeshi* (Kokate, 2012).

MATERIALS AND METHODS

During visit to Mohgaonkalan (Lat. 21°31' - 20°51' N and Long. 78°15' - 79°20' E), of Chhindwara District, M. P., black cherts were collected, one of these cherts on breaking exposed the present fossil specimen. The serial sections were taken by peel method after etching by Hydrofluoric acid. The permanent slides are prepared for studying the anatomical details.

DESCRIPTION

The appearance of leaf is somewhat semi-circular in outline. In transverse section row of air cavities strikes the eye at once. The air cavities are arranged exactly in the middle part of leaf in cross section. The leaf is broad in the middle region and tapers towards the margin. In transverse section the specimen leaf lamina shows length 4.35 mm and width 2.39 mm. (Fig. 1, Plate Fig. 1).

Epidermis

The adaxial epidermis is single layered. The cells of epidermis are smaller in size and thin walled. The presence of stomata and cuticle are not very clear. The hypodermal layer is not distinct in abaxial region. The abaxial epidermis is of thin walled small cells. The abaxial epidermal region is not continuous as adaxial epidermis. The abaxial hypodermal region is consisting of patches of sclerenchymatous tissue alternating with some parenchymatous tissue (Fig. B, Plate Fig.1)

Mesophyll tissue

The mesophyll tissues is not differentiated into spongy and palisade tissue but it comprises only parenchymatous tissue. The parenchymatous cells are circular and isodiametric in nature. The parenchyma is thin walled and compactly arranged measuring 0.0276 mm in size (Text Fig. D Plate Fig. 2). In mesophyll tissue four large elliptical air cavities are present. Their size decreases from the middle broader part towards the narrow marginal part (Fig. A, Plate Fig. 1). The length of largest air cavity measures about 1.346mm in size while smallest air cavity present near the margin is 0.511 mm. in size. The air cavities are lined by the parenchymatous cells. These air cavities are separated by many layered partition walls. The partition walls are made up of parenchyma cells. (Fig A, B Plate Fig. 1 and 3).

Vascular bundles

The vascular bundles are present just below the epidermal layer in the partition wall. In the present specimen the vascular bundles are many below upper epidermis and above the lower epidermis (Fig. A Plate Fig. 1 and 2).

Each vascular bundle is conjoint and collateral nearly oval in shape and 0.009µm in size. It shows sclerenchymatous sheath on both sides of vascular bundles In partition wall of air cavities two vascular bundles are present (Fig. A and B, Plate Fig. 1 and 2). Each vascular bundle consists of single metaxylem element measuring 0.015µm in size while protoxylem elements are not seen. Below the xylem, phloem tissue might be present which is in the form of crushed tissue (Fig. C, Plate Fig. 2). The sclerenchymatous patches are very prominent towards epidermal region.

Discussion and comparison:

The present fossil specimen shows characters;

a) The leaf appears somewhat semi-circular in outline.

b) The air cavities are arranged exactly in the middle part of leaf in cross section.

c) Presence of air cavities forming mesophyll tissue wholly lacunose, lacunae in single series.

d) Presence of vascular bundles on both side of lacuna in partition wall.

e) Presence of sclerenchymatous sheath around vascular bundle.

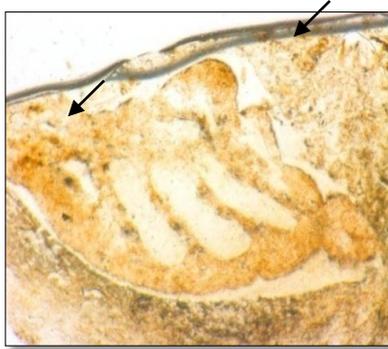
Comparison with fossil leaves:

When present fossil specimen is compared with already reported fossil leaves it shows generally close resemblance with the submerged monocotyledonous leaves. The present fossil resembles with leaf of *Cyclanthodendron sahnii* (Sahni and Surange, 1953), *Musocaulon indicum* (Jain, 1963) and *Cannaites intertrappea* (Trivedi and Verma, 1971) in having air cavities while differs in not having fibrous and dumbbell shaped Scitamian type of vascular bundles. Which suggest that the present fossil specimen does not show affinities with Scitaminae.

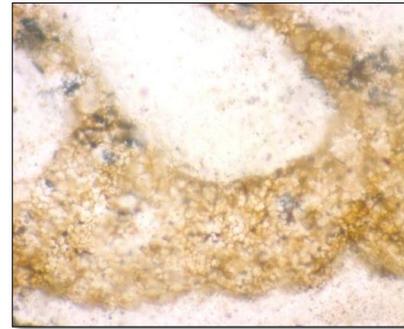
When present fossil specimen is compared with *Festucophyllites intertrappense* and *Elymus deccanensis* (Patil and Singh, 1977) resembles in having air cavities in mesophyll tissue, but differs in arrangement of vascular bundles, fibrous cells as mechanical tissue and presence of bulbiform large cells in the intercostals region and pair of small cells in costal region which are typical characteristics of *Festucoid* type of *Graminae*. As these characters are not observed in the present fossil specimen it might be from other monocotyledons.

The present fossil specimen when compared with reported fossil leaves *Cypercoxylon intertrappeum* (Chitale and Patel, 1970) and *Carexophyllum mohgaonse* (Bhowal and Sheikh, 2003) of family Cyperaceae show resemblance in having presence of undifferentiated mesophyll, presence of air cavities and so may be marshy in habitat like above reported leaves. But differentiate in having thick walled epidermis and sclerenchymatous patches on vascular bundles and having single metaxylem element and no protoxylem element.

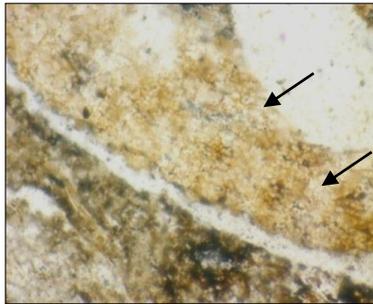
Aerophyllites intertrappea (Chitale and Patil, 1970) when compared with present fossil specimen shows close resemblance. Mainly it resembles in size, shape and in presence of sclerenchymatous patches around xylem and phloem.



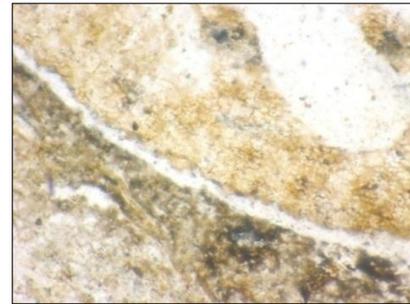
1. T.S. of leaf showing air cavities(Air Cav.) and Vascular bundle(V.Bs)



2. Cellular details of T.S. of leaf showing Upper epidermis (Upp.Epi) and partition wall (Par.Wall).



3. Sclerenchymatous cells in Mesophyll .



4.Parenchymatous cells of Mesophyll (paren.).

Figure 1. *Potamogenatophyllites intertrappeagen. et. sp.nov.*

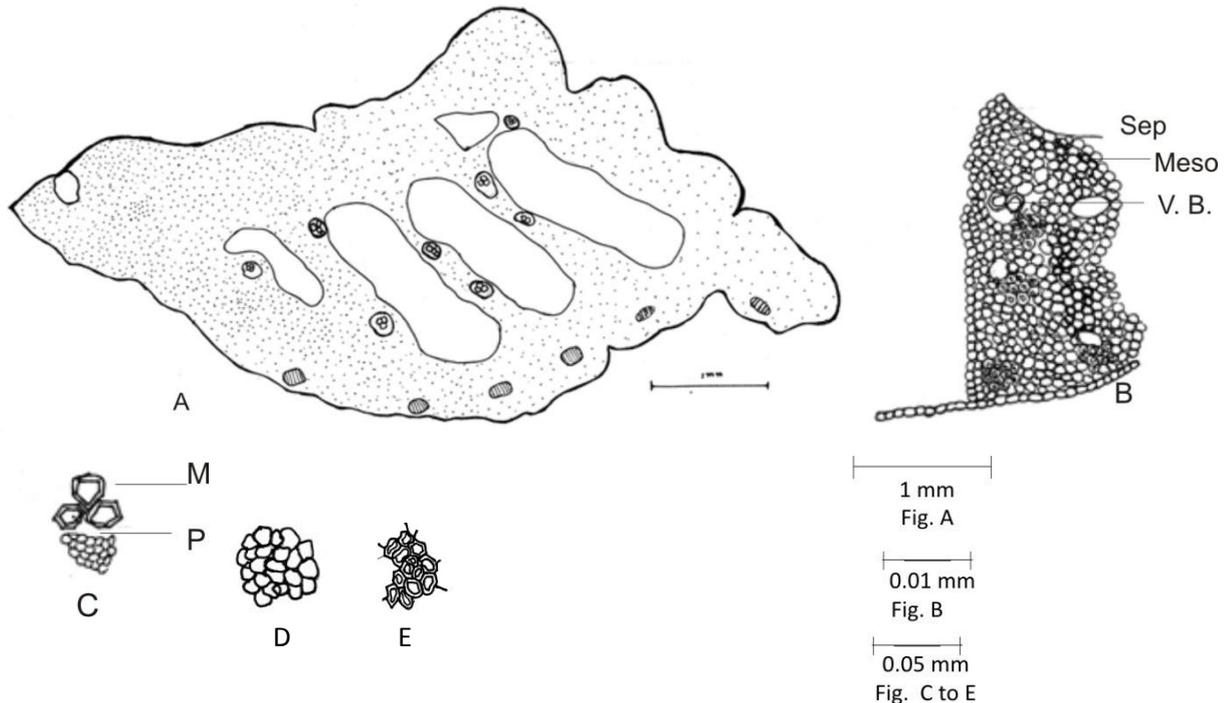


Figure 2. *Potamogenatophyllites intertrappea gen. et. sp.nov.*

A.Diagrammatic sketch of T.S. of leaf showing air cavities (Air Cav.) and Vascular Bundle(V.Bs) B. Cellular details of part of T.S. of leaf showing Upper epidermis(Upp. Epi) and partition wall (Par.Wall). C.Magnified vascular bundle (V.B.) D. Parenchymatous cells of Mesophyll (paren.). E. Sclerenchymatous cells of Mesophyll

In both the cases air cavities are present in mesophyll tissue. In *Aerophyllites intertrappea* air cavities are small and many in number and present in scattered manner while in present fossil specimen they are definite in number, large and elliptical in shape. The partition wall present in 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*. When fossil specimen compared with *Hydrocharitaceae phyllum patilii* (Narkhede and Nandeshwer, 2011) of family Hydrocharitaceae it close resemblance in no of air cavity but differs in position and number of vascular bundle. *Typhophyllites ganeshii* (Kokate, 2012) when compared with present fossil specimen shows close resemblance. It closely resembles in having air cavities in mesophyll tissue. While in present fossil specimen vascular bundle are present only in partition wall.

Comparison with living leaves:

When present fossil specimen compared with species *Ruppia* of Potamogetonaceae shows close resemblance in presence of air lacunae in mesophyll tissue but differs in air lacuna present on both side of midrib (Metcalfe, 1982). When present fossil specimen compared with species *Potamogeton pectinatus* shows close resemblance in presence of leaf blade is broader type of leaf. The mesophyll is lacunose but differs in having lacuna only in one series. Observed characters of specimen shows its identity with monocotyledons which are submerged in nature. As the present fossil specimen is narrow towards lateral parts, thick, rounded and consists of vascular bundles on both sides of lacuna in partition wall. More similarities are seen with submerged members, hence, to establish identity sections of submerged member *Potamogeton* spp. of family *Potamogetonaceae* is studied for comparison

The present fossil specimen resembles anatomically with leaf of living plant of *Potamogeton*. Similarities are seen in the narrow and thick shape, presence of large air cavities, vascular bundles present on both sides of lacuna and also resembles in having chlorenchymatous tissue in epidermal region. The vascular bundles in both the cases are oval in shape, with sclerenchymatous sheath. However the differences are seen in not having vascular bundles present on both sides of lacuna. The palisade tissue is not seen

in the present fossil leaf specimens. So the present specimen shows mingling characters of aquatic monocotyledons which are submerged. From the above discussion, we can conclude that the present fossil specimen being not completely similar to any reported fossil leaves of monocotyledons, on the other hand when compared with living genus *Potamogeton* from family Potamogetonaceae shows close resemblance hence the present fossil specimen can be placed in the same family as the form genus *Potamogetonophyllites intertrappea* generic name is given for family Potamogetonaceae. The specific name is given after the name of Intertrappean beds.

Diagnosis

***Potamogenato phyllites* gen. Nov.**

Monocotyledonous leaf, semicircular in outline, air cavities in single row, mesophyll tissue undifferentiated, vascular bundle are present on both side lacuna on partition wall vascular bundles conjoint, collateral and oval, each vascular bundles with single metaxylem element and protoxylem elements, phloem tissue not well preserved.

***Potamogenato phyllites intertrappea* gen. et. sp. nov.**

Fossil leaf lamina 2.36mm width and 4.35mm in length, leaf semicircular in outline, air cavities in single row, largest air cavity 1.34 mm. and smallest air cavity 5.1mm in size, vascular bundles in partition wall of 9 μ in size. Vascular bundles show sclerenchymatous sheath on both sides, single metaxylem element measuring in 1.5 μ in size. Protoxylem elements 0.9 μ , phloem tissue not well preserved.

Holotype : MOH /KMT /MONOCOTLEAF.

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

Horizon and age: Deccan Intertrappean, Early Tertiary.

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How to Cite this Article:

Kokate P S, K M Thorat, S V Pundkar, 2014. A Report on Monocot Leaf from the Deccan Intertrappean Beds of Mohgaonkalan, (MP) India. *Biosci. Disc.*, **5**(2):197-201.