

FOSSIL FLORA OF THE BARAKAR STAGE IN AURANGA COALFIELD

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ABSTRACT

The present paper deals with the plant fossils and miospores of the Barakar stage in Auranga Coalfield.

INTRODUCTION

THE object of the present study is to obtain more information about the plant fossils and miospores recorded from the stratas referred to the Barakar stage in Auranga Coalfield. Ball (1878) first reported plant fossils from this area. Feistmantel (1881, 1886) described plant fossils with their occurrence in the Coalfield. Preliminary reports are available on the plant fossils and miospores of the Eastern part of the Auranga Coalfield by Bhattacharya, B. (1959) and only on plant fossils from the Western part of Auranga Coalfield by Bhattacharya, A. K. (1963). Thus, till today our knowledge about the fossil flora of the Barakar stage in the Auranga Coalfield is very meagre. Because of this several of the previous records need elaboration in their morphological details in the light of recent studies and also the corrections of erroneous identification. The present paper, therefore, deals with the new records of mega- and microfossil remains with a revision of the previous records described by the previous workers.

GEOLOGY OF THE COALFIELD

The Auranga Coalfield is situated within 23°42' and 23°52' North latitudes and between 84°45' and 84°17' East longitudes. Almost the whole area is in flat to gently rolling country, with a few hills with scraped sides marking the outliers of Mahadevas. The field is sliced by four or five important faults; some of these trends North-West to South-East and have all the characteristics of lateral dislocation, but its structure is evidently more complicated (Fox,

1934). The following geological formations are known in this area :

Mahadeva	—	—	1000 ft.
Panchet	—	—	700 ft.
Raniganj	—	—	1000 ft.
Barakar	—	—	1500 ft.
Talchir	—	—	300 ft.

MATERIAL AND METHODS

The present study is partly based upon the fresh collections made from the Auranga Coalfield (details of locality given below), and also the examination of specimens earlier described by Feistmantel (*l.c.* : preserved at the Geological Survey of India, Calcutta), B. Bhattacharya (1959) and A. K. Bhattacharya, (1963) (preserved at the Geology Department Calcutta University).

Exposure 1—*Churia Fire Clay pit* (23°45'21" : 84°26'40").

Thinly laminated white, greyish white and grey fire clay exposed in the pit (containing megafossils).

Exposure 2—Section exposed in the Auranga river, about 1½ miles west of Road bridge on the river leading to Latihar town from Latihar railway station.

Fire Clay	—	—	2 ft.
Sandstone	—	—	5 ft.
Grey Shale	—	—	½ ft.
Sandstone	—	—	5 ft.
Fire clay	—	—	3 ft.
			(containing impression of fossils)

Sandstone	—	—	5 ft.
Grey Shale	—	—	1 ft.

Exposure 3—In the Stream joining the Sukri river near Tubed village the following rock succession is exposed :

Coaly Shale	—	—	5 ft.
Intercalated Sandstones and Shales	—	—	3 ft.
Coaly Shale	—	—	2 ft.

Exposure 4 — Further 100 yds. south of the exposure No. 3 the following rock succession is exposed :

Sandstone	—	—	1 ft.
Coaly Shale	—	—	8 in.
Grey Shale	—	—	1 ft.
Ferruginous shale	—	—	1 ft.

Exposure 5 — About $\frac{1}{2}$ mile N.W. of Gowa village in Gowa river on the south bank the following succession is exposed.

Sandstone	—	—	1 ft.
Coaly shale	—	—	6 in.
Grey micaceous shale	—	—	1 ft.

This bed is exposed about 200 yds. away from the Talchir beds which is now nearly washed out.

Exposure 6 — Rock section exposed at the confluence point of Gowa river with Auranga river (about a mile W.N.W. of Gowa village). The rock succession is exposed as follows :

Sandstone	—	—	2 ft.
Ferruginous shale	—	—	6 in.
		(containing impressions)	
Fire clay	—	—	1 ft.
Sandstone	—	—	10 ft.
Fire clay	—	—	6 in.

rest concealed below.

Megafossils have been recorded only from exposure Nos. 3, 4 and 5, and microfossils from exposure Nos. 1, 2 and 6.

MEGAFOSSILS

The following is a revised list of plant fossils known to occur in the Barakar stage of Auranga Coalfield (Plant marked with asterisk are only discussed in the description):

- Sphenophyllum speciosum* McClelland
- **Barakaria dichotoma* Sew. & Sahni
- Equisetalean stems
- Sphenopteris polymorpha* Feistm.
- Vertebraria indica* Royle
- Glossopteris angustifolia*
- **G. linearis* McCoy
- G. communis* Feistm.
- G. indica* Schimper
- G. damudica* Feistmantel

- G. browniana* Brongniart
- **G. tortuosa* Zeiller
- G. retifera* Feistm.
- Rhabdotaenia danaeoides* Pant
- *Scale leaves
- **Pseudoctenia balii* (Feistm.) Seward

The name of the following species which occur in older lists have been omitted from those given above for one of the reasons indicated below :

(a) No referable material has been seen during the course of present study:

- Schizoneura gondwanensis* Bhattacharya, A. K.
- Glossopteris stricta* Bhattacharya, A. K.
- Rhipidiopsis ginkgoides* Feistmantel

(b) Identification based on poorly preserved materials and believed to be incorrect:

- Gangamopteris chatterji* Bhattacharya, A. K.
- G. cyclopteroides* Bhattacharya, A. K.
- G. hughesi* Bhattacharya, A. K.
- G. buriadica* Bhattacharya, A. K.
- Glossopteris longicaulis* Bhattacharya, A. K.

(c) Use of other names preferred on account of priority:

- Actinopteris* sp. Bhattacharya, B.

Barakaria Seward & Sahni

Barakaria dichotoma Sew. & Sahni

Pl. 1, Fig. 1

Synonymy

- 1881 — *Cyclopitys dichotoma* Feistmantel
- 1959 — *Actinopteris* sp. Bhattacharya, B.

Remarks — This Lower Gondwana remain was assigned to *Cyclopitys* Schmalhausen by Feistmantel (1881, 1886). Seward & Sahni (1920) expressed doubts for placing them under *Cyclopitys*. According to their examination, the specimen is a verticillate shoot, bearing leaves like equisetalean with forked apex. The specimens are not comparable to *Baiera*, but more to *Schizoneura gondwanensis* Feistm. In view of this the new genus *Barakaria* was instituted.

The re-examination of Feistmantel's specimens converge to support the view of Seward & Sahni (*l.c.*). The Feistmantel's specimen figured here shows a narrow articulated stem

(Pl. 1, Fig. 1) with nodes and internodes. Leaves attached to the nodes in verticillate manner. All of them are \pm coherent for most of their lengths from the nodal point to form almost a open saucer. Each leaf, from about 2/3 distance from base dichotomises into two, with round apex. Median nerve strong dichotomising to supply the segment of leaf.

Another specimen figured by Bhattacharya, B. (1959, Figs. 7a, b) is a \pm complete whorl of leaves preserved dorsio-ventrally. The morphological character of this is like that of the specimens of *Feistmantel* (*l.c.*).

Of all the known equisetalean genus from the Lower Gondwanas *Barakaria* compares to *Raniganjia* Rigby. But the leaves of *Raniganjia* are simple. *Barakaria* compares in the dichotomy of leaves to the northern forms *phenasterophyllites* Sterzel, *Autophyllites* Grand'eury and *Dichophyllites* Borsuk, but all of them differ due to their free leaf segments.

No holotype for *Barakaria* was designated earlier, therefore a lectotype is selected here from the collection of Feistmantel.

Lectotype — 5511, Geological Survey of India, Calcutta.

Locality — Sukri river, West of Gurtar, Auranga Coalfield.

Glossopteris linearis McCoy

Pl. 1, Figs. 2, 3

Remarks — Uptill now the species was only known from the Raniganj stage, it is for the first time recorded from the Barakar stage.

Glossopteris tortuosa Zeiller

Pl. 1, Fig. 4

Remarks — Uptill now the species was only known from the Raniganj formations of the Damuda system. It is for the first time recorded from the Barakar stage.

'Scale Leaves'

Pl. 1, Figs. 5, 6

There are several records of 'scale leaves' from the Lower Gondwanas of India, and their affinities is still not known. Few scale

leaves are recorded in this collection. Ovate in shape, measuring 1-1.2 cm. \times 0.5-0.8 cm. apex pointed acute, base contracted. Veins arise from base, dichotomous, divergent with inter-connections. No seed or sporangia is found associated with these remains.

Pseudoctenis

Pseudoctenis balii (Feistm.) Seward

Pl. 1, Figs. 7, 8

Synonymy

1886 — *Platypterigium balii* Feistmantel

1917 — *Pseudoctenis balii* Seward

The morphology of the specimens has earlier been described by Feistmantel (1886), Seward (1917) and Seward & Sahni (1920), but their characteristic venation arrangement remained neglected. Near its very emergence from the midrib the veins divide and their course also show different curvatures before running \pm 90° from the midrib in whole of the pinnae. The veins which are present on upper half portion of the pinnae from the median portion show a downward curvature, and on the lower half portion of the pinnae show a upward curvature (Fig. 8). Veins are sinuous.

Similar looking frond with non-decurrent base and with a knowledge of epidermal structure from the Lower Gondwanas of India has been placed under *Pteronilssonsonia* by Pant and Mehra (1963). However, the placement of these Lower Gondwana specimens under *Pseudoctenis* remains open due to lack of knowledge of the epidermal structure.

No holotype was designated by Feistmantel, hence, a lectotype is designated here.

Lectotype — 5505, Geological Survey of India, Calcutta.

Locality — Sukri river, west of Gurtar, Auranga Coalfield.

MIOSPORES

Miospores from exposure no. 3, 4 and 5 could only be obtained. For the taxonomic description the system of Potonié (1956, 1958) is followed.

**MIOSPORE GENERA RECORDED
FROM EXPOSURE NO. 3**

The dispersed spore-pollen genera and species recorded from the exposure No. 3 have been arranged systematically as follows:

- Punctatisporites gretensis* Bal. & Henn.
Microbaculispora minutus Venkat. & Kar
Apiculatisporites levis Bal. & Henn.
Laevigatisporites colliensis Venkat. & Kar.
Parasaccites ovatus Tiwari
Densipollenites invisus Bhard. & Saluj.
Vestigisporites diffusus Maithy
Cuneatisporites flavatus Bose & Kar
C. densus Maithy
C. indica Maithy
Platysaccus ovatus Maithy
Striatites ornatus Venkat. & Kar
S. alius Venkat. & Kar
Faunipollenites varius Bharad.
Gondwanipollenites congoensis Bose & Maheshwari
Rhizomaspora reticulata Lele & Maithy
Sulcatisporites ovatus Bharad.
S. maximus Singh
S. barakarensis Tiwari
Schizopollis woodhousei Venkat. & Kar
Guttulapollenites hannonicus Venkat. Gonb. & Kar
Fusacolpites kalimaensis Bose & Kar
F. fusus Bose & Kar
Ginkgocycadophytus cymbatus Pot. & Lele
G. magnus Venkat. & Kar
Brazilea reticulata Nav. & Tiw.
B. crassa Nav. & Tiw.
Maculatisporites gondwanensis
**M. ovalis* sp. nov.

Turma — Aletes Ibr.
Subturma — Azonaletes (Luber) Pot. & Kr.
Infraturma — Reticulonapiti (Erdtm.) Vimal

Genus — Maculatisporites Tiwari

Maculatisporites ovalis sp. nov.
 Pl. 1, Figs. 9, 10

Diagnosis — Size 70-100 μ , oval, thin, reticulum complete, on both the faces; meshes broad, 5-10 μ across, regularly polygonal, muri 1-1.5 μ .

Holotype — Pl. 1, Fig. 9. Size 76 μ .

Locality — Tubed, Auranga Coalfield, Bihar.

Horizon — Barakar stage.

Description — Grains are oval in outline, the reticulation is regular and complete forming pentagonal or hexagonal meshes. Exine is thin and laevigate.

Comparison — In its oval shape it differs from all the known species of *Maculatisporites*.

The various genera found in counting are given below with their respective percentage:

- Punctatisporites* 7%
Microbaculispora 2%
Latosporites 4%
Parasaccites 2%
Densipollenites 2%
Cuneatisporites 5%
Platysaccus 3%
Striatites 4%
Faunipollenites 6%
Gondwanipollenites 2%
Sulcatisporites 15%
Schizopollis 4%
Guttulapollenites 3%
Maculatisporites 20%
Brazilea 14%
Ginkgocycadophytus 5%
Fusacolpites 1%

**MIOSPORE GENERA RECORDED
FROM EXPOSURE NO. 4**

The dispersed spore and pollen genera recovered from the exposure No. 4 have been assigned to the following genera and species:

- Punctatisporites gretensis* Bal. & Henn.
Leiotriletes virkki Venkat. & Kar
Cyclogranisporites gondwanensis
Virkkipollenites densus Lele
Parasaccites obscurus Bharad. & Tiwari
Densipollenites invisus Bharad. & Saluj.
Striomonosaccites ovatus
Striatites haploxyloides Maithy
Faunipollenites varius Bhard.
Gondwanipollenites congoensis Bose & Maheshwari
Direticuloidispora indica Tiwari
Rhizomaspora indica Tiwari
Cuneatisporites densus Maithy
Sulcatisporites ovatus Bharad.
S. barakarensis Tiwari
S. maximus Singh
Schizopollis woodhousei Venkat. & Kar
Vittatina scuta
Ginkgocycadophytus magnus Venkat. & Kar
Maculatisporites ovalis sp. nov.

The various genera found in counting is given below with their respective percentage:

<i>Punctatisporites</i>	3.5%
<i>Leiotriletes</i>	1%
<i>Parasaccites</i>	3%
<i>Densipollenites</i>	18.5%
<i>Striomonosaccites</i>	1%
<i>Striatites</i>	1.5%
<i>Faunipollenites</i>	4.5%
<i>Rhizomaspora</i>	2.5%
<i>Cuneatisporites</i>	1%
<i>Sulcatisporites</i>	43.5%
<i>Ginkgocycadophytus</i>	5%
<i>Maculatosporites</i>	20%

MIOSPORE GENERA RECORDED FROM EXPOSURE NO. 5

The dispersed spore-pollen genera and the species recovered from the exposure No. 5 are as follows :

Punctatisporites uniformis Tiwari
P. gretensis Bal. & Henne.
Calamospora plicata Tiw. & Nav.
Microbaculospira tentula Tiwari
Cristatisporites densicarpus Tiw. & Nav.
C. papillatus Tiw. & Nav.
Virkkipollenites obscurus Lele
V. mehtae Lele
Potonieisporites neglectus Pot. & Lele
Vestigisporites obscurus Maithy
Striatites alius Venkt. & Kar
Faunipollenites varius Bhard.
Sulcatisporites tentulus Tiwari
S. maximus Singh
Cuneatisporites densus Maithy
Balmella punctata Tiw. & Nav.
B. densicarpa Tiw. & Nav.
B. minuta Tiw. & Nav.
Brazilea punctata Tiw. & Nav.
B. crassa Tiw. & Nav.
Pilasporites calculus Bal. & Henn.
P. plurigenus Bal. & Henn.
Quadrissporites horridus Pot. & Lele
Maculatosporites ovalis sp. nov.
Ginkgocycadophytus cymbatus Pot. & Lele

The various genera found in counting are given below with their respective percentage:

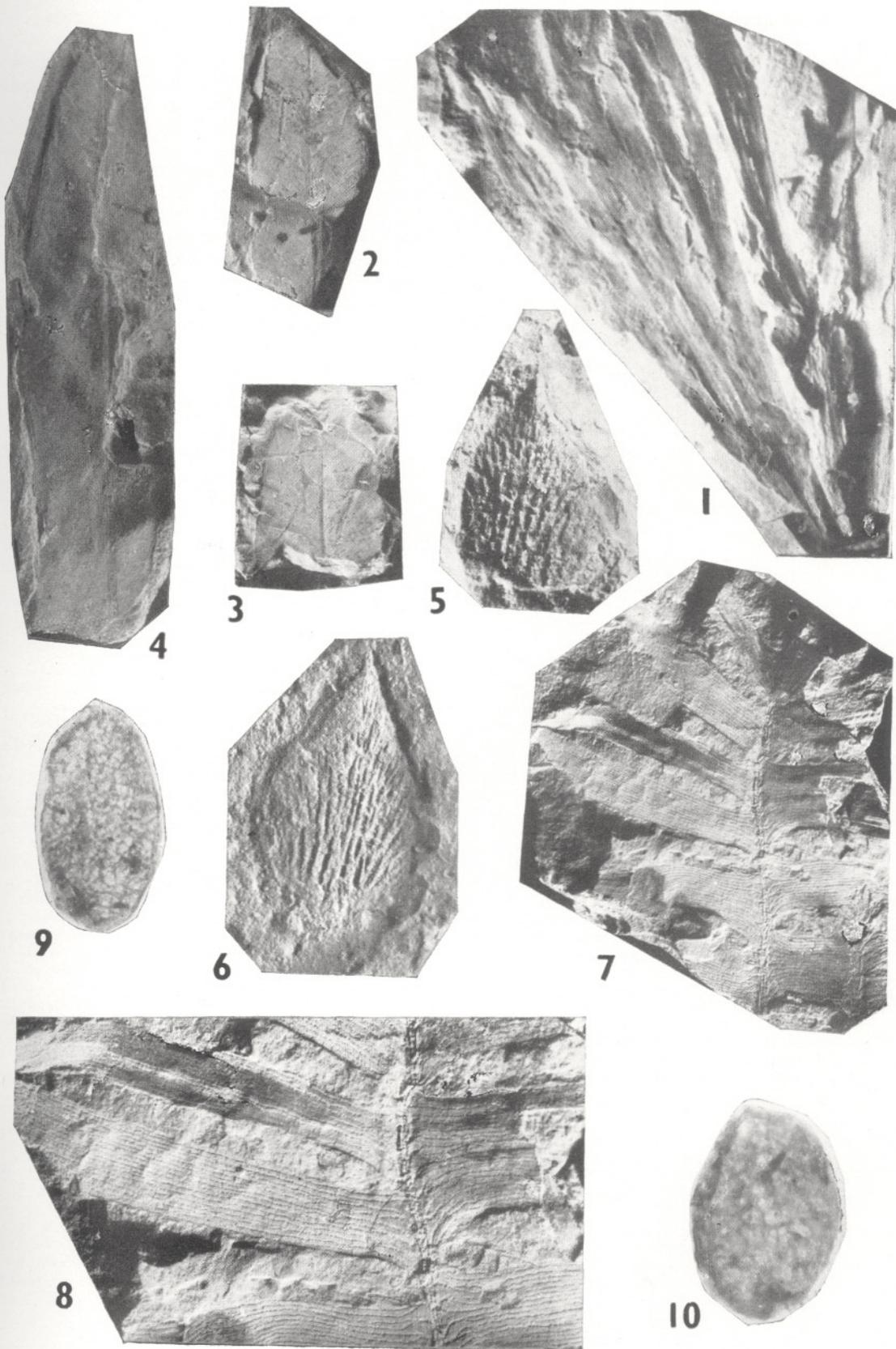
<i>Punctatisporites</i>	10.5%
<i>Calamospora</i>	2%
<i>Cristatisporites</i>	2%
<i>Virkkipollenites</i>	3.5%

<i>Vestigisporites</i>	2%
<i>Striatites</i>	1.5%
<i>Faunipollenites</i>	1%
<i>Sulcatisporites</i>	1.5%
<i>Cuneatisporites</i>	2%
<i>Balmella</i>	19%
<i>Brazilea</i>	16%
<i>Pilasporites</i>	29%
<i>Quadrissporites</i>	20%
<i>Maculatosporites</i>	1%
<i>Ginkgocycadophytus</i>	1.5%

GENERAL DISCUSSION

Our knowledge about the megafossils of the Barakar stage is based upon the work by Feistmantel (1882) Maheshwari and Gyan Prakash (1965). From a critical analysis of these records, it is evident that the Barakar stage is characterized by the dominance of *Glossopteris*, *Gangamopteris* and *Noeggerathiopsis* which are more common in the underlying Talchir and Karharbari stages are rare or missing. Among the records of *Glossopteris* species, the narrow mesh forms are more common than the open mesh forms. The megafossil assemblage from the Auranga Coalfield compares to the known Barakar flora by the dominance of *Glossopteris* and that also of too narrow mesh forms. However, the Barakar flora of the Auranga Coalfield maintains its identity by the presence of *Pseudecten bali* and *Barakaria dichotoma*. These megafossils are known only from the Barakars of Auranga Coalfield.

Miospore assemblages from the Barakar stage have been described by Tiwari (1965, 1968) from Korba, Bokaro and Ib river Coalfields, Venkatachala and Kar (1968 a,b) from North Karanpura Coalfield, and Bhara-dwaj and Srivastava (1969) from the Chirimiri Coalfield. The miospore assemblages recorded from the Exposure No. 3 and No. 4 (Tubed Area) show a close agreement both in qualitative and quantitative compositions. However, the composition of the miospore assemblage from Exposure No. 5 (Gowa) poses a stratigraphical problem due to its peculiar composition. Further similar comparable assemblage is so far not known from the Lower Gondwanas of India. The assemblage shows dominance of fresh water microplanktons (acritarchs) trilete miospores *Punctatisporites* are dominant and saccate miospores are subdominant. It is a well known fact that fresh



water microplanktons have a wide geological range. Therefore, for stratigraphical zonation their importance is negligible. In view of this for such purpose one should take into account only the miospores. The miospores of the Gowa bed in their composition compares to the assemblage of the Talchir stage assemblage by the presence of *Punctatisporites*, *Virkkipollenites*, *Potonieisporites*, *Vestigisporites*, *Striatites*, *Faunipollenites*, *Sulcatisporites* and *Ginkgocycadophytus*. But the lithological units of the bed do not favour for the placement of this bed under the Talchir stage. Due to the presence of carbonaceous shales in the sequence the bed should be definitely younger than the Talchirs. Definite Talchir rocks are exposed about 50 yds. south of this bed and the definite Barakars about a mile north from this bed. On the basis of position of this bed, their lithological

characters and microremain contents, it is suggested here that the bed probably belongs to the lowermost Karharbari stage. Comparable miospore assemblages to this have been recorded by Tiwari and Navale (1967) from the coals of Brazil. These coal beds have been considered by them to be of Lower Permian in age.

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EXPLANATION OF PLATES

PLATE 1

- 1. *Barakaria dichotoma*, 5511. G.S.I. Calcutta. × 1.
- 2 & 3. *Glossopteris linearis*, 34078, 34079. B.S.I.P. Lucknow. × 1.
- 4. *Glossopteris tortuosa*, 34080, B.S.I.P. Lucknow. × 1.

- 5 & 6. Scale leaves, 34081, 34082, B.S.I.P. Lucknow. × 3.
- 7. *Pseudoctenites balii*, 5505, G.S.I. Calcutta. × 1.
- 8. A portion of the specimen in Fig. 7 is enlarged to show the characters of veins. × 2.
- 9 & 10. *Maculatosporis ovalis* sp. nov. × 500. Slide no. B.S.I.P. Lucknow.