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## JURASSIC FLORA OF DHOKUTI, RAJMAHAL HILLS, INDIA

Flora jurajska z Dhokuti, Rajmahal Hills, Indie

### ABSTRACT

The Jurassic flora of Dhokuti was mainly composed of ferns, cycads, and *Bennettitales*. Plants are preserved mostly as fronds, while stems and fructifications are rarely found. Trees occur rarely, which gives evidence to the mesophytic conditions prevailing in the Jurassic period in Dhokuti.

### INTRODUCTION

The fossiliferous locality of Dhokuti is situated about two miles south-east of the railway station of Mirzachowski in the Rajmahal Hills, Bihar. Plant remains are mostly found as impressions on hard, ash grey coloured rocks. Petrified fossils are rare in occurrence so much so, that only a single specimen of a taxanean wood has been described so far from this locality. Plants are preserved mostly as fronds while the stems and fructifications are found rarely. Fossil plants found in Dhokuti are belonging either to pteridophytes or to gymnosperms. The former are represented by the herbaceous lycopods and ferns while the latter include cycads, *Bennettitales* and the taxads. Among the pteridophytes, ferns are occurring more commonly than the lycopods. The latter are represented by only two specimens of *Selaginellites*, while the former occur both in vegetative as well as fertile forms. Cycads and *Bennettitales* are found more commonly than the taxads. Cycads are represented by large sized simple or pinnate leaves while the bennettitalean remains include both fronds as well as the male fructifications of the genus *Williamsonia*.

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## DESCRIPTION

***Pteridophyta.***

*Lycopsidea.* Only two small specimens of *Selaginellites* have been collected so far from Dhokuti. In both the stem is branched and provided with heterophyllous and spirally arranged leaves (Fig. 9). Leaves are small, oblong or ovate and unicostate. Sporangia are produced either on definite spikes or in apical portions of all the branches of the plant (Sharma 1971).

*Filicopsida.*

*Marattiales.* Fertile as well as sterile fronds of *Marattiopsis* are found quite common in Dhokuti. Synangia are present in two rows on the lower surface of the pinnules. Two species of *Marattiopsis* have been described so far from Dhokuti. These are *M. macrocarpa* (O. and M.) Sew. and Sahni (1920) (Fig. 3) and *M. reversa* Sharma (1969a).

*Osmundales.* This order is represented mostly by the sterile fronds of the genus *Cladophlebis* Brongn. Fertile forms occur rarely and are described as *Todites indica* Bose and Sah (1968) (Sharma 1971). On the basis of the study of *Cladophlebis* fronds collected from Dhokuti, the present author has recently suggested that *Cladophlebis indica* (O. and M.) Sahni and Rao (1923) be merged into *C. denticulata* Brongn. which is found very common in this locality (Fig. 2).

*Schizeales.* A number of sterile as well as fertile specimens of the frond genus *Klukia* have been collected from Dhokuti and they are described as *Klukia rajmahalensis* Sharma (1969a), *Klukia* sp. A. Sharma (1971) and *Klukia* sp. B. Sharma (1971). Sori are found scattered on the lower surfaces of pinnules.

*Cyatheales:*

*Cyatheaceae.* This family is represented by the frond genus *Haydenia thyrsopteroides* Seward, which is found both in vegetative and fertile forms. Sori are cup shaped and submarginal on the abaxial surfaces of the pinnules (Sharma 1969a).

*Dicksoniaceae.* A fertile fossil frond resembling the living genus *Dicksonia* has been recently described by the present author as *Dicksonia rajmahalensis* Sharma (1971). Sori are reniform and marginal.

*Dryopteridaceae.* Fertile as well as sterile fronds of *Dryopteris indica* Sharma (1971) have been collected from the fossiliferous locality of Dhokuti (Fig. 5). Sori are reniform and abaxial.

*Gleicheniales:*

*Gleicheniaceae.* Fossil fronds of *Gleichenia gleichenoides*

(O. and M.) Bose and Sah (1968) (Fig. 7) are found very common in the fossiliferous locality of Dhokuti. Majority of these are sterile and the fertile forms occur rarely. In the latter types circular sori are produced abaxially on the pinnules.

Besides the fossil ferns described above, a large number of vegetative fronds of *Sphenopteris* and *Alethopteris* (Fig. 4) have also been collected from Dhokuti (Sharma 1969a, 1971). For want of their fertile parts, these fronds could not be assigned to their proper taxonomic positions and they are still of doubtful affinities.

### **Gymnospermae.**

*Cycadopsida*. A number of fossil cycadean fronds have been collected from Dhokuti. They are large sized, simple or pinnate fronds belonging to the genera *Nilssonia* Brongn., *Cycadites* Sternb., and *Macrotaeniopteris* Schimp. Occurrence of *Nilssonia* is much more common than the other two frond genera and it is represented by as many as four species. These are: *Nilssonia princeps* (O. and M.) Sew. (1917), *N. morrisiana* (Oldh.) Sew. and Sahni (1920), *N. distans* (Morr.) Sharma (1971b), and *N. crassa* (Morr.) Sharma (1971b). *Cycadites* is represented by a single species *C. rajmahalensis* Oldh. which resembles the frond of the living genus *Cycas*. *Macrotaeniopteris* is a simple, large sized frond genus and in Dhokuti it is represented by two species e. g. *M. lata* (O. and M.) Schimp. and *M. crassinervis* Fst. (Fig. 6).

*Bennettitopsida*. Frond genus *Ptilophyllum* Morr. is found quite common in the Jurassic rocks of Dhokuti and is represented by two species e. g. *P. acutifolium* Morr. and *P. cutchense* Morr. (Fig. 1). Besides these fronds, two male bennettitalean fructifications have also been described from Dhokuti. These are *Williamsonia santalensis* Sith. and Bose (Sharma 1969) and *W. campanulatiformis* Sharma (1969) (Fig. 8).

*Taxopsida*. This class is represented in Dhokuti by leaves and woods. The leaves resemble in structure the living genus *Torreya* and are thus named as *Torreyites* sp. (Fig. 10) while the wood has been described as *Taxaceoxylon cupressoides* Sharma (1971a).

### DISCUSSION

From the description given above it is clear that the Jurassic vegetation of Dhokuti was mainly composed of ferns, cycads and *Bennettitales*. Under the shade of these plants there were also present the herbaceous lycopods. Most of the plants were either herbs or shrubs and all were provided with large sized, simple or compound leaves. Trees were rare in occurrence. This shows the presence of mesophytic conditions during the Jurassic period in Dhokuti.

The fern assemblage included herbs as well as shrubs. The latter were represented by the members of the families like *Marattiaceae*, *Cyatheaceae* and *Dicksoniaceae*. Some of these ferns possess the primitive characters while others bear advanced structures. For example, in *Marattiopsis* the sporangia were grouped in naked synangia while in *Dryopteris indica* the sporangia were produced in covered sori. Similarly, in the primitive forms the sporangia were marginal e.g. *Dicksonia*, while they were abaxial in the advanced types like *Gleichenia*, *Dryopteris* etc.

The cycadean frond genus *Nilssonia* occurring in Dhokuti shows some of the peculiar characters which are not found in many of the foreign species. For example, an incomplete covering of rachis by the bases of pinnae or laminae and frequent bifurcation of veins. In some of the fronds vein connections are also observed (S h a r m a 1971b) similar to the one found in an other cycadean frond genus *Ctenis* L. and H.

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#### STRESZCZENIE

##### FLORA JURAJSKA Z DHOKUTI, RAJMAHAL HILLS, INDIE

Opisana flora składa się z uwęglonych, rzadziej skamieniałych, szczątków liści; pędy i owocowania występują rzadko. Reprezentowane są *Pteridophyta* (1 gatunek widłaka i 11 gatunków paproci) oraz *Gymnospermae* (6 gatunków sagowców, 4 — bennetytów i 2 gatunki cisowatych).

Roślinność jurajska Dhokuti składała się głównie z paproci, sagowców i bennetytów. W większości były to rośliny zielne lub krzewy odznaczające się wielkimi liśćmi. Drzewa występowały rzadko, co wskazuje na mezofityczne warunki.

Plate

Tablica

## Plate I

1. *Ptilophyllum cutchense* Morr. A bennettitalean frond,  $\times 1$
2. *Cladophlebis denticulata* Brongn. An osmundaceous frond,  $\times 1$
3. *Marattiopsis macrocarpa* (O. and M.) Sew. and Sahni. A fertile marattiaceous frond,  $\times 2$
4. *Alethopteris* sp. A vegetative frond of doubtful affinity,  $\times 1\frac{1}{2}$
5. *Dryopteris indica* Sharma. A fertile frond with abaxial sori,  $\times 1/2$
6. *Macrotaeniopteris crassinervis* Fst. A simple type of cycadean frond,  $\times 1/2$
7. *Gleichenia gleichenoides* (O. and M.) Bose and Sah. A narrow form of the frond,  $\times 1$
8. *Williamsonia campanulatiformis* Sharma. A bennettitalean male fructification with its counter part,  $\times 1/3$
9. *Selaginellites* sp. B. Sharma. A herbaceous lycopod,  $\times 1/2$
10. *Torreyites* sp. A taxanean twig with simple and spirally arranged leaves,  $\times 3/4$

## Tablica I

1. *Ptilophyllum cutchense* Morr. Liść bennetyta,  $\times 1$
2. *Cladophlebis denticulata* Brongn. Liść z rodziny *Osmundaceae*,  $\times 1$
3. *Marrattiopsis macrocarpa* (O. and M.) Sew. and Sahni. Liść *Marattiopsis* z zarodnikami,  $\times 2$
4. *Alethopteris* sp. Nie oznaczony bliżej płony liść,  $\times 1\frac{1}{2}$
5. *Dryopteris indica* Sharma. Płodny liść z kupkami zarodni (sori) po stronie dolnej,  $\times 1/2$
6. *Macrotaeniopteris crassinervis* Fst. Prosty typ liścia sagowca,  $\times 1/2$
7. *Gleichenia gleichenoides* (O. and M.) Bose and Sah. Wąska forma liścia,  $\times 1$ .
8. *Williamsonia campanulatiformis* Sharma. Męskie owocowanie bennetyta i jego odwrotna strona,  $\times 1/3$
9. *Selaginellites* sp. B Sharma. Zielny widłak,  $\times 1/2$
10. *Torreyites* sp. Gałązka należąca do cisowatych z pojedynczymi i spiralnie ułożonymi liśćmi,  $\times 3/4$

