



Report on Dicotyledonous Unilocular Fruit with Spiny Seeded from Deccan Intertrappean Beds of Mohgaonkalan, M.P., India.

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ABSTRACT

The fossil unilocular fruit with peculiar characteristic of single spiny seed collected from the Deccan Intertrappean Sedimentary beds of the fossiliferous locality Mohgaonkalan coordinates (22° 1' N, 79° 11' E) in Chhindwara District in Madhya Pradesh, India. The Fruit is dicot, simple, capsule, unilocular, single with ridges or spiny seed, indehiscent, dry, basal placentation, polygonal shaped. The seed is large, dicotyledonous, anatropous, bitegmic, briollette with spiny seed coat. After a detailed study the fruit reveals many peculiar characters resemblance with modern family Capparidaceae, Caricaceae, Calophyllum, Moringaceae and Oxalidaceae. but do not shows affinity with reported fossil fruits.

Key words: Fossil Dicot fruit, Ridges or Spiny Seed, Deccan Intertrappean beds, Mohgaonkalan.

INTRODUCTION

A large number of fossil dicotyledonous fruit are known from Deccan Intertrappean beds of Central India. The material for the present study was collected from of Mohgaonkalan (22° 1' N, 79° 11' E) in Chhindwara District in Madhya Pradesh. There is record of a number of fruit. Some reported dicot, unilocular single seeded fruit has been described so far, from the Deccan Intertrappean beds, India. These are *Unispermospinocarpon keriensis* (Kapgade & Paliwal, 2016), *Ranunculaceaeocarpon jamsavlii* (Bonde & Narkhede, 2013), *Tiliaceaeocarpon jamsavlii* (Meshram, Narkhede and Bhowal, 2013), *Compositaeocarpon jamsavlii* (Yadav, 2010), *Tamaricaceocarpon patilii* (Yadav, 2010), *Valvulocarpon chitaleyii* (Yadav, 2010), *Amaranthocarpon mohgaonese* (Saxena, 2004), *Amaranthocarpon Intertrappea* (Saxena, 2004), *Spinocarpon intertrappea* (Dahegaonkar, 2002) and *Geraniocarpon intertrappea* (Dahegaonkar, 2002). Some unilocular multiseeded fruit from Deccan Intertrappean beds, these are *Portulacaceocarpon bhuterensis* (Borkar, Nagrale, Meshram, Korpenwar and

Ramteke, 2016), *Portulacaceocarpon jamsavlii* (Bhowal, Narkhede and Meshram, 2011), Some Reported achene fruit also has been described so far, from the Mohgaonkalan, Deccan Intertrappean beds, India. These are *Cyperceocarpon sahnii* (Dutta & Ambwani, 2005), *Achenocarpon mohgaonii* (Gedam, 2004), *Boeluneria intertrappea* (Ambwani, Kar, Srivastava & Dutta, 2004), *Prakashocarpon mohgaonse* (Dahegaonkar, 2002), *Ceratocarpon spinosa* (Adhao, 1986) and *Monimioocarpon mohgaense* (Lanjewar, 1986), Here is the new addition to the fossil flora from the Deccan Intertrappean beds of Mohgaonkalan.

Present fossil fruit is compare with reported Seed i.e. *Capparisocarpus nagpurii* (Konde & Kolhe, 2012); it is comes under the family Capparidaceae.

METHODOLOGY

A petrified material collected from Mohgaonkalan in Chhindwara District in Madhya Pradesh. Almost well persevered fossil dicotyledons fruit was found by naked eye embedded in the fossiliferous chert. The fruit was exposed in oblong longitudinal section on the chert. Part and counterpart are found. After etching the chert with hydrofluoric acid, peel section were taken serially one by one. The peels were mounted on DPX mountant. photographed were taken and camera lucida also used for the studied of fossil material and anatomical details were studied.

Descrption

The oblong logitudinal section of fruit was well preserved. Fruit dicot, simple, capsule, unilocular, single spiny seed, indehiscent, dry, basal placentation, polygonal shape. It is 1.1cm long and 1cm broad. fruit wall is 0.5 – 4.5 mm thick, fruit wall differentiated into three zone. Outer layer is epicarp 0.1 – 1 mm thick, middle layer is mesocarp measuring 0.3 – 3 mm thick and inner is endocarp measuring 0.1 – 0.5 mm thick. The outer layer epicarp is thick walled parenchymatous cell. Middle layer mesocarp is thick walled cells. Inner layer is endocarp. The seed is large measuring 9 mm long and 6 mm broad, dicotyledonous, anatropous, bitegmic, briollette with spiny seed coat. Seed coat is spiny multicellular. It is differentiated into testa and tegmen. The seed shows micropylar opening. exostome well developed at the micropylar opening. Embryo is well developed and preserved. Embryo is large and almost occupies the

space of seed cavity. Two large cotyledons are present. At the side of chalazal end of seed unignified massive, disclike, hypostase structure is seen.

Epicarp: The outer epicarp is measures about 0.1 – 1 mm thick. it is made up of a multicellular thick walled parenchymatous cells. These cells are rectangular in shape.

Mesocarp: The mesocarp is fleshy thick walled measures about 0.3 – 3 mm thick. it is thick walled parenchymatous cell. Mesocarp with various layers of cells. some empty space are present in mesocarp.

Endocarp: The inner endocarp thin walled measuring 0.1 – 0.5 mm thick with parenchymatous cell.

Locule: The fruit is unilocular, the size of the locule is 9 mm length and 6 mm breadth.

Seed: The present fossil fruit contain a single spiny seed measuring 9 mm long and 6 mm broad. The seed is large, dicotyledonous, anatropous, bitegmic, briollette with spiny seed coat. Seed coat is spiny multicellular differentiated into testa and tegmen. The seed shows micropylar opening. exostome well developed at the micropylar opening. Embryo is well developed and preserved. Embryo is large and almost occupies the space of seed cavity. Two large cotyledons are present. At the side of chalazal end of seed, unignified massive, disclike, hypostase structure is seen.

Seed coat: Seed coat is a two thick layer, measuring 1 – 2 mm thick, it is differentiated into testa and tegmen.

Testa: Testa is multilayer. It shows ridges or spiny in nature. Measuring 0.5 - 1 mm thick.

Tegmen: Tegmen is also multilayer. It is stongly multiplicative and ridges or spiny in nature. measuring about 0.5 – 1.5 mm thickness.

Embyo: Embryo is straight. It consisting of two large cotyledons. Single cotyledons measuring 4.5 mm long and 1 mm thick. Radial scleroid cells at the micropyle.

Hypostase: At the side of chalazal end of seed, unignified massive, disclike, hypostase structure is seen. Measuring 1.7 mm long and 0.2 mm thick.

Discussion & comparison

The following important characters are considered for identification of fruit.

- Fruit was dicot, simple, unilocular, indehiscent, capsule, dry, basal placentation, polygonal shape.
- Fruit is differentiated into epicarp, mesocarp and endocarp.
- Fruit contain single spiny seed in locule.
- The seed is large, dicotyledonous, bitegmic, anatropous.
- Seed is briolette shape, means one end is tapering and another end is round.
- Seed coat is spiny in nature.
- The Seed developed radical at the micropylar opening.
- Embryo is well preserved.
- Two cotyledons are present.
- Embryo is large and almost occupies the space of seed cavity.

Comparison with Modern Taxa

From the above characters, the present fossil fruit shows character of simple capsule, unilocular, indehiscent, dry, spiny seed, polygonal shape. It is differentiated into epicarp, mesocarp and endocarp. It contains single spiny seed in locule. The seed is large, dicotyledonous, bitegmic, anatropous, spiny in nature. Shape of seed is briolette, means one end is tapering and another end is round. The Seed developed radical at the micropylar opening. Embryo is well preserved, large and almost occupies the space of seed cavity.

According to Corner, (1976), Seed of Dicotyledons, Vol. 1&2, following character discuss with fossil material. Seed coat make inwardly the ridges of firm tissue in testa of Cappariaceae, Caricaceae, Calophyllum and Moringaceae. Small ridges in the inner layer of Avertroa (Oxalidaceae). Family

Caricaceae characterised as an ovule anatropous, bitegmic, testa strongly multiplicative, consisting of enlarged cuboid cells with thick outer wall or proliferated by periclenar division in the intervals between the ridges of the mesotesta into 2-4 rows of radially elongate. Seed is ellipsoid, more or less compressed, sometime, smooth or tubuled or spiny. That means seed is spiny but fruit is multiseeded and present fossil fruit is single seeded so, it is different from these family. In family Cappariaceae, ovules anatropous, bitegmic, crassinucleate, micropylar formed by the exostome, out of line with the endostome or formed by the endostome. In *Cleome viscosa*, anatropous ovule, seed compressed, dark brown to blackish, transversely rugulose. Testa consist of much enlarge hyaline cells extending between the ridges of tegmen.

According to the Hooker (1875) Flora of British India., (vol.1) Ranunculaceae to Sapindaceae, London and Duthie J. R. (1903) Flora of the Upper Gangetic plane and of the adjacent Siwalik and sub- Himalayan tracts (Vol. 1, Part 1) Ranunculaceae to cornaceae.

Fruits of extant *Carica papaya* (Caricaceae), *Cleome viscosa* & *Capparis spinosa* (Cappariaceae), *Avertroa bilimbi* (Oxalidaceae), *Calophyllum inophyllum* (Calophyllum), *Moringa oleifera* (Moringaceae) for comparison.

Comparison with reported fossil unilocular capsular as well as achene fruit.

Unispermospinocarpon keriensis (Kapgate & Paliwal, 2016) fruit small, capsular, unilocular, single seeded, small stalked, having a spiny outgrowth from mesocarp, dry dehiscent fruit with basal placentation. *Portulacaceocarpon bhuterensis* (Borkar, Nagrale, Meshram, Korpenwar and Ramteke, 2016), unilocular, multiseeded, dehiscence capsule.

Table 1: Taxonomical and anatomical character.

Cappariaceae	Caricaceae	Calophyllum	Moringaceae	Oxalidaceae	Present fossil fruit
Fruit multiseeded, seed contain transversely rugulose.	Fruit unilocular, multiseeded, seed is spiny.	The fruit is a drupe with thin layers of flesh over a large seed.	Fruit are angular dehiscent capsules. The seeds have three whitish papery wings.	Fruit multiseeded, Seeds have Small ridges.	Unilocular, single seeded seed spiny or ridges.

These content downloaded from family Caricaceae, Cappariaceae, Calophyllum, Moringaceae and Oxalidaceae, on 16 December, 2017, 12:54 PM.

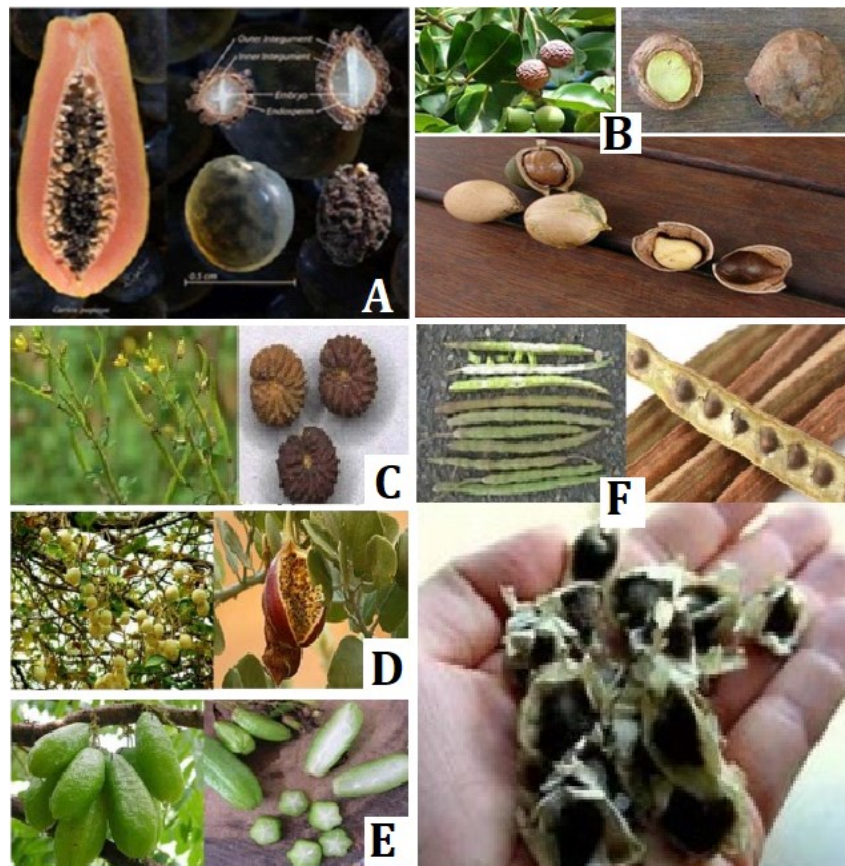
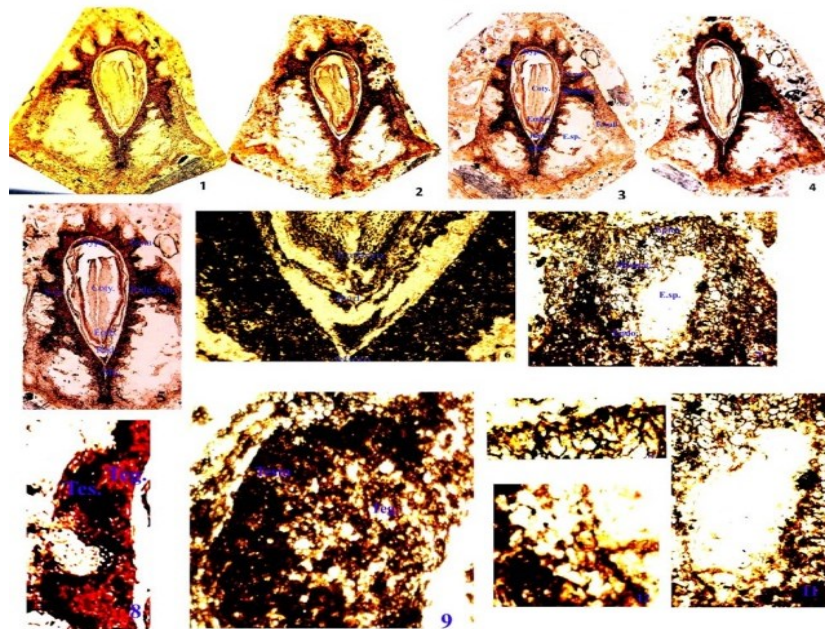


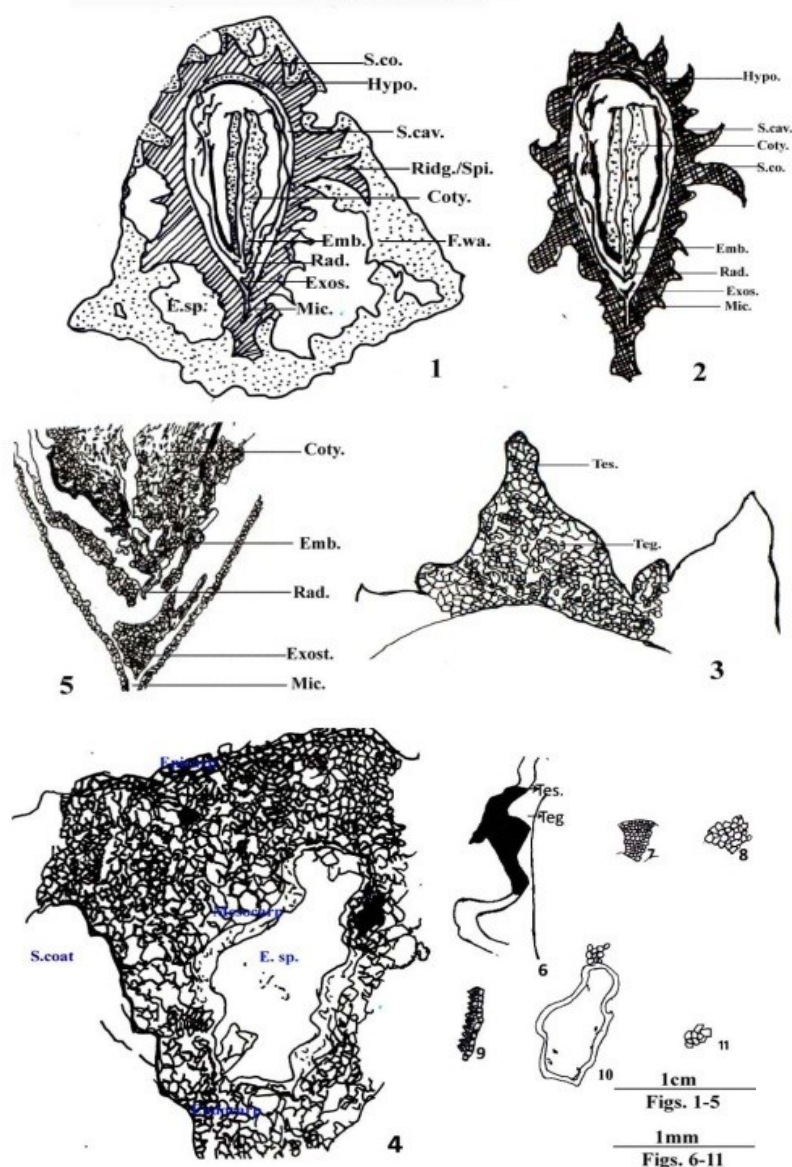
Plate 1: **A:** *Carica papaya* (Caricaceae), **B:** *Calophyllum inophyllum* (Calophyllum), **C:** *Cleome viscosa*
D: *Capparis spinosa* (Capparidaceae), **E:** *Averrhoa bilimbi* (Oxalidaceae), **F:** *Moringa oleifera* (Moringaceae)



Spinosuscarpon mohganii gen. et sp. nov.

Plate 2: **Fig. 1-4:** Complete Fruit in Ob. L.S. part and counterpart appeared on fossiliferous chert showing multilayered fruit wall (F.wall); Locule (L) with single spiny seed (S). **Fig. 5:** A single spiny seed occupying completely lumen of locule. bitegmic seed shows seed coat is Ridges or spiny (Redg. or Sp.) with testa; Hypostate (Hypo.); cotyledon (Coty.); Embryo (Emb.); Radical (Rad.); Micropylar opening (Micro.). **Fig. 6:** Magnified structure of Radical (Rad.), Embyo (Emb.); Micropylar opening (Micro.). **Fig. 7:** Fruit wall showing Epicarp (Epi.); Mesocarp (Meso.) and Endocarp (Endo.), **Fig 8:** Testa (Tes.) and Tegmen (Teg.), **Fig. 9:** Magnified Testa (Tes.) and Tegmen (Teg.), **Fig 10:** Magnified Epicarp, **Fig 11:** Magnified Mesocarp with Empty space, **Fig 12:** Magnified Endocarp

Text Fig 1-11



Spinosuscarpon mohgani gen. et sp. nov.

Plate 3 : Fig 1: Complete Fruit in Ob. L.S. counterpart appeared on fossiliferous chert showing multilayered fruit wall (F.wall); Locule with single spiny seed. **Fig. 2:** A single spiny seed; Seed shows seed coat is Ridges or spiny. Hypostate (Hypo.); cotyledon(Coty.); Embryo (Emb.); Radical (Rad.); Exostome (Exos.) with Micropylar (Mic.) opening. **Fig. 3:** Magnified of seed coat shows testa (Tes.) and tegmen (Teg.); **Fig 4:** Fruit wall showing Epicarp; Mesocarp with fleshy part and empty space (E. Sp.) and Endocarp; **Fig 5:** Cell of Embryo (Emb.); Cotyledons (Coty.); Radical (Rad.); Exostome (Exost.); Micropylar opening (Mic.); **Fig 6:** Part of seed coat i.e.Testa (Tes.) and Tegmen (Teg.). **Fig 7:** cell of testa. **Fig 8:** cell of tegmen. **Fig 9:** Epicarp cell. **Fig 10:** Mesocarp cell. **Fig 11:** Endocarp cell.

Ranunculaceaeocarpon jamsavlii (Bonde & Narkhede, 2013), fruit unilocular indehiscent capsule, with hook, pericarp is differentiated into three zones, epicarp with parenchymatous cells, mesocarp sclerenchymatous and endocarp parenchymatous. Seed elongated Unitegmic, seed encloses dicot embryo. *Tiliaceaeocarpon jamsavlii* (Meshram, Narkhede and Bhowal, 2013), fruit capsular, unilocular, indehiscent,

hexagonal with multi-layered pericarp thin walled parenchymatous cells, single seeded Unitegmic. Embryo present and endospermic tissue present.

Portulacaceocarpon jamsavlii (Bhowal, Narkhede and Meshram, 2011), unilocular, multicarpellary and dehiscence.

Compositaeocarpon jamsavlii (Yadav, 2010) fruit unilocular, indehiscent cypsela, stalked with hook. Seed is Unitegmic, seed encloses dicot embryo.

Tamaricaceocarpon patilii (Yadav, 2010) fruit dicotyledonous, unilocular capsule, seed coat differentiated into testa and tegmen. The outer epidermis of the outer integument persists with hair like projection.

Valvulocarpon chitaleyii (Yadav, 2010) fruit unilocular capsule, single seeded, seed bitegmic in nature. Embryo not preserved.

Spinocarpon intertrappea (Dahegaonkar 2002) fruit dicotyledonous indehiscent, unilocular, spiny, single seed in a locule.

Geraniocarpon intertrappea (Dahegaonkar 2002) fruit dicotyledonous, capsular, unilocular, single seeded, loculicidal dehiscence.

Cyperceocarpon sahnii (Dutta & Ambwani, 2005), fruit nut like (achene) trigonally – oval, small, pericarp apparently granulate, ridges and furrows present, cells compact, verrucate, interlocked.

Achenocarpon mohgaonii (Gedam, 2004), fruit obovoid in shape with uneven pericarp, dicotyledonous, single seeded, unilocular, dry, indehiscent, achene with basal placentation. Seed bitegmic, orthotropous, pyriform with prominent stalked, seed coat two layered, embryo apical, endosperm uniform. *Boeluneria intertrappea* (Ambwani, Kar, Srivastava & Dutta, 2004), the fruit is an indehiscent achene, more or less circular to oval. *Amaranthocarpon mohgaonese and Amaranthocarpon Intertrappea* (Saxena, 2004), fruit is unilocular, indehiscent, spines on entire epicarp, with single large seed, seed coat bitegmic with ill preserved embryo pericarp multi-layered and differentiated into epicarp, mesocarp and endocarp.

Prakashocarpon mohgaonse (Dahegaonkar, 2002), fruit are two, dicotyledonous, one smaller and other larger in size and shape. Each fruit is having an independent stalk. Each containing a single seed, embryo is elongated e straight.

Ceratocarpon spinosa (Adhao, 1986), fruit simple one locular, one seeded achene, fruit wall multicellular,

spiny with persistent style, seed ovoid, filling fruit cavity, embryo small, endosperm present.

Monimiocarpon mohgaonse (Lanjewar, 1986), Fruit simple, unilocular single seeded achene, oval, fruit wall multiple, wall differentiated pericarp is epicarp, mesocarp and endocarp. Seed restricted to upper half of the fruit, ovule to oblong, attachment lateral embryo dicotyledons, flat and globular.

Capparisocarpus nagpurii (Konde & Kolhe, 2012), Seed is Campylotropous, exarillate and exalbuminous, vascular supply is seen in the inner layer of wall i.e. tegmen, Embryo with two flat cotyledons, long hypocotyl curved by two bends, Nucellar tissue parenchymatous.

The diagnostic feature exhibited by the present fossil fruit is Fruit dicot, simple, unilocular, single spiny seed, indehiscent, dry, basal placentation, polygonal shape. These character is not compare with oldest fossil fruit as well as exactly similar to living. So it is not shows any known families. Hence, for the being character of seed of the fruit is spiny nature and collected from Mohgaonkalan so, it is named *Spinosuscarpon mohganii* gen. et sp. nov.

DIAGNOSIS

Spinosuscarpon gen. nov.

Fruit was dicot, simple, capsule, unilocular, single spiny seed, indehiscent, dry, basal placentation, polygonal shape. Outer layer of fruit wall or pericarp is epicarp, middle layer is mesocarp and inner is endocarp. The seed is large, dicotyledonous, anatropous, bitegmic, briollette with spiny seed coat. Seed coat is spiny multicellular, it is differentiated into testa and tegmen. The seed shows micropylar opening. exostome well developed at the micropylar opening. Embryo is well developed and preserved. Embryo is large and almost occupies the space of seed cavity. Cotyledons are large. At the side of chalazal end of seed unligified massive, disclike, Hypostase structure is seen.

Spinosuscarpon mohganii gen. et sp. nov.

Fruit dicot, simple, capsule, unilocular, single spiny seed, indehiscent, dry, basal placentation, polygonal shape. It is 1.1 cm long and 1cm wide. fruit wall is 0.5 – 4.5 mm thick, fruit wall differentiated into three zone. fruit wall or pericarp is differentiated into outer layer epicarp mesuring 0.1 – 1 mm thick, middle layer is

mesocarp measuring 0.3 – 3 mm thick and inner is endocarp measuring 0.1 – 0.5 mm thick. The outer layer epicarp is thick walled parenchymatous cell. Middle layer mesocarp is thick walled cells. inner layer is endocarp. The seed is large measuring 9 mm long and 6 mm broad, dicotyledonous, anatropous, bitegmic, briquette with spiny seed coat. Seed coat measuring 1 – 2 mm thick is spiny multicellular and differentiated into testa and tegmen. The seed shows micropylar opening. exostome well developed at the micropylar opening. Embryo is well developed and preserved. Embryo is large and almost occupies the space of seed cavity. Cotyledons are large measuring 4.5 mm long and 1 mm thick. At the side of chalazal end of seed, unligified massive, disclike, Hypostase structure is seen, measuring 1.7 mm long and 0.2 mm thick.

Holotype - JPN/Ang/ Fruit – 2

Department of Botany,
D.B. Science college Gondia.

Locality - Mohgaonkalan, Chhindwara,
M.P. India.

Horizon - Deccan Intertrappean Series of
India.

Age - Upper Cretaceous

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