

***Patanocarpon deccanii* GEN. Et. Sp. Nov. A New Genus of Bilocular Capsular Fruit from the Deccan Intertrappean Beds of Marai Patan, Maharashtra, India.**

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Abstract: The present paper describes a new petrified fruit from the Deccan Intertrappean Beds of Marai Patan. The present material is a bilocular, sessile, single-seeded, capsular fruit. The pericarp i.e. fruit wall is differentiated into epi, meso, and endocarp. The fruit is measured about 1600 µm in length and 678.9 µm in width.

The fruit embryo of fruit is a multilayered, dicotyledonous. The ovary is bicarpellary, syncarpous with septicidal dehiscence. The fruit discussed in this paper is compared with the reported fossil flora of bilocular fruit and the modern living genera from the families like ‘Polemoniaceae, Convolvulaceae, Hydrophyllaceae, Verbenaceae, Callitrichaceae, Labiatae, Scrophulariaceae, Acanthaceae, Pedaliaceae, Gesneriaceae, and Lentibulariaceae’.

Characteristics of this fruit neither shows any affinity with reported fossil nor with living flora, resulting in the formation of a new genus, *Patanocarpon deccanii* gen. et sp. nov. The generic name signifies the locality from where the fossiliferous chert was collected and a specific epithet derived from the name of the Deccan Intertrappean Beds of India.

Keywords: bilocular, capsular, Deccan Intertrappean, dicotyledonous.

INTRODUCTION: -

The flora of Deccan Intertrappean Beds is comparatively prosperous in fossil angiosperms. The specimen presented deals with elaboration of the morphological as well as anatomical characteristics of a petrified fruit collected from the Deccan Intertrappean Beds of Marai Patan, Jivati tahsil of Chandrapur District, Maharashtra, India.

So far, many bilocular fruits have been reported from the Deccan Intertrappean beds of India. *Biloculaire intertrappea* (Kate, 1974), *Mahabaleocarpon deccanii* (Sakundarwar, 1987), *Nautiyalocarpon singhpurii* (Juneja, 1993), *Schizocarpon aliformii* (Bhowal and Sheikh, 2002), *Rodeocarpon deccanii* (Saxena, 2004), *Bicarpelocarpon singhapurii* (Bhowal and Sheikh, 2008), *Verbenaceocarpon mahabalei* (Dhabarde et al., 2012), *Loganiocarpon deccanensis* (Kokate et al., 2013), *Coffeocarpon deccanii* (Dighe, 2016), and *Gentianaceocarpon singhpurii* (Khursel, 2019).

Material and Method:

A piece of chert has been collected from a well-known fossiliferous locality of Marai Patan of Chandrapur Dist., Maharashtra. After breaking and etching the chert with hydrofluoric acid (HF), it is observed that specimen is cut transversely. The peeling technique is used for taking serial peel sections. The specimen is present in both part and counterpart. A permanent slide is mounted on Canda Balsom and studied under microscope for their morphological and anatomical characteristics.

Description:

Fruit Morphology: The fossil fruit is bilocular; the basal locule is comparatively large and broad, while the terminal locule lies over the broad locule. In the counterpart of fruit, the basal locule is more or less the same, but the terminal locule is bulged at the base, narrow in the

middle, and bulbous at the apex. This is the unique feature of this material. The fruit measures 1600 μm in width and 678.9 μm in length.

Fruit Anatomy: The anatomical studies of the fruit reveal the following characteristics.

Pericarp: It is prominent, fibrous, and differentiated into epicarp i.e. outer fruit wall, mesocarp i.e. middle and endocarp i.e. inner fruit wall and measures about 655.3 μm wide.

Epicarp: It is multilayered with loosely arranged parenchymatous cells. It measures about 142.1 μm in width.

Mesocarp: It is broad and fibrous, and lacunar spaces are present throughout the layer. It measures about 378.9 μm in width.

Endocarp: The inner wall of the fruit is narrow, made of a single layer but hard and strong. It measures about 86.6 μm in width.

Locule: The fruit shows two locules. The basal locule is broad, fertile, and ellipsoidal-vibrillous in shape. It measures about 1339 μm in width, and the terminal locule is triangular at the base and developed into a long oblong shape; having a bulb at the terminal end is the unique feature of this specimen.

Seed: The seed is large and occupies the central cavity of the fruit; thus, the length of the seed is equal to the length of the locule; however, the seed coat does not fuse with the pericarp. The seed coat is thick and unitegmic. The single seed is present in each locule. Upper locules dehisced on the junction of septa, thus septicidal dehiscence.

Embryo: It is well-preserved, relatively large and curved, multilayered with an irregular shape of parenchymatous cells. The embryo is dicotyledonous; there are no cellular details that could be preserved inside the embryo. At some point the embryo and seed coat overlap with each

other. Since the embryo occupied the entire lumen of the seed, endospermic tissue could not be preserved.

Discussion and identification—

The above-described specimen reveals the following important details for its identification.

1. The fruit is capsular, obtuse, triangular in shape, bilocular, fibrous with septicidal dehiscence, fertile locule is single seeded.
2. Each fertile locule contains only one seed; thus, the sum of all seeds in the fruit is two.
3. The pericarp is differentiated into endocarp, mesocarp, and epicarp.
4. Endosperm is absent.
5. The embryo is large, curved, and dicotyledonous.
6. The seed coat is thick and unitegmic

From all these characters, it is help to concluded that, the fruit with two ovules is formed from the ovary of bicarpellary, syncarpous with basal placentation. Thus, the characteristics of the fruit considered as dry, dehiscent, and capsular.

Comparison with fossil fruit

The studied fossil fruit shows great variations from the previously described fossil fruit in a number of characters.

The present fossil fruit is distinctly different from previously described bilocular fossil fruits as follows.

Biloculare intertrappea (Kate, 1974) is a bilocular, schizocarpic fruit with a single large seed in each locule, and oil or resin ducts are present in the outer and inner zones while the present fruit is a bilocular, dicotyledonous, capsular fruit.

Mahabaleocarpon deccanii (Sakundarwar, 1987) is a bilocular, drupaceous fruit with irregular growth of the fruit wall, while the present material is a bilocular, dicotyledonous, capsular fruit.

Nautiyalocarpon singhpurii (Juneja, 1993) is a bilocular drupe fruit with two fertile chambers and a dome-shaped receptacle, while there is no such receptacle seen on the present fruit. Even present fruit is different in terms of capsular fruit.

Schizocarpon aliformii (Bhowal, 2002) is a bilocular fruit having the eye shape structure. This fossil fruit have an empty middle space with two fertile chambers. But the present fruit is a bilocular, capsular fruit.

Rodeocarpon deccanii (Saxena, 2004) is a bilobed, bilocular, septicidal capsule with numerous seeds, whereas the present fruit has only one seed in each locule.

Bicarpelocarpon singhapurii (Bhowal, 2008) Septa of this fruit contain empty air spaces but the present fruit is without an air chamber.

Verbenaceocarpon mahabalei (Dhabarde et al., 2012) is a single-seeded, bilocular, drupaceous fruit, while the present fruit is a bilocular, capsular fruit.

Loganiocarpon deccanensis (Kokate et al., 2013) is a bilocular, dicotyledonous, capsular fruit with axile placentation, while the present fruit is bilocular, dicotyledonous, and capsular with basal placentation.

Coffeocarpon deccanii (Dighe, 2016). This bilocular berry fruit is globular and fleshy in nature, while the present fossil fruit is obtuse, triangular, and capsular.

Gentianaceocarpon singhpurii (Khursel, 2019) is a bilocular, capsular fruit that is well preserved on a small stalk. One locule is large and fertile, while another locule is small and sterile. Whereas the present fruit is bilocular and capsular, and both locules are large and fertile.

Comparison with living fruit

The present specimen shows clear characteristics like bilocular, capsular, dicotyledonous, fibrous fruit, each locule contain only single seed. With this characters present specimen are now compared with different living families of order Gentianales, Oleales, and some families like “Polemoniaceae, Convolvulaceae, Hydrophyllaceae, Verbenaceae, Callitrichaceae, Labiatae, Scrophulariaceae, Acanthaceae, Pedaliaceae, Gesneriaceae, and Lentibulariaceae”.

Families like “Apocynaceae, Gentianaceae, Rubiaceae and Loganiaceae included under the Order Gentianales.

In Apocyanaceae, usually there are two lobes in carpel, number of ovules is infinite and ovules are anatropous. The capsular fruit like *Allemanda*, fruit follicle eg. *Plumeria* and *Nerium*, the berry fruit of this family eg. *Arissa* and drupe fruit *Thevetia*. When ovaries are fused, they show axile placentation, whereas the studied fruit has marginal placentation.

Gentianaceae family has bicarpellary, syncarpous, ovary. The fruit is usually unilocular, while present specimen fruit have two locules.

In Rubiaceae, though fruits are capsular, and dehiscent either on septa or locule. There are many seeds present on the locules, but the present fruit is single seeded.

Family Loganiaceae, the ovaries are bicarpellary, syncarpous and having two locules and the number of the ovules are many. In this family a fruit are capsular, and sometimes the winged seed are found, but in the present material, the fruit is capsular, the fruit is dehiscent on septa.

Family Oleaceae, is the only family comprises in the order Oleales. The ovaries are bicarpellary, syncarpous, fruit having two locules with 2 ovules. Loculicidal capsules are seen in *Syringa* and *Forsythia*, circumscissile capsules in *Menodora*, or samaras as in *Fraxinus* whereas studied fruit shows septicidal capsules.

Convolvulaceae, Callitrichaceae, Labiatae, and Pedaliaceae show two ovules in each locule, or by the formations of false septum fruit seemed to be a tetralocular, while the present fruit has single ovules in each locule.

The fruit is unilocular in the family Hydrophyllaceae; sometimes seeds are sculptured, carunculate, muricate or reticulate.

In Family Verbenaceae, 2-4 celled superior ovary is present, with two ovules. The fruits of this family are usually drupes. The number of the pyrenes are equals to the numbers of the ovules in the ovary or nutlet as it is found in *Verbena*. If are capsular, two to four-valved, such structure is not found in the present fruit.

Fruits of family Polemoniaceae are trilocular, capsular with loculicidal dehiscence. Sometimes a mucilaginous coating is present on seed as in *Collomia* and *Gilia*. The present fruit is different in terms of bilocular, septicidal capsule, and no such mucilaginous coating is seen in the present fruit.

In family Gesneriaceae, ovary is unilocular with many ovules. The fruits are capsular with loculicidal dehiscence. Each locule contain numerous seeds.

Family Lentibulariaceae shows a bicarpellary, syncarpous, superior ovary but differ in the dehiscence of capsule from 2-4 valved, irregular splitting also found in this family.

The present petrified fruit shows closest resemblance with family Acanthaceae such as bilocular, bicarpellary, syncarpous, superior ovaries; loculicidal dehiscent, capsular fruit with one or sometimes more than ovules are present. But present fossils fruit shows a septicidal dehiscence, and a single seed is present in each locule.

Discussion and Comparison as above, it is concluded that the present petrified fruit under investigation neither reveals any affinity with already reported fossil fruits nor with the fruits of living families.

For this reason, the name is given to present fossil fruit as *Patanocarpon deccanii* gen. et sp. nov. The generic name of fruit signifies the locality from where the fossiliferous chert was collected, and a specific epithet is derived from the name of the Deccan Intertrappean Beds of India.

Diagnosis

Fruit is an obtuse, single-seeded capsule with two locules containing a single seed. The pericarp is differentiated into endocarp, mesocarp, and epicarp. A thick, single layered unitegmic seed coat is present. The embryo is large, curved; dicotyledonous without endosperm.

Patanocarpon deccanii gen. et sp. nov.

The present fruit is obtuse to triangular, bilocular, capsular, fibrous and septicidal dehiscence, with a single seed in two fertile locules. The fruit measures 1600 µm in width and 678.9 µm in length. The pericarp is differentiated into endocarp, mesocarp, and epicarp. The

pericarp measures about 655.3 μm . The epicarp is multilayered and measures about 142.1 μm in width; the mesocarp is broad, fibrous, and measures about 378.9 μm in width. while the endocarp of the fruit is narrow, made of a single layer but hard and strong, and measures about 86.6 μm in width. The seed coat is thick. The embryo is large, curved, and dicotyledonous.

Holotype: RHN/Angi. fruit/Deposited at Dept. of Botany, Dr. Ambedkar College, Chandrapur.

Horizon: Deccan Intertrappean Bed of India.

Locality: Marai Patan, Jiwati, Chandrapur, M.H., India.

Age: -? Upper Cretaceous.

*Patanocarpon deccanii***Explanation of Photo Plate I**

Photos 1-3: A typical fruit in L.S. showing the development of bilocular fruit.

Photo 4: A typical fruit in L.S. showing septa of locules.

Photo 5: A typical fruit in L.S. showing dehiscence of the fruit.

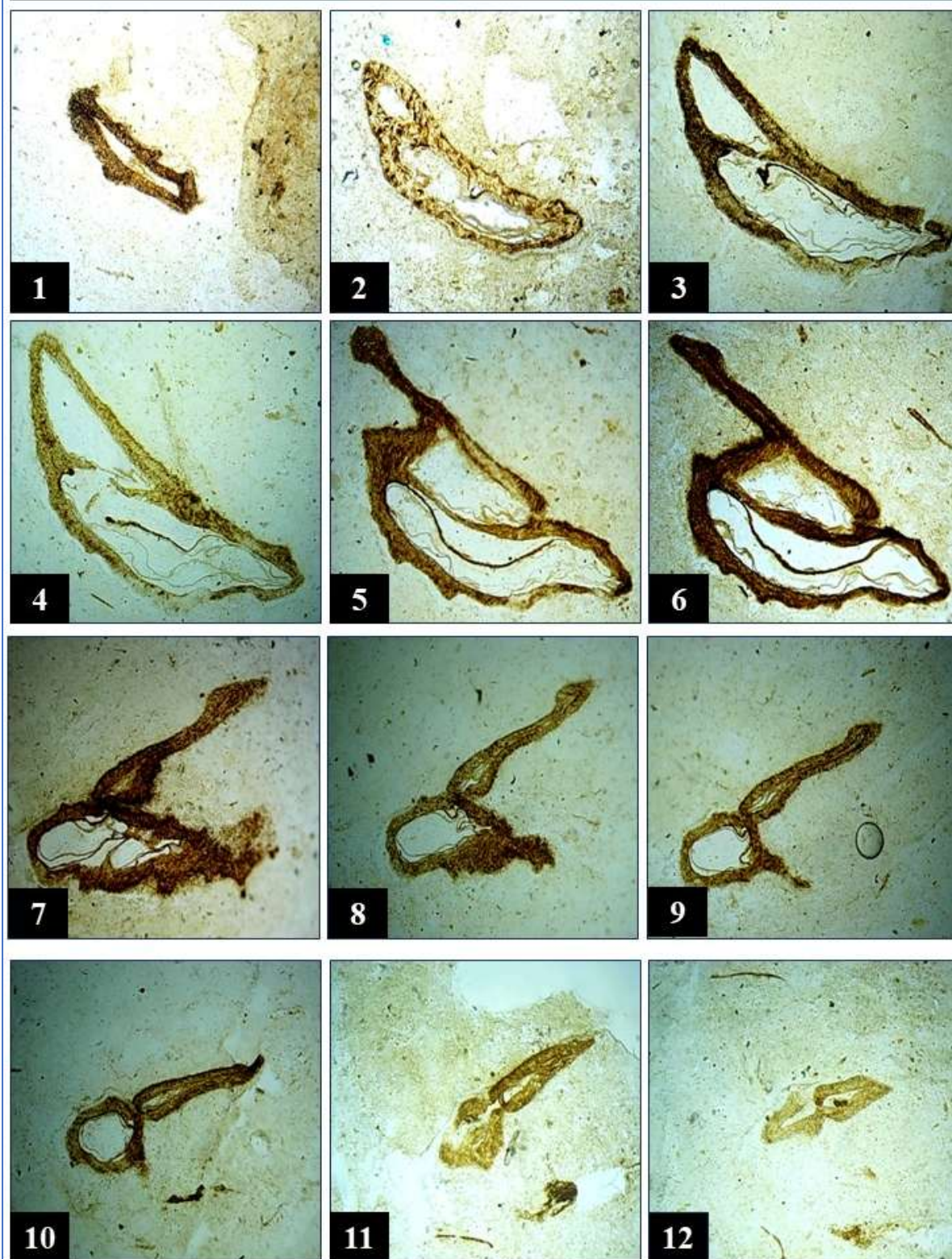
Photo 6: A typical fruit in L.S. showing a long, oblong-shaped locule.

Photos 7-9: A typical fruit in L.S. showing its counterpart.

Photo 10: A typical fruit in L.S. showing its reduced size.

Photo 11-12 shows the disappearance of fruit.

PHOTO PLATE : I PHOTO 1 to 12

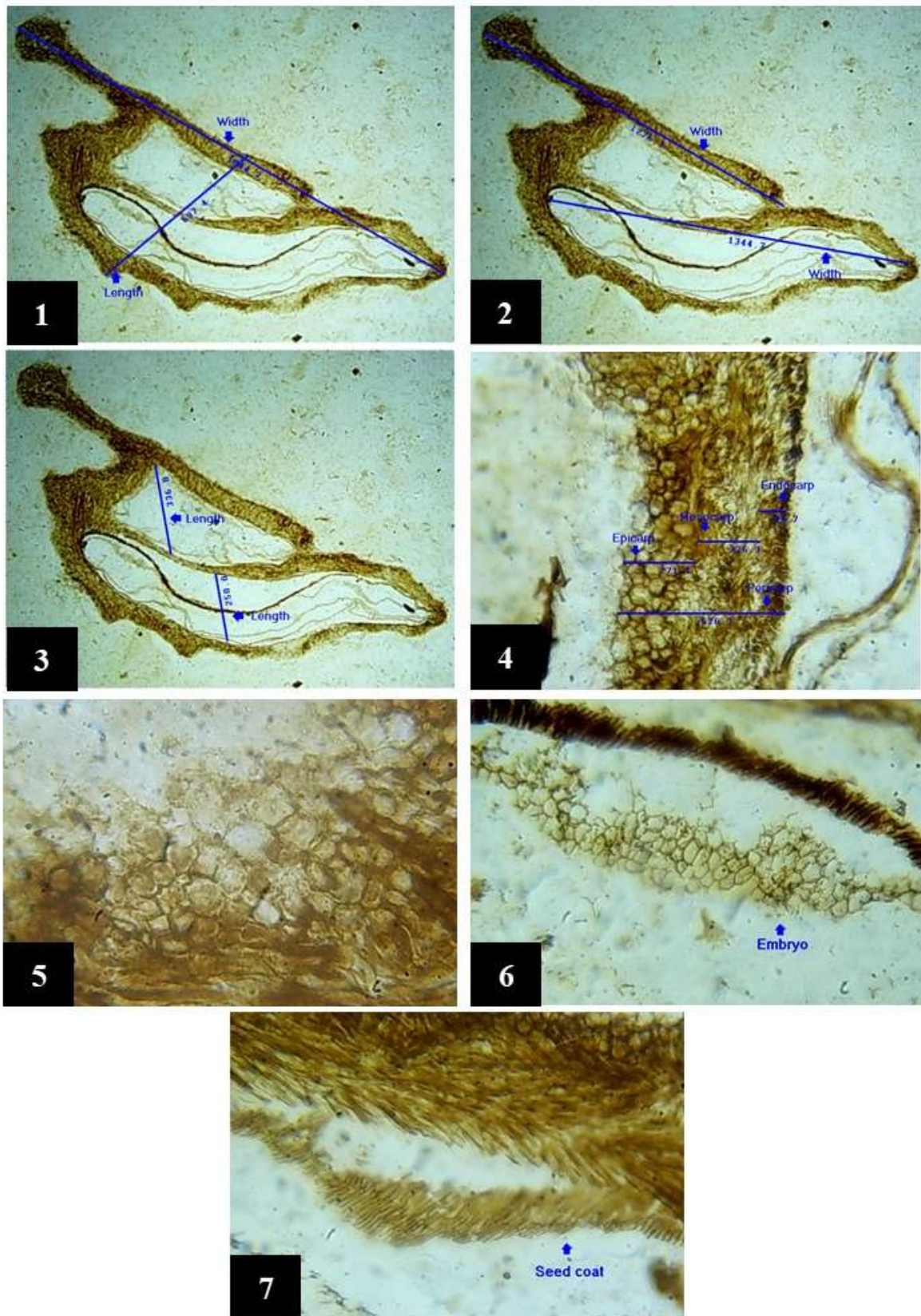


Patanocarpon deccanii

Explanation of photo plate II

1. L.S. of fruit showing fruit width and length... ..X20
2. L.S. of fruit showing locule's width... X20
3. L.S. of fruit showing length of locules... ..X20
4. L.S. of Pericarp showing Epicarp, Mesocarp, and Endocarp... ..400
5. Sclerenchymatous cells of Epicarp.....X1000
6. Multilayered embryo with seed coat... X400
7. L. S. of fruit showing seed coat... ..X1000

PHOTO PLATE II: PHOTO 1 - 7



REFERENCE:

- Bhowal M and Sheikh MT, 2008. A petrified dicot fruit, *Bicarpelarocarpon singhpurii*, from Deccan Intertrappean Beds of Singhpur, M.P., India. *Palaeobotanist*, 57(3):443-447.
- Bhowal, M. & Sheikh, M.T. (2002). A petrified dicot fruit from the Intertrappean beds of Singhpur, Madhya Pradesh, *Trends in Life Sciences (India)*, 17(2): 89-101.
- Cook, C.I.E. (1958-67) The flora of the presidency of Bombay. Bot. Survey of India, Calcutta. 4.
- Corner, E. J. H. (1976). *The seeds of dicotyledons* (Vol. 1). Cambridge University Press.
- Dhabarde, P. F., Sheikh, M. T., and Kolhe, P. D. 2012. A petrified bilocular fruit from the Deccan Intertrappean beds of Singpur, Madhya Pradesh. *Bio. Innov.* 1 (1): 1-5.
- Dighe, S.W., Kokate, P.S. 2016. *Coffeocarpon deccanii* gen. et sp. nov. A New Petrified Dicotyledonous Berry Fruit from Deccan Intertrappean Beds of Central India. *International Journal of Scientific Research*. V5: 275-277
- Hooker, J. D. (1961). The Flora of British India. Vol. I, II, and III. L. Reeve & Co., England.
- Juneja, C.D. (1993). Study of uppermost Intertrappean flora of Central India. Ph.D. Thesis, Nagpur University, Nagpur.
- Kate, U.R., Studies of Deccan Intertrappean Flora of India, Ph.D. Thesis, Nagpur University, Nagpur, 1974.
- Khursel , A. S., & Narkhaede, S. D. (2019). A NEW PET SP.RIFIED BILOCULAR CAPSULAR FRUIT GENTIANACEOCARPON SINGHPURII GEN. ET SP.NOV FROM THE DECCAN INTERTRAPPEAN BEDS OF SINGHPUR, M.P., INDIA. 8(7).

- Kokate, P. S., Upadhye, E. V., & Bhadange, D. G. (2013). *Loganiocarpon deccanensis* gen. et sp. nov. *A bilocular capsular fruit from Deccan Intertrappean beds of Mohgaonkalan, Madhya Pradesh, India. Geophytology*, 43(2), 105-109.
- Sakundarwar, R. S. (1987). Investigation of plant remains from Deccan intertrappean exposures of India. Ph.D. Thesis, Nagpur University, Nagpur.
- Saxsena, N. N. (2004). Angiospermic fossil flora of central India. Ph.D. Thesis, Nagpur University, Nagpur.