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ACKNOWLEDGEMENTS. We acknowledge critical suggestions and comments from Prof. J. S. Singh, BHU, Varanasi.

Received 13 July 2006; revised accepted 29 November 2007

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## A dichotomously branched fossil palm stem from the Deccan Intertrappean beds of India

Palms (family Palmae/Arecaceae) constitute a large assemblage of woody monocotyledonous plants distributed naturally in the Oceanic Islands and coastal areas in the tropics between 44°N and 44°S of the equator<sup>1</sup>. They play a significant role in human welfare and are ranked next to families Poaceae (Gramineae) and Leguminosae in providing the basic necessities like food, shelter and other minor necessities in the tropical countries<sup>2,3</sup>. There are 2364 species of palms embodied in 190 genera<sup>4</sup>. Palms usually have solitary or clustered, unbranched stems, each with a terminal crown of leaves. They are also known for a number of distinctive features in the plant kingdom, like tall woody axis built entirely by primary growth without physiological dormancy; continuous regeneration of adventitious roots throughout their life; massive leaves and inflorescences; longest stem, leaf and largest inflorescences and seeds<sup>5</sup>.

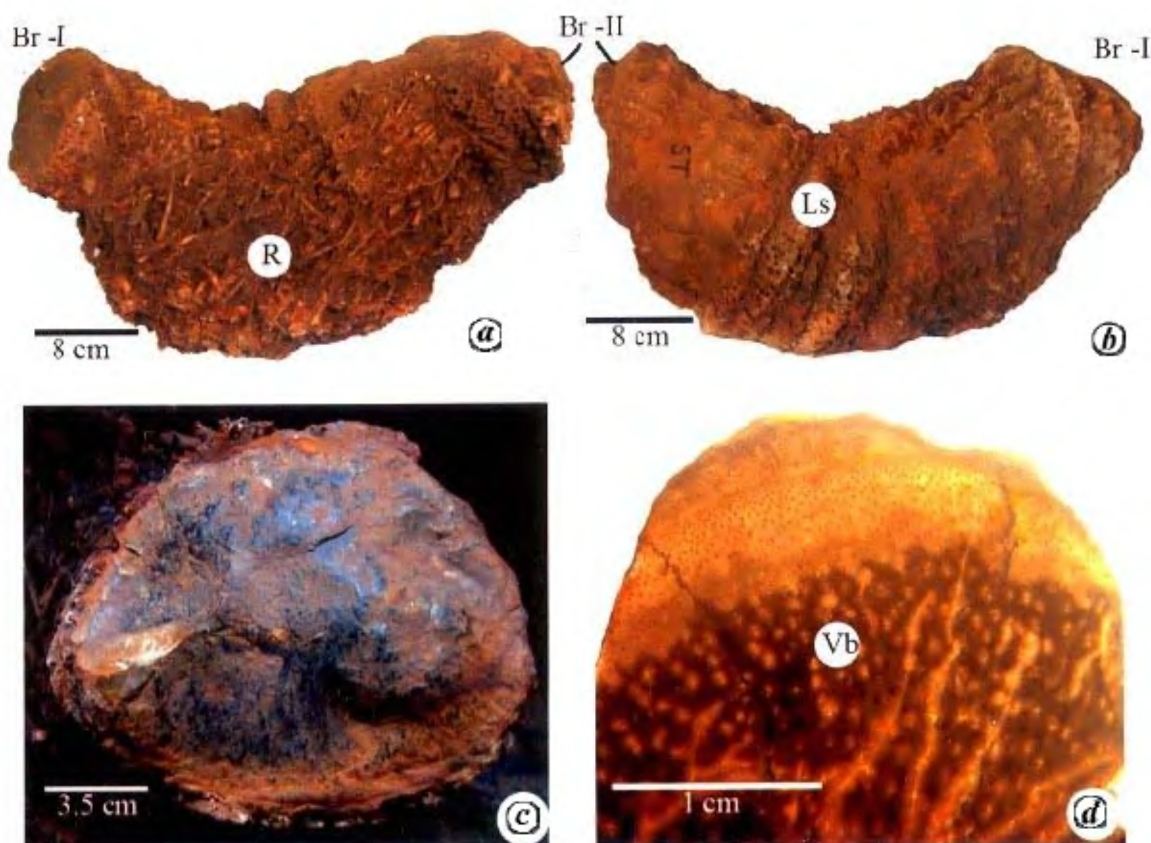
Palms have a long geological history, originating in the Cretaceous period, if not earlier. Their geological remains are

known in the form of permineralizations, impressions, compressions and casts of plant organs such as stem, root, leaf, inflorescence, flower, fruit, seed and pollen grains assigned to the number of organ genera from different parts of the world<sup>6–8</sup>. Permineralized pieces of stems or their parts are assigned to the organ genus *Palmoxylon* Schenk. There are more than 200 species of *Palmoxylon* described from the world, including 69 species from India. The Deccan Intertrappean beds of India are particularly rich in palm fossil remains<sup>9,10</sup>.

In a recent field work in Central India, we procured a unique piece of permineralized palm stem having dichotomous branching with roots from the Deccan Intertrappean beds exposed at Silther (lat. 23°02'00"N; long. 80°38'20"E), Dindori District, Madhya Pradesh. The specimen was a massive piece of stem showing true dichotomous branching (V-shaped axis). One branch was 25.5 cm long and 14.5 × 17.0 cm in diameter, and the other 28 cm long and 12.5 × 16.5 cm in diameter. It appears that the dichotomous branch-

ing is of the first order, as both the branches at their joint are attached with thousands of adventitious roots. Both the branches are covered with a number of rings representing scars of the fallen leaf bases and roots. The roots are 4–8 mm in diameter, but thinner roots are also frequently seen. The stem exhibits fibrovascular bundles typical of palms distributed in the parenchymatous ground tissue (Figure 1 a–d).

Dichotomous branching in the extant palms has been reported in the genera *Alagoptera* Nees, *Chamaedorea* Willd., *Hyophorbe* Gaertn., *Hyphaene* Gaertn., *Nannorrhops* H. Wendl., *Nypa* Steck and *Vonitza* Becc. (now emended in *Dypsis* Naronha ex Mart.). However, the present correspondence is a first report of dichotomous branching in the fossils. The massive branching indicates its affinity possibly with the true dichotomously branched species of *Hyphaene* Gaertn. There are eight species in the genus *Hyphaene* distributed in Africa, Madagascar, the Red Sea, and the coasts of the Gulf of Eilat, coastal Arabia, Sri Lanka



**Figure 1.** Fossil palm stem with dichotomous branching. **a**, Entire specimen showing two branches (Br-I and Br-II) and adventitious roots (R). **b**, The same from other side showing leaf scars (Ls). **c**, Cross-sectional view of Br-I. **d**, Cross-section of Br-I showing distribution of fibrovascular bundles (Vb).

and the west coast of India. Only a few of them show dichotomous branching<sup>1,11,12</sup>. The permineralized fossils of petiole, fruit and stem comparable to that of *Hyphaene* have been reported from the Deccan Intertrappean beds of India<sup>13–15</sup>. A detailed morpho-anatomical account will be published shortly.

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**ACKNOWLEDGEMENT.** We thank Dr V. S. Rao, Director, Agharkar Research Institute, Pune for encouragement and facilities.

Received 18 July 2007; accepted 19 November 2007

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