

STUDIES IN THE GLOSSOPTERIS FLORA OF INDIA —

36. PLANT FOSSILS FROM BARREN MEASURES SUCCESSION OF JHARIA COALFIELD, BIHAR, INDIA

R. K. KAR

Birbal Sahni Institute of Palaeobotany, Lucknow

ABSTRACT

Plant fossils belonging to the Barren Measures Succession of Jharia Coalfield have been described. These are *Cyclodendron lesliei*, Equisetaceous stems, *Sphenopteris hughesii*, *Glossopteris communis*, *G. indica*, *G. decipiens*, *G. browniana* and *G. ampla*. The present assemblage has also been compared with the other known ones from Barren Measures Succession.

INTRODUCTION

FEISTMANTEL (1881) reported some plant remains from the Barren Measures Succession collected near Jainagur and Kulti of South Karanpura and Raniganj coalfields respectively. Since then no body has worked on megafossils of this stage though recently Bharadwaj, Sah and Tiwari (1965), and Kar (1966, 1968) have studied the palynological assemblage of this sequence.

The present paper deals with the plant fossils collected from the Barren Measures Succession of Jharia Coalfield, Bihar. The fossils were collected from the different rock exposures near Mahuda on both sides of the Katri Nala (TEXT-FIG. 1). The Ironstone shale is not well exposed in this locality and the shales are mostly buff to grey in colour. The carbonaceous shale is very rich in mica and the coaly shale has not been met within the fossiliferous localities. The remains of *Cyclodendron* have only been found in the Ironstone shale while other fossils are mostly found in the buff and grey shales. The following plant fossils have been recovered from these exposures:

DESCRIPTION

Cyclodendron Kräusel, 1961

Remarks — Kräusel (1961) after a critical study of *Cyclodendron* and its allied forms described from various parts of South Africa and Congo, regarded *Lycopodiopsis pedoranus* (EDWARDS, 1952, THOMSON 1957),

Eusigillaria favularia, *Sigillariastrobus* sp. and *Subsigillaria leiodermaria* reported by Mercenier (1913) as synonyms of the same.

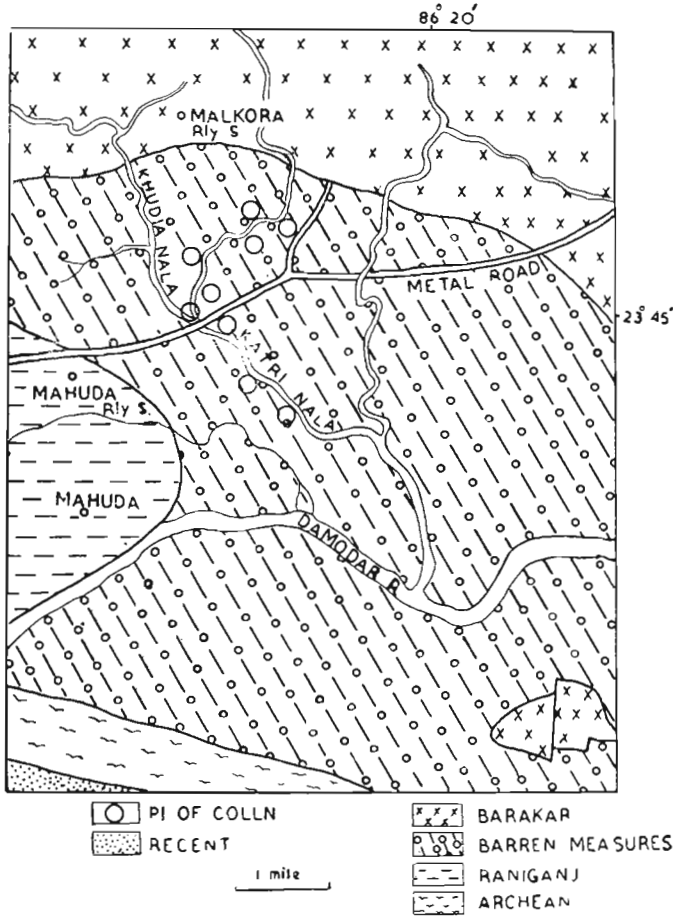
The occurrence of *Cyclodendron* from the Lower Gondwana Succession of India was till recently a doubtful one. The paucity of well preserved material as well as fragmentary remains perhaps forced the earlier workers to include *Cyclodendron*-like stems under various genera. Bunbury (1861, PL. 12, FIG. 1) described a fragmentary stem from the Lower Gondwanas of India near Nagpur as "distinctly marked with numerous, small, roundish, dot-like leaf scars"... which he believed "... may have belonged to a lycopodiaceous plant; but its appearance is so strikingly like that of a small branch of a spruce-fir stripped of its leaves, that in the absence of any positive evidence to the contrary, I am strongly inclined to believe it to be coniferous."

A more or less similar specimen was also described by Schmalhausen (1879, PL. 8, FIG. 12) as *Rhipidopsis ginkgooides*. Feistmantel (1881) reported some fragmentary stem remains possessing oval spindle-shaped leaf scars with quinqueangular arrangement as *Palissya* sp. and *Rhipidopsis ginkgooides* from Nagpur and Kulti Ironstone Shale (Raniganj Coalfield) respectively. Seward and Sahni (1920) regarded those specimens as *Bothrodendron*, similar to *Bothrodendron lesliei* from the Permo-Carboniferous beds of Vereeniging. Recently Maithy (1965) reported cf. *Cyclodendron* sp. from Giridih Coalfield, Bihar.

Cyclodendron lesliei (Seward) Kräusel, 1961

Pl. 1, Figs. 1-2

Description — The present study includes twelve impressions (four in counterpart) of *Cyclodendron lesliei* comprising young as well as old stems (*vide* SURANGE, 1966). All of them are very fragmentary; the



TEXT-FIG. 1 — Geological map of the area showing places of collection.

biggest one is 3 cm. long and 2 cm. broad without any leaf or cuticle.

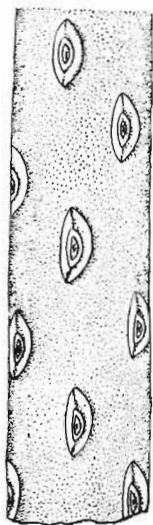
One specimen (Museum No. 11/594, counterpart 12/594) is 2.5 cm. long and 1 cm. broad, showing externally regular leaf-scars, arranged in quincuncial fashion. The leaf-scars are more or less spindle-shaped and depressed. Within each scar there is a raised part which is also depressed in the middle. In the latter there is a small but sharp boss indicating perhaps the position of vascular supply to the leaf. The elevated part of the depressed leaf-scar is sloped on each side. The raised region is situated more closer at one of the sides of the depressed area forming a deeper area on the other side along the longitudinal axis of the scar. The faint groove possessing downward convergence on each side

of the leaf-scar is not perceptible. The presence of parichnos scars or ligule are not registered on the stem (TEXT-FIG. 2).

The counterpart of the same specimen shows elevation with a depression in the middle. The depressed part bears a somewhat circular raised part in the middle which in its turn also bears a very small pin-hole cavity in the centre.

The leaf-scars in all the specimens, however, are essentially spirally arranged without showing any remnant of the parichnos scars or ligule. The leaf-scars vary in size from 0.5-1 × 1-2.5 mm.

Remarks — The specimens referred here to *Cyclodendron leslii* (Seward) Kräusel, however, differ in some characters from the same. The leaf-scars in the specimens studied here are spindle-shaped. The



TEXT-FIG. 2 — Stem of *Cyclo dendron leslii* Kräusel with leaf scars.

elevated part within the depressed leaf-scar is situated unequally with gradual sloping along the longitudinal axis of the scar. These characters are also not found in *Cyclo dendron mathieui* Seward (1931). It may be mentioned here that Høeg and Bose (1960) regarded *C. mathieui* as a synonym of *C. leslii*. Kräusel (1961), however, maintained the former, with a remark that it may be a heterogenous one.

In view of unsatisfactory preservation and the absence of leaves borne by the specimens studied here they have all been placed under *C. leslii*.

Equisetalean stem

Pl. 1, Fig. 5

Description — The collection includes a good number of equisetaceous stems but all of them are fragmentary and badly preserved without any leaf or cuticle. The biggest piece is 8 cm. long and 3.5 cm. broad possessing nodes and internodes. The general character is undoubtedly equisetaceous.

Remarks — The specimen resembles to some extent a similar specimen figured by Maheshwari and Prakash (1965, PL. 1, FIG. 4).

Sphenopteris Brongniart, 1828

Sphenopteris hughesii (Feistmantel) Zeiller, 1902

Pl. 1, Figs. 3-4

Description — Three specimens have been collected and out of them two are represented by a single pinna. The other specimen is 3.8 cm. long and bipinnate. The main rachis is well-developed, straight and uniformly broad. The pinnae are alternate and emerge from the main rachis mostly at an angle of 45°. The pinnules are lobed, their number varies from 7-9; the veins are, however, not well preserved.

Remarks — The specimens resemble in some characters with those figured by Feistmantel (1881, PL. 26A, FIG. 1A) from the Raniganj Stage.

Glossopteris Sternberg, 1825

Glossopteris communis Feistmantel, 1876

Pl. 1, Fig. 7

Description — Many specimens of this species have been recovered from the present material. The size of the leaf varies from 2.5-5 × 10-20 cm. The apex is mostly acute but sometimes leaf with more or less obtuse apex is also found. The mid-rib is usually distinct extending upto the apex. In the basal part of some of the leaves the midrib is longitudinally striated while in others some small, circular structures are found in the same region. The secondary veins come out from the midrib at an angle of 32-45°. The secondary veins at the base and apex form more acute angles than those in the middle region. The margin of the leaf is entire.

Remarks — *Glossopteris communis* seems to be the most common in the assemblage contributing as high as 80 per cent to the population. The species is also quite common in the Barakar and the Raniganj stages (Permian) of the Lower Gondwanas of India. It, however, shows much variation in size, shape, structure of the midrib and nature of the network formed by secondary veins. Some of the specimens though broken at base and apex are 20 cm. long and 5 cm. broad (Museum No. 15/593) while a nearly complete specimen does not exceed 10 cm. in length (Museum No. 2/594).

The specimens compare with those described by Feistmantel (1881, PL. 35A, FIG. 2) from the Raniganj Coalfield.

Glossopteris indica Schimper, 1869

Pl. 1, Fig. 8

Description—The specimen is slightly broken at the base and apex. It is 9 cm. long and 2.2 cm. broad. The midrib is distinct and slightly raised. The secondary veins are not well preserved. They emerge from the main rachis at an angle of 30-40°. The net work is slightly broader at the midrib region.

Remarks—The specimen is comparable in venation with that described by Feistmantel (1881, PL. 35A, FIG. 4) from the Raniganj Coalfield.

Glossopteris decipiens Feistmantel, 1879

Pl 1, Fig. 9

Description—The specimen figured here is preserved in full. It is 8.5 cm. long and 1.8 cm. broad. The leaf is narrow at the base, broader at the middle and again somewhat tapered at the apical region. The midrib is thick and prominent at the basal part, but gradually becomes indistinct and finally seems to disappear at the apical region. The secondary veins are not well preserved, they emerge from the midrib at an angle 35-43°. The network is slightly broader at the midrib region and narrower and longer at the margin.

Remarks—The specimen compares favourably with that of Maheshwari (1965, PL. 2, FIG. 12) from the Raniganj Stage.

Glossopteris browniana Brongniart, 1828

Pl. 1, Fig. 10

Description—The specimen is broken at the base and apex. It is 7.3 cm. long and 2.6 cm. broad. The midrib is well developed and slightly tapering at the upper region. The secondary veins are more or less well preserved. They come out from the rachis at an angle of 32-44°. The network is somewhat broader at the base and slightly narrower at the margin.

Remarks—The present specimen compares in venation with that described by Plumstead (1962, PL. 8, FIG. 8) from Antarctica.

Glossopteris ampla Dana, 1849

Pl. 1, Fig. 6

Description—The leaf is fragmentary. It is 6 cm. long and 10 cm. broad. The midrib is distinct, slightly tapering at the upper margin. The secondary veins are not well preserved, they emerge from the midrib at an angle 45-60°.

Remarks—The specimen compares in its size and venation with that described by Plumstead (1962, PL. 6, FIG. 1) from Antarctica.

DISCUSSION

The present assemblage shows some resemblance with the assemblages reported by Feistmantel (1881) from the Barren Measures Succession of Raniganj and South Karanpura coalfields. From the former he reported *Glossopteris communis*, *G. damudica*, coniferous stems and insect-wing-like fossils. The 'coniferous stems' mentioned by Feistmantel seem to be the *Cyclodendron*. *G. damudica* and insect-wing-like fossils are, however, not recovered from the present locality.

The plant fossils from Jainagur (South Karanpura Coalfield) (see Feistmantel *l.c.*) seem to be rather rich in *Glossopteris* as six species (*G. communis*, *G. indica*, *G. retifera*, *G. damudica*, *G. conspicua* and *G. angustifolia*) have been recorded. Of them *G. communis* and *G. indica* are found in the present collection. *Taeniopteris danaeoides* (Royle) M'Clelland and *Noeggerathiopsis hislopi* Feistmantel are also conspicuous by their absence in the present assemblage.

The present collection for the first time records the following species from the Barren Measures Succession (Permian) of the Lower Gondwana of India.

Cyclodendron lesliei
Sphenopteris hughesii
Glossopteris browniana
G. decipiens
G. ampla

A list of plant fossils so far recorded from the Barren Measures Succession is as follows:

Fossil plants	Locality
Equisetaceous stem	South Karanpura and Jharia coalfields.
<i>Taeniopteris danaeoides</i>	South Karanpura Coalfield.

<i>Fossil plants</i>	<i>Locality</i>	<i>Fossil plants</i>	<i>Locality</i>
<i>Cyclodendron leslii</i>	Jharia Coalfield, ? Rani- ganj Coalfield.	<i>G. browniana</i>	Jharia Coalfield.
<i>Sphenopteris hughesii</i>	Jharia Coalfield.	<i>G. decipiens</i>	Jharia Coalfield.
<i>Glossopteris communis</i>	Raniganj, South Karan- pura and Jharia coal- fields.	<i>G. ampla</i>	Jharia Coalfield.
<i>G. indica</i>	South Karanpura and Jharia coalfields.	<i>Noeggerathiopsis hislopi</i>	South Karanpura Coal- field.
<i>G. retifera</i>	South Karanpura Coal- field.		
<i>G. damudica</i>	Raniganj and South Karanpura coalfields.		
<i>G. conspicua</i>	South Karanpura Coal- field.		
<i>G. angustifolia</i>	South Karanpura Coal- field.		

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EXPLANATION OF PLATE

PLATE 1

1-2. *Cyclodendron leslii* (Seward) Kräusel. Specimen nos. 11/594, 12/594. × Nat. size.

3-4. *Sphenopteris hughesii* (Feistmantel) Zeiller. Specimen nos. 24/593, 24/595. × Nat. size.

5. *Equisetalean stem* Specimen no. 5/592. × Nat. size.
6. *Glossopteris ampla* Dana. Specimen no. 4/591. × Nat. size.
7. *Glossopteris communis* Feistmantel. Specimen no. 13/593. × Nat. size.
8. *Glossopteris indica* Schimper. Specimen no. 7/596. × Nat. size.
9. *Glossopteris decipiens* Feistmantel. Specimen no. 22/593. × Nat. size.
10. *Glossopteris browniana* Brongniart. Specimen no. 10/593. × Nat. size.

