

# A petrified bilocular dicotyledonous fruit from the Deccan Intertrappean beds of Singhpur, Madhya Pradesh, India

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## ABSTRACT

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A petrified bilocular fruit is described from the Deccan Intertrappean beds of Singhpur (Lat.20°1' N; Long.70°1' E), situated about 3 km from the well known locality Mohgaonkalan in Madhya Pradesh, India. The fruit is bilocular, sessile, and ovoid. Of the two locules, one is with a seed, the other is empty. There is an air chamber in the septa. Pericarp is well formed. Epicarp shows presence of lacunar fibrous bundles and towards the inner side parenchymatous tissue with empty raised cavities. Seed is single and bitegmic with ridges and furrows. Fruit shows loculicidal dehiscence. The fruit could not be assigned to any living family. Since it differs from the known fossil fruits, it is named as *Bicarpelarocarpon singhpurii* gen. et sp. nov.

**Key-words**—Dicot fruit, Deccan Intertrappean, Singhpur, Mohgaonkalan, Madhya Pradesh, India.

सिंहपुर, मध्य प्रदेश, भारत के दक्कन अंतःद्रापीन संस्तरों से प्राप्त एक अश्मीभूत द्विकोष्ठीकी द्विवीजपत्री फल  
मौसुमी भॉवल एवं एम.टी. शेख

## सारांश

मध्य प्रदेश, भारत में जानी-मानी उपबस्ती मोहगाँवकलाँ से लगभग 03 किमी स्थित सिंहपुर (अक्षांश 20°1' उत्तर; देशांतर 70°1' पूर्व) के दक्कन अंतःद्रापीन संस्तरों से प्राप्त एक अश्मीभूत द्विकोष्ठीकी फल वर्णित किया गया है। फल द्विकोष्ठीकी, स्थावर एवं अंडाकार है। दो कोष्ठीकों में एक बीज सहित है दूसरा खाली है। अंडाशय में एक वायु कक्षिका है। फलभित्ति भली-भाँति गठित है। बाह्यफलभित्ति रिक्तिका रेशेदार गट्टा और खाली उभरी गुहिकाओं सहित अंदर की तरफ मृदूतकमय कोशिका की मौजूदगी दर्शाती है। बीज एकल है तथा कटक व खाँचा सहित द्विअध्यावरणी है। फल कोष्ठी-विदारक स्फुटन दर्शाता है। फल किसी भी जीवित परिवार में नहीं ठहराया जा सका। चूँकि यह जाने-माने जीवाश्म फलों से भिन्न है, अतः इसे *बाईकार्पेलारोकार्पन सिंहपुरी* वंश नवमप्रजाति नाम दिया गया।

**मुख्य शब्द**—द्विवीजी फल, दक्कन अंतःद्रापीन, सिंहपुर, मोहगाँवकलाँ, मध्य प्रदेश, भारत।

## INTRODUCTION

THE Deccan Intertrappean flora is of special interest as it consists of well preserved remains of Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (monocotyledons and dicotyledons) (Bande, 1992; Bande *et al.*, 1988). Angiosperms dominate the flora and are represented by various plant parts including roots, stem, leaves, flowers, and fruits which are usually found detached. A number of dicotyledonous fruits have been reported from the Deccan Intertrappean sediments, viz. *Enigmocarpon*, *Indocarpa*, *Harrisocarpon*, *Daberocarpon*, *Sahniocarpon* (see Chitaley, 1974) and *Euphorbiocarpon* (Mehrotra *et al.*, 1983). The age of Deccan Intertrappean sediments is considered as Maastrichtian-Danian (Guleria & Srivastava, 2000).

## SYSTEMATICS

### DICOTYLEDONS

**Genus**—*Bicarpelarocarpon* gen. nov.

**Species**—*Bicarpelarocarpon sivghpurii* gen. et sp. nov.

(Pl. 1.1-8; Figs 1-7)

**Material**—The material was collected from the Deccan Intertrappean beds of Singhpur (Lat. 20°1' N; Long. 70°1' E), situated about 3 km from the well known locality Mohgaonkalan in Madhya Pradesh, India. The fossil fruit was almost oval with laterally tapered ends and was found embedded in the fossiliferous chert. The anatomical details were studied by taking several peels without grinding the chert and etching it with Hydrofluoric acid.

**Description**—Anatomically the fruit is well preserved and the fruit wall or the pericarp is differentiated into epicarp, a clearly defined mesocarp and the endocarp, consisting of different and well defined zones of tissue (Fig. 6; Pl. 1.6). The epicarp is poorly preserved and has largely been lost during fossilization. Fragments of a discontinuous thin walled outer layer are interpreted as evidence of an epicarp. The cell nature of this layer is not clear. Lacunar fibrous bundles are present in a single row, which are equidistant from each other (Fig. 6; Pl. 1.6). The bundles show the presence of lacunar spaces surrounded by thick walled tissues. The bundles might have provided mechanical support (Fig. 7). In the inner layer of epicarp are 4-5 clearly arranged layers of parenchymatous tissue. This is characterized by the presence of rounded, raised, empty spaces bounded by cell layers of the epicarp. These empty spaces lack cell contents. These empty spaces might have been the lysigenous? cavities or canals formed due to the destruction of the cells formerly occupying the position of the space (Fig. 7; Pl. 1.7). The epicarp overlies a thick walled mesocarp and endocarp. A seed is present in the fertile chamber of the fruit and occupies almost the entire lumen of the fruit (Figs 2, 3; Pl. 1.2, 3). The seed coat has a wavy appearance due

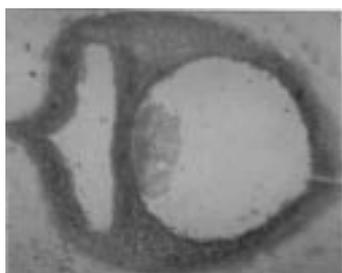
to ridges and furrows. The seed coat is clearly demarcated into outer testa and inner tegmen (Figs 2, 3; Pl. 1.8). Inside the seed, no cellular contents were observed; hence it can be inferred that the embryo was not preserved. Dehiscence appears in the right locule containing the seed. There is a split on the lateral side of the right locule as well as the segmentation on the upper and lower arms of the pericarp presumably to facilitate the release of the seed (Fig. 5; Pl. 1.5).

**Discussion**—The fruit under study is a bilocular fruit, which might have developed from the bicarpellary ovary. Out of the two locules, one has an ovule, the other one has not developed suggesting that it was in the early stages or it had been lost with the counterpart. Due to the presence of an empty chamber in the septa along with two other locules, the fruit gives a false appearance of being trilocular. The empty chamber seems to be an adaptive device to give buoyancy to the fruit. Some other prominent characters observed in the pericarp of the fruit are the presence of lysigenous? canals and fibro lacunar bundles, which might have provided mechanical support to the fruit. The seed is triangular with wavy seed coat differentiated into testa and tegmen.

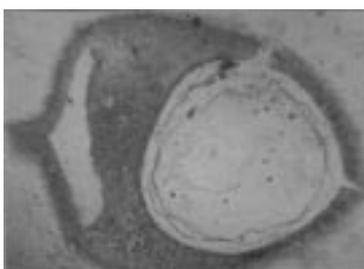
The above characters suggest the possibility of assigning the fruit to the families of four orders, viz. Lamiales, Personales, Polemoniales and Gentianales under the series Bicarpellate (Bentham & Hooker, 1862-1883; Rendle, 1963; Hutchinson, 1959; Benson, 1957; Duthie, 1973). The families in the Lamiales show predominance of carpels, one-ovuled or with two co-lateral ovules, the fruit is enclosed in a persistent calyx, indehiscent with one seed or two or four, one-seeded nuts. Though in the present case the carpel is one-ovuled, the rest of the characters are wide off the mark because the fruit unlike the Lamiales is clearly a dehiscent capsule and without any appendage attached to it.

Scrophulariaceae, Orobanchaceae, Lentibulariaceae, Columelliaceae, Gesneraceae, Bignoniaceae, Pedalinaceae and Acanthaceae of the Order Personales are characterized by the presence of bicarpellary ovary with loculicidal capsule. Though these characters are present in the fossil, no relationship between it and the above families can be established as number of ovules in these families is generally numerous, which is not the case in the studied fossil.

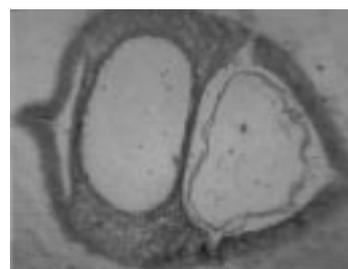
The families of the Order Polemoniales, viz. Polemoniaceae, Hydrophyllaceae, Boraginaceae, Convolvulaceae, Solanaceae and Salvadoraceae (Cooke, 1958) show a number of similarities to the fossil. In Polemoniaceae, the ovary is generally three locular, ovules are one to infinity, seed numerous and fruit a loculicidal capsule. In the Boraginaceae ovary is basically bilocular, bicarpellary, but usually becomes tetralocular by false septation with a single ovule in each locule. Fruit is generally one seeded nutlet. The family Convolvulaceae typically has a bicarpellate, bilocular, syncarpous ovary with 1 or 2 anatropous ovules in each locule, and the fruit is a 2 or 4 valved capsule. In Hydrophyllaceae,



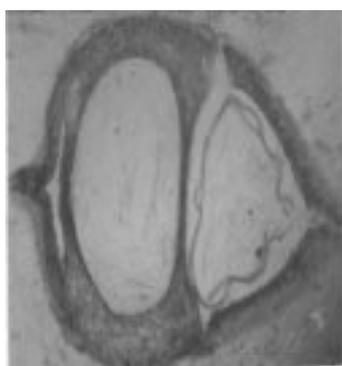
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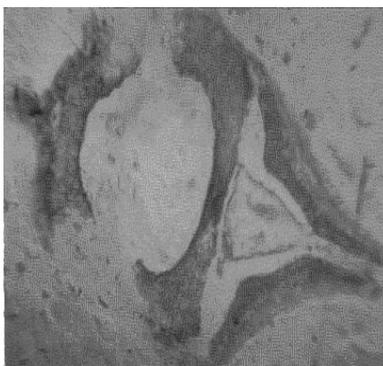
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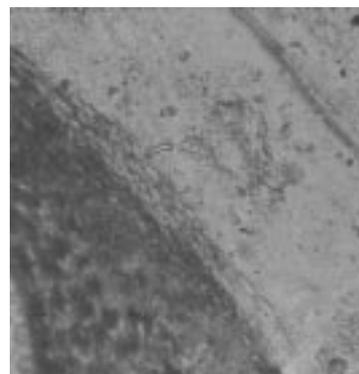
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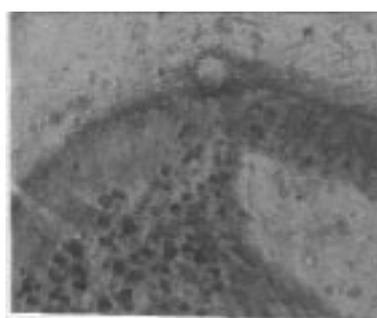
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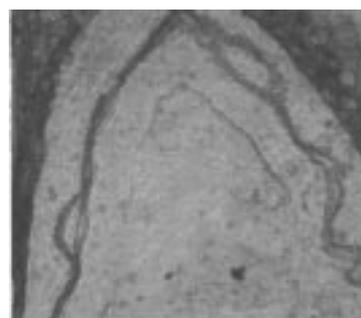
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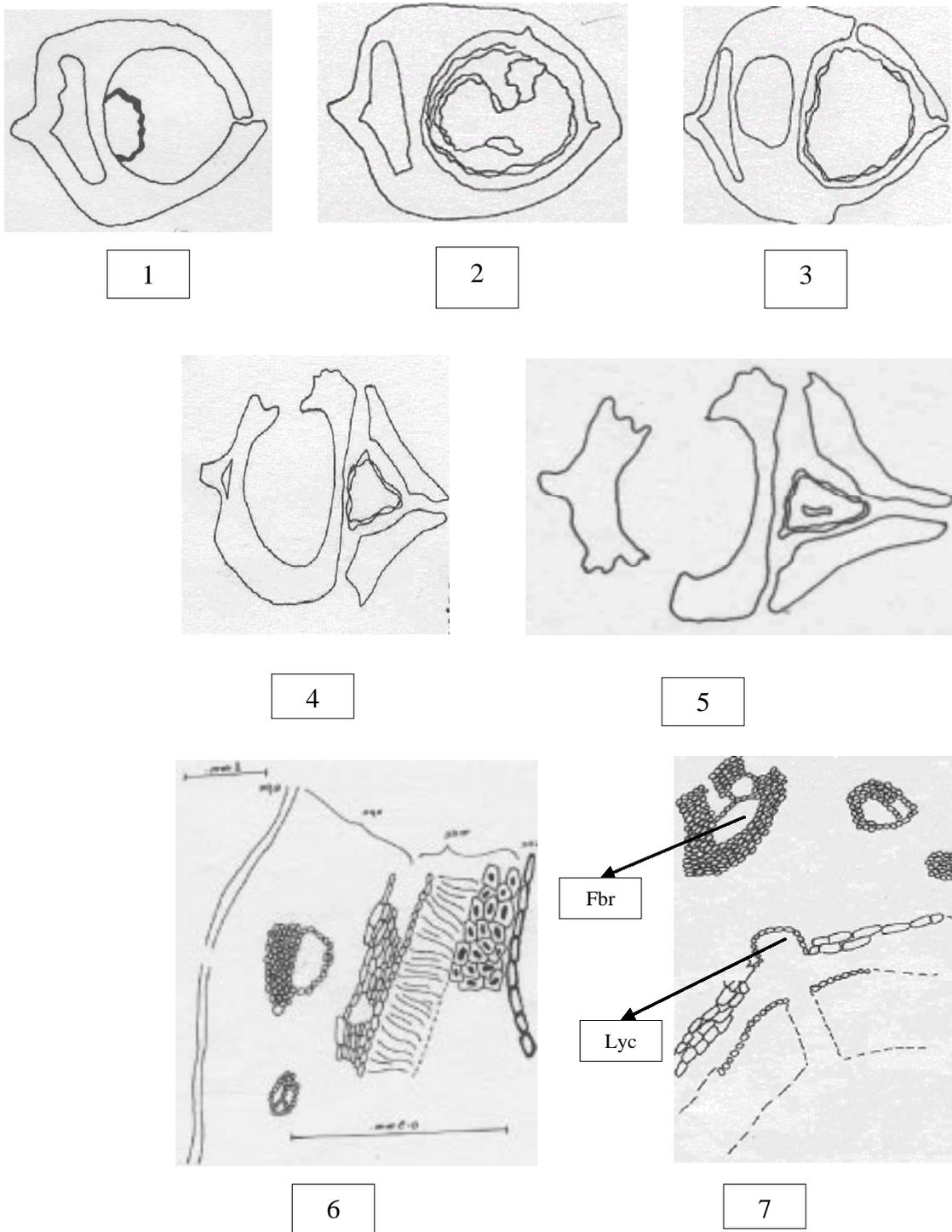
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**PLATE 1**

- 1-5. Serial sections of the fruit showing different developmental stages. x 93.  
 6. Pericarp with outer limiting layer and lacunar fibrous bundles. x 184.  
 7. Fruit wall with lysigenous canals (?). x 184.  
 8. Seed coat with ridges and furrows. x 180.



Figs 1-7—Figs 1-5. Serial section of the fruit showing different developmental stages. Fig. 5. Fruit with remnant of left chamber, central split air chamber and the right locule with diminished triangular seed enclosed by broken fruit walls. Fig. 6. Pericarp with epi (epc), meso (mec) and endocarp (enc). Fig. 7. Epicarp with lacunar fibrous bundles (Fbr) and lysigenous canals (Lyc).

the ovary is superior, one or two-celled, with ovules two to many, and the fruit is usually a loculicidal capsule. In Solanaceae, ovary is generally two-celled with numerous ovules in each locule and fruit is usually a berry. Almost all the families of Gentianales and Salvadoraceae of Polemoniales bear close resemblance in having two chambered ovary, each chamber with one or two erect anatropous ovules. Ovules generally with two integuments fruit are either berry or a drupe, thus vary in fruit morphology. It is therefore, concluded that the fossil fruit cannot be assigned definitely to a particular living family.

Most of the fruits reported from the Deccan Intertrappean beds are capsular in nature and multicarpellary (Chitaley, 1974). As a result, no comparison of the fossil fruit with them is possible. However, the bilocular fruit described here can be compared with a fossil bilocular drupe reported from Mohgaonkalan in an abstract by Yawale (1977). It is an ovoid fruit with a single seed in each locule. The pericarp is differentiated into single-layered epicarp with a layer of cuticle. The mesocarp consists of an outer parenchymatous and inner collenchymatous region and endocarp is stony. The seed locules open into mesocarp with well-organized canals. It shows the presence of cavities in the mesocarp and seeds are parietally attached. It is also wide apart in anatomical characters from the studied fossil, particularly in respect of cell differentiation of pericarp region, presence of carpophore and existence of resin ducts.

Undoubtedly, the fossil is a dicotyledonous fruit. Since it could not be assigned to any known family or taxon, it is placed under an artificial genus *Bicarpelarocarpon* and given a new name *Bicarpelarocarpon singhpurii* gen. et. sp. nov. The generic name is after bicarpellary and bilocular nature of the fruit, while the specific name is after the locality Singhpur, from where the specimen was collected.

**Genus—*Bicarpelarocarpon* gen. nov.**

*Diagnosis*—Fruit bilocular, sessile, with an empty chamber in the septa. Pericarp differentiated into epi, meso and endocarp. Presence of fibro lacunar bundles and empty cavities in the epicarp. Seed single, Bitegmic.

**Genotype—*Bicarpelarocarpon singhpurii* gen. et sp. nov.**

**Species—*Bicarpelarocarpon singhpurii* sp. nov.**

*Diagnosis*—Fruit with pericarp differentiated into epicarp, a clearly defined mesocarp and the endocarp, consisting of

different and well defined zones of tissue. The epicarp is poorly preserved. Lacunar fibrous bundles are present in a single row and they lack cell contents. The epicarp overlies a thick walled mesocarp and endocarp. Single seed present in the fertile chamber of the fruit and occupies almost the entire lumen of the fruit. Seed coat clearly demarcated into testa and tegmen. Dehiscence appears in the right locule containing the seed. There is a split on the lateral side of the right locule as well as the segmentation on the upper and lower arms of the pericarp presumably to facilitate the release of the seed.

*Holotype*—MB/3.

*Repository*—Department of Botany, Hislop College, Nagpur.

*Locality*—Singhpur, Madhya Pradesh, India.

*Horizon*—Deccan Intertrappean Series.

*Age*—Maastrichtian–Early Palaeocene.

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