SONNERATIORHIZOS RAOI GEN. ET SP. NOV. FROM THE DECCAN INTERTRAPPEAN BEDS OF INDIA

S. D. CHITALEY
Institute of Science, Bombay 1

ABSTRACT

A dicotyledonous root with secondary growth is described from the Deccan Intertrappean beds of Mohgaon Kalan in the Chhindwara District, Madhya Pradesh, India. The petrified root is studied from many young and old specimens showing 4-7 arc xylem. General characters resemble those of *Sonneratia apetala* roots and also those of *Sonneratioxylon duabangoides* Shallom, a stem from the same locality. On the basis of these resemblances the present roots have been included under *Sonneratiorhizos raoi* gen. et sp. nov.

INTRODUCTION

THE paper gives a detailed description of a petrified dicotyledonous root with secondary growth. The observations are based on a study of about thirty specimens of roots which are thick and thin. The thick roots show secondary growth, while the thin ones are young without any secondary tissues. All the material comes from the Intertrappean cherts exposed at Mohgaon Kalan in the Chhindwara District of the Madhya Pradesh, India. From the same locality only one dicotyledonous root has been described so far by Rao (1958). His description was based on a single transverse section of a small root.

The roots described in this paper were studied before in brief under the name *Dicotylirhizos sahnii*, (CHITALEY, 1961) suggesting their resemblance with the root described by Rao. However, on intensive study of the same from many more sections along many planes revealed their resemblance more with the stem, *Sonneratioxylon duabangoides* Shallom (1963) described earlier, from the same locality of Mohgaon Kalan. The roots also resemble to a certain extent those of *Sonneratia apetala* Ham. Considering these resemblances the roots are now named as *Sonneratiorhizos raoi* gen. et sp. nov.

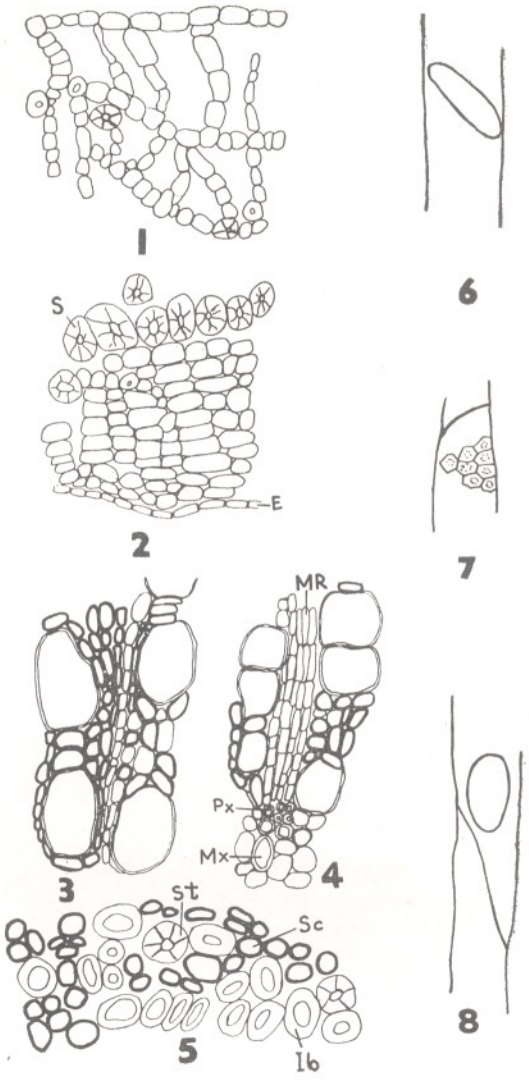
MATERIAL AND METHODS

The material of roots comes from the Deccan Intertrappean brown cherts of Mohgaon Kalan. All these roots are preserved more or less very near each other suggesting that they may be branches of one and the same sections in a chert. Later a few longitudinal and transverse ground sections were prepared of the same. The material did not yield any good peel sections. Some of the ground sections could be stained with safranin for better study of the different tissues.

DESCRIPTION

The young roots (PL. 1, FIG. 5) varying in size from 100 to 500 μ show the outer limiting layer of the epiblema, the cells of which are elliptical, regular, and compact. Cortex is of loosely arranged parenchymatous cells, and varies in thickness from 42 μ to 150 μ according to the size of the root. Endodermis is distinct, the cells of which are barrel-shaped with casparian thickenings on radial walls. Pericycle is present as a single layer of thin-walled parenchymatous cells. Phloem separating the xylem arcs is parenchymatous and distinct. Xylem arcs are 2-4 in number, exarch, with a few large metaxylem polygonal vessels and with a few protoxylem small elements (PL. 1, FIG. 5).

The mature roots varying in diameter from 1 to 5 mm. show very well preserved secondary tissues along with the pith, the primary xylem arcs and the cortex (PL. 1, FIGS. 2 & 4). Epiblema cells are not very clear. Outside the endodermis is the primary cortex (PL. 1, FIGS. 2 & 4) preserved at places. The inner cortex is made up of parenchymatous cells which are thin-walled, with air spaces. This cortex on the outer side becomes still loose and spongy so that definite air chambers are seen lined with thin-walled parenchymatous cells in which stone cells and idioblasts are distributed (TEXT-FIGS. 1 & 2). The endodermis is same as in young roots. Secondary phloem is well developed and is seen as of hard and soft bast patches alternating irregularly with each other, (PL. 1, FIGS. 2 & 4). Stone cells and idioblasts are present in the hard bast (TEXT-FIG. 5).



TEXT-FIGS. 1-8 — *Sonneratiorhizos raoi* gen. et sp. nov. 1. Cortex with air chambers. × 125. 2. Stone cells (S) in cortex; Endodermis (E) seen. × 125. 3. Portion of secondary wood. × 145. 4. Portion of secondary xylem, primary xylem (px. & mx.), and primary medullary ray (MR). × 145. 5. Cells from hard bast — Sclerenchyma (Sc), stone cells (St), and idioblasts (Ib). × 145. 6. Single vessel with oblique performation plate. × 160. 7. Intervascular vestured pits. × 335. 8. Vessel segment with horizontal plate. × 160.

Secondary xylem is predominant and occupies almost whole of the area of the transverse section of the root. It is diffuse porous with the vessels slightly thick-walled, numerous, solitary, or in radial rows of 2-3 in t.s. (PL. 1, FIGS. 2, 4 & 6). The vessel diameter varies from 52 to 100 μ in transverse and radial views and 85 μ in tangential view. The perforation plates are horizontal to slightly inclined as seen from radial section (TEXT-FIGS. 6 & 8). The vessel members vary in length from 214 to 250 μ. The intervascular pit pairs are vestured and each is 7 μ in diameter (TEXT-FIG. 7).

Wood parenchyma is present only as scattered cells in the fibrous region which is well developed surrounding the vessels. Each fibre is slightly thick-walled and is 28 μ in width and 750 μ in length. It is non-septate. Pits are not seen.

Xylem rays are primary and secondary. Primary rays are equal to the number of xylem arcs. They are heterocellular and multiseriate, whereas secondary medullary rays are uniseriate and homocellular consisting of erect cells (PL. 1, FIG. 3; TEXT-FIGS. 3 & 4).

Primary xylem consists of 5-7 exarch arcs surrounding the pith (PL. 1, FIGS. 2, 4 & 6). Metaxylem elements vary in number from 4 to 6, and are polygonal and large with a diameter of 57 μ. Protoxylem elements are one or two per arc, each element being 7 μ wide (PL. 1, FIG. 6; TEXT-FIG. 4).

Pith is roughly angular and is of thin walled parenchymatous cells with intercellular spaces (PL. 1, FIGS. 2, 4 & 6). The thickness of the pith varies from 200 to 343 μ.

DISCUSSION

The root under investigation formerly considered as *Dicotylirhizos sahnii* (CHITALEY, 1961) is now found to be different from it mainly in the number of xylem arcs, in the nature of secondary phloem, spongy cortex and other details of secondary xylem. The primary rays are not described in *Dicotylirhizos sahnii*. They are multiseriate in the present root. Comparisons on the contrary are more close with the stem *Sonneratioxylon duabangoides* Shallom several specimens of which are found in close association with several specimens of the present fossil root, though not in organic connection. The comparisons are so close that if the primary xylem arcs in the root were not preserved it could have been mistaken for a young fossil wood described by Shallom (1963). Comparisons are as follows:

Pith is similar in both. Secondary xylem is similar, except that in the stem parenchyma is absent and in the root it is present

only as scattered cells. The vessels have similar distribution. However, the vessel diameter differs in the two, being larger in the roots. Intervascular pits are vestured in both. Fibres are comparable and so are the xylem rays. Secondary phloem is very much similar, with alternating hard and soft bast. Primary cortex in both is spongy with a few stone cells present in it.

The fossil stem (SHALLOM, 1963) was compared with the living species of Sonneratiaceae family. Since the root under consideration compares so close with the fossil stem it was thought to study the roots of Sonneratiaceae from freshly cut sections. The comparisons have revealed much similarity with the roots of *Sonneratia apetala*.

On the basis of this study the fossil root is now named as *Sonneratiorhizos raoi*, gen. et sp. nov., the specific name being after Prof. A. R. Rao who described the first dicotyledonous root from the Deccan Intertrappean beds of India.

DIAGNOSES

Sonneratiorhizos. gen. nov.

Root dicotyledonous with secondary growth. Xylem arcs 4-7. Vessels solitary or in radial rows of 2-3, with vestured intervascular pitting; perforation plates simple, horizontal to oblique. Parenchyma as scattered cells. Secondary medullary rays uniseriate and homocellular with cells erect. Primary rays against primary arcs, multiseriate and heterocellular. Secondary phloem of alternating hard and soft bast. Endodermis a single layer with casparian strips. Primary cortex spongy with stone cells.

Sonneratiorhizos raoii sp. nov.

Young roots 100 to 500 μ in diameter; Xylem arcs 5-7, exarch; protoxylem 1-2 per arc, each element 7 μ in diameter. Metaxylem elements 4-6 per arc each with 57 μ in diameter. Pith 200-343 μ wide. Secondary xylem with vessels and fibres; vessels 52-100 μ diameter, in t.s. and r.l.s. and 85 μ wide in tangential view; vessel length 214-250 μ; intervascular pits vestured, 7 μ in diameter. Fibres 28 μ wide and 750 μ long, non-septate. Xylem rays secondary uniseriate, and primary multiseriate. Secondary phloem of alternating hard and soft bast, hard bast of sclerenchymatous cells with stone cells and idioblasts. Primary cortex spongy with stone cells and idioblasts; air chambers lined with partitions of small parenchymatous cells.

Holotype — Will be deposited at the Birbal Sahni Institute of Palaeobotany, Lucknow; at present with the author as No. Chit./Moh/2.

Locality — Mohgaon Kalan, Chhindwara District, Madhya Pradesh, India.

Horizon — Deccan Intertrappean Series.

Age — Probably Palaeocene.

ACKNOWLEDGEMENTS

The author is grateful to Dr. A. Rao, for his valuable suggestions during the progress of this work. She is also obliged to Dr. Miss L. J. Shallom and Mr. V. Nambudiri, the latter for photography and the former for preparing some sections of fossil and living roots.

REFERENCES

CHITALEY, S. D. (1961). Contribution to the knowledge of *Dicotylirhizos sahnii*, Rao. *Proc. 48th Indian Sci. Cong.* 374.

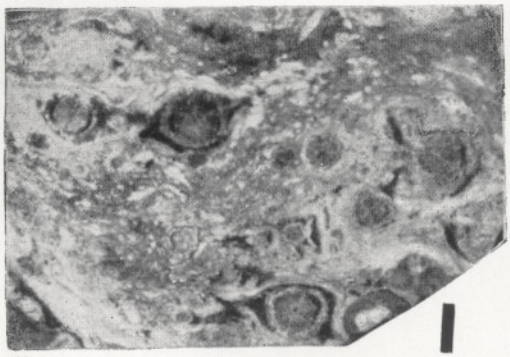
RAO, A. R. (1958). Contributions to our knowledge of the Deccan Intertrappean Flora. *Palaeobotanist.* **6**(1): 19-21 1957.

SHALLOM, L. J. (1963). Fossil dicotyledonous wood from the Deccan Intertrappean beds of Chhindwara. *J. Indian bot. Soc.* **42**: 161-169.

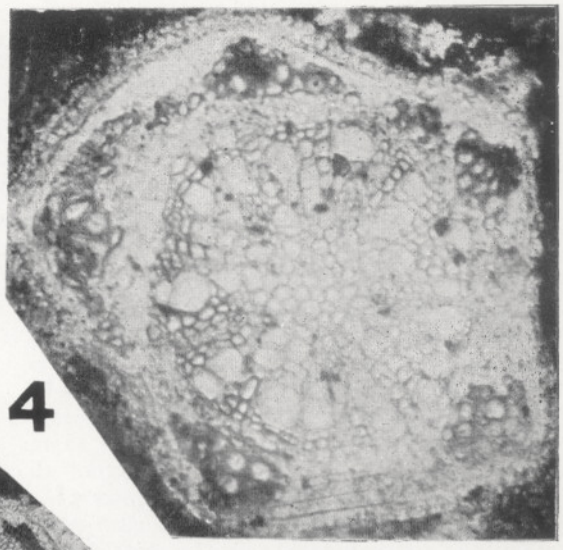
EXPLANATION OF PLATE 1

Sonneratiorhizos raoi gen. et sp. nov.

1. Young and old roots in t.s. in a piece of chert. × 4.
2. 7-arc root in t.s. from pith to cortex. × 160.
3. T.s. root showing I ry and II ry rays and vessel segments. × 160.
4. T.s. 5-arc root. × 160.
5. T.s. 4-arc root. × 230.
6. T.s. root 6-arc. × 160.

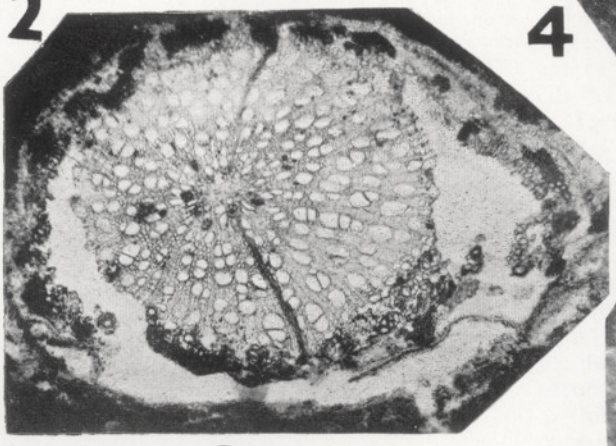


1

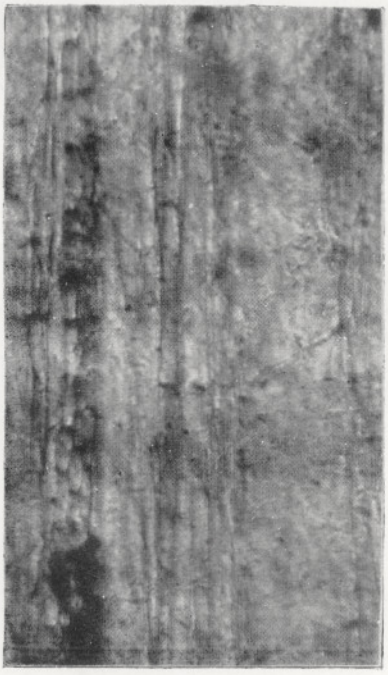


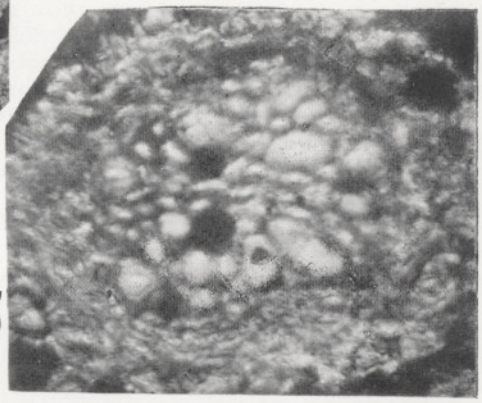
4

2

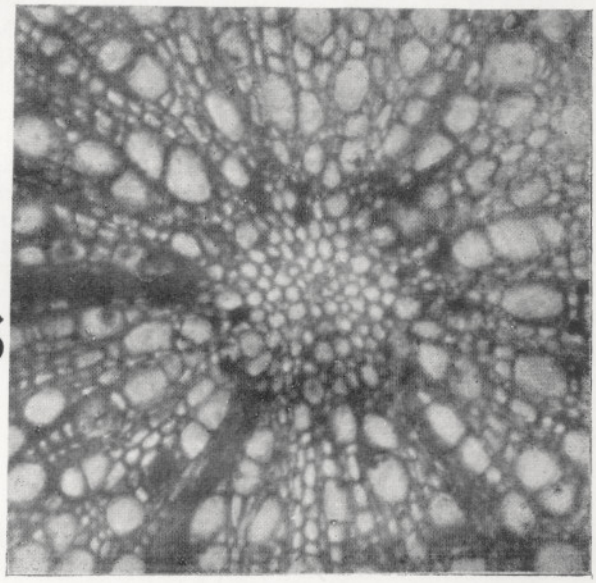


3





5



6