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Angiospermic dicotyledonous seed from the Deccan intertrappean beds of Singhpur, Madhya Pradesh, India

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ABSTRACT

A well preserved dicotyledonous fossil seed was collected from Singhpur M.P. The seed is polygonal in shape, measuring about 5 mm in length and 2.5 mm in breadth, showing stalk like structure at the top with a slit which might be representing the micropyle. The seed coat is bitegmic having outer integument and inner integument. The embryo is very small and occupies the minimum space of the seed. The seed though shows some resemblances of the present day families like Apocynaceae, Alangiaceae, Bignoniaceae, Boraginaceae, Companulaceae, Compositeae, Loganiaceae, Martyniaceae, Pedaliaceae, Pittosporaceae, Sapotaceae, Solanaceae, Verbenaceae, and Convolvulaceae Polygalaceae, Simaroubaceae, Celastraceae, Rhamnaceae. It has close affinities with the members of the family Polygalaceae. It could not conclusively be traced to any particular genus but it broadly placed under Polygalaceae.

Key words- Dicot seed, Bitegmic, Polygalaceae, Deccan Intertrappean

INTRODUCTION

The present chapter deals with a study of fossil dicotyledonous Seed from the Deccan Intertrappean Beds of Jabalpur, Madhya Pradesh, India. So far few seeds have been reported from the different fossliferous localities of Deccan Intertrappean beds of India. They are *Clusiocarpus arillatus* (Kumar, 1984), *Clausiocarpus indicum* (Kolhe and Wazalwar 1998), from Nawargaon, *Deccanosperma allirata, Ramakonospermus chitaleynsis, Mahabalespermum minutum* (Juneja, 1993) and *Ramakonospermus singhpurii* (Bhowal, 2003). Monocotyledonous phoenicoid seed is reported from Pisdura, Maharashtra by Ambawani and Dutta (2005). *Capparisocarpus nagpurii* (Konde 2012). So the present report of new dicot seed from Singhpur is noteworthy contribution to the knowledge of fossil seeds.

METHODOLOGY

The present work was carried out in Singhpur M.P. The material of seed was exposed on fossil chert in obliquely longitudinal view. It was etched with Hydrofluoric acid and washed under water. Serial peel sections were taken without grinding the material Peels were mounted in Canada balsam and studied. Camera lucida sketches were drawn for its detailed study.

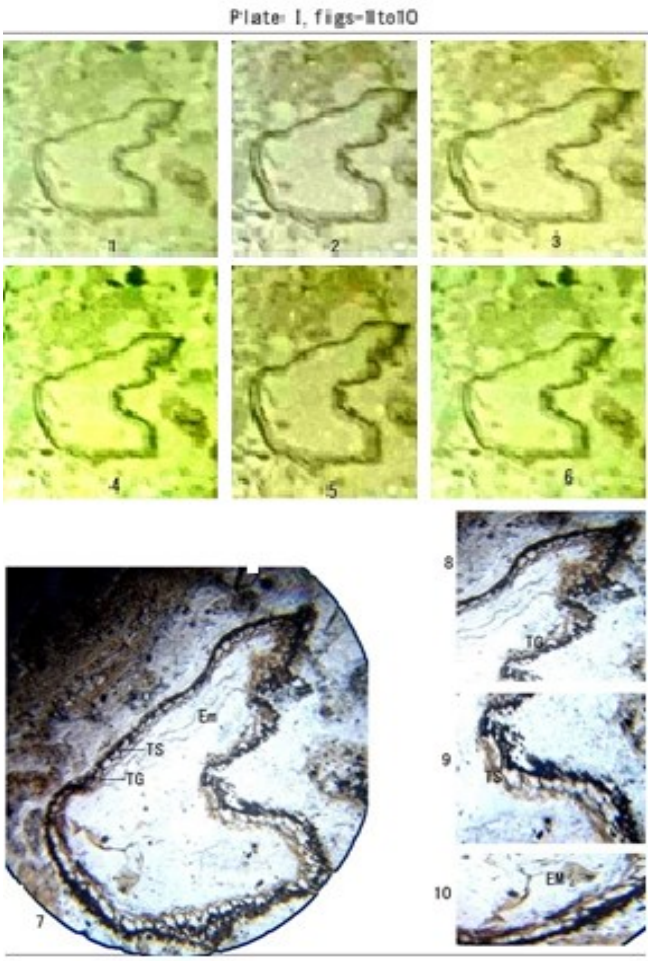
Fig: 1 Satellite image of Singpur Madhya Pradesh India

DESCRIPTION: A seed is petrified, dicotyledonous, bitegmic and endospermic. The seed is differentiated into bitegmic seed coat and large embryo (Plate I. Figs. 1,2,3; Text Figs.1-8) It is polygonal in shape measuring **5 mm** in length and **2.5 mm** in breadth, showing stalk like structure at the top with a slit which might be representing the micropyle. The seed coat is bitegmic having outer integument and inner integument. The embryo is very small and occupies the minimum space of the seed (Plate I. Figs. 1, 2, 3; Text Figs.1-8). The embryo is seen in first few sections and after that it starts disappearing.

SEED COAT: The seed coat is well preserved and differentiated into testa & tegmen. It is bitegmic consisting of testa and tegmen. The seed coat is broad at the upper region (Plate I. Figs. 1, 2, 3; Text Figs.1-8). It measures **640 µm- 340 µm** in width at the broadest and narrowest region respectively.

Seed coat: Seed coat is differentiated into testa and tegmen (Plate I, Fig.9; Text Figs. 2).

1) Testa - It is made up of single layer Consist of a **270 µm** outermost layer thin walled epidermal cells.It is rectangular to polygonal shape and continus. (Plate I, Fig.9; Text Figs. 2-3).



2) Tegmen - It is innermost zone, made up of 3 - 4 celled region. The cells are thick walled, penta & hexagonal in shape. The width varies from **70 µm** to **75 µm** (Plate I, Fig.9; Text Figs. 2-3).

EMBRYO: The embryo is ill preserved. It is not differentiated into parts, but two cotyledons are seen in some section. (Plate I Figs.9-10; Text Fig. 4). Embryo occupies the few space of seed. In between wall of the seed and embryo there is a space all around in this region some thin walled cells are seen.

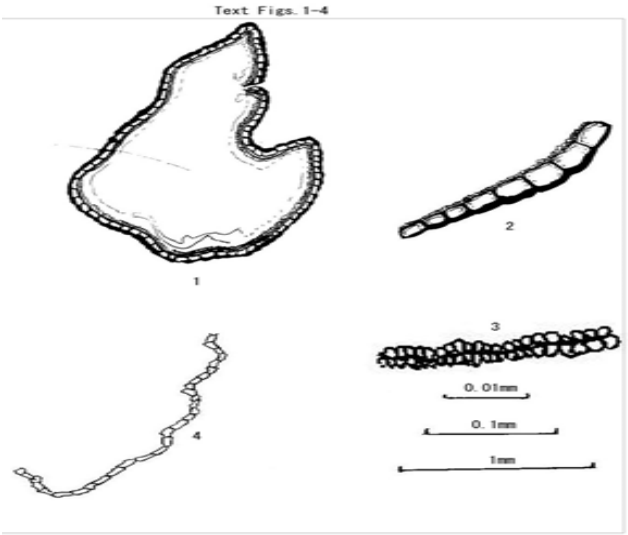
ENDOSPERM: Surrounding the embryo there are thin walled parenchymatous cells which represents the tissue of endosperm. These cells are soft in nature (Plate I, Fig.10).

DISCUSSION & COMPARISON

On the basis of above description seed has certain peculiar characters, which are considered for the identification of seed.

1) Seed is small in size, 5 mm in length.

2) Seed polygonal in shape.
3) Seed coat bitegmic showing presence of testa and tegmen.
4) Testa shows single layer epidermis.
5) Tegmen is made up of 3-4 celled regions.
6) Testa shows well arranged polygonal to elongated cells, some are crushed.
7) Split seen in the seed coat region forming micropyle.
8) Endosperm is not well preserved but some soft cells are seen may be its soft nature.
9) Embryo is ill preserved.
10) Present two cotyledons.
11) Suspensor is not present.



All these characters are of great help in the identification of seeds and find its affinities with seeds of living families. According to Eames (1961) there is a greater reduction of suspensor in angiospermic embryo. In the present fossil seed also, suspensor is completely absent.

The most important characters helpful in the identification of seed is unitegmic seed coat. Testa is differentiated into unspecialized squarish parenchymatous epidermal layer ,middle layer of the testa is also not specialized made up of pent-hexagonal cells.

The studied fossil exhibits certain characters of exotestal seed like the testa have no mechanical tissue as their inner tissues are generally crushe by endosperm or embryo (Corner, 1976). The fossil seed shows embryo with two cotyledons, hypocotyle region, narrow radicle and absence of suspensor. These characters confirm that the seed under investigation is an angiospermic and dicotyledonous in nature which is derived from anatropous ovule. Seed is exarllate. Embryo is large with little endosperm.

After going through the available literature, the standard books of taxonomy and embryology by Rendle (1938); Maheshwari (1950); Hutchinson (1959); Eames (1961); Fahn (1974) were used, and most useful among all by Corner (1976), was of great help in resolving the problem of systematic position of the seed.

Corner (1976) has mentioned about 190 families having unitegmic as well bitegmic seeds, but present paper considered some families showing unitegmic and bitegmic seeds with anatropous ovule like Apocynaceae, Alangiaceae, Bignoniaceae, Boraginaceae, Companulaceae, Compositeae, Loganiaceae, Martyniaceae, Pedaliaceae, Pittosporaceae, Sapotaceae, Solanaceae, Verbenaceae, and Convolvulaceae Polygalaceae, Simaroubaceae, Celastraceae, Rhamnaceae.

Out of these fossil seed shares most of the characters of Pedaliaceae, Martyniaceae, and convolvulaceae. In *Pedaliaceae*, ovules are anatropous, seeds are unitegmic, seed exotestal, exarllate, testa shows presence of palisade, endosperm cellular and embryo is straight. But ,they are quite different like shape and testa single layer therefore it is different from the present seed in minute details like outer integument in seeds of Pedaliaceae is of thick walled lignified cells which are thin walled and parenchymatous in fossil seed.

The seeds of *Martyniaceae*, also have anatropous ovule, unitegmic seed coat, exarllate seed, endosperm cellular and embryo wavy like in fossil seed. But in family Martyniaceae testa is reduced to a sub gelatinous pellicle of large thin walled or sclerotic cells which are not seen (Corner, 1976) in fossil seed. Thus fossil seed differs from the seeds of Martyniaceae. The fossil seed resembles the family *Convolvulaceae* (Corner, 1976) which is widely distributed in tropical and subtropical regions (Hutchinson, 1959, Rendle, 1938) in bearing anatropous ovule with unitegmic seed coat, exarillate seed but the seeds of Convolvulaceae show mesophyll tissue the seed coat and hence it does not correlate with this family.

In Simaroubaceae seed minute to medium size, elongated to elliptical in shape. Seed coat differentiated into Testa and tegmen, present seed also bitegmic but differ in size and shape therefore it is different. In Celastraceae seed obovoid to elongate in shape, seed

medium size. Present fossil seed different to all characters. In Rhamnaceae sp.*Ventilago denticulata*, seed midium to large in size, rounded at the apex, seed coat differentiate testa and tegmen but present fossil seed is small and polygonal in shape therefore it is different. In Polygalaceae seed minute, oval to elliptical in shape with testa and tegmen.Tegmen papery layers and testa thick layers (Corner, 1976) but present seed is polygonal in shape as well as differ in testa and tegmen. In this family shows some resemblances in species *polygala arvensis* like seed size and shape, testa and tegmen thickening. *Polygala arvensis* shows seed having length 3 mm to 7mm. *polygala elongata also shows similar* characters but measurement is different. *Polygala erioptera* shows polygonal shape seed with testa and tegmen. Testa single layer and it is made by rectangular to polygonal parenchymatous cells.

From the above discussion it is clear that fossil seed show close resemblance with the family polygalaceae. The fossil seed under investigation is also compared with earlier reported fossil seeds .The previously reported seed *Clusiocarpus arillatus* (Kumar, 1984) and *Clausicioarpus indicum* differs in seed coat layers. When compared with *Ramkonospemum chitaleyensis (*Juneja, 1993) fossil shows many dissimilarities like embryo is curved and convolute which is not well curved in present specimen as well as seed coat, embryo and endospermic tissues is different therefore it is totally different.

Deccanosperma arillata (Juneja, 1993) differs in having arillate and bitegmic seed. *Mahabalespermum minutum* (Juneja, 1993), *Ramakonospermum singhpurii* (Bhowal, 2003) differ from present seed in well differentiating bitegmic seed coat. Ambwani and Dutta (2006) have reported Phonecoid seed from dinosourian coprolite at Pisdura in Chandrapur district, but present seed dicotyledonous it is not well ellipsoidal it is polygonal in shape. Thus it is the record of bitegmic seed from the Deccan Intertrappean beds of Singhpur. It is different from all other previously reported fossil seeds and show resemblance with the living seeds of living familie, polygalaceae hence named as *Polygalaceaeospermum singhpurii* gen et, sp.nov.

DIAGNOSIS

***Polygalaceaeospermum Singhpurii* gen. nov.:** Seed small polygonal, bitegmic, dicotyledonous. Seed coat with testa and tegmen only. Embryo small well preserved with cotyledons, micropyle seen. Seed coat with testa and tegmen differentiated into outer single layered epidermis made by parenchymatous cells. Tegmen made by in soft parenchymatous cells. Endosperm tissue seen.

***Polygalaceaeospermum singhpurii* gen. et sp.nov.:** Small ovoid unitegmic seed measuring **5 mm** and **2.5 mm** diameter **in** size. Seed cavity oval in shape is differentiated into outer broad testa and tegmen not differentiatd tegman. Testa measures **90 µm** in thickness differentiated into outer single layered epidermis, middle layer, embryo well preserved with two cotyledons measuring **3060 µm** in length and **1200 µm** in breadth in size. Endosperm tissue seen.

Holotype : SMM / Dicot Seed 2/ Deposition at Botany Department, Institute Science, Nagpur.
Locality: Singhpur, M.P. India.
Horizon: Deccan Intertrappean series of Central India.
Age: Upper Cretaceous?

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