CONTRIBUTIONS TO OUR KNOWLEDGE OF THE DECCAN INTERTRAPPEAN FLORA

A. R. RAO

Botany Department, Lucknow University, Lucknow

ABSTRACT

Some microsporocarps of *Azolla intertrappea* Sahni & Rao, H. S. and a dicotyledonous root found in a silicified block from the Deccan Intertrappean beds (Eocene) are described. The silicified dicotyledonous root with secondary growth and pentarch primary xylem is referred to a new form genus *Dicotylirhizos* and put under a new species — *D. sahnii*.

INTRODUCTION

THE late Professor B. Sahni in collaboration with Professor B. P. Srivastava and Dr. H. S. Rao studied the silicified plants in the Deccan Intertrappean beds and described a tertiary flora from these petrified blocks. Since then several workers have also been studying this petrified flora and many interesting new types have come to light. Recently I came across a silicified block from this very locality which, on sectioning, showed a number of plant fragments, like pieces of petrified wood that may be younger twigs of *Dryoxylon mohgaoense* Rode (1936), sections of the ovaries of angiospermous flowers, stems and roots of different plants, sections of monocot leaves, detached seeds and bits of loose aerenchyma, etc. Most of these have been described, except a dicot root which is new to science. The preservation of these plant fragments is not very good and in places it is bad enough. Often the longitudinal sections do not show good preservation of tissues while transverse sections are a little more helpful. In the study of these sections staining with gentian violet (aqueous) proved very helpful.

Among the numerous finds described by Sahni, Srivastava & Rao, specially interesting were the megasporocarps of *Azolla intertrappea* (1934, p. 27), and detached massulae containing microspores and bearing anchor-tipped glochidia. They even mention that they found " leaves and more or less entire microsporocarps with their groups of spherical sporangia ". They further concluded that all these belonged to one and the same species of plant. In 1941 Professor Sahni (1941, p. 489) gave detailed description and illustrations of the megasporocarp of *Azolla intertrappea*, and mentioned the microsporangia as being " spherical, 205 μ in average diameter, each with several sector shaped massulae armed with stiff anchor tipped glochidia all round ". Sahni & Rao, H. S. (1943, p. 52) describing the silicified flora from the intertrappean cherts found in Sausar in the Deccan, further illustrated the megasporocarps and microsporangia of *Azolla intertrappea*. The roots, leaves and microspores are also described and illustrated. But for some reason or other the microsporocarps were not fully described although their occurrence was mentioned and also figured to some extent. Probably they were waiting for some good specimens to turn up in the blocks. Recently while examining the sections of the above-mentioned block of the Deccan intertrappean chert for an entirely different purpose I found a few microsporocarps which evidently belong to *Azolla intertrappea*. I thought that a brief description and illustration of these sporocarps would not be uncalled for here. At least they would corroborate Professor Sahni's description of these fossils.

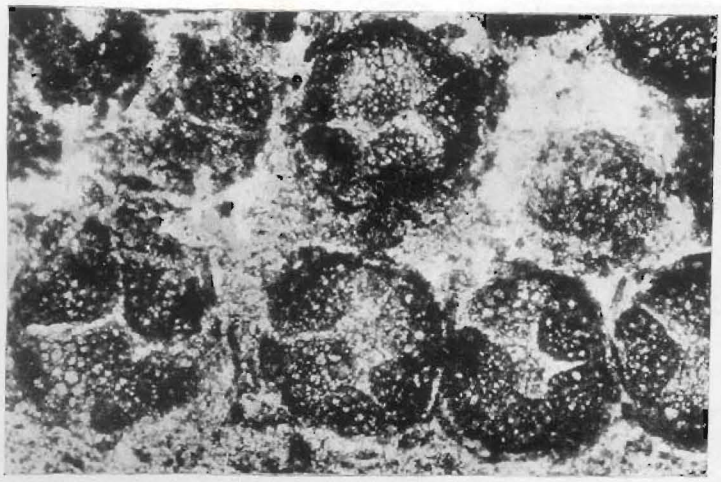
The microsporocarps were scattered in the matrix except in one case (PL. 1, FIG. 1) — perhaps a node — where there are above the sporocarp two slightly elongated bodies which might be two roots or two megasporocarps arising above the base of the sporocarp at the same node. Unfortunately this thin slab fractured into bits during the finer stages of grinding, thus leaving this point in doubt. The scattered sporocarps are 1-1·25 mm. in diameter, spherical in shape (PL. 1, FIG. 2). They may be sometimes compressed out of shape (PL. 1, FIG. 3). There is a thin wall layer (*w*) which is highly compressed and is suggestive of being 2 cells thick (PL. 1, FIG. 4) and loose enough to follow the contours of the microsporangial mass. There are about twenty microsporangia in a transverse section of the

sporocarp. The stalk of the sporocarp is not visible. Each microsporangium is spherical in form (PL. 1, FIG. 5), 200 μ across its greatest breadth. About eight alveolar massulae, roughly tetrahedral in form, fill the sporangium. Generally four or five of these are seen in sections (PL. 1, FIG. 6) and the massulae themselves are on the average $50 \times 57 \mu$ broad and bear glochidia (*gl*) all round (PL. 1, FIG. 7) as already observed by Sahni (1941, p. 499). The glochidia measure on the average 31 μ in length and are less than a micron in thickness (*gl*) (PL. 2, FIG. 8), and are " anchor tipped " (FIG. 8a). As observed by Sahni & Rao the glochidium shaft is unseptate and tapers to a constriction below the anchor part. Spores could not be made out clearly except in one case where two of them lie embedded in the pseudocellular mass of the massulae. No other detail except the thin wall of the spore could be made out.

DICOT ROOT

Although a large number of monocot roots (particularly of palms) have been found in tertiary deposits I do not think that many dicot roots have been described or recorded. There is, however, *Edenoxylon parviareolatum* Kruse (1954, p. 264), a dicot root with definite Sapindaceous affinity, described recently from the Eocene of Wyoming. In Boureau's (1957) recent publication are listed a number of monocot and dicot roots which have been referred to the various families of Angiosperms. But from the Deccan traps themselves only a few fern roots and roots of palms have been described. So far as I am aware no dicotyledonous root has been recorded. It is, therefore, necessary that a dicot root found in these deposits should be described in full although it is only a transverse section of a well-preserved root. The root is about a millimetre in diameter (PL. 2, FIG. 9). This section could not be traced either above or below in the serial sections of the petrified block, probably because the root itself was fragmentary. The thin cortex is partly preserved and is separated at places from the stele evidently due to pressure. The stele is well preserved and shows both the primary and secondary xylem. The former is in the form of five exarch rays (PL. 2, FIG. 10) with the protoxylem (*px*) at the points of the rays. The secondary xylem is a compact cylinder with numerous large vessels (*v*) (PL. 2, FIGS. 9, 10) which are large, angular, thin-walled, solitary or in radial series of 2-4, occasionally paired obliquely and unequally, tangential diameter up to 75 μ. In some of the vessels (*vl*) the contents are represented by a black stuff. Fibres are scarce, parenchyma thin-walled and rather " diffused " in pattern (METCALFE & CHALK, 1950, p. 23). Medullary rays are generally one cell thick. Their contents stain with gentian violet. The phloem is not preserved except in places where it can be made out. The phloem was perhaps meagre and occurred in patches. A clear endodermal layer (*end*) with barrel-shaped cells is seen (PL. 2, FIG. 11) and at places the presence of Casparian strips is suggested. Below the endodermis are two or three layers of parenchyma which are large, angular, slightly thick-walled and which evidently are the pericycle (*per*). In this tissue can be seen embedded at the outer side of the phloem some thick-walled cells probably of pericyclic origin — obviously the hard bast (*hb*). At places (PL. 2, FIG. 12) can be seen thin-walled brick-shaped cells evidently the cambium. No periderm or secretory cells can be made out in the cortex. The pith is small in quantity and thin-walled. As already stated this was the only section available, and the details seen in longitudinal sections could not be observed. With such incomplete information it is not possible or wise to speculate about the affinities of the root beyond its being a dicotyledonous one.

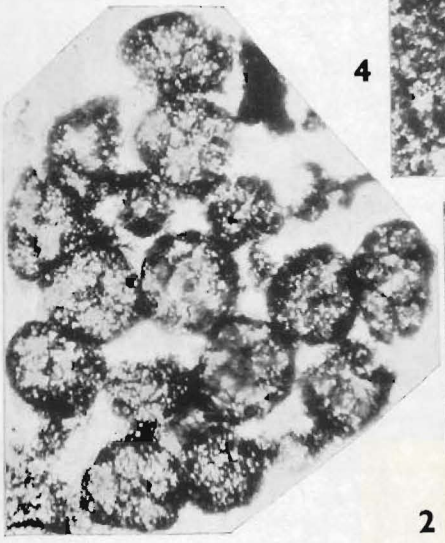
As stated above a number of monocot roots of palms, grasses, etc., and a few dicot roots have been described (BOUREAU, 1957). But these roots have either been found attached to their parent plants or show structural features which admit of their being identified with living families and genera. The root described in this paper cannot be identified with any of these for want of several important diagnostic characters. It should, I think, be for the present kept in a non-committal form genus. But so far as I am aware there does not seem to be any such genus. I, therefore, institute the form genus *Dicotylirhizos* for the reception of petrified dicotyledonous roots with uncertain affinities. The specific name is after my illustrious teacher who was responsible more than anybody else for elucidating the flora of the Deccan Intertrappean beds.

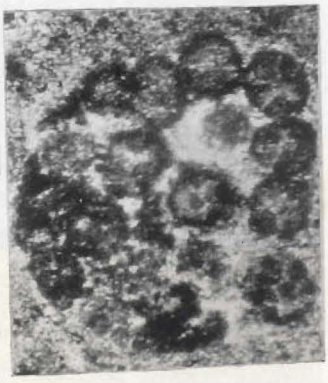


5

1

4



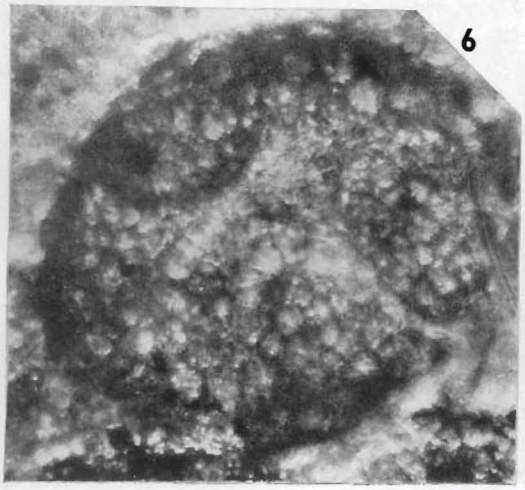


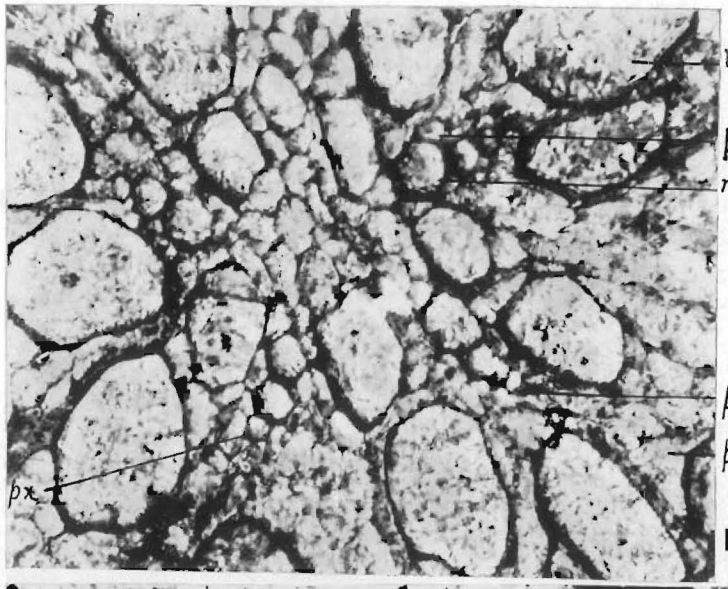
2

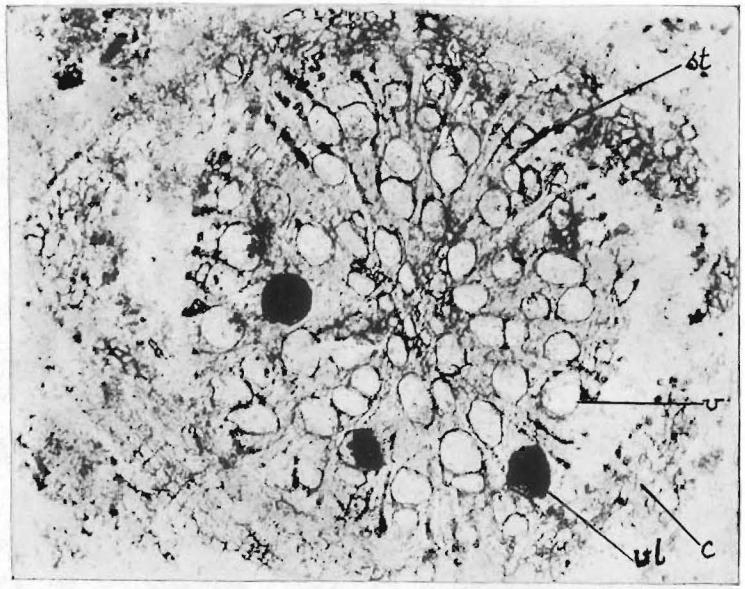
3

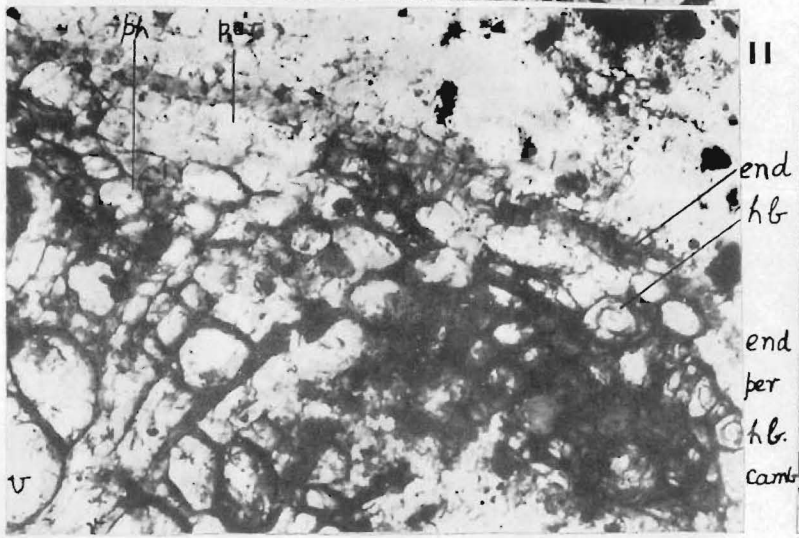
7

6



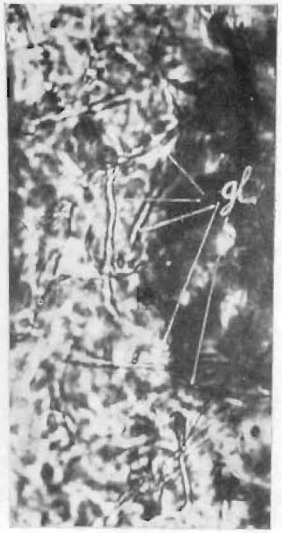

v
px
mx
px
par
px
10


st
v
vl
c
9


ph
pa
11
end
hb
end
per
hb.
camb
v


12


8a


8
gl

DICOTYLIRHIZOS SAHNII GEN. ET SP. NOV.

Diagnosis — Silicified dicot root about a mm. in diameter, with a thin cortex and well-preserved primary and secondary wood, primary xylem in 5 exarch rays. Secondary xylem compact with numerous vessels which are large, solitary or in radial series or obliquely paired or unequal, tangential diameter 70-75 μ. Medullary rays generally uniseriate.

I am grateful to Dr. K. R. Surange and Dr. Uttam Prakash for helpful criticism and loan of literature.

REFERENCES

BOUREAU, E. (1957). Anatomie vegetate L'appareil vegetatif des Phanerogames. **1.** *Presses Univeristaires France. Paris.*

KRUSE, H. O. (1954). Some Eocene Dicotyledonous woods from Eden Valley, Wyoming. *Ohio Journal of Science.* **54**(4): 243-268.

METCALFE, C. R. & CHALK, K. P. (1950). Anatomy of the dicotyledons. 1. *Oxford.*

RODE, K. P. (1936). A silicified dicotyledonous wood, *Dryoxylon Mohgaoense* sp. nov. from the Deccan Intertrappean beds of India. *Jour. Ind. Bot. Soc.* **15**(2): 131-138.

SAHNI, B. (1941). Inidian silicified plants — 1. *Azolla intertrappea* Sah. & H. S. Rao. *Proc. Ind. Acad. Sci.* **14**: 489-507.

SAHNI, B., SRIVASTAVA, B. P. & RAO, H. S. (1934). The silicified flora of the Deccan intertrappean series, Pt. IV. *Azolla intertrappea* sp. nov. *Proc. 21st Ind. Sci. Congress, Bombay*: 26-27.

SAHNI, B. & RAO, H. S. (1943). A silicified flora from the intertrappean cherts round Sausar in the Deccan. *Proc. Nat. Acad. Sci. India.* **13**: Pt. 1: 36-75.

EXPLANATION OF PLATES

All photographs are from untouched negatives.

Azolla intertrappea Sahni & Rao

PLATE 1

1. Photograph of a thin slab showing a transverse section through a (?) node showing a spherical microsporocarp and above it two cylindrical sheathed structures which might be the megasporocarps or roots. × 25.

2. A partly compressed and ruptured microsporocarp with slightly separated microsporangia. × 30.

3. Another old microsporocarp with the microsporangia separated from each other. × 43.

4. Peripheral part of the microsporocarp showing the sporocarp wall (*w*) and microsporangia. The individual massulae are clearly seen. × 210.

5. A group of microsporangia cut at various planes and showing the tetrahedral massulae. The glochidia are seen as thin white streaks. × 125.

6. A single microsporangium showing four tetrahedral massulae. × 320.

7. The space between three massulae showing the glochidia (*gl*) borne on the sides and in front of the massulae. × 400.

PLATE 2

8. A part of the space between three massulae magnified further to show the glochidia. × 610.

8a. The glochidium showing the anchor tip. × 1400.

Dicotylirhizos sahnii Gen. et sp. nov.

9. Transverse section of root showing *c*, cortex; *st*, stele; with *v*, large vessels, some of which (*vl*) contain some black substance. × 99.

10. The central part of the stele showing the five primary exarch xylem rays and the secondary wood; *px*, protoxylem; *mx*, metaxylem; *v*, vessel; *par*, parenchyma. × 356.

11. The peripheral part of secondary wood enlarged to show *v*, vessels; *r*, uniseriate rays; *ph*, phloem; *per*, pericycle; *hb*., lignified cells of pericycle or hard bast; *end*, barrel-shaped cells of endodermis. × 277.

12. Peripheral part of secondary wood showing thin-walled, brick-shaped cells probably the cambium (*camb*). × 265.