

FURTHER CONTRIBUTION TO THE MESOZOIC FLORA OF KUTCH, GUJARAT

JAYASRI BANERJI

Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226 007, India

Abstract

Two species of *Adiantopteris*, some plant fragments resembling various organs of *Marselia*, a fern frond, scattered groups of trilete spores and *Stachyotaxus* sp. have been described in this paper. On the basis of these findings palaeoecology of the Bhuj Formation exposed near Trambau has also been discussed.

Introduction

Fossil plant remains described in this paper were collected during February, 1985 from the following two localities, for details see Bose and Banerji (1984) and Banerji, (in press).

(1) Trambau—Southern bank of Pur-River Section about 3 km west of Trambau village.

(2) Kurbi—Fossiliferous bed exposed at about 0.5 km northeast of Kurbi village.

The fossiliferous beds of Trambau are dominated by pteridophytes and conifers. In this section some beds are dominated by conifer remains, while in others pteridophytes are relatively more frequent. Recently, a bed has been found (see Banerji, in press) which is almost entirely composed of liverworts along with rare occurrence of algal remains and fragments of plants resembling rhizome, leaves and sporocarp of *Marselia*. Fossiliferous beds exposed at Kurbi, show dominance of pteridospermic and bennettitalean remains along with rare occurrence of pteridophytic remains. The Kurbi assemblage shows somewhat older aspect than Trambau assemblage (see Bose & Banerji, 1984).

Description

Genus—*ADIANTOPTERIS* Vassilevskaja

Adiantopteris sp. A

Pl. 1, fig. 1

Description—The description is based on two fragmentary specimens present in the form of impression. In these specimens, at places thin carbonized crusts are visible. For description fronds have been assumed to be bipinnate.

Primary rachis 0.3 mm wide; pinnae incomplete. Largest available pinna 2 cm long and 1 cm wide, probably linear-lanceolate in shape. Pinnules stalked, sub-opposite, attached at an angle of about 50°-60°, cuneate, measuring 6 × 5 mm, base constricted, lateral margins more or less straight, apical margin variously lobed. Veins diverging from base, forked.

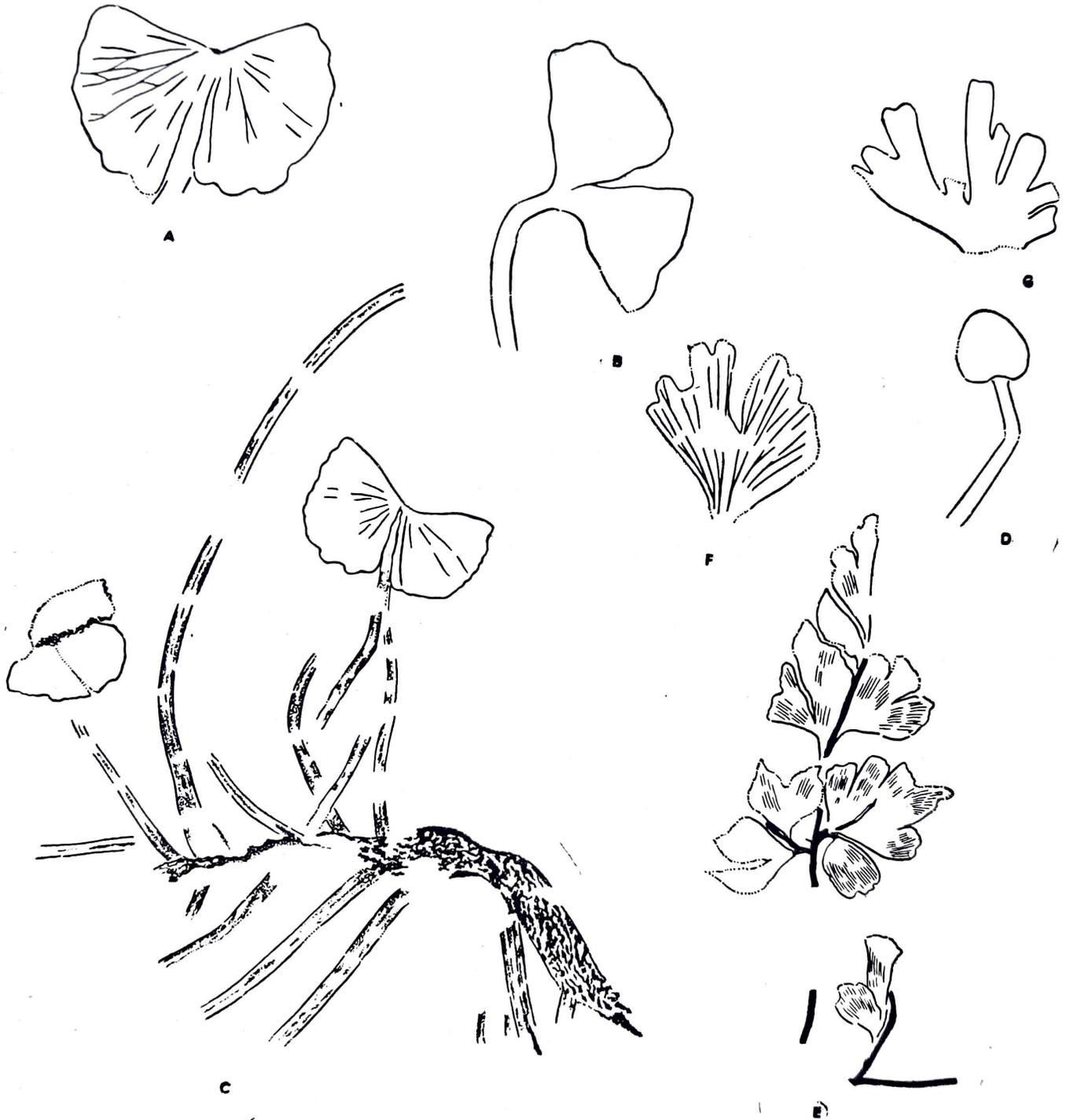
Occurrence—Pur-River Section near Trambau, Kutch.

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Collection—Specimen nos. B.S.I.P. 35896 and 35908.

Remarks—Both the specimens are sterile. Near apical margin some of the pinnules have carbonized crust, but, when macerated, they do not show any definite structure.

Comparison—The present specimens resemble somewhat with the figured specimen of *Adiantopteris gracilis* (Vassilevskaja) Samylina (1976) described from the Cretaceous of Omsukchan, Magadan District, U.S.S.R.



Text-fig. 1—A. Enlarge leaflets of *Marselia*-like plant showing venation pattern, B. S. I. P. specimen no. 35900, $\times 6$. B. detached leaf of *Marselia*-like plant with two leaflets, B. S. I. P. specimen no. 35905, $\times 6$; C. specimen showing habit of plant, prostrate rhizome with upright branches and only one leaf with two leaflets are preserved, B. S. I. P. specimen no. 35900, $\times 4$; D. detached stalked sporocarp, B. S. I. P. specimen no. 35905, $\times 6$; E. frond of *Adiantopteris* sp. B, B. S. I. P. specimen no. 35897, $\times 2$, F & G. Showing detached pinnae of Fern frond type 1 with lobed degenerate lobes and forked venation, B. S. I. P. specimen no. 35898, \times Ca 4.

Adiantopteris sp. B

Pl. 1, fig. 20; Text-fig. 1E

Description—The description is based on only two specimens. Fronds seem to be tripinnate, about 2.5 cm long, primary pinna measuring about 2.5×1.6 cm; secondary rachis 0.4 mm wide; secondary pinna sub-oppositely attached at an angle of 45° - 55° , cordate, tertiary rachis 0.3 mm wide; pinnules cuneate in shape, 5-5.5 mm long and 2.5-3.5 mm wide, base constricted, lateral margin entire, apical margin crenulate or wavy. Forked veins emerging from base.

Occurrence—Pur-River Section near Trambau, Kutch.

Collection—Specimen no. B.S.I.P. 35897.

Comparison—The present species differs from *Adiantopteris* sp. A in having less spreading pinnules with crenulate apical margin, whereas, in *Adiantopteris* sp. A pinnules are stalked, more spreading and with lobed apical margin. In shape and crenulate apical margin *Adiantopteris* sp. A is somewhat comparable with *Adiantites toyoraensis* described by Oishi from Japan, but pinnules in the latter species are comparatively larger in size.

FERN FROND TYPE 1

Pl. 1, fig. 3; Text-fig. 1F & G

Description—Fronds bearing alternate or sub-opposite pinnae; partially degitate or fan shaped, typically 4×7 mm, each lobe about 1-1.5 mm wide, substance of lamina extremely thin; margin entire. Veins arising and diverging from base, forked or unforked.

Occurrence—Pur-River Section near Trambau, Kutch

Collection—Specimen no. B.S.I.P. 35898.

Remarks—In overall aspect frond seems to be related to *Lygodium*.

MARSELIA-LIKE PLANT FRAGMENTS

Pl. 1, figs. 10-20; Text-fig. 1 A-D

Description (Rhizome with upright branches)—The most complete specimen, preserved as impression (pl. 1, figs. 10 & 12) shows prostrate rhizome with upright leaf stalks. Unfortunately, except two leaf stalks, all are broken at distal ends. Only two upright stalks seem to have leaflets (preservation of the stalk is incomplete).

Another specimen figured in Pl. 1 fig. 13 shows a stalk with a part of lamina. Rhizome 1.5 mm wide, surface seems to be covered with hairs. Roots not clearly marked, probably going downwards from rhizome in groups. Upright stalks slender, about 0.5 mm thick, length variable, surface smooth, most probably arising in two rows. Leaf divided into leaflets, two obtuse leaflets attached at one point with apical margin slightly lobed or crenulate (Pl. 1, fig. 11). Veins forked or unforked, at places cross-connections visible. (Text-fig. 1A).

Detached stalked leaf with two leaflets and stalked sporocarp like bodies—A specimen shown in pl. 1 fig. 17 shows two obtuse leaf segments with small stalk. Associated with this there are 2 or 3 stalked sporocarp like bodies. Such detached stalked sporocarp like bodies (pl. 1, fig. 19) have been found in association with the specimen figured in pl. 1, fig. 13. Sporocarp like bodies oval or bean shaped, measuring $1-2 \times 1-1.5$ mm in size, surface seems to be smooth.

Detached leaves with five leaf segments—Two specimens showing detached leaves with 5 leaf segments have been figured in pl. 1, figs 14 and 16. Leaf segments are obtuse or

wedge shaped, size $3 \times 2.5-3.5$ mm, apical margin crenulate, vein seems to be more than one. The specimen, figured in pl. 1, fig. 16, shows broader base leaf-segments and the apical margin is also broadly lobed, vein indistinct.

Two-sporocarps attached to rhizome—The figured specimen in pl. 1 fig. 20 shows small portion of a rhizome, about 3.5 mm long and 2 mm wide, emerging close to this is a small upright stalk which is about 1 mm long and 0.8 mm wide and it has two sporocarps attached almost at right angle. Sporocarp circular-bean shaped, 1.5×1.5 mm in size.

Occurrence—Pur-River Section, Kutch.

Collection—Specimen nos. B.S.I.P. 35900, 35901, 35902, 35903, 35904, 35905 & 35906.

Remarks—The plant fragments described above seem to be closely related to extant *Marselia* in general morphological features. Unfortunately, so far, I have not got a complete plant where rhizome, leaves and sporocarps are intact. Moreover, I could not isolate any spore from the bulk maceration. Therefore, at present, I prefer to leave the affinities of these plant remains open.

SCATTERED GROUPS OF TRILETE SPORES

Pl. 1, figs. 4-9

Description—On one of the shale samples 5-6 oval groups of spores were found together at one place. On maceration they yielded triangular-subtriangular trilete spores, 60-100 μ m in size, trilete rays extending upto $3/4$ th radius, rays with 6-8 μ m broad flange like extension of lips, exine 4-6 μ m thick, echinate, echinae more pronounce at apical region in proximal side, distally more or less uniformly distributed, exine at places showing pseudo-reticulate pattern.

Occurrence—Pur-River Section near Trambau, Kutch.

Collection—Specimen no. B.S.I.P. 35899.

Comparison—These trilete spores are somewhat comparable with *Pilosisporites trichopapillosus* (Thiergart) Delcourt and Sprumont described by Singh (1964) from the Lower Cretaceous of Alberta. The present spores, like *P. trichopapillosus* have echinate ornamentation of exine but they differ from *P. trichopapillosus* in having pseudo-reticulate pattern formed by echinae bases.

Genus—*STACHYOTAXUS* Nathorst

Stachyotaxus sp.

Pl. 1, fig. 21

Description—Description is based on a specimen with part and counterpart. It was found in association with shoots of *Elatocladus confertus* and two detached seeds.

Megastrobilus incomplete, about 1 cm long and 0.6 cm wide, megasporophylls elongated, probably oppositely disposed at an angle of $70^\circ-80^\circ$, sessile, base decurrent, distal part upturned forming a depression, only at one place two seeds are placed side by side and their micropylar end seems to be facing towards axis.

Occurrence—Kurbi, Kutch.

Collection—Specimen nos. B.S.I.P. 35907A and 35907B.

Comparison—*Stachyotaxus* sp. shows apparent resemblance with *Stachyotaxus sampathkumarani* Rao (1964) described from Onthea, Rajmahal Hills, Bihar. The present

specimen shows some resemblance with *Beaniopsis rajmahalensis* Ganju (1946), which has been referred to *Stachytaxus* by Bose and Maheshwari (1974), but due to the fragmentary nature at present it is described as *Stachytaxus* sp.

General Discussion

The plant fossils described here from Trambau, Kutch District, Gujarat include *Adiantopteris* sp. A & B., a fern frond and *Marselia*-like plant remains which are reported for the first time from Kutch. Besides these, *Stachytaxus* sp. has been described from Kurbi, which shows the presence of podocarpaceae at Kutch during that time. Amongst these, the occurrence of *Marselia*-like plant remains are significant. The typical habit of the *Marselia*-like plant remains are quite suggestive of their being *Marselia* than any other plant. But, still the recovery of spores from the fertile organs is awaited. At present it can be suggested here, that if these plant organs belong to *Marselia*, then they show additional evidence of prevailing fresh water condition near Trambau during the time of deposition, which has earlier been suggested by Bose & Banerji (1984) and Banerji (in press) due to the presence of *Trambauathallites*, *Isoetes* and root markings (insitu in position) in this assemblage.

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Explanation of Plate

1. Pinnate frond of *Adiantopteris* sp. A, B. S. I. P. specimen no. 35896, × Nat. size.
2. Bipinnate frond of *Adiantopteris* sp. B, B. S. I. P. specimen no. 35897, × Nat. size.
3. Fern frond type 1—showing lobed-degitate leaflets, B. S. I. P. specimen no. 35898, × Nat. size.
4. Specimen showing 6 groups of trilete spores, B. S. I. P. specimen no. 35899, × 4.
- 5—9. Trilete spores recovered from the groups, showing flanged trilete laesurae and exine ornamentation, B. S. I. P. slide nos. 1-3/35899, × 500.
- 10, 11. *Marselia*-like plant, specimen showing habit of the fossil plant, B. S. I. P. specimen no. 35900 × Nat. size & × 2.
12. Counterpart of the above specimen, B. S. I. P. specimen no. 35901, × Nat. size.
13. Another specimen of *Marselia*-like plant showing a part of rhizome with upright leaf stalk with a portion of leaflet, B. S. I. P. specimen no. 35902, × Nat. size.

- 14, 15. Detached leaf with 5 leaflets showing crenulate apical margin, B. S. I. P. specimen no. 35903, \times Nat. size and \times 2.
16. A detached leaf with 5 leaflets showing lobed apical margin, B. S. I. P. specimen no. 35904, \times Nat. size.
- 17, 18. Showing detached stalked leaf with two leaflets and stalked sporocarp of *Marselia* like plant found in close association, B. S. I. P. specimen no. 35905, \times Nat. size and \times 2.
19. Two sporocarps with small stalk found in the specimen shown in fig. 12, B. S. I. P. specimen no. 35901 \times Nat. size.
20. Two sporocarp on a single stalk found attached to the rhizome, B. S. I. P. specimen no. 35906, \times Nat. size.
21. *Stachytaxus* sp. showing megasporophyll with seed impression, B. S. I. P. specimen no. 35907, \times 6.

