



## Report of A New Petrified Winged Fruit *Aizoceocarpon tetragonii* Gen. Et Sp. Nov. From The Late Cretaceous Sedimentary Sequences of Central India

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### ABSTRACT

The reported fossil samara fruits were collected from three different localities of the Deccan Intertrappean beds of central India. All three specimens were exposed in oblique longitudinal plane, one from the classical locality Mohagaonkalan (22°1.415' N; 79°11.204' E,) Madhya Pradesh, India; second from the fossiliferous locality Singhpur, Madhya Pradesh, India (Lat. 19°58.141'N, Long. 78°40.838'E) and third from Marai Patan of Vidarbha region of Maharashtra, India about 80 km from Chandrapur (Lat. 21° 13.280'N, Long. 79°0.84'E). After etching with hydrofluoric acid, the fruit revealed details of morphology and anatomy through examination of fractured surface, serial sectioning, and successive peels.

Fruit is finwinged, dicotyledonous, unilocular, indehiscent capsule with one seed in a locule. Finally summing up the comparison and discussion on the described fossil fruit it can be concluded that the present specimen under investigation resembles much more to the fruits of family Aizoaceae. Hence the present fruit is named as *Aizoceocarpon tetragonii* gen. et sp. nov.

**Key words:** winged fruit, cretaceous, Mastrichtian, Central India, Aizoaceae, etc.

### INTRODUCTION

Winged fruits occur in numerous genera scattered through at least 93 families of flowering plants (Dallwitz *et al.*, 2000 onwards). The wings of wind-dispersed fruits take various configurations and may be formed from different structures including outgrowths of the ovary, hypanthium, perianth parts, and/or bracts.

The fossil fruits were collected from three different localities of the Deccan Intertrappean beds of central India. All three specimens were exposed in oblique longitudinal plane, one from the Mohagaonkalan beds (22°1.415' N; 79°11.204' E), second from the fossiliferous locality Singhpur, Madhya Pradesh, India (Lat. 19°58.141'N, Long. 78°40.838'E) and third from Marai Patan of Vidarbha region, India about 80 km from Chandrapur (Lat. 21° 13.280'N, Long. 79°0.84'E). (Fig.1).

A number of dicotyledonous fruits were previously described from the Deccan Intertrappean beds of India. Among these the prominent ones known so far are—*Enigmocarpon parijai* (Sahni, 1943), *Indocarpa intertrappea* (Jain, 1964), *Harrisocarpon sahnii* (Chitale & Nambudiri, 1973), *Sahnioecarpon harrisii* (Chitale & Patil, 1973), *Daberocarpon gerhardii* (Chitale & Sheikh, 1973), *Deccanocarpon arnoldii* (Paradkar, 1975), *Enigmocarpon sahnii* (Chitale & Kate, 1977), *Centrospermocarpon chitaleyi* (Sheikh & Khubalkar, 1979) *Euphorbiocarpon drypeteoides* (Mehrotra *et al.*, 1983), *Grewia mohgaonse* (Paradkar & Dixit, 1984), *Oleaceocarpon nagpurensis* (Sheikh *et al.*,

1986), *Gyrocarpusocarpon intertrappea* (Mistri & Kapgate, 1988), *Duabangocarpon deccanii* (Kadoo & Kolhe, 2002), *Chitleoecarpon intertrappea* (Kapgate *et al.*, 2006) and *Spinocarpon mohgaonse* (Kapgate, 2013). A winged dicot fruit is described from these localities for the first time.

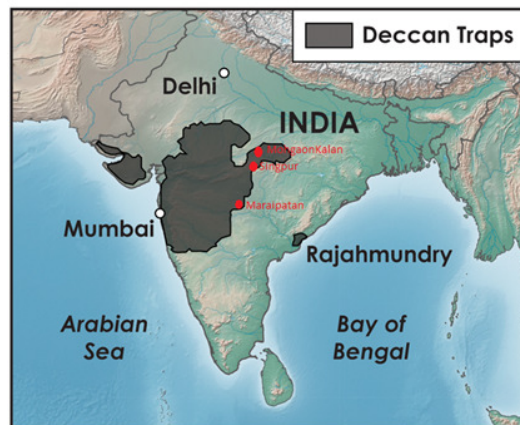


Fig 1-Modified map of Deccan Trap of central India showing fossil localities of winged fruit.

### MATERIAL AND METHODS

The fossiliferous cherts were collected from three different localities of the Deccan Intertrappean beds of India. After breaking the cherts the specimen were exposed in oblique longitudinal plane. After etching with hydrofluoric acid and washing with water, serial peel sections were taken by peel technique. The peels were mounted on DPX mountant. Thus the fruit revealed details of morphology and anatomy through examination of fractured surface, serial sectioning, and successive peels.

**DESCRIPTION**

The present fruits are dicotyledonous, unilocular, single seeded, indehiscent samara fruit measures  $1.7 \times 3$  mm broad and  $1.8 \times 2.7$  mm long in oblique longitudinal section along with two wings. The fruit is differentiated into outer pericarp, expanded portion of fruit wall called wings, inner pulp containing seed and locule. The detailed description of each part is given below (Pl. 1 fig.1,2,3).

**Fruit morphology**

The petrified, well preserved fruit is small, obovate in shape (Pl.1 fig.1,2,3). It is broad in the middle and narrower towards the base than the apex. The fruit measures 2.7 mm in length and 3 mm across at the broadest middle part.

**Pericarp**

The fruit wall or pericarp is well preserved and moderately thick, measures about 130–150  $\mu$ m and is differentiated into outer epicarp, middle mesocarp, and inner endocarp (Pl.2 fig.1).

**Epicarp**

It is the outermost layer of the fruit measuring about 30–40  $\mu$ m in thickness. It is made up of one layer of thin walled, horizontally elongated parenchymatous cells.

**Mesocarp**

The mesocarp is 55–70  $\mu$ m thick and made up of thick walled sclerenchymatous cells. Few canals are present in this region.

**Endocarp**

It is the innermost layer measuring 50–60  $\mu$ m in thickness and consists of thick walled rectangular cells.

**Inner pulp**

In between pericarp and seeds a few thin walled parenchymatous cells are preserved at places (Pl.2 fig.3); otherwise except for the seed and placenta no other tissue is preserved. These cells inside fruit measure about  $3 \times 4$   $\mu$ m in size.

**Locule**

In oblique longitudinal section single locule is seen with well-preserved seeds (Pl. 2 Fig. 1). The diameter of locule is  $0.4 \times 0.7$  mm.

**Seed**

Seed is oval to obovate, measures  $0.3 \times 0.5$  mm in diameter. Seed coat is unitegmic, thin, measures 40–50  $\mu$ m in thickness and made up of rectangular parenchymatous cells. Presence of thin walled parenchymatous tissue indicates the nucellus. Embryo appears to be made up of thin walled cells with single layer epidermis. The undifferentiated cellular mass of thin walled parenchymatous cells is found (Pl. 2 Fig. 2).

**Wing**

The wings are usually symmetrical with one another about the central axis, prefer the term

“finwinged”. Wings developed from the fruit wall tends to have a simpler marginal vein pattern. The wing has a single pattern of cells spreading in one plane. Small areoles spread on the wings (Pl. 2 Fig. 3,4).

**DISCUSSION AND IDENTIFICATION**

The above described specimen revealed following important details for its identification.

1. Fruit is unilocular, single seeded and indehiscent samara fruit.
2. Fruit wall is moderately thick.
3. Seed coat unitegmic
4. Embryo thin walled.
5. Nuclear endosperm.
6. Symmetrical wings with marginal vein
7. Small areoles present.

From these characters it is evident that the described fruit was formed from unicarpellary, simple, dry, single seeded samara fruit.

**Comparison with fossil fruits**

The previously described fossil fruits from the Deccan Intertrappean beds of India are different from the present fruit in a number of characters. *Enigmocarpon parjai* (Sahni, 1943) is 2.3 mm long and 1.5–2 mm broad and 6–12 locular with thick spongy wall. Each loculus contains the rows of seeds. *Endocarpa intertrappea* (Jain, 1964) is septifragal capsule with columella and a fleshy testa. It is 30.0 x 2.3 cm in size and much larger than the present fossil. *Daberocarpon gerhardii* (Chitaley & Sheikh, 1973) is ten locular fruit containing single seed in each locule. *Sahnioocarpon harrisii* (Chitaley & Patil, 1973) had pentalocular capsule, one seed in each locule with persistent calyx, while present fruit is unilocular capsule without persistent calyx. *Harrisocarpon sahnii* (Chitaley & Nambudiri, 1973) is pentalocular capsule, two seeds in each locule with loculicidal dehiscence. *Deccanocarpon amoldii* (Paradkar, 1975) is an eight locular capsule with one seed in each loculus. *Centrospermocarpon chitaleyi* (Sheikh & Khubalkar, 1979) differs in having one umbo, one notch, seeds arranged in two rings; seeds in peripheral rings are non-endospermic and in five tiers with spiny seed coat. *Euphorbiocarpon drypetecides* (Mehrotra *et al.*, 1983) trilocular, dicotyledonous drup with single seed in each locule. *Grewia mohgaonse* (Paradkar & Dixit, 1984) differs in having five lobed drupaceous fruit, two pyrened structure with one seed in each pyrene. *Wingospermocarpon mohgaonse* (Sheikh & Kapgate, 1984) is unilocular with seven winged seeds. *Gyrocarpusocarpon intertrappea* (Mistri & Kapgate, 1988) differs in having single large elongated wing. *Orygiocarpon jhargadi* (Yawale & Channe, 1998) differs in having pentalocular,

many seeded, loculicidal capsule. *Duabangocarpon deccanii* (Kadoo & Kolhe, 2002) differs from the present fruit as it is multiseeded, multilocular capsular fruit with persistent calyx. *Chittlecarpon intertrappea* (Kapgate *et al.*, 2006) differs from the present fossil as it is seven locular, seven ribbed capsular fruit with loculicidal dehiscence differs in having septicidal capsule having one to many seeds of oblong to linear shape in each locule. Thus, the present fossil fruit does not resemble any of the fossil capsular fruits described earlier.

#### Comparison with the modern taxa

The present fossil fruit was also compared with the modern dicotyledonous families having samara fruit like Aizoaceae, Malphigiaceae, Simarubaceae, Urticaceae, Rhamnaceae, Combretaceae and Dipterocarpaceae. Polygonaceae, Malvaceae, Oleaceae.

The fruit of family Dipterocarpaceae differs in having multilocular and persistent calyx which form the wings. *Aspidopteris* and *Hiptage* of family Malphigiaceae differs in having trilobular fruit, whereas the present fruit is unilocular. The fruit body is fusiform, confined mainly to the middle, or to the upper half of the fruit. A median vein runs along the lower portion of the fruit, connecting between the pedicel and endocarp. The wings are membranous, with venation fanning outward from the endocarp, spaced about 1–1.5 mm apart and extending to the fimbrial vein with occasional cross veins and loops between adjacent veins linking to form an irregular network between adjacent main veins, with occasional freely ending veinlets.

Family Polygonaceae differs in the wings are supplied only with very fine, subparallel, fusiform-reticulate venation and lack a fimbrial vein, but in some genera there is a prominent intramarginal vein in each wing. *Calligonum* and *Rumex* differ from the usual pattern, have a complex reticulate, rather than fusiform-reticulate pattern, and *Colligonum* has a prominent fimbrial vein. Family Malvaceae e.g. *Craigia* differs in the wings with chartaceous, thick veins ascending to tips, dichotomizing and anastomosing, occasionally forming transversely elongate areoles. The margins are thickly sutured and the surfaces are covered by tribranched hairs. Family Oleaceae e.g. *Fontanesia* Labill differs in having the wings broader, the locular area is fusiform. The style base, and hypogynous perianth may persist. The wings are coriaceous, without any obvious venation giving the fruit a more circular outline.

The fruit of Simarubaceae e.g. *Ailanthum* and *Samendera* differs in having multichambered

fruit and number of wings. Family Urticaceae e.g. *Holoptelea* differs in having number of wings. Family Rhamnaceae e.g. *Ventilago* differs in thick seed coat and multiwinged nature. Family Combretaceae e.g. *Anogeiss* and *Cyrocarpus* differs in having one angular wing, large pendulous seed and thick seed coat. Fruits are orbicular to broader than long, with a prominent apical beak. Wings are chartaceous, translucent at edges, without any obvious veins.

Family Aizoaceae shows similarity in having wide-elliptical indehiscent 3 to 4 winged fruits develop from an inferior ovary. The wings are coriaceous with main veins fanning into the wings from the endocarp with a festooned brochidodromous pattern. The density of main veins is 1.2 per mm. A fabric of finer veins between the main veins forms an irregular reticulum of polygonal areoles.

Finally summing up the comparison and discussion on the described fossil fruit it can be concluded that the present specimen under investigation resembles much to the fruits of family Aizoaceae. On comparing with the genus of the same family like *Tetragonia* the present fruit closely resembles with *Tetragonia*. Hence the present fruit is named as *Aizoecarpon deccanii* gen. et sp. nov. The generic name is after the family and specific name is after the Deccan trap. The fruits of Aizoaceae family are typically loculicidal capsules, but those of *Tetragonia* L. are indehiscent and winged. *Tetragonia* (Pl. 1 fig.4) with about 85 species of shrubs, occurs in tropical and temperate regions of the Southern Hemisphere with a center of distribution in southern Africa.

#### Diagnosis

##### *Aizoecarpon* gen. nov.

Fruit is dicotyledonous, unilocular, indehiscent capsule with one seeds in a locule, finwinged.

##### *Aizoecarpon deccanii* gen. et sp. nov.

Fruit is a dicotyledonous, unilocular, single seeded, and indehiscent samara fruit measures 1.7 × 3 mm broad and 1.8 × 2.7 mm long. Fruit wall 130–150 µm thick, differentiated into epicarp, mesocarp and endocarp. Epicarp 30–40 µm thick, one layered of thin walled parenchymatous cells; mesocarp 55–70 µm thick sclerenchymatous; endocarp 50–60 µm thick. Seed is oval to obovate, measures 0.3 × 0.5 mm in diameter. Seed coat is unitegmic, thin, parenchymatous measures 40–50 µm in thickness. Nucellus present. Embryo with thin walled cell. Wings developed from the fruit wall tends to have a simpler marginal vein in pattern.

**Holotype**—VDN / Angio. Fruit

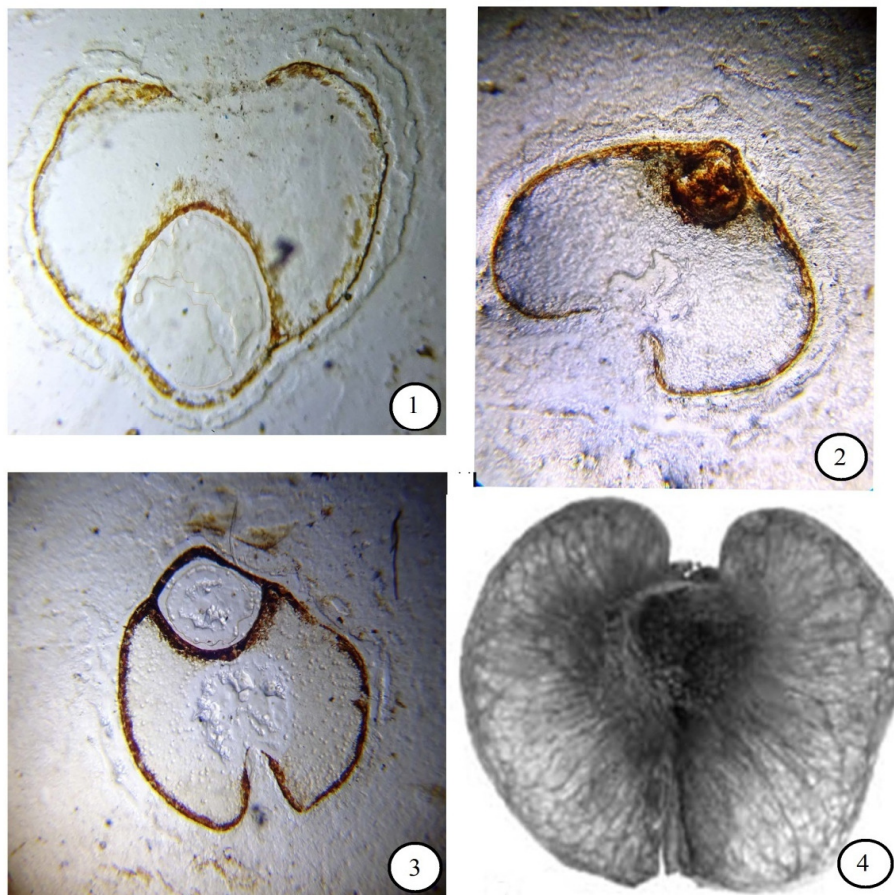
**Repository**—Botany Department, Institute of science, Nagpur

**Locality**—Mohgaokalanand, Singpur Madhya Pradesh; Maraipatan Maharashtra.

**Horizon**—Deccan Intertrappean beds.

**Age**—Late Cretaceous - Early Paleogene.

Plate fig.1

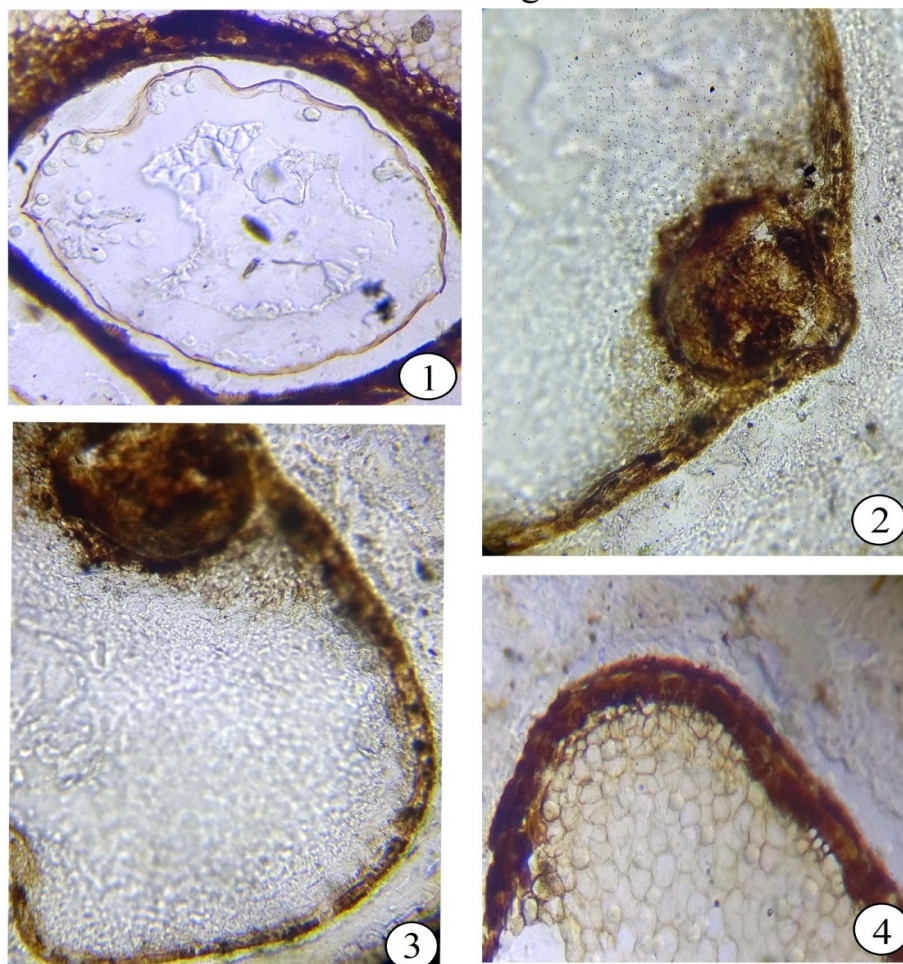


***Aizoceocarpon tetragonii* gen. et sp. nov.**

**Explanation of Plate 1 figures 1 to 4**

1. Samara fruit specimen 1 collected from Marai Patan locality.
2. Specimen 2 collected from Singpur locality
3. Specimen 3 collected from Mohgaonkalan fossiliferous locality.
4. Extant genera of family Aizoaceae.

Plate fig. 2

***Aizoecarpon tetragonii* gen. et sp. nov.****Explanation of Plate 2 figures 1 to 4**

1. Magnified view of seed of specimen 3.
2. Magnified view of seed of specimen 2 showing seed coat.
3. Magnified view of wing showing marginal vein pattern.
4. Magnified view of finwing.

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