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A report on biocompounds from palm fossil of India

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Abstract:
The occurrence of a large number of fossil woods having resemblance in anatomical features with the modern palm genus, *Phoenix* L in Deccan Intertrappean fossil flora of Maastrichtian-Danian age (i. e. Late Cretaceous and Earliest Tertiary (65-67 my)) indicates the most primitive record of date palm. Present discovery of biocompounds from fossil wood of *Phoenix* collected from Deccan Intertrappean having affinity with the biocompounds known from modern plant further exemplify the earliest documentation of *Phoenix* in Indian peninsula.

Key words: Fossil wood, Indian date palm, *Phoenix*, Biocompounds, First record

Well preserved biocompounds are discovered for the first time from permineralized fossil palm stem, *Palmoxylon* belonging to Late Cretaceous Deccan Intertrappean sediments **[1, 2, 3]** of central India (79° 11'E:22°1'N) **[4].** Anatomically specimen (8.4X3.2 cm) shows irregularly oriented fibrovascular bundles, 800 to 1500 µm, 10-25/sq cm, dorsal sclrenchymatous sheath reniform, slightly lignified; xylem mono to trivasal with scalariform thickenings, scabrate -type stegmata occur in fibrous bundles, parenchymatous ground tissues lacunar, cells elongated, form loose network **(Figure 1A-C)** and features are comparable with phoenicoid fossil stem of *Palmoxylon lametaei* **[5].** The biochemical study of the specimens was performed following the latest protocol **[6, 7, 8].** Powdered sample (app 10 g) was processed for individual and gradual solvent extraction using hexane, dichloromethane and methanol. Another set of sample was used only for Individual methanol solvent extraction. Thin layer chromatography (TLC) used for qualitative scrutiny of the compounds and their identifications were confirmed by gas chromatography mass spectroscopy (GCMS, **Figures 2 A-D**). Distinct presence of different compounds of Alcohol, Esters, Terpenes, Hydrocarbons, Fatty Acid and Phenol is recorded in the samples. Maximum matching compounds with retention time and percent area (peak) is sorted out in the **Table 1 (see supplementary material).**

Compounds are fairly comparable with the known compounds of modern palm species of *Phoenix dactylifera L.* and *P. canariensis* Chabaud **Table 2 (see supplementary material)** in having Alcohal (1- Tridecanol), Hydrocarbons (Dodecane, Tetradecane, Hexadecane, Pentadecane, Undecane) and Fatty acids (Lauric acid, Myristic acid, Stearic acid**) [9, 10, 11, 12].** Discovery of well preserved natural biocompounds in fossil specimen recovered from rock sequence formed in between intermittent volcanic episode signifies the slow rate of preservation under anoxic condition with minimal disturbance. Similarly the exceptionally preserved plant fossils of almost all the groups of plant **[13, 14, 15]** in the Intertrappean sediments of central India suggests the optimum condition for the preservation. The floral and faunal studies of Deccan Intertrappean series indicate that the elements survived successfully during episodic volcanism **[16].** It has been estimated that there were seven volcanic episodes and biota survived in between successive lava flows **[17].** During the time there were lakes, rivers and such conditions helped the plant to preserve in their adjoining areas, subsequent volcanic eruption and cooling of lava provided an admirable condition for the preservation of plant and animal remains **[18].** Late Cretaceous Intertrappean sediments are considered as Maastrichtian and Danian in age 4 **[19, 20].** Interestingly K/T boundary represents the phase of mass extinction of flora /fauna. However, record of well organized plant communities, micro palaentological

assemblages and present recovery of natural compounds in fossil plant substantiate the existence of life forms during/beyond the limit of K/T. Plausibly sequential volcanic phenomenon did not dissuade the flora and fauna to extinct from the biological scenario in Indian peninsula during K/T boundary **[21].**

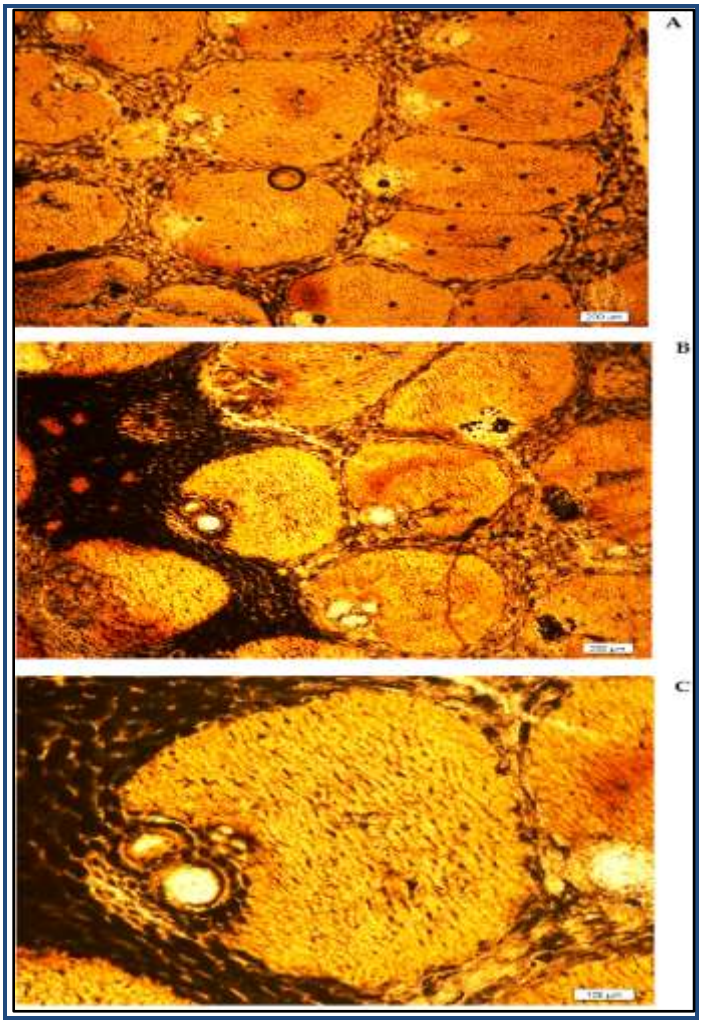

Figure 1: A) Inner zone showing lacunar ground tissue parenchyma consists of variable shapes and circular to elongated cells showing spongy nature of ground tissue; **B)** Cross section of stem showing orientation and distribution of closely spaced fibrovascular bundles, thick walled fibrous sheath cell with small and larger lumen; **C)** Enlargement of oval shaped fibrovascular bundle consisting of 2 circular metaxylem vessel, thick walled sclerenchymatous fibrous sheath around the vascular part of the bundle.

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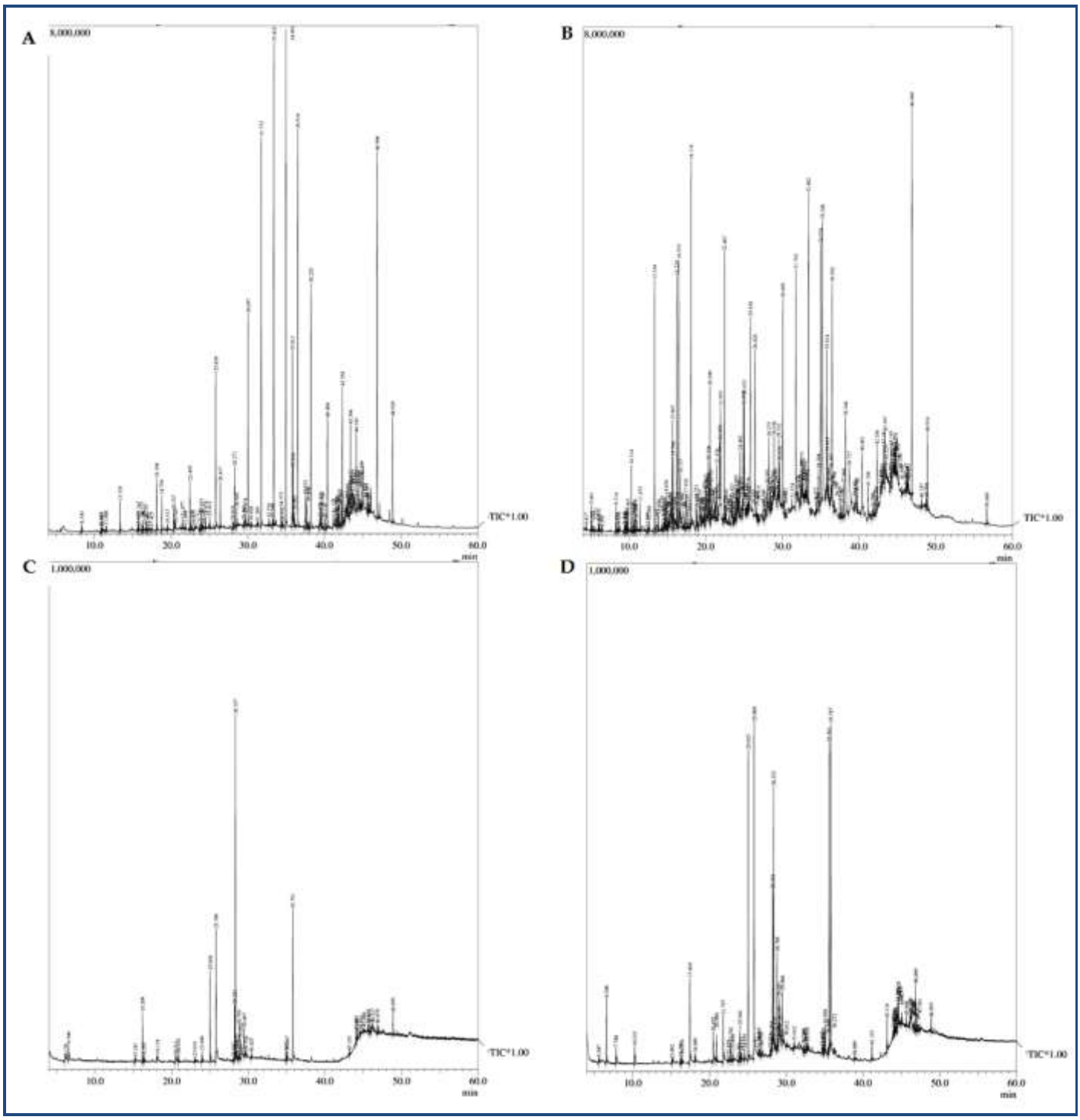

Figure 2: A) GCMS profile in Hexane; **B)** GCMS profile in Dichloromethane; **C)** GCMS profile in Methanol; D) GCMS profile in Dichloromethane (gradual).

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Supplementary material:

Table 1: showing compounds having maximum percent area and similarity index

No.	Peak No.	R. Time	Percent area	Similarity Index	Hexane extract compounds
1	44	34.991	11.19	97	Eicosane C20H42
2	41	33.418	11.06	98	Heneicosane C21H44
3	48	36.514	9.17	96	Hexacosane C26H54
4	38	31.772	8.04	97	Celidoniol, Deoxy C29H60
5	52	38.255	6.68	95	Docosane C22H46
No.	**Peak No.**	**R. Time**	**Percent area**	**Similarity Index**	**Dichloromethane Extract(Gradual)**
1	130	35.248	5.36	93	Hexadecanoic acid, 2-hydroxyl-1-(hydroxyl methyl) ethyl ester C19H38o4
2	48	18.116	4.19	98	Pentadecane C15H32
3	127	33.402	3.96	98	Heneicosane C21H44
4	129	34.974	3.91	94	Pentacosane C25H52
5	32	14.987	3.58	92	Tricosane C23H48
No.	**Peak No.**	**R. Time**	**Percent area**	**Similarity Index**	**Methanol Extract (Individual)**
1	48	35.787	11.83	96	Di-n-octyl phthalate C24H38O4
2	47	35.591	11.09	96	Benzene dicarboxyllic acid doctyl ester C24H38O4
3	20	25.023	10.38	96	Hexadecanoic acid methyl ester C17H34O2
4	28	28.323	8.64	95	9-Octadecanoic acid (2) methyl ester C19H38O2
5	27	28.216	5.07	95	9,12-octa decodienoic acid (2) methyl ester C19H38O2
No.	**Peak No.**	**R. Time**	**Percent area**	**Similarity Index**	**Methanol Extract (Gradual)**
1	16	28.327	28.07	96	9-octadecanoic acid(Z)-methyl ester C19H36O2
2	25	35.791	15.06	96	1,2 benzene dicarboxyllic acid dioctylester C24H38O4
3	11	25.028	7.44	96	Hexadecanoic acid methyl ester C17H34O2
4	14	28.221	4.15	93	Methyl octa deca-9,12, Dienoate C19H34O2
5	18	28.795	2.99	91	Heptadecanoic acid,16 methyl,methyl ester C19H38O2

Table 2: Showing comparative biocompounds of fossil and living species

Fossil sample	*P. dactylifera*	*P. canariensis*
Dodecanoic acid (Lauric acid)	Lauric acid	Lauric acid
Myristic acid (Tetra decanoic acid)	Myristic acid	Myristic acid
Stearic acid (Octadecanoic acid)	Stearic acid	Stearic acid
Tridecanol	Tridecanol	
Undecane	Undecane	
Dodecane	Dodecane	
Tridecane	Tridecane	
Tetradecane	Tetradecane	
Pentadecane	Pentadecane	
Hexadecane	Hexadecane	