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SOME PTERIDOPHYTES FROM THE JABALPUR FORMATION

ZEBA-BANO
Birbal Sahni Institute of Palaeobotany, Lucknow-226 007, India

ABSTRACT

In this paper some pteridophytes are described from the Jurassic-Lower Cretaceous rocks of Satpura Basin and Jabalpur, Madhya Pradesh. These are ?*Equisetum* sp.,| *Todites indicus* (Oldh. & Morr.) Bose & Sah, *Gleichenites* sp., *Hausmannia dichotoma* Dunker, *Cladophlebis medlicottiana* (Oldh.) Pascoe, *Sphenopteris anderssonii* Halle, *Sphenopteris* sp. cf. *S. otagoensis* Arber and 2 species of *Sphenopteris*.

Key-words — Pteridophytes, Megafossils, Jurassic-Lower Cretaceous, Jabalpur Formation (India).

साराँश

जबलपुर शैल-समूह से कुछ टेरिडोफ़ाइट — ज़ेबा बानो

इस शोध-पत्र में सतपुड़ा बेसिन तथा जबलपुर, मध्य प्रदेश की जुरेसिक अधर क्रीटेश्यस कालीन चट्टानों से कुछ टेरिडोफ़ाइट वर्णित किये गये हैं। ये ?इक्वीसीटम् जा०, टोडाइटिस इन्डिकस (ओल्डहेम एवं मॉरिस) बोस एवं शाह, ग्लाइकेनाइटिस जा०, हाउसमानिया डाइकोटोमा डन्कर, क्लेडोफ्लेबिस मेड्लिकॉटियाना (ओल्डहेम) पॉस्को, स्फीनॉप्टेरिस एन्डरसोनाई हाले, स्फीनॉप्टेरिस जा० सजातीय स्फी० ओटागोयेन्सिस आरबर तथा स्फीनॉप्टेरिस की दो जातियाँ हैं।

INTRODUCTION

So far the fossil flora of the Jabalpur Formation of Madhya Pradesh has been described and illustrated to a large extent by various workers from the South Rewa Gondwana Basin, Jabalpur and the eastern extremity of the Satpura Basin (near Marhpiparia & Sehora). The flora of the remaining part of the Satpura Basin, however, has mostly been listed; the plants which have been figured or figured and described are: *Moranocladus oldhami* (Zeiller) Sahni (1928) from Morand River; *Hausmannia dichotoma* Dunk., *H. buchii* Andreae, ?*Sagenopteris* sp., *Nilssonia* sp. (Crookshank, 1935) and *Hausmannia crookshanki* Shah & Singh (1964) from Jatamao; and *Araucaria indica* (Sahni) Sukh-Dev & Zeba-Bano (paper in press) from the Hard River. Recently a large number of plant remains have been collected from various localities of this region. Out of them, the pteridophytes are described here.

DESCRIPTION

ORDER — EQUISETALES

Genus — *Equisetum* Linnaeus

?*Equisetum* sp.

Pl. 1, fig. 13; Text-fig. 1H

Description — Fragmentary stem showing a portion of node and internode, up to 1.8 cm broad at nodal region. Node slightly swollen. Internode incomplete, up to 1.2 cm in length, marked with longitudinal ridges and grooves which closely alternate with those from the next internode. Leaf-sheath inconspicuous, appressed.

Collection — Museum Specimen no. 41/1441, Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Hard River near Hasnapur, Narsinghpur District, Madhya Pradesh.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Comparison — So far a single species of *Equisetum*, viz., *E. rajmahalense* (Oldham & Morris) Feistmantel, is known from the Upper Gondwana of Kutch (Roy, 1968) and the Rajmahal Hills (Bose & Sah, 1968). The present specimen, though fragmentary, is quite distinct from *E. rajmahalense* in having internodes marked with longitudinal ridges and grooves. In *E. rajmahalense* the internodes of the stem are smooth, without ridges and grooves. Since the present specimen is very fragmentary, therefore at present the detailed comparison with the other species of *Equisetum* is not possible. Shah and Singh (1965) have also reported equisetaceous stem from the Morand Valley but they have not given any figure or description.

FILICALES

FAMILY — OSMUNDACEAE

Genus — *Todites* Seward

Todites indicus (Oldham & Morris) Bose & Sah

Pl. 2, fig. 17; Text-fig. 1I

1877 *Alethopteris* (*Cladophlebis*) *indica* Oldham & Morris: Feistmantel, p. 7, pl. 1, figs 3-5.

1882 *Asplenium whitbyense* Heer: Feistmantel, p. 28, pl. 1, figs 2-7.

1932 *Alethopteris indica* (Oldham & Morris): Dev, p. 104, pl. 7, figs 1, 2.

Description — Frond sterile, available length and breadth 6·7-7·3×4·7-12·0 cm. Rachis thick, stout, up to 4 mm wide, surface with a median ridge. Pinnae elongate, alternate, attached to rachis at an angle of about 65°. Pinna rachis slender, grooved, arched or flexuous, more than 1 mm in thickness. Pinnae slightly tapering towards apical region, up to 7·5 mm long and 1·5 mm broad in basal and middle region, but 0·4-0·7 cm in breadth towards apex. Pinnules alternate, very closely set, touching or overlapping pinnules and neighbouring rachis, linear-lanceolate or narrowly wedge-shaped, basal pinnules almost straight and attached more or less at right angles to pinna rachis. Apical pinnules slightly falcate and forwardly directed. Pinnules typically 0·8-1·0×0·3 cm, attached to pinna rachis by their full bases at an angle of about 85°, bases somewhat joined or free. Margin almost entire or slightly wavy. Apex bluntly acute to pointed. Venation not clearly visible, midrib prominent near base, gradually becoming evanescent towards apex. Lateral veins mostly bifurcating once, almost reaching margins.

Collection — Museum specimen nos. 3/1440, 8/1440 and 30/1440 (C.P. 30/1440), Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Near Imjhiri, Narsinghpur District, Madhya Pradesh.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Comparison — The present specimens match exactly some of the sterile fronds of *T. indicus* described by Bose and Sah (1968, pl. 2, figs 14, 18) from the Rajmahal Hills. *T. indicus* in general morphology of frond closely resembles *T. williamsoni* (Brongn.) described by Yokoyama (1906, pl. 3, fig. 1) from China, but in the latter species lateral veins are regularly bifurcating and its pinnules are also larger in size.

FAMILY — GLEICHENIACEAE

Genus — *Gleichenites* Göeppert

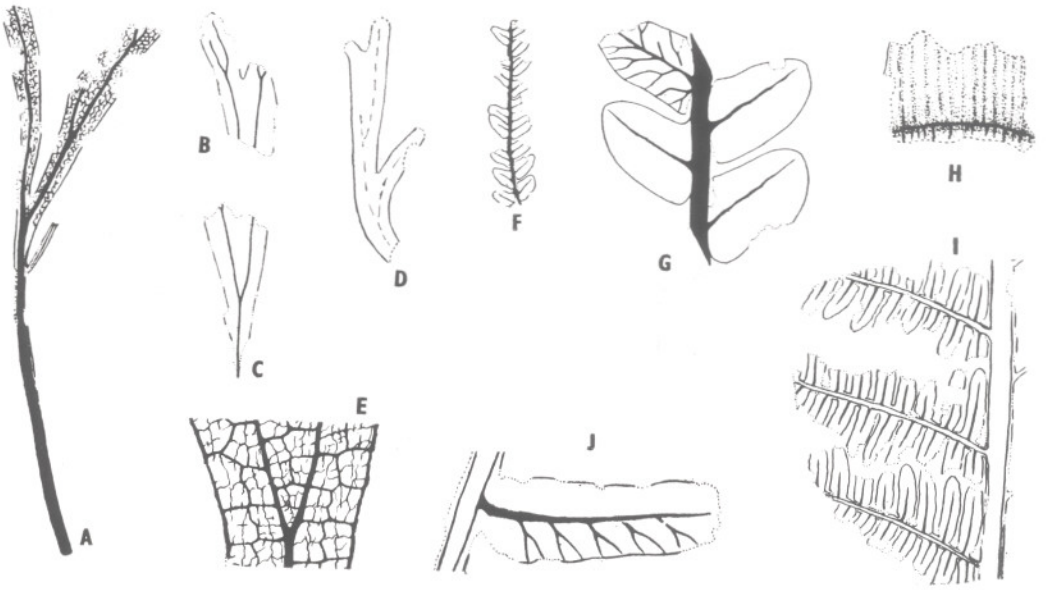
Gleichenites sp.

Pl. 1, figs 8-10; Text-fig. 1F, G

Description — Detached fragmentary pinnae, broader at base and narrowing gradually towards apex, up to 1·2 cm in length and 0·3 cm in width. Pinnules small, seem to be thick, sterile, slightly longer than broad, 1·5-2×1-1·5 mm, alternate, closely attached at an angle of about 60-65°. Margin entire. Apex broadly rounded or obtuse. Acroscopic basal edge slightly enlarged along the rachis, basiscopic edge rounded. Midrib prominent, arising at an acute angle, straight or undulated, evanescent towards apex. Lateral veins usually forked once, rarely twice (usually near base), reaching the margin.

Collection — Museum specimen nos. 71A/1438 and 71B/1438 (C.P. 49/1438 of both specimens), Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Near Parsapani, Hoshangabad District, Madhya Pradesh.



TEXT-FIG. 1A-I — *Hausmannia dichotoma* Dunker. **A-E**: **A**, specimen no. 59/1434 × 1. **B**, specimen no. 25/1434 × 1. **C**, specimen no. 7/1434 × 1. **D**, Crookshank's (1935) fig. 1 reproduced × 1. **E**, showing venation, specimen no. 7A/1434 × 4. *Gleichenites* sp. **F-G**: **F**, specimen no. 71A/1438 × 2. **G**, few pinnules of fig. F enlarged showing venation in one pinnule × 10. **H**, ?*Equisetum* sp. specimen no. 41/1441 × 1. *Todites indicus* (Oldh. & Morr.) Bose & Sah. **I**, specimen no. 30/1440 × 1.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Comparison — The present specimens resemble to a large extent both *Gleichenia gleichenoides* (Oldh. & Morr.) Bose & Sah (1968) and *G. rewahensis* Feistmantel (1882) in form, size and angle of attachment of pinnules. However, in venation pattern these are more closer to *G. rewahensis* in having comparatively more secondary veins which usually fork once and sometimes twice. *Gleichenites* sp. described by Bose and Sah (1968) from Bindaban differs from the present species in possessing much longer pinnules. The present specimens also somewhat resemble *G. micromera* Heer (1874) described from Kome beds of Greenland in general form of pinnae and pinnules, but in venation pattern these are more closer to *Gleichenites* cf. *G. micromerus* Heer described by Halle (1913) from Patagonia. In Patagonian specimens the pinnules show an apical basal sinus, whereas in the present specimens this character is absent and the upper basal margin extends along the rachis.

FAMILY — DIPTERIDACEAE

Genus — *Hausmannia* Dunker

Hausmannia dichotoma Dunker

Pl. 1, figs 1-4; Text-fig. 1A-E

1935 *Hausmannia dichotoma* Dunk.: Crookshank, p. 168, pl. 9, figs 1-3.

1966 *Hausmannia dichotoma* Dunker: Surange, p. 110, fig. 70 (Crookshank's figure reproduced).

Description — Leaf petiolate. Petiole slender, about 1·5 mm wide, available length 3·7 cm, uniformly broad. Lamina sterile, obcuneate, up to 3·5 cm in length, structure of lamina thick or leathery, deeply dissected into strap-shaped segments, ultimate segments approximately 5 mm in width near apex. Margin entire, sometimes undulated. Midrib branching dichotomously up to 5 times, bifurcation occurring prior to division of lamina, ultimately lower and middle part of segments with 1-2 main veins. Lateral veins arising at an angle of about 65°-90° from principal veins which on

further division and union with one another forming squarish, rectangular or polygonal broad meshes; finer veinlets arising from them, forming smaller inner meshes or remaining open. Prominent marginal veins present in each segment, one on either side, joining with other veins.

Collection — Museum specimen nos. 7/335, 7A/1434 (C.P. 8/1434), 25/1434 and 59/1434 (C.P. 61/1434), Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Near Jatamao, Hoshangabad District, Madhya Pradesh.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Comparison & Discussion — *Hausmannia dichotoma* is widespread in the Lower Cretaceous rocks of Europe. It also occurs in the Liassic of Bornholm and Jurassic of U.K. In India, Crookshank reported its occurrence in 1935 from the Jurassic rocks of Jatamao. His specimens were fragmentary and he did not describe them. Recently, a few better preserved specimens have been collected from the same locality matching in details with *H. dichotoma* Dunker and the specimens earlier described by Crookshank (one of his specimens figured here, text-fig. 1D). These further confirm the presence of *H. dichotoma* in the Jabalpur Formation.

UNCLASSIFIED FERNS

Genus — *Cladophlebis* Brongniart

Cladophlebis medlicottiana (Oldham) Pascoe

Pl. 1, figs 5-7, 11; Text-fig. 2A-E

1876 *Alethopteris medlicottiana* Oldham: Feistmantel, p. 127.
1877 *Alethopteris medlicottiana* Oldham: Feistmantel, p. 87, pl. 1, figs 2-6.
1882 *Alethopteris medlicottiana* Oldham: Feistmantel, p. 30, pl. 1, figs 12-14.
1931 *Alethopteris medlicottiana* Oldham: Fox, pl. 7.
1959 *Cladophlebis medlicottiana* (Oldham) Pascoe, p. 19, fig. 2, pl. facing p. 990.
1960 *Cladophlebis* sp.: Bose, p. 90, pl. 1, figs 3, 4.
1968 *Alethopteris medlicottiana*: Krishnan, pl. 6, fig. 5.
1972 *Cladophlebis medlicottiana* (Oldham) Pascoe: Sukh Dev, p. 277, pl. 1, figs 1-5, text-fig. 1.

Emended Diagnosis — Bipinnate frond, rachis stout, about 3 mm wide. Pinnae alternate, large, imparipinnate, more than 10 cm long and 3·5 cm wide, ovate-elongate, attached to rachis at an angle of 60°-70°. Pinnules alternate to sub-opposite, linear, slightly broader at base, narrowing gradually towards apex, straight or falcate, typically measuring 3·5×0·3 cm. Pinnules attached by their entire base at an angle of about 45°-70°, angle of divergence less towards apex (reduced to 30°). Terminal pinnules shorter and broader, bases generally joined with each other by a narrow web. Margin entire. Apex acute. Midrib prominent, arising closer to basiscopic edge of pinnule, running almost straight towards apex. Secondary veins catadromic, arising at an angle of about 20°-50°, forking once, first catadromic vein arising from rachis from the origin of midrib, usually forked twice, apical veins remaining unforked.

Cells of rachis rectangular, elongate, sometimes squarish or polygonal. Lateral-walls thick, straight or wavy, end-walls transverse or oblique. Surface wall smooth.

Cells of lamina obscure, irregular in shape, lateral and end-walls when visible wavy or sinuous with broad loope; surface wall mottled. Stomata rarely visible, 30×25 μ in size, broadly oval in shape, anomocytic, stomatal pore lanceolate.

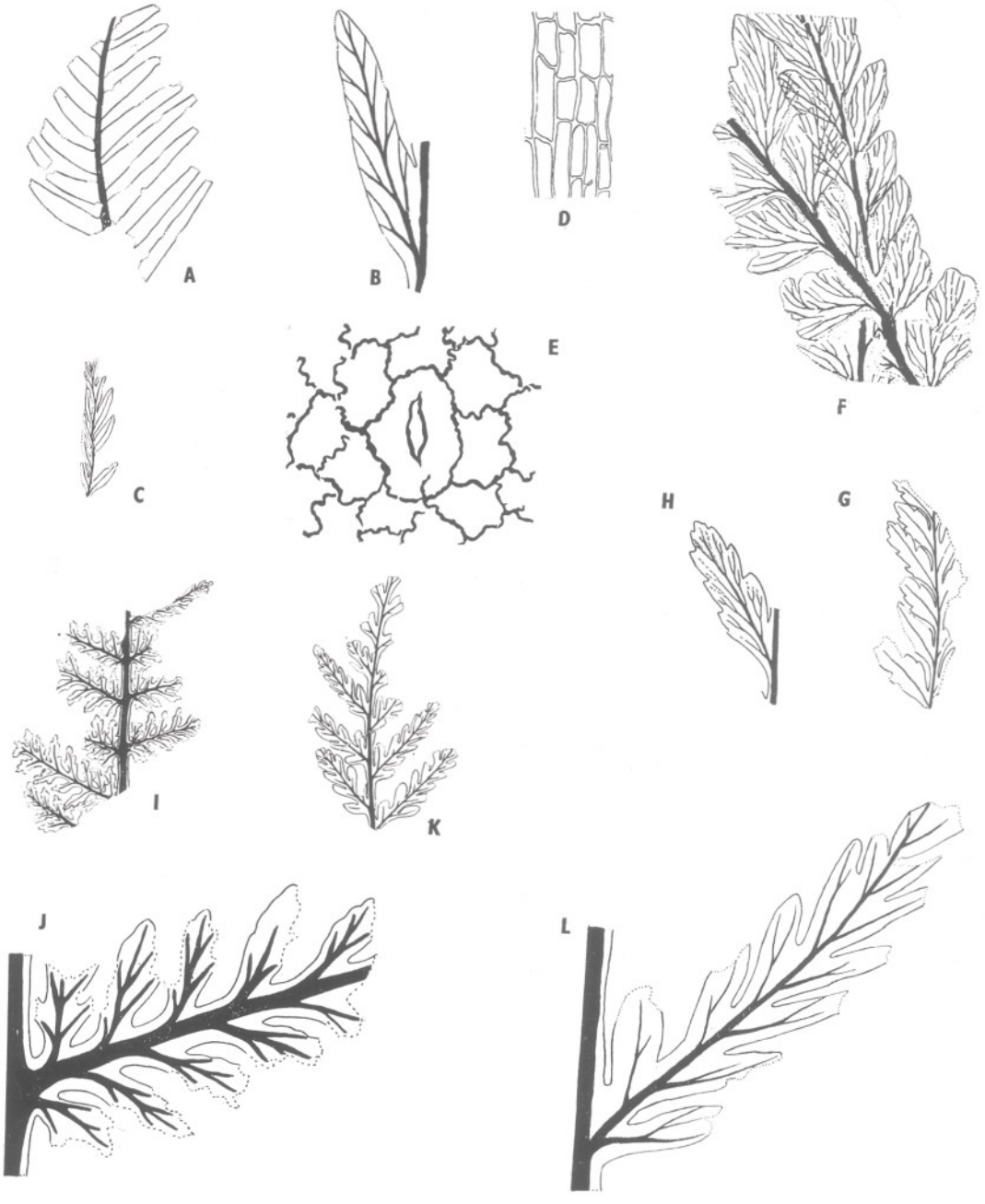
Lectotype — G.S.I. no. 4/850 (Feistmantel, 1877, pl. 1, fig. 2).

Occurrence — Near Jatamao, Hoshangabad District; Hard River, Sehora, Narsinghpore District; Jabalpur; Bansa and Patparha, Shahdol District.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Comparison & Discussion — *Cladophlebis medlicottiana* was hitherto known from the Upper Gondwana of Jabalpur and the South Rewa Basin. Now it has been found, though in lesser number, from other localities of the Jabalpur Formation, viz., Jatamao, Hard River and Sehora. On maceration, a few fragmentary pieces of cuticles were obtained from the Hard River and Sehora specimens.

The apical portion of the leaf of *C. medlicottiana* resembles to some extent *Pecopteris* (?) *salicifolia* described by Oldham and Morris (1863) from Rajmahal Series but in *Pecopteris* (?) *salicifolia* pinnae are much longer, oblique and spreading. In



TEXT-FIG. 2A-L — *Cladophlebis medlicottiana* (Oldh.) Pascoe. **A-E: A,** specimen no. 29228 × 1. **B,** a pinnule enlarged showing venation, specimen no. 45/1434 × 8. **C,** specimen no. 23/1434 × 1. **D,** cells of rachis, slide no. 29228-1 × 250. **E,** stoma and adjacent cells of lower surface, slide no. 29228-2 × 500. *Sphenopteris* sp. cf. *S. otagoensis* Arber. **F,** part of specimen enlarged showing form of pinnules and venation, specimen no. 5904 × 2.5. *Sphenopteris* sp. A. **G-H: G,** specimen no. 5905 × 1. **H,** a pinnule of fig. G enlarged showing venation × 2. *Sphenopteris anderssonii* Halle. **I-J: I,** specimen no. 62/1434 × 1. **J,** a pinna of fig. I enlarged showing venation × 4. *Sphenopteris* sp. B, **K-L: K,** specimen no. 10/1434 × 1. **L,** a pinna of fig. K enlarged showing venation × 4.

cuticular features *C. medlicottiana* resembles *C. ankazoaboensis* Appert (1973, pl. 90, figs 3-7). Both the species have similar anomocytic type of stomata but differ entirely in shape and size of their pinnules.

Genus — *Sphenopteris* Sternberg

Sphenopteris anderssonii Halle

Pl. 2, figs 20, 21; Text-fig. 2I-J

1882 *Pecopteris* sp. Feistmantel, pl. 2, fig. 1.
1913 *Sphenopteris anderssonii* Halle, p. 33, pl. 3, fig. 10; pl. 4, figs 1, 2; text-fig. 8a-c.

Emended Diagnosis — Frond bipinnate, 5·6-11×2·6-4 cm. Rachis 1-2 mm wide, stout, gradually tapering towards apex. Pinnae distant, sub-opposite or alternate, elongate, imparipinnate, linear, typically measuring 1·6-3×0·5-0·8 cm, attached at an angle of about 60°-90°. Basal pinnae larger in size, slightly falcate. Pinnules alternate to sub-opposite, making an angle of about 30°-65° with the pinna axis, lanceolate, 3-7×2-2·5 mm in size, pinnatifid, having 2-3 lobes on each side, lobes cuneate with entire or slightly wavy margins and bluntly acute apices. Catadromic basal pinnules close to rachis, slightly larger in size, ovate, facing downwards, having a few lobes. Pinnules attached by their entire base, acroscopic basal margin forming a deep sinus and then extending upwards, basiscopic margin confluent with the lower pinnules. Midrib prominent, flexuous, persisting nearly to the apex and giving rise to a few secondary veins. Secondary veins arising at an acute angle, midveins of basal most pinnules arising just at the emergence of pinna axis and directed downwards.

Holotype — Halle's specimen pl. 4, fig. 1 from Graham Land.

Collection — Museum specimen nos. 5/382 of the Geological Survey of India, Calcutta and 62/1434 (C.P. 62A/1434), Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Near Jatamao, Hoshangabad District, Madhya Pradesh.

Horizon & Age — Jabalpur Formation Jurassic-Lower Cretaceous.

Comparison — The present specimen resembles closely *S. anderssonii* described by Halle (1913) from Graham Land. In both, the pinnae are distant and basalmost pinnules are characteristic (bigger in size and facing downwards) and closely attached to the main rachis. The venation pattern in the present specimen is also identical with Halle's specimens; in both the midvein is flexuous and giving off few, distinct, unforked lateral veins.

Amongst Indian sphenopterids, the present specimens resemble to some extent *S. rajmahalensis* described by Sahni and Rao (1934) from Rajmahal Hills, but in *S. rajmahalensis* pinnae are more distant and spreading and pinnules are cuneate, united at the base and undivided. The pinnules of the present specimen are lanceolate or ovate and variously lobed.

S. anderssonii may also be compared with *Sphenopteris* (*Coniopteris*?) *permira* described by Frenguelli (1945) from Argentina. In gross features pinnules of both species seem to be identical. The fronds of *S.* (*Coniopteris*?) *permira* are, however, smaller in size and have more pinnae.

Sphenopteris sp. cf. *S. otagoensis* Arber

Pl. 1, fig. 14; Pl. 2, fig. 18; Text-fig. 2F

1960 *Coniopteris hymenophylloides* (Brongniart) Seward: Bose, p. 91, pl. 1, fig. 5.

Description — Fragmentary frond (presumed to be bi- or tripinnate) available size 3·2×1·0 cm. Rachis slender, flexuous, up to 1 mm wide. Pinnae linear, fragmentary. Pinnules alternate, lobed, lanceolate or broadly ovate, 4-7×2·4 mm in size, contracted at base, attached to rachis at an angle of 40°-60°. Basal pinnules deeply lobed, having 3-5 lobes; lobes opposite, ovate, rounded or cuneate in shape. Apical pinnules unlobed or lobes faintly marked, margin entire or undulating, apex obtuse or bluntly acute. Principal vein just after emergence divides into three secondary veins. The two lateral secondaries further divides thrice at different levels. The principal vein further giving off lateral veins at different intervals, forking mostly once or twice, veins narrow, flexuous, reaching margins.

Collection — Museum specimen no. 5904, Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Chui Hills, Jabalpur, Madhya Pradesh.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Remarks — The specimen was previously identified as *Coniopteris hymenophylloides* by Bose (1960) but the recent diagnosis of *C. hymenophylloides* as given by Harris (1961) is based on fertile specimens. As the present specimen is a sterile frond so it is described here as *Sphenopteris*.

Comparison — *Sphenopteris* sp. cf. *S. otagoensis*, in general morphology of pinnules and venation pattern, resembles *S. otagoensis* Arber (1917, p. 43, pl. 1, figs 5, 6, 8; pl. 5, fig. 7) described from New Zealand. As the present specimen is very fragmentary, further comparison with Arber's species is not possible.

In venation pattern, i.e. midrib giving off groups of repeatedly forked secondary veins, the present specimen resembles *S. diagmensis* (Seward) described by Sze (1933, p. 77, pl. 11, figs 14, 15) from Shensi. But the pinnules in the latter specimen have many founded lobes. *Sphenopteris* sp. cf. *S. otagoensis* closely resembles in general morphology of frond and in profuse branching of veins some sterile leaves of *Culcitites madagascariensis* Appert (1973, p. 35, pl. 47, figs 1-7; pl. 48, figs 1-8; pl. 50, figs 1-5; pl. 53, figs 1-6).

Sphenopteris sp. A

Pl. 1, fig. 12; Text-fig. 2G, H

1960 *Coniopteris* sp. cf. *C. hymenophylloides* (Brongniart) Seward: Bose, p. 91, pl. 1, fig. 6.

Description — Detached pinnae (presumed to be bi- or tripinnate), available length 3·0 cm and width approximately 1·8 cm. Rachis about 1 mm wide, flattened, winged. Pinnules alternate to subopposite, lanceolate, forwardly directed, tapering towards apex and base, lobed, 1·2×0·4 cm in size, attached to rachis at an angle of 30°-45°. Lobes of pinnules cuneiform, alternate, about 5 lobes present in each pinnule; basiscopic margin of basal lobe decurrent and joined to acroscopic margin of lower pinnule. Veins faintly marked. Principal vein just after emergence divides into lateral veins. Lateral veins catadromic, forking at different levels, almost reaching margins.

Collection — Museum specimen no. 5905, Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Chui Hills, Jabalpur, Madhya Pradesh.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Remarks — *Sphenopteris* sp. A was previously described as *Coniopteris* sp. cf. *C. hymenophylloides* by Bose (1960). The sterile fronds of *C. hymenophylloides* are different from the present specimen, as in the former specimens the pinnules are much dissected and basal pinnules are divided into filiform processes. In gross features this specimen may be compared with ?*Sphenopteris* described by Oldham and Morris (1863, pl. 32, figs 1-3) from Rajmahal Hills. Both the species have similar morphology of pinnules and their venation pattern but the Rajmahal species is a very fragmentary one.

Sphenopteris sp. B

Pl. 2, figs 15, 19; Text-fig. 2K, L

Description — Frond fragmentary, imparipinnate (?) 4·3×2·0 cm, having a few pinnae. Rachis slender, stout, about 1 mm wide, gradually tapering towards apex. Pinnae alternate, linear, broader at base and narrowing towards apex, largest measuring 1·6×0·4 cm, straight or slightly falcate, attached to rachis at an angle of about 30°-40°, joined with each other by a narrow web along the rachis. Pinnules catadromic, variable in shape and size, two basal pinnules broader and ovate, other pinnules somewhat ovate to triangular, mostly with entire margin, rarely slightly wavy, bases of pinnules connected with each other. Midrib prominent in the basal part of pinnule, bifurcating once or twice.

Collection — Museum specimen no. 10/1434 (C.P. 44/1434), Birbal Sahni Institute of Palaeobotany, Lucknow.

Locality — Near Jatamao, Hoshangabad District, Madhya Pradesh.

Horizon & Age — Jabalpur Formation, Jurassic-Lower Cretaceous.

Comparison — In gross features the present specimen resembles closely *Sphenopteris* sp. cf. *S. zarecznyi* (Raciborski)

described by Thomas (1911) from Kamenka but it differs from the latter species in having only one or two secondary veins.

Pinnules having few veins *Sphenopteris* sp. B resemble to some extent *Sphenopteris fittoni* Seward described by Halle (1913, p. 28, pl. 3, figs 15-18, 22, 25; text-fig. 7a-c) from Graham Land but in the latter species pinnules are deeply lobed and pointed.

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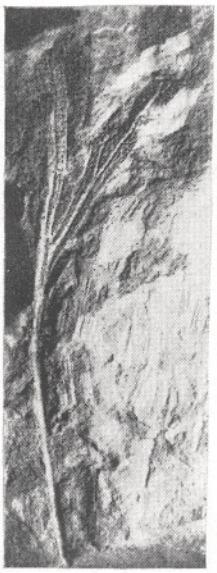
EXPLANATION OF PLATES

PLATE 1

1. *Hausmannia dichotoma* Dunker, specimen no. 59/1434.× 1. Jatamao.
2. *H. dichotoma*, specimen no. 7A/1434.× 1. Jatamao.
3. *H. dichotoma*, specimen no. 25/1434.× 1. Jatamao.
4. *H. dichotoma*, a portion of lamina enlarged showing venation, specimen no. 7A/1434.× 4. Jatamao.
5. *Cladophlebis medlicottiana* (Oldham) Pascoe, specimen no. 29228.× 1. Sehora.
6. *C. medlicottiana*, specimen no. 10/335.× 1. Jatamao.
7. *C. medlicottiana*, specimen no. 13/1441.× 1. Hard River.
8. *Gleichenites* sp., specimen no. 71B/1438.× 2. Parsapani.
9. *Gleichenites* sp., specimen no. 71A/1438.× 2. Parsapani.
10. *Gleichenites* sp., a portion of pinnae enlarged showing venation, specimen no. 71A/1438.× 16. Parsapani.
11. *Cladophlebis medlicottiana* (Oldham) Pascoe, specimen no. 45/1434.× 5. Jatamao.
12. *Sphenopteris* sp. A. specimen no. 5905.× 1. Chui Hill, Jabalpur.
13. ?*Equisetum* sp., specimen no. 41/1441.× 1. Hard River.
14. *Sphenopteris* sp. cf. *S. otagoensis* Arber, specimen no. 5904.× 2. Chui Hill, Jabalpur.

PLATE 2

15. *Sphenopteris* sp. B, few pinnae enlarged showing venation, specimen no. 10/1434.× 5. Jatamao.
16. *Cladophlebis medlicottiana* (Oldham) Pascoe, slide no. 29228-2.× 500. Sehora.
17. *Todites indicus* (Oldh. & Morr.) Bose & Sah, specimen no. 30/1440.× 1. Imjhiri.
18. *Sphenopteris* sp. cf. *S. otagoensis* Arber, specimen no. 5904.× 1. Chui Hill, Jabalpur.
19. *Sphenopteris* sp. B, specimen no. 10/1434.× 1. Jatamao.
20. *Sphenopteris anderssonii* Halle, a few pinnae enlarged showing venation, specimen no. 62/1434.× 5. Jatamao.
21. *S. anderssonii*, specimen no. 62/1434.× 1. Jatamao.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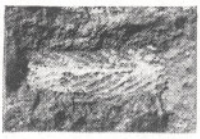
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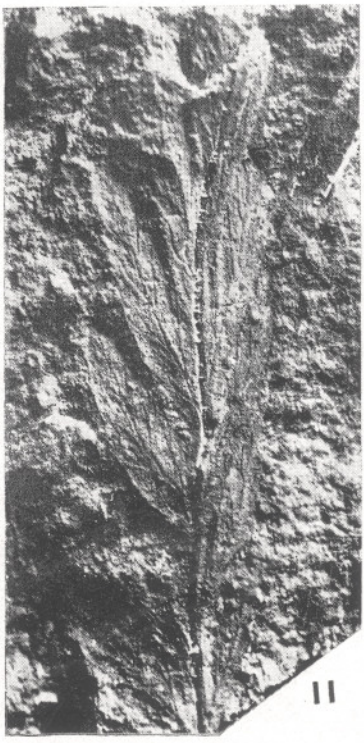
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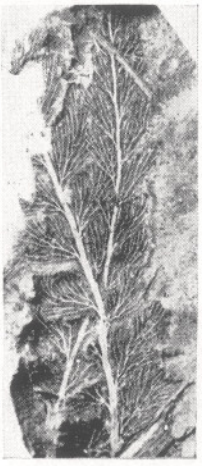

PLATE 1

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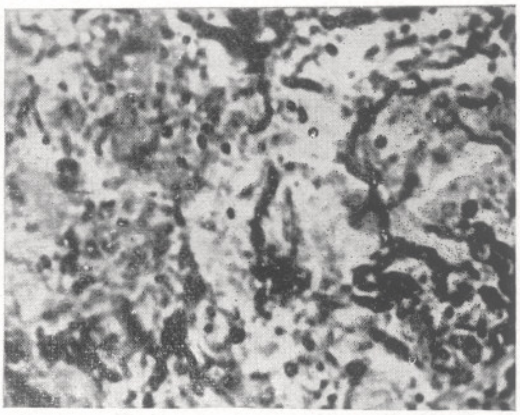

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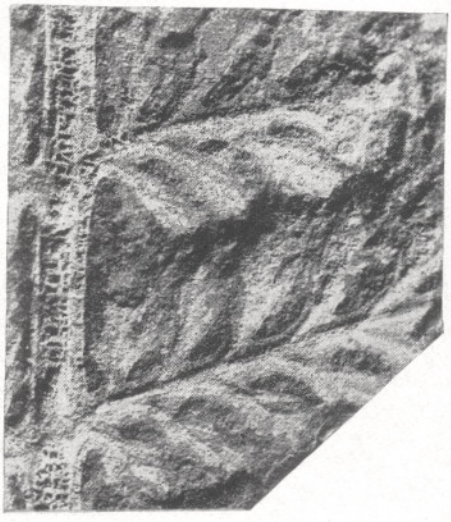

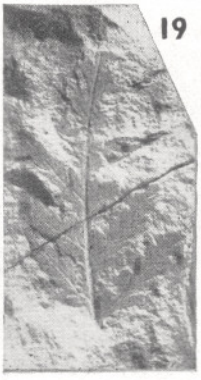

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PLATE 2