



## REPORT OF SOME FOSSIL ANGIOSPERM FLORA FROM THE NEW EXPOSURE AT PUDIYALMOHADA IN JIVATI TALUKA OF CHANDRAPUR DISTRICT

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### Abstract:

The present paper deals with the study of some angiosperm flora including palm wood with roots and a dicot flower and fruits collected from a new exposed near village Pudiymohada of Jivati taluka of Chandrapur District. The locality (N19°34.269' E079°01.866') shows well preserved fossil flora belongs to Deccan Intertrappean Beds of India (65-70 millions age). It spared along the road side, in the field and nearby foot of hill. The palm stems and isolated roots are found scattered. The Black chert shows well preserved flora, some of them found by naked eye. Few dicot fruits with one flower found embedded in black cherts are exposed while breaking and etching by Hydrofluoric acid. The monocot wood shows resemblances with Palmoxylon and isolated roots as Rhizoplamoxyton. The dicot flower is of Sahnianthus and fruit is capsular, showing loculicidal dehiscence. It is globular in shape containing six to eight locules having many seeds in each arranged in two rows showing axile placentation. These fruits resembles with reported **Enigmocarpon** fruits with minor differences, hence named as **E. chandrapurensis** sp. nov.

**Keywords:** Fossil, petrified, palm, dicot, flower, capsular fruit, Deccan, Intertrapps

### Introduction:

Angiosperm flora forms a major group of the Indian Deccan Intertrappean beds. Practically all the parts of the Angiosperm tree, viz., roots, stems, leaves, petioles, Inflorescence, flowers and fruits etc, have already been described in fossil state from the Deccan Intertrappean beds of India (Chitaley, 1962; Prakash, 1972; Lakhanpal, 1973, Kapgate 2005). Palms occur quite commonly in the Indian Tertiary's especially in the Intertrappean Beds.

Chandrapur is the easternmost district of Maharashtra and lies between 19° – 30' and 20°– 45' North latitudes and 78° 48' and 80° 55' east of longitudes. It covers an area of 11,443 sq.km. Geologically this area is well known as Gondwana belt but few Deccan Intertrappean exposures are also found. Some of these are Shankar lodi (N 19° 31.847; E 078° 58.469), Paramdoli (N 19° 32.403; E 078° 56.995), Maraipatan (N 19° 32.166; E 079° 07.521), Lendiguda (N 19° 32.004, E 079° 04.747), Pudiymohada (N 19° 38.269, E 079° 01.866), Kakezari (N 19° 34.923, E 079° 00.347), Bhari (N 19° 29.819, E 079° 11.166). Most of these localities consist illpreserved plant materials and gastropods. So far only *Nautiyalocarpon patanii* (Dahegaonkar, 2002), *Selaginella homophyllii* (Kapgate and Wanjari, 2014), *Marsilea patanii* (Patil et al. 2014) are reported from Patan (Maraipatan) locality. The present paper deals with the study of new petrified monocot stem and roots and a dicot

flower and capsular fruit which are collected from a new locality exposed near village Pudiymohada on Gadchandur-Patan Road and 25km away from Gadchandur of Jivati taluka, Chandrapur District. The locality ( N19°34.269' E079°01.866') shows well preserved fossil flora of all plant groups belongs to Deccan Intertrappean Beds of India of uppermost Cretaceous (Danian) to lower Eocene period (Plate figs. 1and2).

### Material and Method:

The fossiliferous cherts had been collected from the new Deccan Intertrappean beds of Pudiymohada, M.S., India. While breaking the cherts few fruits and a flower were exposed. After etching the specimens with hydrofluoric acid (HF), serial peel sections are taken with Cellulose Acetate peel Technique (Darrah, 1936). The peels were mounted in DPX and photographed.

### Description:

Following typical angiosperms genera are found well preserved and so considered for study:-

#### **Palm wood :- *Palmoxylon* sp.**

The Palm wood consists only of central cylinder, cortical region unrepresented. In the peripheral region fibrovascular bundles somewhat congested, rarely touching the adjoining bundles, central bundles more diffuse usually no marked difference in size of peripheral and central bundles, bundles mostly oval to somewhat dumbbell shaped, bundles of outer zone 210-420 µm by 270-610 µm and

central zone 490-620  $\mu\text{m}$  by 485-820  $\mu\text{m}$  in size, 160-200 per sq. cm, dorsal sclerenchyma and ventral sclerenchyma as such cannot be separated, sclerenchyma forming complete sheath around the xylem and phloem tissue median sinus small, round to angular; xylem consists of 2-4 vessels, most bundles show a single phloem strand, sometimes phloem is divided into two strands by median fibrous partition, stigmata not seen; small fibrovascular bundles present. Ground parenchyma small patches of ground parenchyma occurring among the fibrovascular bundles, compact, homogeneous, with small intercellular spaces. Fibre bundles absent (Plate fig. A).

**Palm roots :- *Rhizopalmoxyton* sp.**

The root mantle embodies adventitious coralloid roots embedded in the chert matrix (Plate figs. BandC). They are circular, small to medium sized, 3.0- 7.0 mm in diameter. Rhizodermis is single layered devoid of root hairs, made up of rectangular, suberized. Exodermis is 3-5 layered, made up of hexagonal cells with truncate radial walls. Outer cortex is single zoned, 3-7 layered with polygonal, thick walled, 27 x 41  $\mu\text{m}$ . Inner cortex is 8 mm to 10.5 mm wide and composed of three distinct zones. Outer zone is 3-5 layered and made up of small, compactly arranged cells with few intercellular spaces. Middle zone is 1-3 mm wide, cells large, intercellular spaces wider forming the aerenchyma. Air cavities vary in size. Inner zone 3-5 layered, made of dense tissue of smaller cells arranged in concentric circles with small intercellular spaces. Endodermis is the innermost layer of the inner zone, single layered composed of cells with unthickened outer walls. Passage cells have not been observed. Fibre cells are irregularly distributed in the outer and middle zones of inner cortex. Pericycle is the outermost layer of the vascular cylinder. It is 1-3 layered with thin walled cells. Inner side of the stele consists of 12- 15 separate xylem and phloem bundles at different radii, alternate to one another in the thick walled sclerotic conjunctive tissue composed of elongated fibre-like cells. The xylem bundles consists of a radial series of tracheary elements. The innermost metaxylem vessels are the widest round to oval, 165 – 870  $\mu\text{m}$ . Phloem bundles are circular, 150 x 180  $\mu\text{m}$ . Pith is circular, 0.9-1.3 mm in diameter (Plate fig. F). Medullary bundles are 1-3, present in medium sized roots only. The medullary bundle consist a single large vessel surrounded by a fibrous sheath. Pith is circular, sclerenchymatous. The smaller roots of 0.5-1.0 mm size show minor differentiation in the inner

cortical tissues with a solid parenchymatous pith (Plate figs. DandE).

**Dicot flower :- *Sahnianthus* sp.**

The present flower is Actinomorphic, hermaphrodite, heterostylous, calyx 10.5 mm in length and 1.8 mm across the base of the calyx tube, pedicel slender and at least 4.5 mm long. Calyx tubular, 8 lobed, valvate, gibbous at the base, perhaps for storing some secretory fluid, Corolla not preserved. Androecium of at least 8 stamens episealous, inserted often low down in the calyx tube, filaments variable in length, usually inflexed in younger flower, anther dorsifixed, .2 mm in length and 1.2 mm in width, 2 lobed, connected situated at one third the distance from the top end of the anther, dehiscence by longitudinal slits; pollen grains spherical, .04 mm in diameter coarsely granular. Gynoecium total length 2 mm. in short style and 3 mm in long styled flower ovary superior, short-stalked, 1.2 mm in diameter, 6-8 locular, placentation axile, placenta continuous up to the base of the style, ovary completely septate from the bottom, in older flowers showing indications of loculicidal dehiscence, ovules anatropous, styles of various lengths, .35 mm in short styled flower, .8mm in medium styled flower and 1.5 mm in long styled flower, stigma capitate, .35mm in length (Plate fig. 4).

**Dicot fruit :- *Enigmocarpon chandrapurensis* sp. nov.**

Fruit globular, eight-locular capsule, 11 mm long and 13 mm broad, stalk not seen (Plate figs. 5and7). Fruit wall externally smooth, 2 mm thick. Outer epidermis of the fruit wall of thin-walled parenchymatous cells; hypodermis of six to eight layers of thick-walled cells with brown to black contents; rest of the fruit wall and the septae parenchymatous of spongy tissue, inner epidermis of fruit wall and septae with stalked globular outgrowths, measuring 0.8-1.2 mm. Seeds, obovate triangular, 1.5-2 mm long, six to eight per loculus, horizontally packed back to back in alternating rows; micropyle curved towards the short thick funicle, raphe as thick as seed body and of spongy tissue; epidermis of integument of polygonal cells with sinuous side walls, below the epidermis several layers of longitudinal fibres present; seed cavity lined by elongated thick-walled cells; vascular supply curved; embryo dicotyledonous, exalbuminous. Placenta 4 mm thick, with outer lacunar cortex and inner compact cortex. Central lysigenous cavity filled by thin walled parenchymatous cells (Plate figs. 6and8). Dehiscence loculicidal (Plate fig.6).

## Discussion and Results:

From the above description following important features confirmed its identification-

- Anatomy of the stem resembles modern and fossil palm trees. The form genus *Palmoxylon* includes general anatomy of Palm stem (Sahni, 1946; Ramanujam, 1953; Metcalf, 1960; Rao and Menon, 1971; Trivedi and Verma, 1971; Prakash, 1974).
- Adventitious roots though not associated with stem but resembles with reported palm roots kept under form genus *Rhizopalmoxylon* (Mahabale and Udawadia, 1960; Awasthi et al. 1995; Bonde et al. 2009).
- Flower specimen is a typical dicot type and shows similarities with well known *Sahnianthus* flower. *Sahnianthus* flower described by various authors from different Intertrappean beds. (Shukla, 1944 ; Chitale, 1955, *Sahnianthus dinecterium* Shukla, 1958; Dayal 1967; *Sahnianthus parijai* Shukla, 1948; Paradkar and Senad, 1984). This Flower shows affinities with the flowers of family Lytheraceae / Sonneratiaceae.
- *Enigmocarpon* fruits developed from *Sahnianthus* flowers and described by various authors from different Intertrappean beds (Rode, 1933, Sahni, 1943; Chitale, 1954; Dwivedi, 1956; Patil, 1972). The present Fruit specimens are many and shows similarities with a typical dicot fruit *Enigmocarpon* with minor differences in fruit wall and seeds, hence new species is created and named as ***E. chandrapurensis*** sp. nov. The specific name is given after the district where this locality belongs.

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Explanation of PLATE Figures:- 1 and 2: fossiliferous exposure at Pudiymahada. 3: Gastropod (Molluscan shells) exposed on Black chert. 4, *Sahnianthus* flower exposed near fruit on the same chert. 5-8: *Enigmocarpon* fruits exposed on different cherts. A: Palm trunk preserved in situ. B: Isolated palm roots cut oblique transversely. C: Isolated palm roots cut oblique longitudinally. D: Some roots in magnified view. E: Transversely cut palm root showing its details. F: Single root in enlarged view.

