

CHITALEYPUSHPAM MOHGAOENSE GEN. ET SP. NOV. FROM THE DECCAN INTERTRAPPEAN BEDS OF INDIA*

S. A. PARADKAR

Department of Botany, Institute of Science, Nagpur

ABSTRACT

The paper describes the structure of a new fossil flower preserved in black chert from the Deccan Intertrappean beds of India exposed at Mohgaonkalan. It is 3.5 mm. long and 2.5 mm. broad at the tip and is hermaphrodite, stalked, bracteolate, with one whorl of tubular, valvate perianth, oval in T.S. The lobes of perianth are free only at the tip and not gibbous at the base. The androecium is of seven stamens, not connate, epiphyllous with dorsifixed anthers. Pollen is present *in situ*, each grain being $18-20 \times 12-15 \mu$, tricolporate, psilate, subprolate, ora \pm circular. The gynoecium is superior, not stipitate, ovary five angular, five locular, with axile placentation. Style is short, not differentiated from the simple stigma.

This is the third record of a petrified flower from this famous locality of Mohgaonkalan from where *Sahnianthus parijai* Shukla and *Sahnipushpam shuklai* Verma, syn. *Sahnipushpam glandulosum* Prakash, have been described. The present specimen is compared with these and as the differences are many it is named as *Chitaleypushpam mohgaense* gen. et sp. nov. Affinities of the flower are discussed.

INTRODUCTION

SO far, two petrified flowers have been described from the Deccan Intertrappean beds of Mohgaonkalan. *Sahnianthus parijai* Shukla (1944) was the first to be described. Later Verma and Prakash worked simultaneously on the flower *Sahnipushpam* Shukla (1950). As Verma's account was published earlier (1956) than that of Prakash (Dec. 1956), the name *Sahnipushpam shuklai* Verma has priority over *Sahnipushpam glandulosum* Prakash, which is now considered as a synonym (Prakash and Jain, 1963). While the occurrence of petrified flower is rarity, the discovery of another petrified flower different from the above two, proves the importance of the Deccan Intertrappean beds of India. This new flower is described in this paper in detail.

MATERIAL AND METHODS

The description of the flower is based on the study of three specimens. The specimen A was first seen in slightly oblique trans-

verse section on a black chert. Specimen B was found exposed in T.S. and specimen C exposed in L.S. All the three specimens have similar characters and are well preserved giving good peel sections. Serial transverse sections were taken in the case of the specimen A till the ovary was reached. Then it was sectioned in longitudinal plane to observe whether it had a stalk, bracteole etc. Specimens B and C are kept as isotypus.

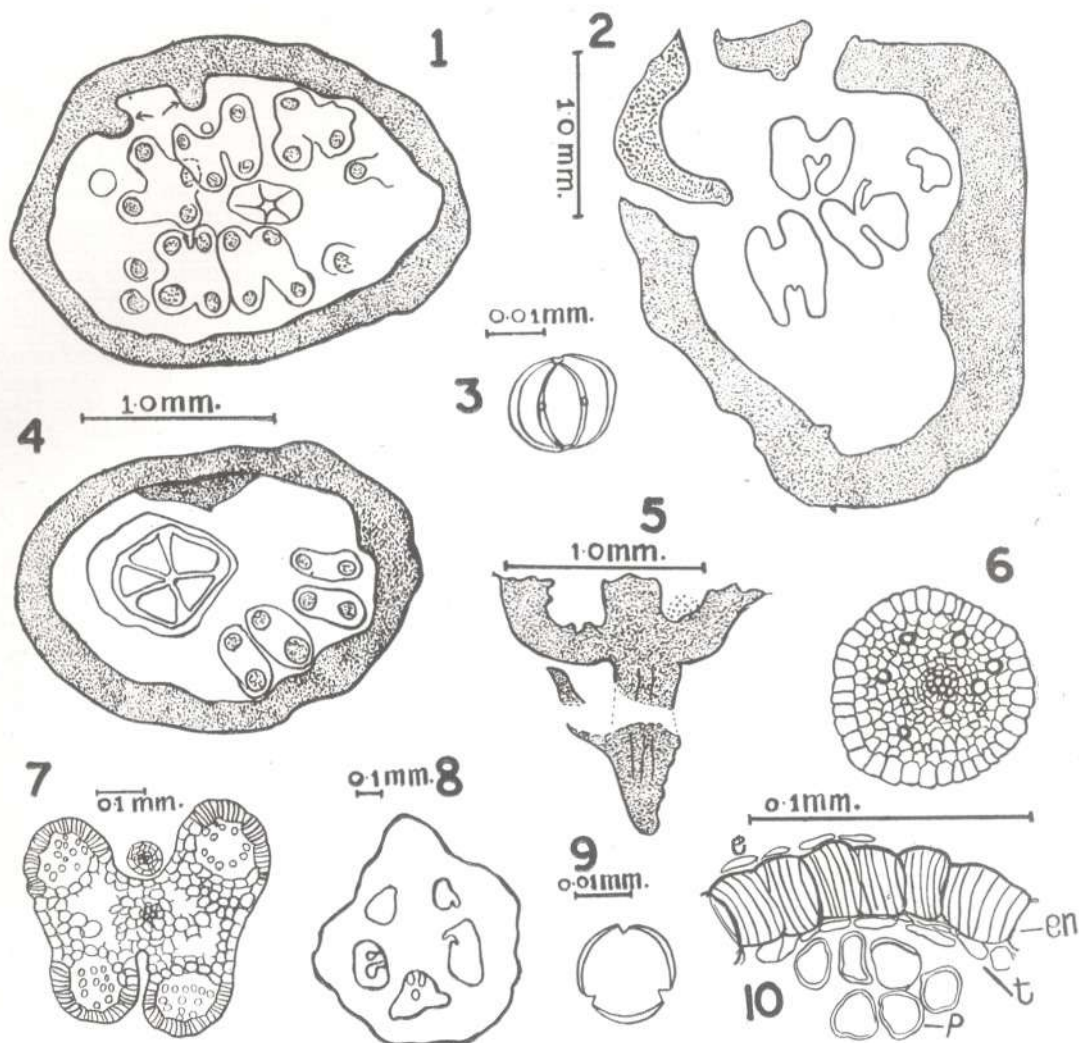
DESCRIPTION

The tiny petrified flower is stalked, bracteolate, actinomorphic, monochlamydeous, bisexual, having seven epiphyllous stamens with dorsifixed, undehiscent anthers and superior, five-angled and five-locular ovary. *Stalk*—It is 1.3 mm. long and 0.3 mm. thick with vascular tissues seen in L.S., the number of vascular bundles not clear. (Text fig. 5; Pl. 2, Fig. 8).

Bracteole—It is attached almost at the base of the stalk. It reaches up to the base of the perianth. The bracteole is 0.5 mm. long being broad at its base and tapering towards its apex, consisting of thin walled cells with some contents. A vascular bundle is also seen in its longitudinal section. (Text fig. 5; Pl. 2, fig. 8).

Perianth—The small flower is 3.5 mm. long and 2.5 mm. broad at the tip and with almost the same diameter throughout its length except at the base where the perianth narrows to 1.2 mm. at the point of the attachment to the stalk. The single whorl of perianth consists of seven united members which are free only at the top (Text fig. 2; Pl. 1, fig. 3, 6). The perianth is oval in T.S. Its wall is thick at the base, 300-325 μ at the middle, and at upper region it thins down to 170-250 μ . The wall shows 10-12 layers of cells. Outermost is epidermis with a thin layer of cuticle. This is followed by 3-4 layers of parenchyma cells. The inner zone of 5-7 layers contains 19-21 vascular bundles which are seen cut transversely to obliquely (Pl. 1, fig. 2). The inner

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TEXT-FIGS. 1-10 — 1. Diagrammatic oblique T.S. Flower showing seven stamens surrounding the style and epiphyllous attachment of filament seen as bulging from perianth (shown by arrows). 2. Diagrammatic L.S. Flower showing free-tips of tubular perianth and dorsifixed attachment of anther. 3. Equatorial view of Pollen. 4. Slightly oblique diagrammatic T.S. Flower, of basal part. Ovary seen, pentangular and pentalocular. 5. Diagrammatic L.S. Flower base and stalk showing vascular bundles and bracteole. 6. T.S. filament. 7. T.S. filament and anther showing four pollen sacs, connective and endothecium. 8. Diagrammatic T.S. pentalocular ovary showing placentation and funicular outgrowths. 9. Pollen, polar view. 10. Part of T.S. anther showing epidermis — *e*; endothecium — *en*; remains of tapetum — *t* and pollen *P*.

outline of the perianth in T.S. is giving bulges at places showing positions where filaments were attached. (Text fig. 1; Pl. 2, fig. 9). The cells of the perianth including the epidermis are filled with dark brown contents probably some pigments, implying its petaloid nature (Pl. 1, fig. 2). The vascular bundles and neighbouring cells do not show these dark contents. The perianth

is thus tubular, actinomorphic, not gibbous or irregular.

Androecium — The serial transverse sections show the presence of only seven anthers (Text fig. 1; Pl. 2, fig. 9). Moreover the number of vascular bundles in the perianth whorl is also a multiple of seven, thus supporting the number of stamens. The seven stamens are slightly bent towards the

centre of the flower where the style is seen surrounded by anthers (Text-fig. 1; Pl. 2, fig. 9). They are epiphyllous with filaments slightly curved and anthers dorsifixed. (Pl. 1, Figs. 3 and 6). The filament is 150 μ in diameter at its basal part and about 70 μ thick near its point of attachment to the anther. Transverse section of the filament shows a vascular bundle with 3-4 narrow vessels, and a thin layer of phloem around them with 3-4 layers of parenchyma cells, surrounded by an epidermis (Text-fig. 6; Pl. 1, Fig. 7). The filament is smooth and terete, attached at 1/3rd the distance on the anther.

The anthers are 2-lobed and 4 locular and are 700 μ long and 400-480 μ broad, broader at the point of attachment of connective to the filament. The anther wall at the four corners as seen in T.S. is of specialized cells, the endothecium with bars of thickenings. Remains of epidermal cells of anthers are seen at places (Text-fig. 10; Pl. 1, Figs. 4, 7). Some cells of this layer are indicative of the longitudinal dehiscence of anthers (Pl. 1; Fig. 4). Rest of the anther cells are parenchymatous. The connective shows a single vascular bundle with 3-4 narrow vessels and a small zone of phloem cells. (Text-fig. 7; Pl. 1, Fig. 7). The four loculi or pollen sacs contain mature pollen grains *in situ*, ready for dehiscence (Pl. 1, Figs. 4, 7; Pl. 2, Fig. 10). Tapetum has been observed on the inside of the endothecium as fragmentary remains in some of the anthers. It is glandular and secretory in nature. (Text-fig. 10, Pl. 1, Fig. 7). The loculi on one side of the anther are quite apart and even at this mature stage show no union amongst themselves. Thus the four loculi remain separate and the dehiscence is longitudinal as indicated by the endothecium layer. (Text-fig. 7; Pl. 1, Fig. 4).

The pollen grains *in situ* are 12-15 \times 18-20 μ each, tricolporate, psilate, subprolate, ora \pm circular. They are small and separate, not in tetrads. They indicate mature condition of the anther prior to dehiscence and the protandrous nature of the flower (Text-figs. 3, 9; Pl. 1, Figs. 4, 5).

Gynoeceium—This consists of a pentacarpellary pistil. The ovary in T.S. (Text-figs. 4, 8; Pl. 1, Fig. 1) is five angular with axile placenta. Five septae reach the centre of the ovary from the five angles of the ovary wall. The ovary is thus five locular. It is 0.7 mm. in diameter. The ovary wall

shows 5-6 layers of cells (Pl. 2, Fig. 11), and in L.S. vascular bundles are seen in the central axial part. The ovary is in very young condition with the ovules just on the point of development from the placenta. This is indicated by the funicular outgrowths of stalk-like structures from the placenta enlarging at its tip to form an ovule (Text-fig. 8, Pl. 2, Fig. 11). This is seen in three out of five loculi of the ovary. The style is short and 350 μ in diameter and is not solid but shows five canals or cavities. The style has same thickness in all sections till it reaches the ovary. Stigma is simple, not broader than the style. In fact this could not be made out as a separate structure from the style.

DISCUSSION

The present flower is comparable to *Sahnipushpam shuklai* Verma (syn. *Sahnipushpam glandulosum* Prakash), only in the superior pentacarpellary nature of the gynoeceium. This five carpellary condition in *Sahnipushpam* is shown to deviate between 4-6 carpellary one (Chitale 1964; Prakash and Jain 1963) and the presence of false septae make the ovary 9-12 locular. Moreover the outline of the ovary is circular in *Sahnipushpam* whereas it is 5 angular in the present flower. No other character of the flower under consideration is comparable with *Sahnipushpam*.

Sahnianthus parijai (Shukla 1944; Chitale 1950, 1955) has more points in common with the present flower. The similarities and differences are shown in Table 1.

It is thus observed that the present flower though similar to *Sahnianthus* in some characters, differs from it in many features. These are the size and shape of perianth whorl, number and position of stamens, number of carpels, absence of nectary and ovary stalk. *Sahnianthus* is larger in size with gibbous perianth whereas the present flower is much smaller with a regular tubular perianth. The number of stamens is less here than that in *Sahnianthus*. The arrangement of stamens is also different in both. Similarly the five locular, five angular ovary is very much different from the rounded and more locular condition in *Sahnianthus*. The size and shape of perianth, number of stamens and carpels are the most important characters of generic value to distinguish

TABLE 1

	<i>Sahnianthus parijai</i> (SHUKLA 1944; CHITALEY 1950, 55)	PRESENT FLOWER
Bract	Present	Not seen
Stalk	Present	Present
Bracteole	Present	Present
Flower size		
Length ex- cluding the stalk	7.0-10.5 mm.	3.5 mm.
Breadth	1.3-2 mm. in the middle 2.5-3.0 mm. at base	2.5 mm. broad throughout, 1.2 mm. at the stalk
Symmetry	Actinomorphic	Actinomorphic
Perianth	One whorl, 6-8 united, upper 1/3 free, valvate, gibbous	One whorl, 7, united, tips free, tubular, valvate, not gibbous
Sex	Hermaphrodite	Hermaphrodite
Androe- cium	8-12, inflexed in bud, opposite the perianth, some alternate	7, curved inwards, alternate to peri- anth lobes
Filaments	Of different lengths; epiphyllous	Small, almost of same length; epi- phyllous.
Anthers	Oblong, dorsifixed, 0.75-1.0 mm. long	Dorsifixed, 0.70 mm. long
Dehiscence	Longitudinal	Longitudinal
Loculi	4, distant	4, distant
Pollen	40 μ , spherical	12-15 \times 19-20 μ , tricolporate, psi- late, subprolate,
Gynoecium	Protandrous	Protandrous
Position	Stalked	Not stalked
No. of loculi	Superior	Superior
Shape in T. S.	6-12	5
Placenta	Circular	5 angular
Ovules	Axile	Axile
Style	2 rows in each loculus	2 rows in each loculus
Stigma	Simple, long, chambered	Simple, short, chambered
Nectary	Capitate	Simple
	Present at the base of the ovary	Nectary absent

between two such flowers which are monochlamydeous, bisexual, hypogynous, bracteolate, stalked and with axile placentation. Hence, these differences of a major nature warrant the creation of a new genus for this tiny flower which is named as *Chitaleypushpam mohgaoense* gen. et sp. nov. The generic name is given after my esteemed guide and Professor Dr. S. D. Chitale, in appreciation of her kind interest in my work. The specific name is after the famous locality from where the fossil was collected.

AFFINITIES

The flower *Chitaleypushpam* because of its single whorl of perianth, superior gynoecium shows affinities with the flowers of Rhizophoraceae, Samydaceae, Sonneratiaceae and Lythraceae (Gamble, 1957). In Rhizophoraceae the ovary, when superior is adnate to calyx which is not the case in the present flower. Samydaceae shows parietal placentation in ovary while it is axile in this fossil flower. In the Sonneratiaceae the perianth is united at the base to the ovary but the present flower shows a free ovary. Lythraceae has more characters in common with the flower *Chitaleypushpam*. Fresh flowers of *Ammania*, *Woodfordia*, *Lagerstroemia* were compared with the flower of *Chitaleypushpam*, for the pollen and other characters. It is observed that the pollen grains of *Ammania* are very small, only $12 \times 15 \mu$ in size but those of *Woodfordia* are $18 \times 20-25 \mu$ in size and are also tricolporate, psilate, subprolate like the pollen grains of *Chitaleypushpam*. The pollen is thus somewhat Lythraceous in the fossil flower. However, *Lagerstroemia* pollen grains are different being $32 \times 45 \mu$ in size, and are tricolpate, prolate and with clear exine stratifications. Some genera of Lythraceae also show like *Chitaleypushpam* only one whorl of perianth, superior ovary with axile placentation and epiphyllous stamens. But the number of perianth lobes is either 4, 6 or 8 and the number of stamens is indefinite or as many as the perianth lobes. Also the pentacarpellary condition of the pistil is not seen in Lythraceae along with 7 perianth lobes and 7 stamens. It is thus seen that the present fossil flower, though similar to the flowers of Lythraceae in some characters, is still much different from it. It may belong to an extinct family of dicotyledons showing more relationships with Lythraceae than with any other family. Perhaps *Sahnianthus* may also be found belonging to the same extinct family because of its few Lythraceous characters, and many of its own. Further work in this direction is under progress.

DIAGNOSES

Chitaleypushpam gen. nov. Flower dicotyledonous, stalked, bracteolate, bisexual, hypogynous, monochlamydeous, actinomorphic. Ovary sessile pentacarpellary,

pentalocular, pentangular, with axile placentation. Perianth tubular. Androecium epiphyllous. Pollen grains tricolporate, psilate, subprolate.

Chitaleypushpam mohgaense sp. nov. — Stalked, bracteolate, bisexual, hypogynous, monochlamydous flower, actinomorphic, 3.5 mm. long, 2.5 mm. broad; perianth lobes seven, united, valvate, tubular, tips free; stamens seven of equal length, epiphyllous, curved inwards, alternate with perianth; anthers dorsifixed, 2 lobed, 4 locular, 700 μ long, dehiscence longitudinal; pollen 12-15 \times 19-20 μ , tricolporate, psilate, sub-

prolate, ora \pm circular; gynoecium not stalked, 5 angled; ovary superior, 5 locular, axile placentation, 2 rows of ovules in each loculus; style short, chambered; stigma simple, no nectary.

Holotype — FA/P. Slides kept in the Dept. of Botany, Institute of Science, Nagpur.

Isotypes — FB/P and FC/P kept in the Dept. of Botany, Institute of Science, Nagpur.

Locality — Mohgaonkalan, Chhindwara district, Madhya Pradesh, India.

Horizon — Deccan Intertrappean series.

Age — ? Upper-most Cretaceous.

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EXPLANATION OF PLATES

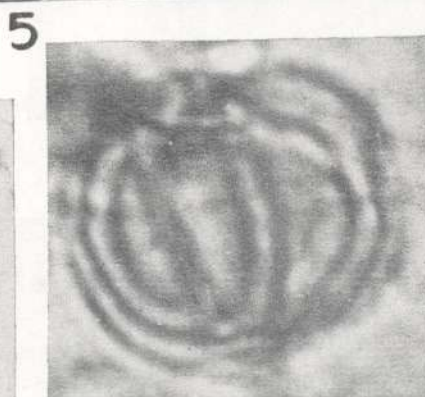
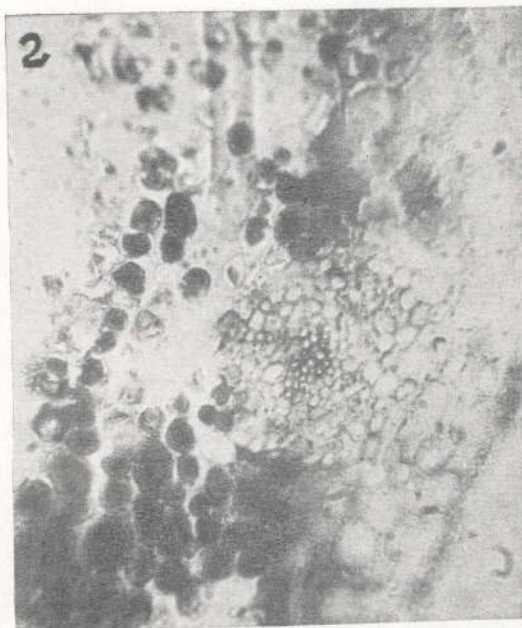
PLATE 1,

1. Oblique T.S. Flower, basal part showing pentangular, pentalocular ovary and part of two stamens. $\times 60$.
2. Part of perianth wall in T.S. showing vascular bundle and pigment cells. $\times 500$.
3. L. S. flower on rock showing free tips of perianth and dorsifixed anthers and part of ovary. $\times 12$.
4. Part of T.S. anther with dehiscence in endothecium and pollen. $\times 450$.
5. Single pollen grain, equatorial view. $\times 2000$.
6. L.S. flower on rock, counterpart of Fig. 3. $\times 12$.

7. T.S. filament and part of T.S. anther showing epidermis, endothecium, remains of tapetum and pollen. Connective is also seen. $\times 500$.

PLATE 2,

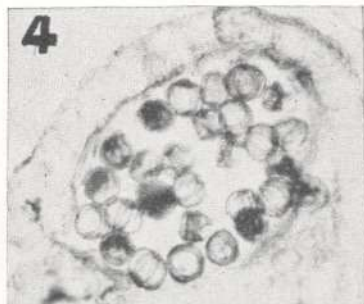
8. L.S. flower base and stalk with bracteole. $\times 60$.
9. T.S. flower showing seven stamens surrounding the style and epiphyllous attachment of filament. $\times 60$.
10. T.S. part of anther showing single pollen sac and pollen. $\times 700$.
11. Pentangular, pentalocular ovary, showing funicular outgrowths — *f.* $\times 300$.



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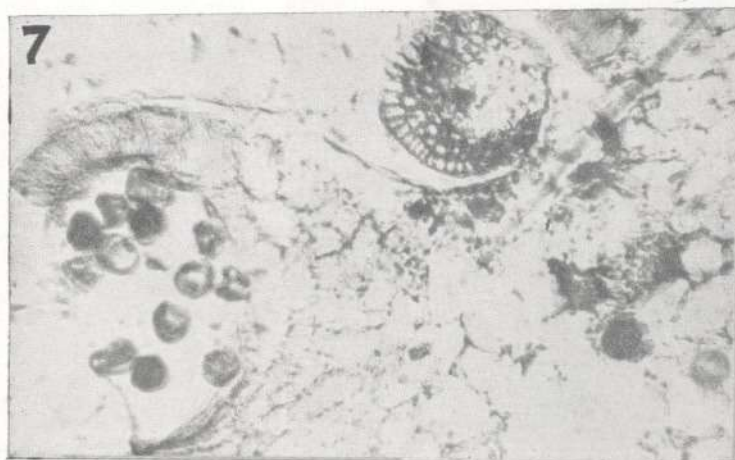
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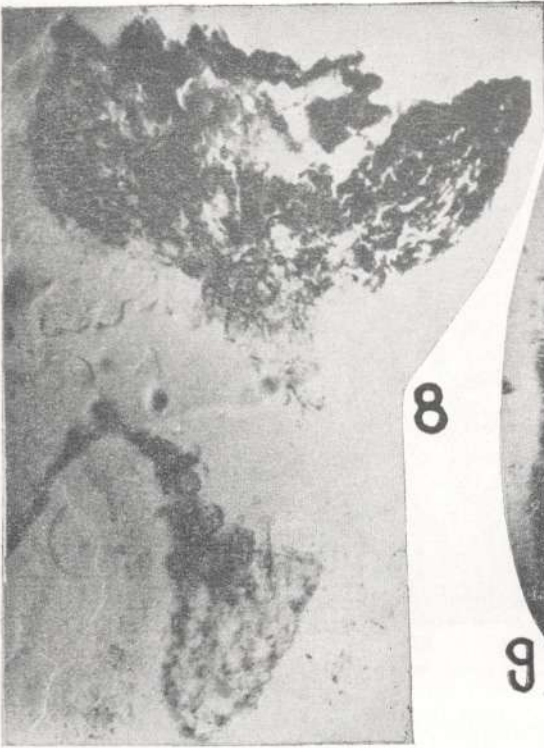


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