

STUDIES IN THE GLOSSOPTERIS FLORA OF INDIA—
19. TWO NEW SPECIES OF *DADOXYLON* FROM
THE LOWER GONDWANAS OF INDIA

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ABSTRACT

Two new species of *Dadoxylon*, viz. *Dadoxylon gondwanense* and *Dadoxylon kharkhariense* are described. The former is characterized by radial pitting 1-5 seriate, contiguous, alternate and sub-opposite; cross-field pits 2-8; medullary ray uniseriate and biseriata and 1-43 cells high. The latter wood *Dadoxylon kharkhariense* is characterized by the presence of pitting both on the radial and tangential wall of the tracheids, 1-3 seriate, alternate, sub-opposite and opposite; contiguous or separate, sometimes in distinct groups of 2 or 3 pits; cross-field pits 2-5 (7); medullary rays uniseriate, rarely biseriata.

INTRODUCTION

FROM the Lower Gondwanas of India only seven species of *Dadoxylon* are known. Three species, viz. *Dadoxylon zalesskyi* Sahni (1932), *Dadoxylon parbeliense* Rao (1935) and *Dadoxylon jamudhiense* Maheshwari (1964) have been recorded from the Raniganj Stage. The rest four species *Dadoxylon indicum* Holden (1917), *Dadoxylon bengalense* Holden (1917), *Dadoxylon barakarensense* Surange and Saxena (1959) and *Dadoxylon parenchymosum* Surange & Maithy (1963) are known from the Barakar Stage.

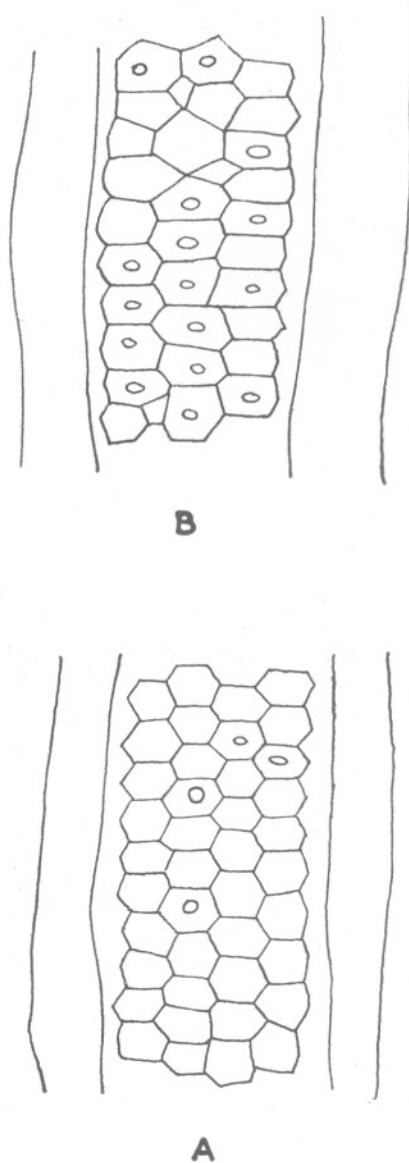
The present material was collected from the 18th coal seam of Kharkhari Colliery, Jharia Coalfield, Bihar, about 3-4 miles west of Katrasgarh Railway Station.

DESCRIPTION

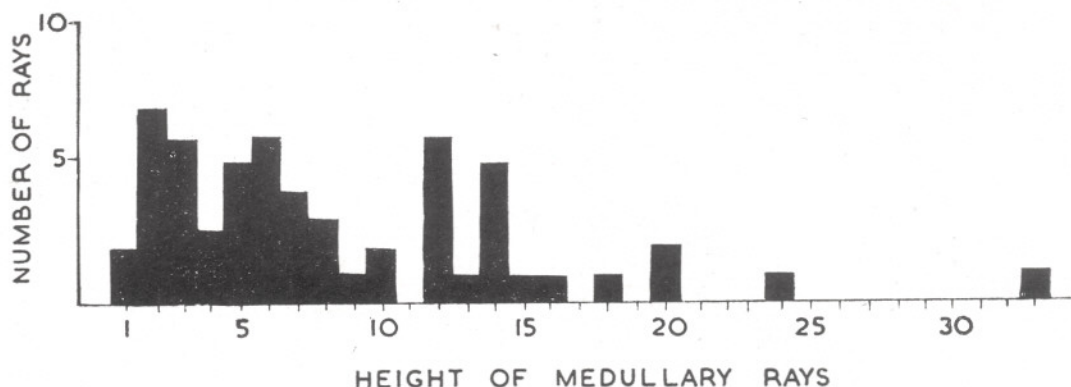
Dadoxylon gondwanense sp. nov.

Pl. 1, Figs. 1-4; Text-figs. 1-2

Only a piece of decorticated secondary wood, devoid of pith. The wood in transverse section shows distinct growth zones (PL. 1, FIG. 1). The early wood is much developed 40-50 cells deep, thick-walled; square to rectangular in shape and their size vary from 35-55 μ and sometimes up to 70 μ . Late wood thick-walled transversely elongated with small lumen in centre and are 17-28 μ in size. The walls between the inter-



TEXT-FIG. 1 — *Dadoxylon gondwanense* sp. nov. Radial longitudinal section of the early wood tracheids showing the arrangement of pits. $\times 500$.



TEXT-FIG. 2 — *Dadoxylon gondwanense* sp. nov. Graph showing the frequency of the medullary ray cells (Surface examined 12 mm.²).

vening tracheids are thick and measure $9\ \mu$ to $28\ \mu$. The medullary rays are placed at the intervals of 2 to 9 tracheids.

Pitting — Radial wall of the tracheids are pitted from 1 to 5 seriate, commonly triseriate and tetraseriate. Uniseriate pits are arranged in a row, contiguous. Biseriate, triseriate and tetraseriate pits are contiguous, alternate or sub-opposite (PL. 1, FIG. 2; TEXT-FIGS. 1A-B). Pits are bordered, hexagonal or flattened by mutual contact. The size of the pits vary in biseriate condition from $10.5\text{--}14\ \mu \times 12\text{--}14\ \mu$. The coefficient vary from 1.2 to 0.75. The size of the uniseriate pits are $10.5\text{--}17.5 \times 10.5\text{--}17.5\ \mu$. The coefficient vary from 1.7 to 0.8. Each pit has one circular pore in the centre, $5\text{--}7\ \mu \times 4\text{--}7\ \mu$ in size.

The number of the cross-field pits are 2-8 (commonly 4-8), bordered, contiguous or separate and circular to oval in shape (PL. 1, FIG. 4). Each cross-field pit has a circular-oval pore. The dimensions of the field pits and the pores are as follows:

Field pits	Pore
$10.5 \times 9\ \mu$	$3.5\ \mu$
$7 \times 9\ \mu$	$3.5\ \mu$
$9 \times 10.5\ \mu$	$3.5\ \mu$
$10.5 \times 10.5\ \mu$	$3.5\ \mu$

Medullary rays — The medullary rays are commonly uniseriate and biseriate, 1-43 cells high (PL. 1, FIG. 3). The size of the medullary ray cells vary from $24\text{--}31\ \mu \times 21\text{--}24.5\ \mu$. The density of the medullary rays is 6 ray per millimetre square (surface

examined 12 mm.²). The density of the number of ray cells per millimeter square is $441/12 = 36\ \text{mm.}^2$, and neglecting the biseriate ray cells is $410/12 = 34\ \text{mm.}^2$. The percentage of the uniseriate to biseriate rays is 87 per cent by 13 per cent. The maximum frequency is of 3, 6 and 12 celled ray (TEXT-FIG. 2).

Resin canals and xylem parenchyma are absent.

DIAGNOSIS

Dadoxylon gondwanense sp. nov.

Growth zones distinct, early wood 40-65 cells, late wood 2-4 cells; pitting on the radial walls of the tracheids 1-5 seriate (commonly 3-4 seriate); alternate or sub-opposite, contiguous; cross-field pits 2-8 (commonly 4-8), contiguous or separate, circular-oval in shape; medullary rays uniseriate and partially biseriate, height of the medullary rays vary from 1-43 cells, the maximum frequency is of 3, 6 and 12 celled ray and the percentage of biseriate rays is 13 per cent.

Holotype — 32790/430, Birbal Sahni Institute of Palaeobotany collection.

Locality — Kharkhari Colliery, Jharia Coalfield, Bihar.

Horizon — Barakar Stage, Lower Permian.

Comparison — *Dadoxylon gondwanense* shows clear affinities with the *Dadoxylon* of the Southern hemisphere, but is not referable to any of the known species of *Dadoxylon*.

Dadoxylon parbeliense Rao (1935) is distinguished from *Dadoxylon gondwanense* by the

presence of rows of separately placed pits and low height of the medullary rays. *Dadoxylon jamudhiense* Maheshwari (1964) is distinguished by the absence of growth rings and the radial tracheid wall pitting is from 1-3 seriate only. The South African *Dadoxylon*, i.e., *Dadoxylon rangei* Kräusel (1928) and *Dadoxylon porosum* Kräusel (1928) resembles by the presence of several pits in the cross-field, but is distinguished in having strictly uniseriate medullary rays and low height of the medullary rays. *Dadoxylon maniero* Grambast (1960) differs in having radial pitting only 1-3 seriate and much higher percentage of biseriate medullary rays. From *Dadoxylon roxoi* Maniero (1945), it is distinguished by the absence of intercellular spaces in between the secondary xylem and tangential wall pitting of the tracheids. *Dadoxylon maniero* Kräusel and Dolianiti (1958) is distinguished by the absence of growth rings and low height of the medullary ray. Thus, the present wood is incomparable to any of the known species of *Dadoxylon* from Southern hemisphere, hence a new specific name is proposed for it.

Dadoxylon kharkhariense sp. nov.

Pl. 1, Figs. 5-8; Text-figs. 3-4

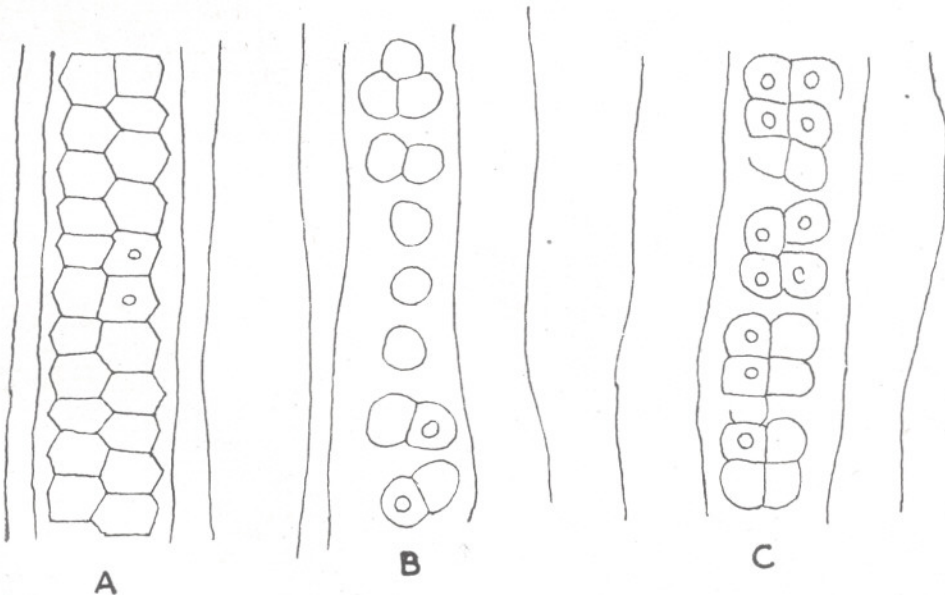
Only one piece of decorticated secondary wood is known. The wood shows distinct

growth zones, early wood 40-70 cell deep, square to rectangular and measures 42-56 μ . Late wood 2-3 cells, transversely elongated, thick-walled with elliptic lumen in centre, 17-24 μ in size. The intervening walls in between the tracheids is thick (15-28 μ). Medullary rays are placed at the intervals of 5 to 14 tracheids.

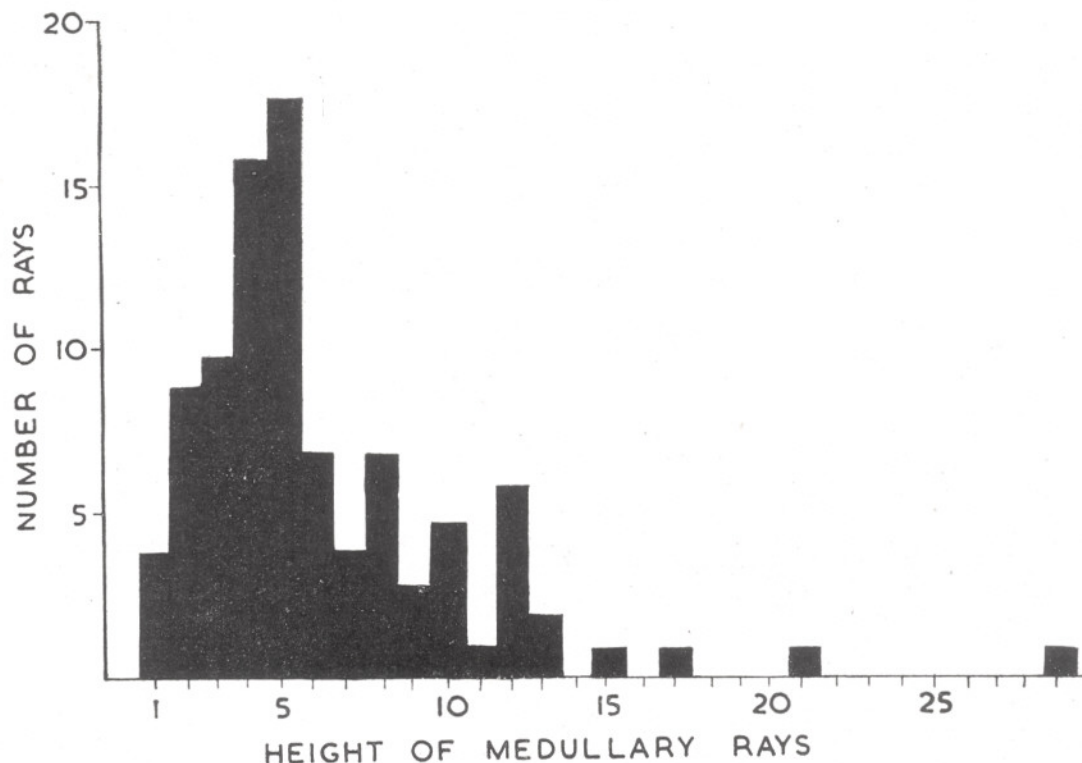
Pitting — Tracheids radially pitted 1 to 3 seriate. The uniseriate pits are placed in a row, contiguous. Two seriate pits are contiguous. Their arrangement is alternate, subopposite or opposite (TEXT-FIGS. 3A, C). Sometimes pits are placed in separate groups of 2 or 3 pits (TEXT-FIG. 3B). Triseriate pits are alternate and contiguous (PL. 1, FIG. 5). The pits measure 8-12 $\mu \times$ 12-15 μ . The coefficient varies from 1 to 0.7. Pit pore oval to circular and are generally 3.5 μ in diameter. The tangential walls of the tracheids are pitted (PL. 1, FIG. 6), uniseriate, contiguous and oval with a circular pore.

The number of the cross-field pits are 2-5, sometimes 7, contiguous, elliptic with a elliptical pore (PL. 1, FIG. 8). Pits vary in size from 8-12 $\mu \times$ 7-9 μ .

Medullary rays — Medullary rays are uniseriate and sometimes biseriate (PL. 1, FIG. 7) and measure 24.5 \times 17.5-28 μ . The height of the rays vary from 1 to 29 cells. The density of the rays per millimeter



TEXT-FIG. 3 — *Dadoxylon kharkhariense* sp. nov. Radial longitudinal section of the early wood tracheids showing the arrangement of the pits. \times 500.



TEXT-FIG. 4 — *Dadoxylon kharkhariense* sp. nov., Graph showing the frequency of the medullary ray cells (Surface examined 12 mm.²).

square is 9. The density of the rays cells per millimeter square is $530/12 = 44/\text{mm}^2$ and neglecting the biseriata ray cells is $528/12 = 44 \text{ mm}^2$. The percentage of biseriata to uniseriate rays is 1 per cent by 99 per cent. The maximum frequency is of 5 ray celled medullary ray (TEXT-FIG. 4). Xylem parenchyma and the resin canals are absent.

DIAGNOSIS

Dadoxylon kharkhariense sp. nov.

Growth zones distinct, early wood 50-70 cells, late wood 2-3 cells. Radial and tangential walls of the tracheids pitted, one to three seriate, contiguous; biseriata pits are arranged alternate or opposite; triseriate pits are alternate. Sometimes pits are placed in separate groups of 2 or 3 pits; cross-field pits 2-5 (7), contiguous, elliptic; medullary rays uniseriate and biseriata.

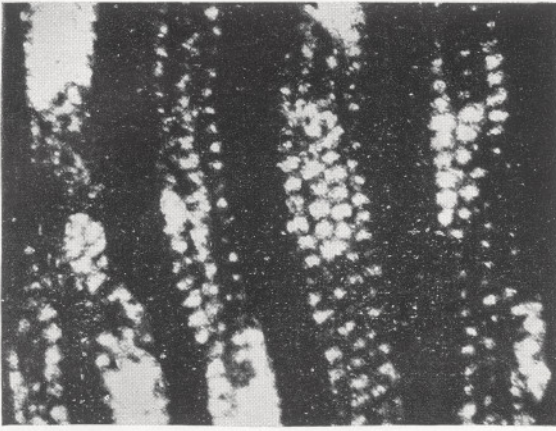
The height of the ray vary from 1 to 29 cells. The maximum frequency is of 5 ray cell. The percentage of biseriata ray is 1 per cent only.

Holotype — 32791/483, Birbal Sahni Institute of Palaeobotany collection.

Locality — Kharkhari Colliery, Jharia Coalfield, Bihar.

Horizon — Barakar Stage (Lower Permian).

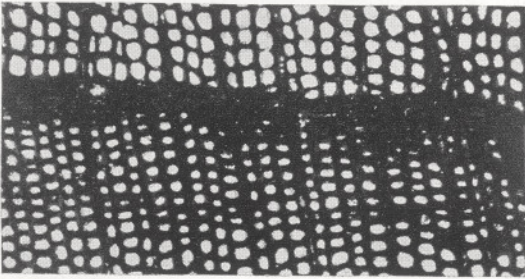
Comparison — Due to the presence of pits on the tangential walls of the tracheids, it is comparable to *Barakaroxylon jhariense* Surange & Maithy (1962), *Dadoxylon derbyi* Olivera (1936), *Dadoxylon brakareense* Surange & Saxena (1958) and *Dadoxylon roxoi* Maniero (1945). *D. kharkhariense* is distinguished from *Barakaroxylon jhariense* by the presence of opposite contiguous pits, separately placed paired pits or in groups of 3. *D. brakareense* Surange and Saxena (1958) differs by the presence of xylem parenchyma. *Dadoxylon derbyi* Olivera is distinguished from it by the presence of only



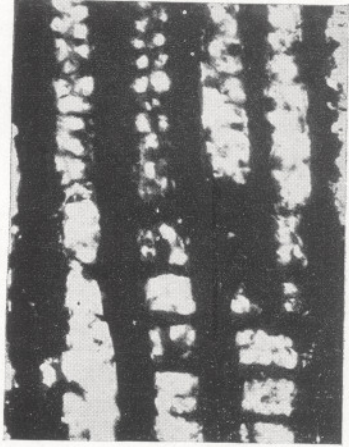
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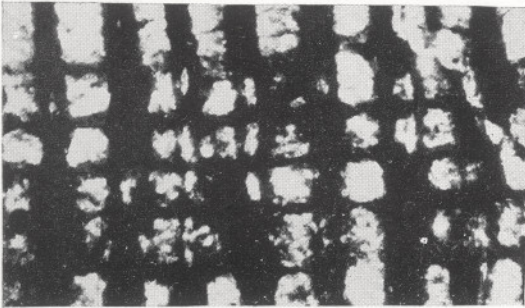
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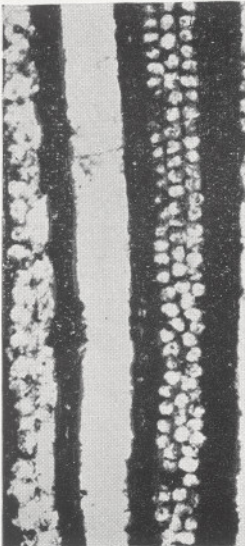
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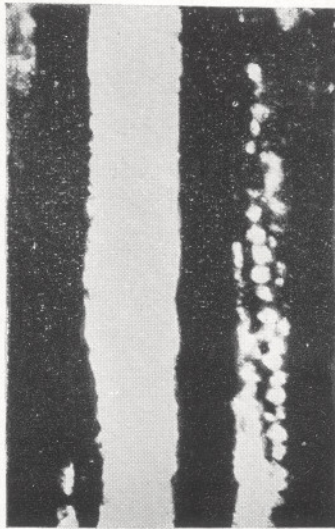
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6



7

uniseriate radial pitting, uniseriate medullary ray and pits in the cross-field only 1-2. From *Dadoxylon roxoi* the present wood is distinguished by the absence of inter-cellular spaces in between the secondary xylem and the presence of opposite pits.

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EXPLANATION OF PLATE 1

Dadoxylon gondwanense sp. nov.

1. Cross-section of wood magnified to show growth ring, early and late wood tracheids. × 50.
2. Radial longitudinal section to show triseriate and tetraseriate, alternate and contiguous pits. × 200.
3. Tangential longitudinal section to show uniseriate medullary rays. × 100.
4. Radial longitudinal section to show cross-field pits and biseriate, sub-opposite contiguous pits. × 200.

Dadoxylon kharkhariense sp. nov.

5. Radial longitudinal section to show triseriate and biseriate contiguous pits. × 200.
6. Tangential longitudinal section to show uniseriate contiguous pits. × 200.
7. Tangential longitudinal section to show uniseriate medullary rays. × 100.
8. Radial longitudinal section to show cross-field pits. × 200.