

PREVIOUS WORK

Upper Gondwanas in India have been divided into following four stages :

- I) Rajmahal
- II) Kota
- III) Jabalpur
- IV) Umia

In the last hundred years several workers have made contribution on the Upper Gondwana plants of India. Feistmantel (1877a,b, 1879), Seward & Sahni (1920), Sahni (1921, 1928, 1931b,c, 1935, 1936, 1940), Jacob (1938), Sitholey (1954,1963), A.R.Rao (1947, 1959, 1964, 1972, 1974), Sah and Sukhdev (1958), Sah and Jain (1964), Sharma (1967-1971), Vishnu Mittre (1953-1959) etc. Recently the work is revised by Sahni (1921, 1928), Sitholey (1954, 1963) and A.R.Rao (1972). Surange et al. (1974) have given a brief account of palaeobotanical work done in India by different workers on different plant groups. His work includes extensive data but here a brief account of the research made on the Indian Upper Gondwana is included.

The floristic composition of Indian Upper Gondwana flora is made up of several groups such as Bennettitales, Coniferales, Pteridosperms, Ginkgoales, Filicales and Pentoxylales - a new group of gymnosperms discovered by Sahni.

I) Rajmahal Stage :

It is named after famous fossiliferous Rajmahal Hills in Bihar where rich flora is preserved in the Jurassic period. In this flora pteridophytes are found in good proportion but within this group ferns are more in number while others are few.

LYCOPSIDA

Genus Lycopodites is represented by L. gracilis described by Seward & Sahni (1920). Srivastava described the petrified stem Lycoxylon indicum from Rajmahal Hills.

ARTHROPHYTA

Equisetales

Only 3 members of Equisetales are found. Out of which Equisetales rajmahalensis is reported from Rajmahal Hills by Sahni and Rao (1933) and Bose & Sah (1968).

PTEROPHYTA

Marattiaceae

Marttiopsis macrocarpa is reported from Rajmahal Hills by Seward and Sahni (1920).

Osmundaceae

Osmundites sahnii is a stem of this family reported by Vishnu-Mittre (1953).

Todites indicus represent the leaves of this family which is reported by Bose & Sah (1962) from Rajmahal Hills, Bihar.

Gleicheniaceae

Gleichenites gleichenoides is reported from Rajmahal Hills by Seward and Sahni (1920).

BENNETTITALES :

The group forms one of the major constituent of the flora and represents various leaves, fructifications and stems.

Leaves :

1) Genus Ptilophyllum Morris

Bose and Kasat (1972) have given a brief account of this genus in India. It forms the typical fossil of the upper Gondwana flora hence the flora is named as the Ptilophyllum flora. According to them 15 species of Ptilophyllum are found in India. Out of which following species are present in Rajmahal Hills.

- 1) P. acutifolium Morris
- 2) P. cutchense Morris
- 3) P. tenerrimum Feistm.
- 4) P. sakrigaliensis Sah

- 5) P. amarjolense Bose
- 6) P. sahnii Gupta and Sharma
- 7) P. nipaniea Vishnu-Mittre

II) Genus - Dictyozamites Oldham

Bose and Zeba-Bano have given a brief account of this genus in India. According to them following species are represented from Rajmahal Hills.

- 1) D. falcatus (Morris) Medlicott & Blandford
- 2) D. indicus Feistm.
- 3) D. hallei Sahnii & Rao
- 4) D. sahnii Gupta & Sharma
- 5) D. sp.

III) Genus - Pterophyllum Brongniart

Bose & Banerji (1981) have described cycadophytic leaves from Upper Gondwana of India where they have reported following species of Pterophyllum are found in the Rajmahal stage.

- 1) P. distans Morris
- 2) P. guptai Bose & Banerji
- 3) P. princeps Oldham & Morris
- 4) P. incisum Sahnii & Rao
- 5) P. morrisianum Oldham
- 6) P. rajmahalense Morris
- 7) P. medlicottianum Oldham & Morris

8) P. kingianum Feistm.

9) P. sp.

IV) Genus - Otozamites Braun

Bose (1974) has given a brief account of this genus in India. According to him Otozamites gondwanensis Bose is the only species reported from Rajmahal Hills.

V) Genus - Anomozamites Schimper

1) A. crenata Bose & Banerji (1981)

2) A. amiarjolense Sharma, Surana & Singh

3) A. fissus Feistm.

FRUCTIFICATIONS :

Male and female fructifications have been reported from Rajmahal Hills. Sitholey and Bose (1971) referred all the male flowers having rays with tapering finger like appendages to a Genus Weltrichia Braun. 3 species of this genus have been described they are :

1) W. singhii, Bose (1967)

2) W. santalensis (Sitholey & Bose) Bose (1967)

3) W. polyandra (Ganju) Sitholey & Bose (1971)

Female flowers belonging to the genus Williamsonia are found in this area. Bose (1968) has given a brief account of this genus in India. According to him following species are reported :

1. W. blandfordii Feistm. 1876
2. W. microps Feistm. 1877
3. W. indica Seward 1970
4. W. sewardiana Sahni 1932
5. W. sahnii Gupta 1943
6. W. harrisiana Bose 1968
7. W. guptai Sharma 1968
8. W. amarjolense Sharma 1968
9. W. seniana Bose & Kasat 1969
10. W. cf. W. seottica Sharma 1970

Bisexual flowers belonging to Genus Cycadeoidea

Buckland are not much common in India. Bose (1966a) described C. dactyolota which is a detached flower.

Scale leaves belonging to genus Cycadolepis Saporta have been described from Rajmahal Hills, Bihar. They are

- 1) C. indica Gupta 1954
- 2) C. oldhamii Bose & Jain 1964

Stems : Genus Bucklandia represents the Bennettitalean stem. Bose (1953a) described B. sahnii and B. sp. Sharma (1967, 1969 b) described B. guptai and B. dichotoma.

CONIFERALES :

This group is represented in large number from all divisions of Upper Gondwana.

FAMILY-PODOCARPACEAE

Leaves :

1) Genus - Elatocladus Halle

Most of the Indian leafy twigs are assigned to this genus. Sahni (1928) reviewed this genus and showed that following species are found in the Rajmahal stage.

- 1) E. conferta (Oldham & Morris) Sahni
- 2) E. sp.

Vishnu-Mittre (1959) reported E. sahnii from Rajmahal Hills.

2) Genus - Indophyllum Vishnu-Mittre

Vishnu-Mittre (1959) described following 3 species from Rajmahal Hills. They are :

- 1) I. sahnii
- 2) I. raoii
- 3) I. nipanica

Fructifications :

1) Genus - Podostrobus Rao & Bose (1971)

P. rajmahalense and P. sahnii are the 2 male cones from Rajmahal Hills.

2) Genus - Nipaniostrobus Rao

It is a female cone having scales with single seed

Vishnu-Mittre (1959) reported N. pagiophylloides and N. aciculifolia.

3. Genus - Mehtia Vishnu-Mittre

Vishnu-Mittre described M. nipaniensis, M. santalensis and M. rajmahalensis.

4. Genus - Sitholeya

It also a female cone described by Vishnu-Mittre (1959). S. rajmahalense is the only species of it reported from Rajmahal Hills.

5. Genus - Nipanioruha Rao

This genus was established by Rao (1947) for shoots of this family. Vishnu-Mittre (1959) described N. lanceolata and N. cordifolia from Rajmahal Hills. Rao (1949) described the female cone of N. granthia.

Stem :

1) Genus - Mesembrioxylon Seward

M. rajmahalense was described by Jain in 1965. Bose and Maheshwari (1974) have changed its name to Podocarpoxyton rajmahalense.

Genus - Circoporoxylon Krausel

^{1/} Krausel & Jain (1964) described C. amarjolense from Rajmahal Hills.

Family - Araucariaceae

It is represented by detached leafy twigs, petrified woods and male & female cones.

LEAVES :

1) Genus - Brachyphyllum Brongniart

Sahni (1928) have given a brief account of this genus in India. According to him the following species have been reported from Rajmahal Hills.

- i) B. expansum (Sternb.) Seward
- ii) B. mamillare Brongn

Vishnu-Mittre (1959) reported B. florini Bose (1952) reported B. spiroxylum from Rajmahal Hills.

ii) Genus - Pagiophyllum Heer

Sahni (1928) reported Pagiophyllum sp. cf. P. perigranum and Vishnu - Mittre (1959) reported P. araucaroides from Rajmahal Hills.

Feistmantel (1877) described Echinostrobus rajmahalensis which is recently changed to Allocladus rajmahalense by Townrow (1967).

Reproductive Organs :

Genus Araucarites Presl represents cone scales of this family.

Bose and Maheshwari (1971) have given brief account of this genus. According to them following species have been reported from Rajmahal Hills.

- 1) A. brindrabanensis Vishnu-Mittre
- ii) A. nipaniensis Singh
- iii) A. cutchensis Feistm.

Genus - Araucarioxylon

Bose and Maheshwari (1974) made a review of this genus in India and according to them following species of this genus are recognised from Rajmahal Hills :

- i) A. agathoides
- ii) A. amraparense
- iii) A. mandroense
- iv) A. bindrabanense
- v) A. rajmahalense
- vi) A. santalense

In addition to these reports following conifers have been reported from Rajmahal Hills :

Ganju (1947a) described Torreyites sitholeyi which shows affinities to family Taxaceae.

Kräusel and Jain (1964) described Taxaceoxylon rajmahalense which is a wood of Taxaceae. ✓

Ginkgoales :

Sah & Jain (1965) have described Ginkgoites rajmahalensis from Rajmahal Hills.

Srivastava and Sah (1966) described Ginkgo (Ginkgoites) digitata from Rajmahal Hills. According to Sitholey & Bose (1974) its identification is doubtful.

A new group of Gymnosperms, Pentoxylae was discovered by Sahni (1948). Its female fructifications are described as Carnoconites compactum and C. laxum both described by Srivastava (1935, 1937).

Leaves - Nipaniophyllum raoii Sahni (1948) and male fructification Sahnia nipaniensis by Vishnu-Mittre (1953).

1) Genus - Thinnfeldia, Ettingshausen

Feistmantel (1877a) described T. indica from Rajmahal Hills. Gururaja & Pant (1970) have also reported it. Sah & Sukhdev (1957) described T. chunakhalensis. Sharma et al. (1971) reported T. amarjolense, Thinnfeldia sp. cf. T. lancifolia, Thinnfeldia sp. cf. T. feistmantelli, T. sp A and T. sp. B from Amarjola in Rajmahal Hills. However, Srivastava (1974) suggests that these leaves can be compared with the species of Dicroidium.

2) Genus - Cycadopteris Zigno

Bose (1958 b) reported Cycadopteris sp. from Rajmahal Hills.

2) Kota Stage :

In the Pranhita-Godavari valley the Kota stage is named after a place Kota situated 5 miles north of Sironcha. In the East coast it is located at Raghavapuram in the West Godavari district, Raghudevapuram in the East Godavari district, Vemavaram in the Prakasam district of Andhra Pradesh, Sriperamatur near Madras and Sivaganga in Ramnad district in Tamilnadu.

I) PTERIDOPHYTES :

Gopal et al. (1957) described Cladophlebis lobata and C. reversa from the Ramnad district in Tamilnadu. According to Surange (1966) C. indica is reported from Sripernamatur beds. According to Saksena (1974) from Adilabad district and Vemavaram in Andhra Pradesh and Sivaganga in Tamilnadu, Sphenopteris is reported.

Recently Bose et al. (1981) reported Gleichenia nordenskiöldii. Heer, ?Gleichenia sp., ?Cladophlebis sp. from Gangapur beds in Andhra Pradesh.

II) PTERIDOSPERMS :

Rao (1959) reported Dicroidium feistmantelli from Vemavaram. Later on, Jain (1968) described Dicroidium sp. from the same locality Baksi (1968) described Dicroidium sp. from Raghavapuram in Andhra Pradesh.

Feistmantel (1879) described Dicroidium sp from

Sriperamatur under the name Thinnfeldia sp. or ? Dichopteris.

Gopal et al. (1957) reported Thinnfeldia sp. from Sivaganga in Ramnad district.

Sahni (1928) recorded Retinoporites indica from Vemavaram. Later on, Bose & Rao in 1968 revised its name as Pachypteris indica.

GINKGOALES :

Feistmantel (1879) and Seward & Sahni (1920) reported Ginkgoites crassipes from Sriperamatur.

Recently, Vagyani reported it from Uppugunduru in Prakasam district of Andhra Pradesh. Baksi (1967) reported G. feistmantelli from Raghavapuram in Andhra Pradesh.

BENNETTITALES :

Genus - Ptil ophyllum, Morris (1840)

According to Bose & Kasat (1972) following species have been reported from this stage.

1. P. acutifolium, Morris
2. P. cutchense, Morris
3. P. rarinervis (Feistm.) Bose & Kasat

Genus - Pterophyllum, Brongniart (1828)

Bose & Banerji (1981) have given a brief account of

this genus in India. According to them, P. footeanum Feistm. is reported from Vemavaram in Andhra Pradesh. Vagyan (1986) reported it from Uppugunduru in Prakasam district of Andhra Pradesh. P. incisum, Sahni & Rao (1933) is reported from Vemavaram P. distans Morris is reported from Uppugunduru in Prakasam district by Vagyan & Zutting in 1986.

Bose et al. (1981) have reported(?)Ptilophyllum cutchense. Morris from Gangapur formation in Andhra Pradesh and Taeniopteris sp. cf. T. spatulata, McClend a member of cycadales.

Genus - Dictyozamites, Oldham

Bose & Zeba-Bano (1976) have given a brief account of this genus. D. feistmantelli, Bose & ZebaBano is reported from Vemavaram, Sriperamatur and Raghavapuram. D. indicus, Feistmantel (1976) is reported from Vemavaram. Mahabale & Satyanarayana (1979) reported D. falcatus (Morris) Medlicott & Blandford 1879 from Raghudevapuram in East Godavari district of Andhra Pradesh. D. sahnii, Gupta & Sharma (1968) have been reported by Mahabale & Satyanarayana from the above locality in 1979.

Genus - Otozamites, Braun 1842

Bose (1974) has given a brief account of this genus in India. O. vemavaramensis Bose & Jain 1967, O. exhislopii

Bose 1974, and O. gondwanensis Bose 1974 have been reported from Vemavaram in Andhra Pradesh.

Genus - Anomozamites, Schimper 1870

Bose et al. (1981) have reported Anomozamites sp. from Gangapur formation in Andhra Pradesh.

Genus - Taeniopteris, Brongniart 1832

According to Bose & Banerji (1981) it is reported from Sriperamatur, Naikulam and Sivaganga in Tamilnadu and in Andhra Pradesh from Vemavaram and Raghavapuram. Recently Mahabale & Satyanarayana (1979) have reported it from East Godavari district in Andhra Pradesh.

Genus - Morrisia, Bose 1958

According to Bose & Banerjee (1981) Morrisia mcClellandi (Oldham & Morris) Bose (1979) is reported from Raghavapuram, Vemavaram in Andhra Pradesh, and Sriperamatur and Sivaganga in Tamilnadu, in addition to Rajmahal hills.

IV) CONIFERALES :

Genus - Elatocladus, Halle 1913

Sahni (1928) reported Elatocladus plana (Feistm.) Seward (1919), from Raghavapuram in Andhra Pradesh and from Sriperamatur in Tamilnadu. Mahabale & Satyanarayana (1979) reported it from East Godavari district in Andhra Pradesh. Recently,

Vagyani & Jamane (1987) reported it from Uppugunduru in Andhra Pradesh. Sahni (1928) reported E. jabalpurensis (Feistm.) Seward 1919 from Vemavaram and E. conferta (Oldham & Morris) Halle (1913) from Chirakunt in Andhra Pradesh.

Bose et al. (1981) reported Elatocladus sp., F.confertus (O. & M) Halle, E. kingianus, Bose Kutty & Maheshwari.

Genus - Brachyphyllum Brongniart 1828

Sahni (1928) reported B. expansum (Sternberg) Seward at Vemavaram in Andhra Pradesh and at Sriperamatur in Tamilnadu. It is also reported by Mahabale & Satyanarayana (1979) from East Godavari district in Andhra Pradesh. B. feistmantelli (Halle) Sahni 1928 is reported from Vemavaram in Andhra Pradesh, and B. rhombicum (Feistm.) from Sriperamatur in Tamil nadu by Sahni (1928).

Genus - Pagiophyllum, Heer 1881

Jain (1968) reported Pagiophyllum sp. from Vemavaram in Andhra Pradesh. Baksi in 1967 reported Pagiophyllum sp. cf. P. perigrinum (Lidley & Hutton) Sahni 1928 from Raghavapuram in Andhra Pradesh, Bose et al. (1981) reported P. marwarensis, Bose & Sukh-Dev from Gangapur formation in Andhra Pradesh.

Genus - Desmiophyllum, Lesquereux 1878

Sahni (1928) reported D. indicum from Raghavapuram in Andhra Pradesh. Vagyani (1984) reported it from Vemavaram in

Andhra Pradesh.

Genus - Torreyites, Seward 1919

Seward & Sahni (1920) described Torreyites constricta from Vemavaram which was earlier described by Feistmantel (1979a) as Cycadites constricta. This plant resembles in habit and surface feature of the lamina of the living genus Torreya belonging to family Taxaceae. Biradar (1967) reported fossil woods of following genus from Kota in Andhra Pradesh.

1. Mesembrioxylon
2. Dadoxylon
3. Ginko
4. Taxaceoxylon

Gupta (1954) reported Conifero-caulon sp. cf. C. rajmahalense from Gangapur formation in Andhra Pradesh.

3) JABALPUR STAGE :

The Jabalpur series is divided into two stages, the lower one is called as Chaugan Stage and the upper one is called as Jabalpur Stage. They are characterised by white coloured clays and soft sandstones. Sometimes carbonaceous shales also occur. In Satpura region coal seams are seen present at Hard and Morand rivers. It is distributed in India at Bansa beds and Jabalpur in Madhya Pradesh, Chikiala, Tirupati, Pavalaur in Andhra Pradesh, Satyavedu in Tamilnadu and Katrol in Kutch and Salt range.

PTERIDOPHYTES :

Feistmantel (1877d) reported Sphenopteris comp. arguta Lindley & Hutton from Sher river in Madhya Pradesh. He also described Alethopteris Whitbyensis, Schimper, A. medicottiana Oldham. from Sher river and Jabalpur.

Surange (1966) suggests that the identifications are doubtful and some of these forms can be merged with Cladophlebis. He also reported Dicksonia sp. from Jabalpur.

Kasat (1969) reported Todites indicus (Oldham & Morris) Bose & Sah (1968) from Sehona, district Narsinghpur, Madhya Pradesh belonging to Jabalpur stage.

PTERIDOSPERMS :

Genus - Pachypteris Brongniart

Bose & Roy (1968) described P. indica from Sher river

in Jabalpur. According to them Sehora is the richest locality for this plant.

Genus - Cycadopteris Zigno

Bose (1958a) reported Cycadopteris sp. from Bansa belonging to Jabalpur stage. It is also reported from Chunakhal in Rajmahal Hills. Bose & Sukh-Dev have given a detailed account of Cycadopteris in India and described 4 new species.

1. C. pulcherrima
2. C. auriculata
3. C. indica
4. C. majus

So, it appears that pteridosperms are not much common in the Jabalpur stage and the genera present here are also reported from Rajmahal and Umia stage. Therefore, presence of these genera in this period suggests their lingering existence.

BENNETTITALES :

Genus - Dictyozamites, Oldham (1863)

Bose & Zeba-Bano (1976) have given a brief account of this genus and its distribution in India. According to these authors it is a rare plant in the Jabalpur stage and best known specimen from Paraspani. D. feistmantelli. Bose & Zeba-Bano is reported from Paraspani and Jatmao in Hoshangabad district of Madhya Pradesh. D. indicus Feistmantel 1876 is

also reported from Paraspani. Hence, the occurrence of these two species confirms that it is a rare plant in this stage.

Genus - Otozamites, Braun 1842

Bose (1974) have given a brief account of this genus and its distribution in India. According to this author, it is completely absent in this stage.

Genus - Ptilophyllum, Morris (1840)

Bose & Kasat (1972) have given a brief account of this genus in India. Feistmantel (1877 d) reported P. acutifolium and P. cutchense from Sher river in Madhya Pradesh. In addition to the above reports following species have been reported from Jabalpur stage.

Jacob & Jacob (1954) reported P. oldhamii and P. indicum from Jabalpur series. P. horridum Roy 1963 which was first reported from Kutch was later on reported by Bose & Kasat from Bansa and Sehora in Madhya Pradesh. Sah (1958) described P. sakrigaliensis from Rajmahal hills. It was, later on reported from Jabalpur series by Bose & Kasat.

P. distans (Feistm.) Jacob & Jacob 1954

P. institacallum Bose 1959

P. jabalpurensis Jacob & Jacob 1954

J. gladiatum Bose & Sukh-Dev 1958

are the other species reported from Jabalpur stage.

Hence, it appears that genus Ptilophyllum is quite common in the Jabalpur stage and occurs frequently as in Rajmahal.

Genus - Pterophyllum, Brongniart 1828

Bose & Banerji (1981) have given a brief account of this genus in India. According to them P. distans Morris, P. medlicottianum Oldham & Morris are the only species reported from this stage. Hence, it appears that out of ten species of Pterophyllum in India occurrence of 2 species suggest that it is not a common plant in this stage.

Genus - Anomozamites Schimper 1870

Bose & Zeba-Bano (1979) described Pterophyllum sp. from Hansapur in Narsinghpur district of Madhya Pradesh. Later on Bose & Banerji (1981) changed its name to a new species of the genus Anomozamites to A. hansapurensis. So it appears that in the Jabalpur stage Anomozamites is not a common plant.

CYCADALES :

Genus - Taeniopteris Brongniart, 1832

Sukh-Dev & Zeba-Bano (1980) have reported T. spatulata McClelland from Hoshangabad district in Madhya Pradesh. Bose & Zeba-Bano (1979) also reported it from Jabalpur series.

It is observed that though Taeniopteris is common on the east coast and in the Rajmahal. It is represented by only one species in the Jabalpur stage.

CONIFERS :

Genus - Elatocladus Halle

According to Sahni (1928) E. plana (Feistm.) Sahni reported from Bansa in South Rewah district of Madhya Pradesh. E. conferta (Oldham & Morris) Sahni is reported from Sher river in Satpura basin and Bansa in South Rewah district of Madhya Pradesh.

E. tenerrima (Feistm.) Sahni is reported from Sher river and E. jabalpurensis (Feistm.) Sahni is reported from Jabalpur and Satpura, in Madhya Pradesh. Earlier Feistmantel (1877) described it under the name Palissiya jabalpurensis (Feistm.).

Genus - Brachyphyllum, Brongniart

According to Sahni (1928) following species of Brachyphyllum have been reported from Jabalpur stage. They are -

1. B. mamillare. Brongniart
2. B. rhombicum (Feistm.) Sahni
3. B. feistmantelii (Halle) Sahni
4. B. expansum (Sternb.) Sahni
5. B. expansum (Sternb.) var. indica Sahni

This species happen to be available only in the Jabalpur stage.

Genus - Pagiophyllum, Heer

According to Sahni (1928) P. perigrinum (Lindl. &

Hutt.) Sahni, P. cf. perigrinum (L. & H.) Sahni have been reported from Sher river in Satpura basin and Bansa in South Rewah district of Madhya Pradesh.

Genus - Araucarites Presl.

According to Seward & Sahni (1920) and Sahni (1920) A. latifolius Feistm. is reported from Bansa and A. cutchensis Feistm. has been reported from Sher river and Bansa belonging to Jabalpur stage.

Genus - Conites Sternberg

According to Sahni (1928) Conites sp. of Strobilites anceps Berry is reported from Bansa.

Genus Strobites sewardii Sahni is reported from Jabalpur. It was found associated with E. jabalpurensis.

Genus - Desmiophyllum Lesqueruax

Sahni (1928) described D. indicum from Bansa in South Rewah district and Sher river in Satpura basin belonging to Jabalpur stage.

GINKGOALES :

Genus - Ginkgoites Seward

Feistmantel (1876, 1877) described from Sher river fossil leaves resembling Ginkgo as G. lobata. Later on Seward & Sahni changed its name as Ginkgoites lobata. Bose & Sukh-Dev (1958) have reported G. feistmantelii from Bansa in Madhya Pradesh.

4) UMIA STAGE

The upper most division of Upper Gondwanas is called as Umia Stage named after Umia village in Kutch. The plant beds are Lower Cretaceous in age.

PTERIDOPHYTES :

FAMILY-MATONIACEAE

Genus - Matonidium Schenk.

Sahni (1936) reported M. indicum from Himmatnagar sandstones in Western India belonging to Umia stage.

Genus - Phlebopteris Brongniart

Roy (1968) reported Phlebopteris sp. from Kutch.

FAMILY - OSMUNDACEAE

Todites indicus is reported from Cretaceous formation of India.

Cladophlebis kathiwarensis is reported by Roy and Cladophlebis sp. cf. C. longipennis also from Songad. Sphenopteris specifica (Feistm.) Roy and Sphenopteris sp. have been reported from Kakadbit in Kutch and Songad near Kathiawar.

Genus - Onychiopsis Yokoyama

O. psilotoides (Stokes & Webb.) ward is also reported

from Kutch. Hence, Roy suggests that these localities in Kutch belong to Lower Cretaceous period.

Equisetites rajmahalensis (Oldham & Morris) Feistmantel was reported from Kakadbhiti by Roy in 1968.

Genus - Weichselia Steihler

Sahni (1936) described W. reticulata (Stokes & Webb) Ward from Himmatnagar sandstones in Gujarat belonging to Umia stage. This genus is representative of Wealden forms and indicates the Lower Cretaceous age.

FAMILY - ISOETACEAE

Genus - Isoetites Muenster

Bose & Roy (1964) have reported following 2 species of this genus :

- 1) I. serratifolius
- 2) I. indicus

PTERIDOSPERMS :

Genus - Pachypteris Brongniart

P. indica is reported from Trambau, Kakadbhiti and other localities in Kutch by Bose & Banerji (1981). They have also reported P. specifica Feistm. from these localities. It is more common than P. indica. P. cf elegans is also reported from Trambau in Kutch.

Genus - Thinnfeldia Ettingshausen

Recently Maheshwari (1986) have reported T. indica Feistmantel from Naicolam in Tirucherapalli district of Tamilnadu belonging to Lower Cretaceous period.

BENNETTITALES :

Genus - Ptilophyllum Morris

Bose & Kasat (1972) have given a brief account of this genus in India. According to them following species have been reported from Umia stage :

1. P. acutifolium Morris
2. P. cutchense Morris
3. P. oldhamii Jacob & Jacob
4. P. indicum Jacob & Jacob
5. P. horridum Roy
6. P. sakrigaliensis Sah
7. P. distans Jacob & Jacob
8. P. jabalpurensis Jacob & Jacob

Genus - Dictyozamites Oldham

Bose & Zeba-Bano (1976) have given a brief account of the genus Dictyozamites in India. According to them D. feistmantelii is doubtfully reported from Lower Cretaceous.

Recently Bose & Banerji (1981) have reported Dictyozamites sp. from Kakadbit in Kutch.

Genus - Otozamites Braun

Bose (1974) has given a brief account of the genus Otozamites in India. According to him there are no reports from Lower Cretaceous beds at Bansa, Himmatnagar and Songad. However, occurrence of O. imbricatus Feistm. and O. sp. from Kutch suggests Lower Cretaceous age.

Following 2 new species have been recently reported from Kutch. Namely - (1) O. walkamotaensis Bose & Seba Bano and (2) O. kachchhensis Bose & Banerji 1981. These localities in Kutch belong to Upper Jurassic or Lower Cretaceous in age and therefore, occurrence of these genera in Kutch have no definite age. But we prefer to include them in the Lower Cretaceous due to occurrence of typical members like Matonidium and Weichselia (Wealden forms).

Genus - Taeniopteris Brongniart

Following species have been reported by Bose & Banerji (1981).

1. T. spatulata McClelland
2. T. kutchensis

Genus - Pterophyllum Brongniart

According to Bose & Banerji (1981) following species have been reported.

1. P. distans Morris

Genus - Anomozamites Schimper

A. hubrensis Bose & Banerji (1981) has been reported from Habur in Rajasthan.

CONIFERS :

Genus - Elatocladus, Halle

According to Sahni (1928) E. tenerrima (Feistm.) Sahni has been reported from Kakadbhiti in Kutch belonging to Umia stage.

Recently Bose & Banerji (1981) have reported E. confertus (Oldham & Morris) Halle from Kakadbhiti in Kutch. E. jabalpurensis (Feistm.) Sahni and E. chawadensis Bose & Banerji from Chawad river in Kutch.

Genus - Brachyphyllum Brongniart

According to Sahni (1928) B. expansum is reported from Kakadbhiti in Kutch. Recently Bose & Banerji (1981) described B. royii from Kakadbhiti in Kutch.

Genus - Pagiophyllum, Heer

Sahni in 1928 described P. cf. P. divaricatum (Bunbury) from Kakadbhiti in Kutch.

Recently, Bose & Banerji (1981) described P. grantii a new species and emerged P. cf. P. divaricatum into this new species. They have also added following 2 new species from Chawad river section in Kutch namely :

1. P. chawadensis
2. P. morissi

Genus - Araucarites

Feistmantel (1876) first reported A. cutchensis from Kutch. Bose & Banerji (1981) have again reported it from several localities in Kutch. Bose & Maheshwari (1973) have described A. minutus from Kutch and Bose & Banerji (1981) have described a new species A. janaianus from Chawad river in Kutch. Bose & Banerji (1981) also reported A. cf. nipaniensis Singh from Trambau and Walka Mota in Kutch.

Bose & Banerji (1981) have added some new genera and their species having gymnospermous affinities from Kutch.

1. Trambau apiculata
2. Lorumformophyllum dentatum

Genus - Allocladus Townrow (1967)

Bose & Banerji (1981) have reported A. biswasianus from Kutch.

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