

# RODEITES SAHNI REINVESTIGATED — II\*

S. D. CHITALEY & S. A. PARADKAR

Department of Botany, Institute of Science, Nagpur

## ABSTRACT

The paper describes the structure of a 5 cm. long petiole bearing five *Rodeites* sporocarps one above the other in a row, collected from the Mohgaonkalan beds of the Deccan Intertrappean Series of India. It shows in T.S. a well defined epidermis, aerenchymatous cortex and a central angular horse-shoe shaped robust vascular strand. On comparison with petioles of *Marsilia*, *Pilularia* and *Regnellidium* it is observed that the present petiole is different from them in thickness, arrangement of vascular tissues and in the number of protoxylem groups.

Eleven indusial septae are seen clearly in one of the sporocarps. They are attached to the inner side of the sporocarp wall.

The petiole bearing sporocarps and sporocarp with eleven indusial septae are being recorded here for the first time. Observations in this paper support the previous study of *Rodeites* sporocarps by the authors indicating that *Rodeites* was not identical with *Regnellidium*, but was an extinct fourth genus of Marsileaceae showing more resemblance to *Marsilea* than to *Regnellidium*. A new species *Rodeites polycarpa* is created in this paper.

## INTRODUCTION

THE genus *Rodeites* was described by Sahni (1943). Further contributions to its knowledge were made by Mahabale (1956) and by Surange (1966). Chitale and Paradkar in their paper on *Rodeites* Sahni Reinvestigated—I (Chitale and Paradkar, 1972) have brought forward some new and interesting facts to light regarding this genus. Present findings by us are in continuation with the previous investigations. This paper describes for the first time a petiole bearing sporocarps of *Rodeites* in a row one above the other. Some more characters are also newly described.

## MATERIAL AND METHODS

This paper is based on the study of a new specimen of *Rodeites* in which five sporocarps are seen attached to a petiole. The sporocarps are borne one above the other in a row. The straight petiole is 5 cm. long and 3.1 mm. broad. This specimen is preserved in brown chert. Two more petioles of the same were found in black chert. They measure 2 cm. long and 3.9 mm. broad and 1 cm. long and 5 mm. broad

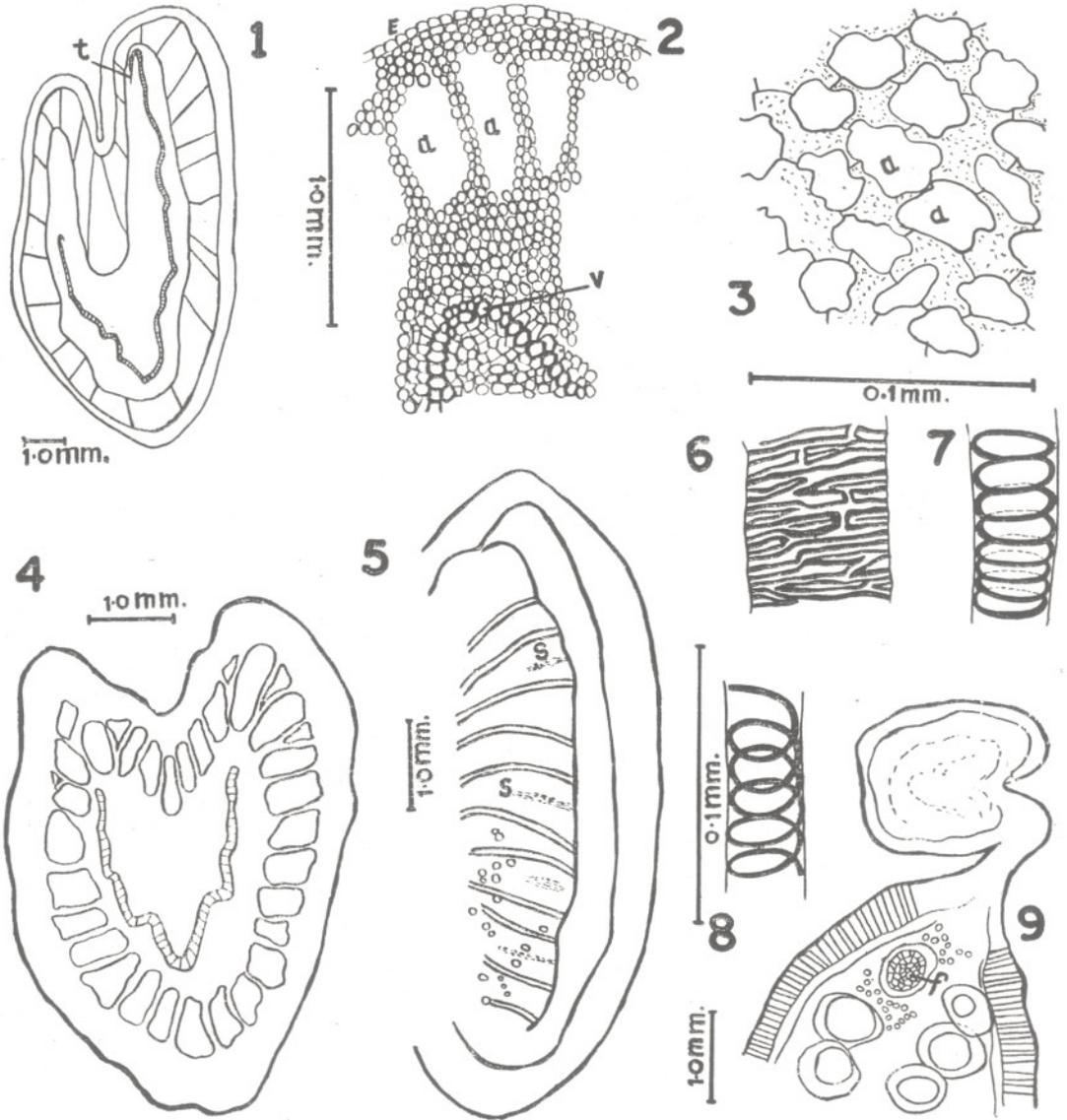
respectively. The specimen was photographed as such and later on it was cut through the middle portion of the petiole to study its internal structure in T.S. More sporocarps and petioles of the same type were exposed after cutting this specimen of petiole. Both ground and peel sections were prepared along transverse and longitudinal planes.

## DESCRIPTION

The petiole, bearing the *Rodeites* sporocarps in a row (Plate 1, Fig. 1), is grooved longitudinally and a notch is seen in its T.S. It shows an aerenchymatous cortex and a central angular horse-shoe shaped conducting strand clearly visible even with the naked eye (Plate 1, Fig. 4). The petiole in T.S. shows one layered epidermis and 3-4 layers of outer cortical cells. Next is a region of aerenchymatous cortex with radially arranged bands of cells separating the cavities. The bands bifurcate at places so that air spaces are increased in number (Text-figs. 2, 4). The inner cells of the cortex are more compact and thick-walled than the central thin-walled parenchymatous region of the petiole. The air-cavities show at places, in different sections, presence of thick-walled diaphragms of cells for mechanical support (Text-fig. 3). This is a typical character of aquatic plants.

The vascular tissues are arranged in T.S. in an angular horse-shoe shaped strand. These consist of tracheids with annular, spiral and scalariform (Text-figs. 6, 7, 8; Plate 1, Fig. 3) thickenings. The protoxylem elements with annular and spiral thickenings are 28  $\mu$  and 27  $\mu$  broad respectively; while scalariform metaxylem elements are 53-55  $\mu$  broad each. Protoxylem is at the angles of the horse-shoe shaped strand and is seen at least at 7-9 places. Phloem surrounds the xylem on outer and inner sides, but is not so well preserved. One of the free arms of xylem is seen to curve towards its inner central side. This is the vascular trace going alternately into a sporocarp (Text-fig. 1,t).

\*Contributed to the Palaeobotanical Conference, Birbal Sahni Institute of Palaeobotany Silver Jubilee, December 1971.



TEXT-FIGS. 1-9—1. Diagrammatic T.S. petiole showing curved sporocarp trace 't'. 2. Part of T.S. petiole, *E*—epidermis; *a*—air-chambers; *V*—Vascular tissues. 3. Stellate cells of diaphragm and *a*—air-spaces. 4. Diagrammatic T.S. notched petiole showing horse-shoe shaped vascular bundle and air-chambers. 5. Diagrammatic V.S. sporocarp showing eleven septae and position of sori—*S*; microspores seen *in situ*. 6, 7, 8. Xylem tracheids with scalariform, annular and spiral thickenings respectively. 9. Diagrammatic T.S. petiole showing attachment of sporocarp on one side of notch. Sporocarp with megasporangia having female gametophyte and microspores.

The structure of the fossil petiole with good amount of vascular tissue as compared with that of *Marsilea*, *Pilularia* and *Regnellidium* petioles, indicates the robust nature of the present fossil petiole bearing sporocarps. In *Marsilea*, *Pilularia* and *Regnellidium* the shape of vascular tissues in T.S.

shows two groups of V-shaped xylem, diverging at an angle, with the protoxylem at the tips and metaxylem in the middle of each xylem group. The structure is thus very different and distinct from that of the living genera, the petioles of which are thinner in diameter.

The sporocarps are attached on the two (Text-fig. 9) sides of the groove alternately by means of a very small stalk, about 1 mm. long and 1 mm. broad probably an extension of the sporocarp-wall tissue (Text-fig. 9). This suggests an almost direct attachment of sporocarps to the petiole, a condition much different from the curved stalk shown by Sahni (1943) for his type specimen. Probably Sahni's material belonged to a different species of *Rodeites* as already suggested by Chitaley and Paradkar (1972).

The sporocarps in this chert are larger, 15-16 mm.  $\times$  6 mm.  $\times$  12 mm. each and more flattened than those observed previously (Chitaley and Paradkar, 1972). They have well preserved wall structure and the two kinds of spores with all the megaspores showing cellular female gametophyte in each of them (Text-fig. 9; Plate 1, Fig. 2). The mega-spores and the micro-spores are larger in size than those previously reported by us. Otherwise the structures are similar in both. The mega-spores are 740-880  $\mu$  each and the microspores are 75-80  $\mu$  in size each (Plate 1, Fig. 2).

In one of the sporocarps exposed in the same chert, eleven indusial septae were observed arising from the inner wall of the sporocarp (Text-fig. 5; Plate 1, Fig. 5). In between some of these septae, there are seen tissues which may be representing the receptacle (Text-fig. 5,s) or placenta of the sori along with some microspores still *in situ*. The number of septae and consequently the number of sori is much different from the previously reported number by Sahni (1943). The attachment of the placenta on the inner wall of the sporocarps confirms the finding reported by Chitaley and Paradkar (1972) that it is more like *Marsilea* rather than that of *Regnellidium*.

## DISCUSSION

Such a specimen with a number of *Rodeites* sporocarps in organic connection with petiole and the clearly observed septae in the sporocarp are described here for the first time. The sporocarps are borne at an angle of 45° on the petiole. The number of sporocarps and the way in which they are borne suggest the *Marsilia polycarpa* condition as described by Gupta (1962). The sporocarps are distinctly more bilate-

rally flattened than singly occurring rounded sporocarps, probably due to crowding on the petiole. The sporocarps are equidistant from each other and are almost directly attached to the petiole. This specimen and others described previously by Chitaley and Paradkar (1972) clearly indicate variations in the genus *Rodeites*. Chitaley and Paradkar (1972) had hinted that there were at least two varieties if not species of *Rodeites* because of size variations and occurrence of sporocarps in groups of different patterns. These varieties were named as *Rodeites dakshini* var. *intertrappeana* and *R. dakshini* var. *polycarpa*. We now have more evidence to confirm these differences in size and shape of sporocarps, in the attachment of the stalk, the number of sori inside and the group pattern. These differences help us to create a new species of *Rodeites*. Thus, *Rodeites dakshini* var. *polycarpa* (Chitaley and Paradkar, 1972) is now raised to the level of a species and is named as *Rodeites polycarpa* sp. nov. Chitaley and Paradkar.

Chitaley and Paradkar (1972) have shown that *Rodeites* is similar to *Marsilea* in the attachment of sporocarps and its wall is similar to other genera of Marsileaceae. This study of *Rodeites* petiole and sporocarps further supports the conclusions drawn by Chitaley and Paradkar (1972) that *Rodeites* is not identical with *Regnellidium diphyllum* Lind. and that it is a separate extinct fourth genus of Marsileaceae.

Specific Diagnosis of *Rodeites polycarpa* sp. nov. Chitaley and Paradkar:—

Sporocarps in linear groups one above the other, each bilaterally flattened, ellipsoidal (16 mm.  $\times$  6 mm.  $\times$  12 mm.) attached alternately, almost directly on petiole; petiole grooved with aerenchymatous cortex and with an angular horse-shoe shaped xylem strand; petiole 3 to 3.9 mm. in diameter and 5 cm. long; sporocarp wall very thick 580-650  $\mu$ , multi-layered; epidermis 50-60  $\mu$ ; prismatic layer 300  $\mu$ , middle layer 100-110  $\mu$  thick and parenchymatous inner layer 130-210  $\mu$  thick; stomata present in epidermis; vascular bundles 20-28, ducts present in inner layers; soral chambers 10-12 on either side of sporocarp, attachment of sori vertical and lateral extending to centre, sorus receptacle with a vascular bundle; megaspores large, 740-880  $\mu$  with aspidote aperture, 150  $\mu$  broad; megaspore wall 40  $\mu$  thick; female gametophyte

distinguished into apical and basal regions, apical region of smaller cells, basal of larger cells, whole tissue not touching the spore wall except at the apex, apical region showing archegonia; microspores 75-80  $\mu$  each in diameter.

*Holotype* — *Rodeites polycarpa* Chitale and Paradkar. Nos. 92-96 Rp/Cp 1 depo-

sited in the Botany Department, Institute of Science, Nagpur.

*Isotype* — Nos. 81-85 and No. 97 with septae.

*Locality* — Mohgaonkalan, Chhindwara District, Madhya Pradesh, India.

*Horizon* — Deccan Intertrappean Series.

*Age* — ? Uppermost Cretaceous.

#### REFERENCES

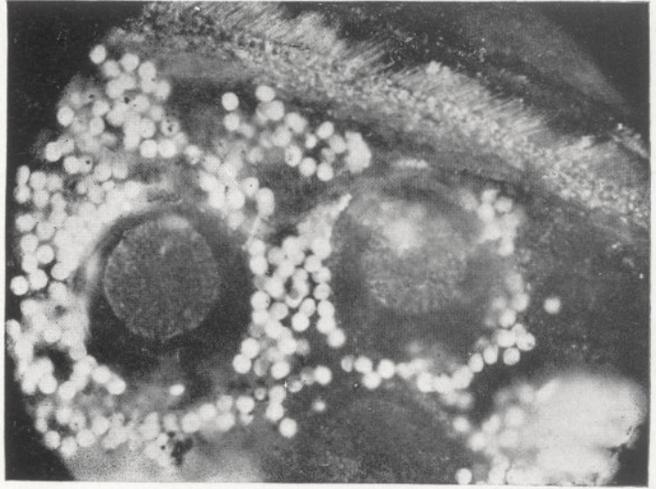
- CHITALEY, S. D. & PARADKAR, S. A. (1972). *Rodeites* Sahni Reinvestigated-I. *Bot. Jour. Linn. Soc.* **65**: (1), 109-117.
- GUPTA, K. M. (1962). *Marsilea* Monograph C.S.I.R. Delhi.
- MAHABALE, T. S. (1956). Trends of Specialization in the sporocarp and spores of living and fossil Marsiliaceae. *Palaeobotanist.* **5**: (2), 66-72.
- SAHNI, B. (1943). *Rodeites dakshini* gen. et sp. nov. Palaeobotany in India IV. *J. Indian bot. Soc.* **22**: 179-181.
- SURANGE, K. R. (1966). Indian Fossil Pteridophytes, C.S.I.R., Delhi.

#### EXPLANATION OF PLATE 1

1. Type specimen of *Rodeites polycarpa* sp. nov. on rock.  $\times 2.5$ .
2. V.S. Sporocarp showing wall, megaspores with intrasporic female gametophyte and microspores.  $\times 30$ .
3. L.S. Tracheids showing thickenings.  $\times 500$ .
4. T.S. notched petiole exposed on rock showing horse-shoe shaped vascular strand and air-spaces.  $\times 10$ .
5. V.S. Sporocarp showing eleven septae, soristisues and microspores *in situ*.  $\times 30$ .



1



2



3

4



5

