PART II
6
SYSTEMATIC PALYNOLOGY

The palynological assemblages of Umia Formation of Kutch basin and Jabalpur Formation of Jabalpur basin are made up of the 145 species referable to 90 formgenera. The assemblage belongs to the major plant groups like pteridophyta, bryophyta, gymnosperms and fungi. The description of the assemblage has been attempted according to the classification of spores and pollen grains as proposed by Potonie and Kremp (1954, 1955 and 1956a,b) and subsequently enlarged by Potonie (1956, 58, 60, 66 and 70).

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Cyathidites australis Couper, 1953
Pl.2 Figs. 1-5

Description

Miospores ± triangular with straight-slightly concave interapical sides and rounded apices; size range 80-95 μm. Trilete, lasura distinct, straight, extending the full length. Exine 2-3 um thick with psilate to scabrate ornamentation.
Distribution

_Cyathidites australis_ Couper, 1953 is a common taxon of Mesozoic-Tertiary sediments of India. It is abundantly represented in the Upper Jurassic-Lower Cretaceous sediments of Madhya Pradesh (Dev, 1959; Dogra, 1986), Kutch, Gujarat (Singh, Srivastava and Roy, 1964; Rawat, 1969; Venkatachala, 1969; Venkatachala, Kar and Raza, 1969), Rajasthan (Srivastava, 1966) and Upper Gondwana of Tamilnadu (Ramanujam and Srisailam, 1974).

This taxon has a world wide distribution including the Mesozoic and Tertiary sediments of Canada and Australia.

_Cyathidites ghuneriensis_ Singh, Srivastava and Roy, 1964
Pl.1 Figs. 6,8,9

Description

Miospores + triangular with rounded apices and concave interapical sides; size range 70-80 \( \mu \)m. Trilete, Y-mark distinct reaching 3/4 radius, lasura open. Exine nearly 1um thick with granulose ornamentation.

Distribution

_Cyathidites ghuneriensis_ was recorded by Singh, Srivastava and Roy (1964) from the Trambau carbonaceous shale and Ghuneri coal of Lower Cretaceous age of Kutch, Gujarat.

_Cyathidites minor_ Couper, 1953
Pl.1, Figs. 1,3,4
Description

Miospores triangular with straight to slightly concave interapical sides and rounded apices; size range 50-70 \( \mu m \). Trilete, lasura simple, reaching up to the 3/4 radius. Exine 1-2 \( \mu m \) thick with smooth surface.

Distribution

_Cyathidites minor_ Couper, 1953 is also abundantly represented in the Upper Jurassic-Lower Cretaceous sediments of Kutch, Gujarat (Singh, Srivastava and Roy, 1964; Venkatachala, 1969), Rajasthan (Srivastava, 1966) Tamilnadu (Jain and Subraman, 1970; Ramanujam and Srisailam, 1974). Also reported from the Jurassic-Lower Cretaceous of Canada and Australia.

_Cyathidites_ sp. I
Pl.1, Fig.2

Description

Miospore ± triangular in shape with rounded apices and concave interapical sides; size 55x51 \( \mu m \). Trilete, rays simple, extending 3/4 radius, sometimes bifurcating, vertices all equal, measuring 120\(^\circ\). Exine 2-3 \( \mu m \) thick, proximally laevigate, distally with granulose ornamentation.

Comparison

The present taxon is closely comparable to _Cyathidites minor_ Couper, 1953 in general shape and size but can be differentiated from the latter in having a bifurcated
lasura, thick exine and granulose ornamentation. *Cyathidites ghuneriensis* Singh, Srivastava and Roy, 1964 can be distinguished from the present species on account of its bigger size and comparatively thin exine. The present taxon differs from *Cyathidites* sp.II on account of its smaller size and absence of interapical thickenings.

*Cyathidites* sp. II
Pl.1, Fig.7

**Description**

Miospore ± triangular in shape with rounded apices and concave interapical sides; 70x59 µm in size. Trilete distinct, rays simple, 25x59 µm in length, bifurcating, vertices all equal measuring 120°. Exine 2-3 µm thick at the apices and more thicker at the interapical sides, proximally laevigate and distally with granulose ornamentation.

**Comparison**

The present species can be differentiated from *Cyathidites minor* Couper, 1953 on account of its bigger size and thick exine and distally granulose ornamentation. *Cyathidites ghuneriensis* Singh, Srivastava and Roy, 1964 resembles the present taxon in overall shape and size but the latter has very thick exine at the interapical sides. The present taxon can be differentiated from *Cyathidites* sp.I on account of its bigger size and presence of interapical thickenings.
Genus *Dictyophyllidites* Couper, emend Dettmann, 1963

Type species *Dictyophyllidites harrisii* Couper, 1958

*Dictyophyllidites harrisii* Couper, 1958

Pl. 4, Fig. 3

**Description**

Miospore roundly triangular with convex sides and broadly rounded apices; 55x60 μm in size. Trilete, rays distinct, almost reaching 2/3 radius. Kyrtome is present around the trilete rays. Exine thin and smooth.

**Distribution**

This taxon has world wide distribution in the sediments of Mesozoic and Cretaceous age. Srivastava (1975) recorded this taxon from the Lower Cretaceous of Southern United States.

Genus *Appendicisporites* Weyland and Kreiger 1953

Type species *Appendicisporites tricuspiditus*

Weyland and Kreiger 1953

*Appendicisporites potomacensis* Brenner 1963

Pl. 3, Figs. 2, 4, 5, 9, 12

**Description**

Miospore ± triangular with almost convex sides and short conical apices, appendices projecting 3-4 μm long. Size range 45-55 μm. Trilete, lasura long, reaching the equator. Exine moderately thick, two layered, ornamented with furrows and ridges, ridges 2-4 μm wide and spaced 1-4 μm apart, parallel to the sides of the spores.
Distribution

*Appendicisporites potomacensis* Brenner, 1963 was recorded from Cretaceous sediments of Meghalaya (Kar and Singh, 1986). Besides, the taxon is also reported from South United States (Srivastava, 1975) and Canada (Singh, 1964, 74; Pocock, 1965; Norris, 1967; Playford, 1975).

*Appendicisporites problematicus* (Burger) Singh, 1971

PI. 3, Fig.8

Description

Miospore ± subtriangular - triangular in outline with very short appendices; 50×45 μm in size. Trilete, lasura straight, reaching nearly 3/4 radius. Exine 2-3 μm thick, sculptured with furrows and ridges Ridges 3-4 μm thick, sparsely spaced and ± parallel to interradial sides.

Distribution

*Appendicisporites problematicus* Burger, 1966 was recorded from Lower Cretaceous sediments of Meghalaya (Kar and Singh, 1986), South United States (Srivastava 1975) and Netherlands (Burger, 1966).

Genus

*Concavisporites* (Pflug) Delcourt and Sprumont, 1953

Type species

*Concavisporites rugulatus* Pflug in Thomson and Pflug, 1953

*Concavisporites cutchences* Singh, Srivastava and Roy, 1964

PI. 3, Figs. 1,3
Description

Miospores triangular with straight to slightly concave sides and rounded apices; size range 40-50 μm. Trilete, lasura distinct, extending up to the equator, rays simple, vertex elevated, bounded by conspicuously thick inter radial bands curving over the ray ends. Exine moderately thick and laevigate.

Distribution

This taxon was reported by Singh, Srivastava and Roy (1964) from the Lower Cretaceous of Kutch, Gujarat, India.

Concavisporites cf. C. punctatus Delcourt and Sprumont, 1955

Pl.4, Fig.7

Description

Miospore ± triangular with rounded apices and straight to convex sides; 67x66 μm in size. Trilete distinct, lasura long, extending up to the apices and bifurcating near the apices, lasurae bordered by thickenings (Kyrtome) Exine 2-3 μm thick with infranigranulose to infrapunctate ornamentation.

Distribution

Similar specimens were recorded from the Lower Cretaceous sediments of Kutch, Gujarat (Singh, Srivastava and Roy, 1964).

Inferaturma Apiculati (Bennie and Kidston) Potonie, 1956.
Genus. Concavissimisporites (Delcourt and Sprumont) Delcourt, Dettmann and Hughes, 1963

Type species Concavissimisporites verrucousus Delcourt and Sprumont, 1955

Concavissimisporites subverrucousus Venkatachala, Kar and Raza, 1969 Pl.4, Figs.2,8

Description

Miospores ± triangular with rounded apices and concave interapical sides; size range 50-80 μm. Trilete, lasura distinct reaching up to the periphery. Exine 1-2 μm thick with inferagranulose-interapunctate ornamentation.

Distribution

This species has been reported from the Lower Cretaceous sediments of Kutch, Gujarat (Venkatachala, Kar and Raja, 1969).

Concavissimisporites trilobatus sp. nov.
Pl.3, Figs.6,7

Holotype: Pl.3, Fig.6 Slide no. PbPl/SD2/-42:138 Size-50x58 μm. Lower Cretaceous, Korawadi River Section (Dharesi) Bhuj, Kutch, Gujarat, India.

Specific Diagnosis

Miospores ± triangular with rounded apices and deeply concave interapical sides; size range 50-70 μm. Trilete, lasura straight lips elevated, reaching more than 3/4 radius. Exine 2-3 μm thick, much thicker at the interapical regions,
having a coarsely granulose-microverrucose ornamentation on both proximal and distal surface.

Comparison

The present taxon can be differentiated from the other known species of the genus by its coarsely granulose ornamentation and highly elevated trilete mark which at times is similar to that found in the genus *Hymenozonotiletes* Naumova, 1937 ex. Naumova, 1953.

*Concavissimisporites* sp.
Pl.4, Figs. 4, 6, 9

Description

Miospore ± triangular, amb distinctly trilobed, apices lobed and interapical sides notched; size range 70-74 μm. Trilete distinct, ray reaching up to the equator. Exine 2-3 μm thick with granulose surface ornamentation.

Comparison

The present taxon can be differentiated from the other known species of the genus by its characteristic trilobed amb.

Genus *Ceratosporites* Cookson and Dettmann, 1958

Type species *Ceratosporites equalis* Cookson and Dettmann, 1958

*Ceratosporites kutchensis* Venkatachala, 1969
Pl.3, Fig.11
Description

Miospore roundly triangular, 45x50 μm in size. Trilete distinct, lips thick. Exine moderately thick, proximally smooth and distally sculptured with 2-4 μm long spiny processes with bulbous base and flattened tips.

Distribution

The present taxon has also been recorded earlier from the Lower Cretaceous sediments of Kutch, Gujarat (Venkatachala, 1969).

Genus **Baculatisporites** Thomson and Pflug, 1953

Type species **Baculatisporites primarius** (Cookson) Potonie 1956 (Wolf) Thomson and Pflug, 1955.

**Baculatisporites camaumensis** (Cookson) Potonie, 1956

Pl.4,Fig.5

Description

Miospore ± triangular-circular, 48x50 μm in size. Trilete distinct, reaching to the equator. Exine thick ornamented with closely placed bacula, 2-3 μm in height and nearly 2 μm in diameter.

Distribution

This taxon is common in the Lower Cretaceous of Kutch (Singh, Srivastava and Roy, 1964), Upper Gondwana of Tamilnadu (Ramanujam and Srisailam, 1974), Lower Cretaceous of South United States (Srivastava, 1975) and Upper Mesozoic

*Baculatisporites* sp.
Pl.4 Fig.1.

Description

Miospore circular to oval, 45x44 μm in size. Trilete distinct lasura straight, open, reaching nearly half the radius. Exine 2-3 μm thick, baculate, bacula sparcely placed, ± 2 μm wide and 1-2 μm in height.

Comparison

*Baculatisporites* sp. can be differentiated from *Baculatisporites camauensis* (Cookson) Potonie, 1956 as the latter have tapering baculae.


Type species *Lycopodiumsporites agathoecus* (Potonie) Theirgart, 1938.

*Lycopodiumsporites ranikorensis* Sah and Kar, 1986
Pl. 5, Figs. 4,8,11,12

Description

Miospores ± subcircular-triangular with broadly rounded apices and convex interapical sides; size range 50-60 μm. Trilete distinct, labra thin, lasura long, reaching 2/3 of the equator. Exine 1-2 μm thick, foveoreticulate, muri ± 1 μm thick, lumina 2 μm across and irregular in shape and size.
Distribution

This taxon is recorded from the Upper Cretaceous sediments (Jadukata Formation) of Meghalaya (Kar and Singh, 1986)

*Lycopodiumsporites speciousus* Dutta and Sah, 1970
Pl.5, Figs.5,7

Description

Miospores subcircular-subtriangular; size range 51-59 \( \mu m \). Trilete, lasura open, straight, extending more than half the radius. Exine 1-2 \( \mu m \) thick, reticulate, reticulation present on the distal surface, proximal surface psilate, luminae circular to polygonal in shape, muri 1-2 \( \mu m \) thick.

Distribution

This taxon is common in the Upper Cretaceous sediments of Meghalaya (Kar and Singh, 1986) Jadukata Formation, Mahadek Formation, and Cherra Formation).

*Lycopodiumsporites* sp.
Pl.5, Fig.10

Description

Miospore ± triangular with convex interapical sides and broadly rounded apices. 62x65 \( \mu m \) in size. Trilete distinct, rays open, lips thick, raised, lasura long, reaching up to the periphery. Exine ± 1 \( \mu m \) thick with microreticulate ornamentation.

Comparison

This taxon can be differentiated from the other known species of the genus on account of its exinal pattern.
Genus *Leptolepidites* Couper, 1953

Type species *Leptolepidites verrucatus* Couper, 1953

*Leptolepidites verrucatus* Couper, 1953
Pl.5, Figs. 6

**Description**

Misopore triangular-deltoid in shape with conical apices and straight interapical sides; 50x40 \( \mu m \) in size. Trilete, rays straight, extending up to the periphery. Exine 5-8 \( \mu m \) thick, much thickened at the apices, proximally laevigate, distally sculptured with rounded verrucae, 8x5 \( \mu m \) in diameter, projecting outside the amb, radial folds present in the interapical sides.

**Distribution**

Couper, 1953 has recorded this species for the first time from the Upper Mesozoic and Cainozoic sediments of New Zealand. The occurrence of this species in India, therefore, favours a close correspondence between the two floral provinces.

*Leptolepidites psilatus* sp. nov.
Pl.5, Figs.2,9

**Holotype:** Venkatachala, 1968; pp. 2 Pl.1, Fig. 6

**Specific Diagnosis**

Miospores roundly triangular-subcircular with rounded apices and convex interapical sides; size range 40-60 \( \mu m \). Trilete, rays distinct, reaching 3/4 radius. Exine 2-3 \( \mu m \)
thick, proximally laevigate, distally verrucate, verrucae irregularly distributed, 4-5 μm in diameter and nearly 2μm high, projecting outside the amb.

Comparison

Leptolepidites verrucatus Couper, 1953 can be differentiated from the present taxon on account of possessing uniform verrucae on the spore surface while in the latter case the verrucae are irregularly distributed.

Leptolepidites sp.
Pl. 5, Fig. 1

Description

Miospore + roundly triangular with convex sides and rounded apices; 44 x 48 μm in size. Trilete, Y-mark distinct, reaching almost up to the equator. Exine moderately thick, proximally smooth and distally verrucose, verrucae + 2μm high and 2-3 μm in diameter and densely spaced.

Comparison

The present taxon can be distinguished from Leptolepidites verrucatus Couper, 1953 on account of comparatively densely spaced smaller verrucae and absence of folds on the interapical sides. It can be differentiated from Leptolepidites psilatus sp. nov. because of its smaller size and much densely spaced, smaller verrucae.

Genus Echinatisporis Krutzsch, 1959
Type species Echinatisporis longichinus Krutzsch, 1959
Echinatisporis korawadiensis sp. nov.
Pl.6, Figs. 3,7,10,11,14

Holotype: Pl.6, Fig.7 Slide No. PbPl/Sd11/+43:126. Size 47x50 μm. Early Cretaceous, Korawadi River Section (Dharesi) Bhuj, Kutch, Gujarat.

Specific Diagnosis
Miospores roundly triangular-subcircular with rounded apices and convex interapical sides; size range 40-50 μm. Trilete, rays distinct, extending up to the periphery, labra raised. Exine 1-3 μm thick, sculptured with spines, spines with bulbous base and short acuminate apex, projecting outside the amb, distribution of the spines irregular.

Comparison
The present species resembles very closely to Echinatisporis levidensis Srivastava, 1972 in overall shape and body organization but can be differentiated from the latter by its comparatively bigger size and non-membranous labra. Echinatisporis spinilabra Srivastava, 1972 corresponds to the present taxon in having larger spines but the size of the taxon is quite reduced here. The base of the spine is also not bulbous in the former taxon.

Genus Corrugatisporites Thomson and Pflug, 1953.

Type species Corrugatisporites toratus Thomson and Pflug, 1953.

Corrugatisporites formosus Dutta and Sah, 1970
Pl.6, Fig.13
Description

Miospore ± triangular with convex sides and rounded apices; 60x56 μm in size. Trilete, lips thin, lasura faint
Exine moderately thick with verrucose ornamentation, verrucae broad irregular and anastamosing to form a vermiculate-rugulate pattern contact area beset with grana.

Distribution

Dutta and Sah (1970) reported this taxon from the Cherra Formation of Meghalaya.

Corrugatisporites turpitus Dutta and Sah, 1970
Pl.6, Fig.5

Description

Miospore roundly triangular with convex sides and rounded apices; 45x41 μm in size. Trilete, Y-mark distinct, rays open, labra moderately thick, ornamentation corrugate.

Distribution

Dutta and Sah (1970) reported this taxon from the Tertiary sediments of Meghalaya.

Corrugatisporites sp.
Pl.6, Fig.12

Description

Miospore ± circular-triangular with convex sides and broadly rounded apices, 56x51 μm in size. Trilete, rays distinct, lasura simple extending half the radius. Exine 1-2 μm thick and with sparcely thickened corrugations.
Comparision:
This taxon differs from the other known species of the genus in having very less corrugations on the exinal surface and a comparatively bigger size.

Genus Contignisporites Dettmann, 1963
Type species Contignisporites glebulentus Dettmann, 1963

Contignisporites glebulentus Dettmann, 1963
Pl.6, Figs.2,9

Description
Miospores subcircular-triangular; size range 30–60 μm Trilete, rays distinct, lips thin, straight, lasura long, reaching up to the equator. Exine moderately thick, sculptured with closely spaced ribs, 2 μm broad running parallel from one side to the other, proximal surface smooth.

Distribution
Contignisporites glebulentus Dettmann, 1963 is recorded from the Jurassic sediments of Madhya pradesh (Singh, 1966; Singh and Kumar, 1966), Lower Cretaceous of Kutch, Gujarat (Venkatachala, 1969; Venkatachala, Kar and Raza, 1969), Lower Cretaceous of Tamilnadu (Jain and Subaraman, 1970; Ramanujam and Srisailam, 1974) and Lower Cretaceous of Andhra Pradesh (Rao and Ramanujam, 1979) This taxon was first time reported from the Cretaceous of Australia by Dettmann (1963).

Contignisporites fornicatus Dettmann, 1963
Pl.6, Figs.1
Description

Miospores ± roundly triangular; size range 40-50 μm. Trilete, rays distinct, lasura long, open, straight reaching up to the equator. Exine 1-2 μm thick and ornamented with bilaterally symmetrical, sculptural elements including a series of ± parallel ribs, ribs 4-5 in number which seldom bifurcate on the spore surface.

Distribution

This taxon is recorded from the Jurassic of Madhya Pradesh (Singh and Kumar, 1966) Lower Cretaceous of Kutch, Gujarat (Singh, Srivastava and Roy, 1964; Venkatachala, 1969; Venkatachala, Kar and Raza, 1969) Upper Gondwana of Tamilnadu (Ramanujam and Srisailam, 1974) and Lower Cretaceous of Andhra Pradesh (Rao and Ramanujam, 1979).

It is also recorded from the Cretaceous of Australia (Dettmann, 1963).

Contignisporites cooksonii (Balme) Dettmann, 1963

Pl.6, Fig.4

Description

Miospores subcircular-subtriangular; size range 40-58 μm. Trilete distinct, lips open, lasura long, reaching up to the equator. Distal surface marked by 6-9 parallel rounded crested muri, proximal surface smooth.

Distribution

Contignisporites cooksonii (Balme) Dettmann, 1963 is recorded from the Jurassic of Madhya Pradesh (Singh,

Genus Klukisporites Couper, 1958.
Type species Klukisporites variegatus Couper, 1958.

Klukisporites apunctus Venkatachala, Kar and Raza, 1969
Pl.7, Fig. 5

Description
Miospore ± triangular, 51x48 μm in size. Trilete, rays long and broad, extending 3/4 radius. Exine 1-2 μm thick, proximally laevigate, distally reticulate.

Distribution
This taxon was reported for the first time from Upper Jurassic of Kutch, Gujarat (Venkatachala, Kar and Raza, 1969).

Klukisporites foveolatus Pocock, 1964
Pl.7, Figs. 4, 7

Description
Miospore ± triangular - circular with rounded apices and convex interapical sides, 60x58 μm in size. Trilete, lips raised, rays reaching the equator. Exine up to 2-4 μm thick, reticulate, muri nearly 2 μm high and 2 μm in width, anastomosing to form polygonal lumina on the distal side of the spore, proximally exine laevigate.
Distribution

This taxon is recorded from the Cretaceous sediments of Vridhachalam area, Cauvery Basin (Venkatachala and Sharma, 1974).

*Klukisporites kallameduensis* Venkatachala and Sharma, 1974.

Pl.7, Fig.12

Description

Miospore ± triangular-circular with rounded apices and convex interapical sides; 60x58 µm in size. Trilete, lips raised, rays reaching the equator. Exine upto 2-4 µm thick, reticulate, muri nearly 2 µm high and 2 µm in width, anastamosing to form polygonal lumina on the distal side of the spore, proximally exine laevigate.

Distribution

This taxon is recorded from the Cretaceous sediments of Vridhachalam area, Cauvery Basin (Venkatachala and Sharma, 1974).

Genus *Cicatricosisporites* Potonie and Gellitich, 1935.

Type species *Cicatricosisporites dorogensis* Potonie and Gellitich, 1933.

*Cicatricosisporites dorogensis* Potonie and Gellitich, 1933.

Pl.7, Figs. 6,8,10
Description

Miospores ± triangular - subcircular; size range 40-70 µm with straight sides and rounded apices. Trilete distinct, lasura long, reaching up to the apices. Exine 1-2 µm thick, sculptured with ridges which are closely placed, ridges 5-7 in number and lying parallel to the interapical sides.

Distribution

Kar and Sah, 1986 reported this taxon from the Cretaceous (Karaikel well) of South India (Banerjee and Misra, 1968)

*Cicatricosisporites augustus* Singh,1971
Pl.7, Figs.1,9

Description

Miospores ± triangular -subcircular; size range 45-60 µm with rounded apices and straight interapical sides. Trilete, Y-mark distinct lasura long, reaching up to the apical angles, lips thin. Exine nearly 2 µm thick, sculptured with thin ridges, ridges 8-10 in number, less than 1 um apart running parallel to the sides of the grain.

Distribution

It is known from the Upper Cretaceous sediments of Meghalaya (Kar and Sah, 1986). Srivastava, 1975 reported the taxon from the Lower Cretaceous of Southern United States. Singh (1971) described *Cicatricosisprites apunctus* from Albian sediments of North-Western Alberta, Canada.
Genus Bullasporis Krutzsch, 1959
Type species Bullasporis bullis Krutzsch, 1959
Bullasporis minutus Venkatachala and Sharma, 1974
Pl.7, Fig.3

Description
Miospore ± roundly triangular with rounded apices and convex interapical sides; 50x38 µm in size. Trilete, lasura faint. Exine thick sculptured with baculae which are 5 µm in length with a short stalk.

Distribution
This taxon is recorded from the Cretaceous sediments of Vridhachalam area, Cauvery Basin, India (Venkatachala and Sharma, 1974).

Bullasporis triangularis Venkatachala and Sharma, 1974. Pl.7, Fig.11

Description
Miospore ± triangular with concave sides and rounded angles. 70x64 µm in size. Trilete, Y-mark distinct, reaching almost 2/3 radius. Exine covered with baculae.

Distribution
Bullasporis triangularis Venkatachala and Sharma, 1974 is reported from the Cretaceous sediments of Vridhachalam area, Cauvery Basin, South India.

Type species *Bhujiasporites hirustus* Venkatachala, 1969.

*Bhujiasporites hirustus* Venkatachala, 1969
Pl.8, Fig.13

Description

Miospore ± triangular-subtriangular in polar view laterally compressed, spores gulate, 60x50 μm in size. Trilete, Y-mark raised, extending the full length. Exine 6-7 μm thick, interapunctate, sculptured with coni-hirsute spines on the distal surface.

Distribution

*Bhujiasporites hirustus* Venkatachala, 1969 was recorded from the Lower Cretaceous sediments of Kutch, Gujarat (Venkatachala, 1969; Venkatachala, Kar and Raza, 1969).

Genus *Foveosporites* Balme, 1957

Type species *Foveosporites canalis* Balme, 1957

*Foveosporites* sp.
Pl.8, Fig.3

Description

Miospore ± triangular-circular with convex sides and rounded apices; 38x45 μm in size. Trilete, Y-mark distinct, lasura reaching up to the equator, folds present along the lasura. Exine less than 1 μm thick, distinctly foveolate, foveolae small circular and sometimes coalesce to form channels.
Comparision

The present taxon closely resemble the Foveosporites canalis Balme, 1957 on account of its shape and body organization but can be distinguished by the presence of folds along the triradiate mark in the former case. This species can also be differentiated from Foveosporites sahii Rao et al. 1983 by its small size of foveolae and folds along the lasurae.


Type species Dicyotriletes bireticulatus (Ibrahim) Potonie and Kremp, 1955.

Dicyotriletes sp.
Pl.8, Fig.2.

Description

Miospore + triangular with rounded apices and convex interapical sides, 52x44 μm in size. Trilete, Y-mark distinct, lasura straight, thin reaching up to the equator. Exine 2-3 μm thick, exinous sculpture foveolate, thickness of the muri 2 μm, lumina rounded, 1-2 μm across.

Comparision

The present taxon can be differentiated from the other known species on account of its exinal pattern.

Inferaturma Tricrassati Dettmann, 1963.


Type species Gleicheniidites senonicus Ross, 1949.
Gleicheniidites senonicus Ross, 1949
Pl. 8, Figs. 7, 11, 12

Description

Miospores ± triangular - subrounded with concave interapical sides and rounded apices; size range 53-60 μm. Trilete, lasura long, reaching up to the periphery. Exine 1 μm thick at the apices and 3-4 μm thick at the interapical sides with psilate ornamentation.

Distribution

This taxon is reported from the Lower Cretaceous beds of Central Alberta (Singh, 1964) and Lower Cretaceous horizons of Southern United States. (Srivastava, 1975).

Gleicheniidites mundus Sah and Jain, 1964
Pl. 8, Fig. 1

Description

Miospore small, ± triangular with concave sides and rounded apices; 28x31 μm in size. Trilete distinct, rays extending up to the apical angle, lasurae thin, labra raised. Exine variably thickened, very thin nearly 1 μm at the angles but broader, 3-4 μm at the interapical sides with laevigate ornamentation.

Distribution

This taxon has been described from the Jurassic sediments of Rajmahal Hill, Bihar India (Sah and Jain, 1964).
Gleicheniidites sp.
Pl. 8, Fig. 5

Description
Miospore ± triangular with slightly concave sides and flattened apices, 51x47 µm in size. Trilete distinct, lasura open, simple, reaching up to the apical angle. Exine 2-4 µm thick at the interapical sides and thinner at the apices with laevigate surface.

Comparison
The present taxon can be differentiated from the other known species of the genus on account of its flattened (blunt) apices.

Genus Sestrosorites Dettmann 1963
Type species Sestrosorites irregulatus (Couper) Dettmann, 1963

Sestrosorites dettmanni Dutta and Sah, 1970
Pl. 8, Fig. 8

Description
Miospore ± triangular with straight-concave sides, 50x51 µm in size. Trilete distinct, lasura long, extending up to the equator. Exine differentially thick measuring up to 4-5 µm along the interapical region and 2-3 µm near the apical region, ornamentation reticulate, muri small, circular with irregular lumina.
Distribution

Dutta and Sah (1970) recorded this taxon from the Lower Middle horizons of Cherra Formation (Paleocene) of Meghalaya.

*Sestrosporites pseudoalveolatus* Venkatachala, 1969

Pl.8, Fig. 4

Description

Miospore ± triangular with straight to concave sides and rounded apices; 48x50 µm in size. Trilete, Y-mark distinct, rays straight, reaching the equator, lips thick. Exine 1-2 µm thick with reticulate ornamentation.

Distribution

This species is recorded from the Lower Cretaceous sediments of Kutch, Gujarat (Venkatachala, 1969).

*Sestrosporites* sp.

Pl.8, Fig.10

Description

Miospore ± roundly triangular with convex sides and rounded apices, 55x50 µm in size. Trilete, rays distinct, lasura open, reaching 1/2 the radius, lips thick. Exine 1-3 µm thick with reticulate ornamentation.

Comparison

This taxon can be differentiated from *Sestrosporites dettmanii* Dutta and Sah, 1970 on account of its shape, nature of trilete mark (which is open, broad and reaching 1/2 the
radius in the present taxon) and inconspicuous thickenings along the interapical region.

Infraturma  

Genus  

Type species  

Cingulatisporites intermedius sp. nov.

Holotype: Kar and Singh, 1986 Figs.1, Pl.5 Early Cretaceous.

Specific Diagnosis

Miospore ± triangular; 58x55 μm in size (including cingulam), sides concave, apices pointedly rounded. Trilete, Y-mark distinct, extending 3/4 radius, lasura long, straight, 25 μm in length, labra thick. Body of the spore 55x46 μm, cingulam 2-8 μm wide, broader at the apices and narrower at the interapical sides. Exine 1-2 μm thick and psilate.

Comparison

The present taxon differs from Cingulatisporites lathiensis Srivastava, 1966 in size, shape, aperture and nature of cingulum. Cingulatisporites notaclarus Sah and Jain, 1965 can be distinguished from the present taxon in having knobed apices, convex interapical sides and ornamented cingulum. Cingulatisporites intermedius sp. nov. differs from
Cingulatisporites formosus Venkatachala and Sharma, 1974 in size and psilate exinal pattern.

Genus Bosiesporites (Dev) Singh, Srivastava and Roy, 1964
Type species Bosiesporites praecilcular (Dev) Singh, Srivastava and Roy, 1964

Bosiesporites punctatus Venkatachala, 1969
Pl.8, Fig.14

Description

Miospore ± triangular with straight - concave sides and rounded apices; 60x63 μm in size. Trilete, lasura open, rays almost reaching up to the inner part of the cingulum, labra raised, 3 μm thick. Exine 2 μm thick, punctate, puncta less than 1 μm wide. Cingulum variably widened up to 3 μm wide at the sides and 6 μm at the apices.

Distribution

This taxon is described from the Lower Cretaceous sediments of Kutch, Gujarat (Venkatachala, Kar and Raza, 1969).

Genus Plicifera Bolkhovitina, 1965
Type species Plicifera delicata Bolkhovitina, 1965
Plicifera sp.
Pl.8, Fig.6

Description

Miospores ± triangular with convex sides and rounded apices; 50x50 μm in size. Trilete, rays distinct, reaching
the equator. Exine proximally smooth, distally three arcuate folds cover the trilete area and reach the angular apices.

Comparison

Present species differs from *Plicifera minutus* Venkatachala and Sharma, 1974 on account of its very large size.

Genus *Densoisporites* (Weyland and Kreiger) Bhardwaj and Kumar, 1972

Type species *Densoisporites velatus* (Weyland and Kreiger) 1953

*Densoisporites mesozoicus* Singh, Srivastava and Roy, 1964

Pl.9, Figs. 7,9,10,11

Description

Miospores ± roundly triangular - circular, with pointed apices and convex sides; size range 60-70 μm. Trilete, Y-mark distinct, lasura long, extending up to the equator or periphery of the cingulum labra thick, raised. Exine 7-10 μm with distinct granulose ornamentation, grana 1-2 μm high, projecting out of the periphery, cingulum nearly 5 μm wide.

Distribution

This taxon is recorded from the Upper Gondwana sediments (Trambau Carbonaceous Shale) of Kutch basin, Gujarat (Singh, Srivastava and Roy, 1964).

*Densoisporites sp.I*

Pl.9, Fig. 5
Description

Miospore ± triangular with rounded apices and convex interapical sides, 65x55 µm in size. Trilete, rays distinct, open and reaching up to the periphery. Central body 50x40 µm in size. Cingulum 4-5 µm in width. Exine 2 µm thick coarsely granulose to coniate in nature.

Comparison

The present species is comparable with Densoisporites mesozoicus Singh, Srivastava and Roy, 1964 from the Cretaceous sediments of Kutch in shape but can be differentiated from the former by the pointed apices and large size.

*Densoisporites* sp. II
Pl.10, Fig.7

Description

Miospore ± triangular - subrounded with convex sides and rounded apices; 63x65 µm in size. Trilete distinct, Y-rays reaching the periphery of the cingulum, 3-5 µm wide, lasura segmented. Exine ± 2 µm thick, coarsely granulose in nature.

Comparison

The present species can be differentiated from the other known species of the genus on the basis of its discontinuous broken lasurae.
Genus Gabonisporis Boltenhagen emend.
Type species Gabonisporis vigourouxii Boltenhagen, 1967

Gabonisporis bacricummulus Srivastava, 1972
Pl.9, Figs.4,6 Pl.10, Fig.9

Description
Miospores + circular -oval in shape; size range 50-60 μm. Trilete, lasura long, 20-28 μm. in length, reaching the periphery. Exine two layered, outer layer membranous, enveloping the spore body.

Distribution
The present taxon has been recorded from the Lower Cretaceous (Edmonton Formation) of Alberta, Canada (Srivastava, 1972).

Gabonisporis labyrinthus Srivastava, 1972
Pl.9, Figs. 1,2,3,8

Description
Miospores trilete, amb circular to triangular with convex sides and slightly pointedly-rounded apices, size range 50-55 μm. Trilete distinct, lasura short, simple, labra thin. Exine 2-3 μm thick, two layered, outer layer 3 μm thick, inner layer 2 μm thick.

Distribution
Srivastava (1972) reported this taxon from the Lower Cretaceous beds (Edmonton Formation) of Alberta, Canada.
Genus Taurocusporites Stover, 1962

Type species Taurocusporites segmentatus Stover, 1962

Taurocusporites mesozoicus sp.nov.
Pl.10, Figs.1,3,4, Pl.11, Figs.5,8

Holotype: Pl.11, Fig.5 Slide No. PbPl/SD8/ + 48: + 135. Size 58 μm Lower Cretaceous, Korawadi River Section (Dharesi) Bhuj, Kutch, Gujarat.

Specific Diagnosis

Miospores + circular - roundly triangular with rounded apices and convex interapical sides, Size range 40-60 μm. Trilete, lasura distinct, straight reaching 3/4 radius, lips slightly raised, sometimes segmented. Exine proximally smooth, distally bi-trizonate, scabrate in nature.

Comparison

The present taxon is comparable with Taurocusporites minor Singh, (1964) in shape and zonal organisation but differs from the latter by its very large size and comparatively raised labra. Taurocusporites sp. reported by Jain and Subraman (1970) from Dalmiapuram also resembles to the present taxon in exinal pattern.

cf. Taurocusporites
Pl.10, Fig.10.

Description

Miospore + circular - roundly triangular with convex interapical sides and rounded apices; 72 x 80 μm in size.
Trilete distinct, rays sinuous, reaching up to the equator, proximally laevigate distally rugulate.

Comparison

The present sp. differs from all other known species of the genus by its very large size and distal rugulate exinal pattern.

Genus  
*Hymenozonotriletes* Naumova, 1937  
Ex. Naumova, 1953

Type species  
*Hymenozonotriletes polyacanthus*  
Naumova, 1937

*Hymenozonotriletes mesozoicus* (Pocock) Jain and Subraman, 1970

Pl. 10, Figs. 5, 6, 8

Description

Miospores ± triangular subcircular in outline with rounded apices and convex interapical sides; size range 62-72 μm. Trilete, lasura long, ribbon shaped, extending up to the periphery. Exine 5-10 μm thick, sculptured with fine spinose-coni processes.

Distribution

This taxon is recorded from the Lower Cretaceous horizons of Tamilnadu (Jain and Subraman, 1970) and Lower Cretaceous beds of Central Alberta (Singh, 1964). Canada.

Subturma  
*Auritotriletes* Potonié and Kreiger, 1954

Infraturma  
*Auriculati* (Schopf) Potonié, and Kreiger 1954

Genus  
*Trilobosporites* (Pant) Potonié, 1956
Type species: *Trilobosporites hannonicus* (Delcourt and Sprumont) Potonie', 1956

*Trilobosporites triangularis* Venkatachala, Kar and Raza, 1969

**Description**

Miospore ± triangular with rounded apices and concave interapical sides; 75x79 µm in size. Trilete, Y-mark distinct, rays reaching up to the equator. Exine variably thick, more thickened at the apices, proximally verrucose verrucae evenly distributed.

**Distribution**

Venkatachala, Kar and Raza, 1969 reported the taxon from Lower Cretaceous rocks, Kutch, Gujarat, India.

*Trilobosporites indicus* sp.nov.

**Holotype:** Pl.11, Fig.3 Slide No. PbPl/SD19/17:129. Size 44x40 µm. Lower Cretaceous, Korawadi River Section (Dharesi) Bhuj, Kutch, Gujarat.

**Specific Diagnosis**

Miospores ± triangular - subrounded with rounded valvate angles and concave apical sides; size range 40-58 µm. Trilete, triradiate scar bordered by low verrucae. Exine 4-6 µm thick at the interapical sides and very thick at the apices forming 7-10 µm thick valvae. Very small verrucae present on the proximal surface and distally with granulose ornamentation.
Comparision

The present taxon is comparable to *Trilobosporites hennonicus* (Delcourt and Sprumont) Potonie, 1956 in size but the latter have granulose ornamentation *Trilobosporites triangularis* Venkatachala, Kar and Raza, 1969 have larger size and very thick valvae at the angles. *Trilobosporites indicus* sp. nov. can be differentiated from *Trilobosporites bernissartenis* (Delcourt and Sprumont) Potonie’, 1956 in having very small size and small vercucae.

- **Infraturma**  
  *Perinotriletes* Dettmann, 1963

- **Genus**  
  *Crybelosporites* Dettmann 1963

- **Type species**  
  *Crybelosporites striatus* (Cokson and Dettmann) Dettmann, 1963

**Crybelosporites sp.**  
Pl.12, Fig. 7

Description

Miospore + subtriangular - subcircular in equatorial outline with broad rounded apices and convex sides; 64x62 μm in size. Central body dark in colour measuring 48x48 μm. The zona measures 9 μm in width and lighter than central body. Trilete mark invisible. Exine 3 μm thick and granulose.

Comparision

The present taxon can be differentiated from *Crybelosporites pannucus* Srivastava, 1975 by its obscured tetrahedral scar and non-colesced rugulae. The genotype of
the taxa is distinguished by the rugulae arranged to form striations.

Turma

Subturma

Infraturma

Genus

Type species

Description

Miospores ± subtriangular - triangular; size range 55-65 µm (including zona), Triradiate scar indistinct, central body triangular, equilateral, 50x50 µm in size. A dark, 4-6 µm thick dense outline is present around the central body. Exine 4-5 µm thick, coarsely granulose, 7-8 µm wide membranous zona cover the central body.

Distribution

Singh, Srivastava and Roy, 1964 reported this taxon from the Lower Cretaceous sediments of Kutch (Ghuneri coal) Gujarat, India.

Aequitriradites ornatus Upshaw, 1963

Pl.11, Fig. 4

Description

Miospore ± circular, 55x40 µm in size (including zona). Triradiate scar invisible, central body circular,
45x40 μm in size. Exine 4-5 μm thick, 10 μm wide membranous zona is present around the central body.

Distribution

Upshaw (1963) described this taxon from the Upper Cretaceous of Alberta, Canada.

<table>
<thead>
<tr>
<th>Turma</th>
<th>Hilates Dettmann, 1963</th>
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<td>Subturma</td>
<td>Zonohilates Dettmann, 1963</td>
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<td>Genus</td>
<td>Cooksonites (Pocock) Dettmann, 1963</td>
</tr>
<tr>
<td>Type species</td>
<td>Cooksonites variabilis Pocock, 1962</td>
</tr>
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</table>

**Cooksonites variabilis** (Pocock) Dettmann, 1963

Pl.11, Fig.11

Description

Miospores ± circular - triangular; size range 60-70 μm. Trilete, lasurae simple, reaching 1/2 the radius. Exine two layered, a thick exine layer cover the entire surface of the central body and extending upto the distal surface.

Distribution

This taxon is recorded from the Upper Gondwana deposits of Palar Basin, Tamilnadu (Ramanujam and Varma, 1981). Dettmann and Playford (1963) reported the present taxon from Cretaceous of Australia.

**Cooksonites reticulatus** Pocock, 1962

Pl.11, Fig. 6

Description

Miospore oval subtriangular with rounded apices and very convex interapical sides; 55x62 μm in measurements.
Alete, exine two layered, a ptella, the thickened ektexine layer covering the entire proximal surface of the central body, thinner over the proximal pole and thicker at the equator.

Distribution

Singh (1964) reported this taxon for the first time from the Lower Cretaceous sediments of Alberta, Canada.

Genus Coptospora Dettmann, 1963
Type species Coptospora striata Dettmann, 1963

Coptospora mesozoica Kumar, 1973
Pl.12, Figs. 9,12

Description

Miospores ± subcircular - circular in outline, size range 55-75 μm. Nonaperturate or hilate. Exine 2-3 μm thick, infrareticulate-granulose.

Genus Rouseisporites Pocock, 1962
Type Species Rouseisporites reticulatus Pocock, 1962

Rouseisporites reticulatus Pocock, 1962
Pl.12, Fig.8

Description

Miospore roundly triangular - subcircular; 60x58 μm in size. Trilete, Y - mark distinct, rays reaching the equator. Exine distally reticulate, ornamented with low muri forming complete meshes both proximally and distally which are polygonal in nature.
Distribution

Singh (1964) recorded the genus from Lower Cretaceous beds of East–Central Alberta, Canada.

Turma

Monoletes Ibrahim, 1933

Subturma

Azonomonoletes Luber, 1935

Infatrurma

Laevigatomoleti DybandJack, 1957

Genus

Monoletes (Erdtman) Potonie, 1956

Type Species

Monolites major Cookson, 1947

Monolites intragranulosus Singh, Srivastava and Roy, 1964

Pl.12, Figs. 1,2,3,4,6,11

Description

Miospores bilaterally symmetrical, bean shaped in lateral view (concavo–convex), size range 80–100 μm long and 45-55 μm broad. Monolete, lasura almost straight, ± 60 μm long, 2/3 radius. Exine thin psilate–finely intragranulose on both the surfaces.

Distribution

This taxon is well known from the Lower cretaceous horizons of Kutch, Gujarat (Singh, Srivastava and Roy, 1964) and Upper Gondwana rocks of Tamilnadu (Ramanujam and Srisailam, 1974).

Infatrurma

Ornati Potonie,' 1956

Genus

Polypodiisporites Potonie,'1934

Type Species

Polypodiisporites favous Potonie', 1934
Polypodiisporites sp. I.
Pl.12, Fig.5.

Description
Miospore bilaterally symmetrical, broadly oval, 72x54 μm in size. Monolete, lasura distinct, straight, reaching pole to pole. Exine 3-4 μm thick, ornamented with 2 μm broad and 2 μm high verrucae.

Comparison
The present species can be differentiated from Polypodiisporites rajasthanensis Srivastava, 1966 on account of its straight lasura. The germinal aperture in the latter case is boat shaped.

Polypodiisporites sp. II
Pl. 12, Fig 10

Description
Miospore bilaterally symmetrical, broadly oval in shape; 65x45 μm in size. Monolete, lasura distinct, straight, bordered by thickened lips. Exine upto 3-4 μm thick, ornamented with broad and high verrucae which coalesce together to form a vermiculate pattern.

Comparison
Polypodiisporites sp. II can be differentiated from Polypodiisporites rajasthanensis Srivastava, 1966 on the basis of its nature of germinal aperture and
vermiculate exinal pattern. The present taxon is also different from *Polypodiisporites* sp. I on account of its aforesaid pattern of exine.

Antiturma  *Pollenites* Potonie’, 1931
Turma  *Saccites* Erdtman, 1947
Subturma  *Disaccites* Cookson, 1947
Infraturma  *Pinosaccati* (Erdtman) Potonie’, 1952
Genus  *Protoconiferous* Bolkovitina, 1952
Type Species  *Protoconiferous flavus* Bolkovitina, 1956

*Protoconiferous grandis* Bolkovilina, 1956
*Pl. 13*, Fig. 4.

Description

Miospore almost circular, 115 x 115 µm in diameter, disaccate, body indistinct, diploxylonoid, sacci meeting in the central region forming a narrow distal furrow at the proximal end, ornamentation coarsely granulose. The sculpture/ornamentation of the central body is not clear due to obscured nature.

Distribution

This taxon is reported from the Mesozoic sediments of Jabalpur (Dev, 1959; Dogra, 1986)

Genus  *Alisporites* Daugherty, 1941
Type Species  *Alisporites opii* Daugherly, 1941

*Alisporites thomasii* (Couper) Pocock, 1962
*Pl. 13*, Figs. 5, 7, 8
Description

Miospores bisaccate, size range 70-80 \(\mu m\). Central body longer than broad, sometimes ± circular, bladders well developed and almost equal or slightly bigger than the central body, bladders bases marked distinctly by a narrow parallel distal furrow, exine thin walled and reticulate.

Distribution


Alisporites rotundus Rouse, 1959
Pl. 13, Fig.10

Description

Miospore bisaccate, ± oval in shape; measuring 77x50 \(\mu m\) in size. Central body ill defined, circular - vertically oval, 38x50 \(\mu m\) in size. Exine of the central body microreticulate. Bladders well developed, equal to or slightly longer than the central body, distally pendent, coarsely reticulate.

Distribution

Rouse (1959) reported the present taxon for the first time from the Upper Jurassic rocks of Western Canada. Singh
(1964) recorded it from Lower Cretaceous sediments of Central Alberta, Canada. Dogra (1986) described this taxon from the Jabalpur Formation in the type area.


*Podocarpidites ellipticus* (Cookson) Potonie'1958.

**PI. 14, Fig.10**

**Description**

Miospore bisaccate; size range 59-71 μm, central body circular, marginal crest distinct. Bladders larger than the central body, thin walled, distally pendent with reticulate ornamentation, central body granulose.

**Distribution**

This is a common taxon of Mesozoic-Cretaceous sediments, of India. It is reported from Cretaceous rocks of Kutch, Gujarat (Singh, Srivastava and Roy, 1964; Venkatachala, 1969) Mesozoic sediments of Tamilnadu (Ramanujam and Srisailam, 1974), Upper Gondwana rocks of Jabalpur (Kumar, 1973) and Upper Cretaceous sediments of Meghalaya (Kar and Singh, 1986).

This taxon is also reported from Early Cretaceous of Southern, United States (Srivastava, 1972).

*Podocarpidites novus* Sah and Jain, 1964

**PI.13, Fig.1; PI.14, Fig.4**
Description

Miospores disaccate; size range 50-70 µm, Central body oval, ± 40-50 µm in size. Bladders 47-50 µm in length, larger than the central body, central body finely sculptured, bladders coarsely reticulate, sulcus wide, bladders distally pendent.

Distribution

*Podocarpidites novus* Sah and Jain, 1964 is reported from the Jurassic rocks of Rajmahal Hills, Bihar (Sah and Jain, 1964).

*Podocarpidites ornatus* Pocock, 1962
Pl.14, Fig.11

Description

Miospore bisaccate, equatorial outline of the central body oval - subcircular with crenulate margin; ± 80 µm in size. Bladders subproximally attached, distally pendent. The points of attachment extending well into the proximal side, distal furrow narrow with almost parallel margin. Proximal cap granulose, bladders diploxylonoid, ± oval in shape with reticulate ornamentation.

Distribution

Singh, (1964) reported the present taxon from the Lower Cretaceous sediments of Central Alberta, Canada.

*Podocarpidites rarus* Singh Srivastava and Roy 1964
Pl.13, Figs.2,3
Description

Miospores bilateral, bisaccate; size range 66-70 μm. Central body subcircular-oval and 36-40 μm in size. Exine finely granulose. Bladders larger than the central body and reticulate in ornamentation.

Distribution

Singh, Srivastava and Roy (1964) reported this genus from Lower Cretaceous of Kutch, Gujarat.


*Striatopodocarpites ovalis* Sinha, 1972

Pl.13, Fig.9

Description

Miospore bisaccate, diploxylonoid, overall size 70 μm, central body distinct, circular - oval, 40x42 μm in size. Bladders hemispherical measuring 30x50 μm attached sub equatorially, sulcus broad, bladder reticulate, central body having 6-7 horizontal striations.

Remarks

This taxon is abundantly represented in the Permian sediments of India. The occurrence of this taxon in the present assemblage indicates its induction through near by permian outcrops.
Genus — Platysaccus Naumova emend Potonie and Klaus, 1954

Type species — Platysaccus papilionis Potonie and Klaus, 1954

Platysaccus bhardwajii Rao, Ramanujam and Varma, 1983
Pl.14, Fig.5

Description

Miospore bisaccate, diploxyloid; 65x18 μm in size. Central body dark, circular, small in size, measuring 25x23 μm, ornamentation of central body is not clear in the present specimen. Sacci measuring 38x28 μm, distally attached, finely reliculate.

Remarks

It is an index form of Permian age. Its occurrence in the present assemblage indicates that there was a Permian outcrop in the nearby area.

Subturma — Polysaccites Cookson, 1947

Genus — Podosporites Rao, 1943

Typespecies — Podosporites tripakshi Rao, 1943

Podosporites tripakshi Rao, 1943
Pl.14, Fig.6

Description

Miospore polysaccate, 70x58 μm in size. Central body subcircular-circular, measuring 40x37 μm. Three sacci present measuring 10x5 μm, haploxyloid, central body microreticulate in ornamentation.
Distribution

Rao, 1943 reported the present taxon from the Jurassic Rocks of Rajmahal Hills, Bihar.

*Podosporites microsaccatus* (Couper) Dettmann, 1963
Pl.14, Figs 2,8

Description

Miospores ± subcircular - circular in outline; size range 40-52 μm. Trisaccate, central body smooth, larger than the bladders, bladders 20x30 μm in size, inframicroreticulate in ornamentation.

Distribution

This taxon is reported from the Cretaceous sediments of Australia (Dettmann, 1963; Balme, 1957).

Genus - *Microcachryidites* Cookson ex Couper, 1953
Type species - *Microcachryidites antarcticus* Cookson, 1947

*Microcachryidites antarcticus* Cookson, 1947
Pl.14, Figs.1,3,7

Description

Miospores bisaccate; size range 40-50 μm. Central body very large as compared to the sacs, sacci 20-30 μm in size, central body 40-50 μm. Exine of the central body psilate - granulose and sacci have infrareticulate ornamentation with closed meshes.
Distribution

This taxon is very widely distributed in Mesozoic strata of India. (Singh, Srivastava and Roy, 1964; Venkatachala, 1969; Venkatachala, Kar and Raza, 1969; Venkatachala and Sharma, 1974).

Venkatachala and Sharma (1974) has done a palynological zonation of Cauvery Basin on the basis of this taxon.

Genus - *Tsugaepollenites* (Potonie and Venitz)
Type species - *Tsugaepollenites igniculus* (Potonie)

Pl.14, Fig.9

**Description**

Miospore + circular - polygonal in shape; 48x48 μm in size. Monosaccate, saccus forming a thin frill around the pollen. Radial constriction obscured. Exine 2-3 μm thick with regulate or vermiculate ornamentation.

Infraturma - *Aletesacciti* Leschik, 1955
Genus - *Callialasporites* (Dev) Bhardwaj and Kumar, 1972
Type species - *Callialasporites trilobatus* Dev, 1959

Pl.15, Figs.1,5,6

**Description**

Miospores + triangular - subcircular; Size range 60-
69 μm. Central body triangular with three equatorially attached bladders, germinal aperture not seen, limbus not present. Exine of the central body granulose.

**Distribution**

*Callialaspoirtes trilobatus* (Balme) Dev, 1959 is a widely known taxon of Jurassic - Cretaceous sediments of India. This taxon was recorded for the first time from the Jurassic of Madhya Pradesh (Dev, 1961; Dogra, 1986) Lower Cretaceous of Kutch, Gujarat (Singh, Srivastava and Roy, 1964; Varma and Rawat, 1964; Rawat, 1969) Jurassic of Rajmahal Hills, Bihar (Sah and Jain, 1965) Jurassic of Rajasthan (Srivastava, 1966), Cretaceous of Pondicherry (Banerjee and Misra, 1968), Upper Jurassic of Andhra Pradesh (Kar and Sah, 1970) and Upper Gondwana of Tamilnadu (Ramanujam and Srisailam, 1974).

*Callialasporites segmentatus* (Balme) Srivastava, 1963

**Description**

Miospores ± circular with no germinal aperture; size range 55-70 μm in size. Central body oval - circular in outline. Equatorial bladder segmented by thin limbus. Exine of the central body granulose.

**Distribution**

The present taxon is recorded from the Lower

Jurassic of Rajmahal Hills, Bihar (Sah and Jain 1965)
Upper Gondwana of Tamilnadu (Ramanujam and Srisailam, 1974)

Cretaceous of Pondicherry (Banerjee and Misra, 1968) and Jurassic of Andhra Pradesh (Kar and Sah, 1970).

Callialasporites dampieri (Balme) Dev, 1961
P1.15, Fig.10

Description

Miospore + circular, 80x84 μm in size. Central body subcircular, 70x72 μm in size, surrounded by an equatorially attached bladder, 10-12 μm wide Y-mark absent. Exine of the Central body 1-2 μm thick, finely granulose.

Distribution

This taxon is widely distributed in the Mesozoic - sediments of India. It is abundantly recorded from Jurassic of Kutch, Gujarat (Varma and Rawat, 1964; Jana, 1984 and Rawat, 1969) Jurassic of Rajasthan (Srivastava, 1966), Cretaceous of Pondicherry (Banerjee and Misra, 1968).

Srivastava (1975) reported this genus from Lower Cretaceous sediments of Southern United States.

Callialasporites triletes Singh, Srivastava and Roy, 1964
P1.15, Figs.8,9

Description

Miospore circular, 70x60 μm in size, Central body
roundly triangular. Trilete mark distinct, rays extending upto the equator of the central body. Exine of the central body granulose. Equatorial bladder 10-12 µm wide and dissected.

Distribution

Singh, Srivastava and Roy (1964) reported this taxon from the Lower Cretaceous sediments of Kutch, Gujarat. Banerjee and Misra (1968) recorded it from Cretaceous of South India (Karaikell well, Pondicherry).

Genus - Circella Luber, 1935

Circella cf C. splendidus Dev. 1959
Pl.16, Fig.5

Description

Miospore subcircular - circular in outline, 90x90 µm in size. Monosaccate, central body ± circular measuring 67 µm in diameter. Exine psilate, saccus 12-14 µm wide bearing striations with wavy outline.

Genus - Venkatapollis gen. nov.

Type Species - Venkatapollis indica gen et. sp. nov.

Venkatapollis indica gen. et. sp. nov.

Generic Diagnosis

Miospores ± spherical - circular under compressed conditions; size range 40-65 µm. Monosaccate, saccus large,
equatorially attached, 10-15 μm in width, psilate - coarsely reticulate in ornamentation. Central body circular - oval in shape, 40-50 μm in size having a dense inner core simulating an inner body within the central body. Central body with psilate, scabrate - micro-reticulate ornamentation.

Etymology

The taxon is named after Dr. V.S. Venkatachala former director of Birbal Sahni institute of Palaeobotany who is a well known palynologist and has made very significant contributions to Mesozoic sediments of India.

Generic Comparison

The genus Venkatapollis gen. nov. resembles Katrolaites Venkatachala and Kar, 1967 in general shape and size but the latter can however be distinguished by the presence of operculum. Taurocusporitus Stover, 1962 also resembles the present genus in shape and distinct central body but the former differs in having a distinct trilete mark. The genus Callialasporites Dev, 1959 approximates the present taxon in having similar shape size, equatorial bladder and absence of germinal aperture but the former differs in mode of attachment of the bladder to the central body, limbus is present in Callialasporites. Coptospora Dettmann, 1963 is distinctly hilate grain where as in the present genus no such character is present. Tsugaepollenitesn Potonie and Venitz, 1934 also resembles the present genus in
shape but can readily be distinguished by its rugulate central body and frill like outer margin.

Venkatapollis indica sp. nov.
Pl.16, Figs.6,9
Text Fig. 9

Holotype: Pl.16, Fig.6. Slide PbPl/SD2/30:135; Size 53x58 um.

Type Locality: Korawadi River Section, Dharesi (Bhuj) Lower Cretaceous, Gujarat, India.

Specific Diagnosis

Miospores ± circular to oval; size range 45-65 μm in diameter. Monosaccate, central body as well as outer rim smooth, central body with a distinct inner core.

Description

Miospores ± circular to oval; size range 53-61 um in diameter. Monosaccate, central body 45 um in size, comparatively denser central part than that of the outer rim. Saccus smooth, 13 um in width. Exine of the saccus and central body 2-5 um thick and psilate.

Venkatapollis Sp. A
Pl.16, Fig.8

Description

Miospore ± circular - oval, 53x58 μm in diameter. Monosaccate central body 45x40 μm dark with smooth periphery. Bladder comprising the outer rim coarsely reticulate.
TEXT FIG. 9  VENKATAPOLLIS INDICA gen et sp nov.  
( Not to scale )
Comparison

Venkatapollis sp. A is different from genotype Venkatapollis indica gen et. sp nov. on account of its reticulate outer periphery and from Venkatapollis sp. B on the basis of smooth central body.

Venkatapollis sp. B
Pl.16, Fig.11

Description

Miospore ± circular, 53x58μm in diameter. Monosaccate, central body 45x43 μm in diameter with microreticulate inner periphery, saccus 13 μm wide and coarsely reticulate.

Comparison

Venkatapollis sp. B differs from the genotype Venkatapollis indica gen et sp. nov. on account of its microreticulate central body.

Turma - Aletes Ibrahim 1933
Subturma - Azonoletes (Luber) Potonié and Kremp, 1954
Infraturma - Granulonapiti Cookson, 1947
Genus - Araucariacites Cookson ex Couper, 1953

Araucariacites australis Cookson, 1947
Pl.17, Figs.1-5, 10, 11

Description

Miospores subelliptical - circular in outline; size
range 80-95 µm, inaperturate, having secondary folds all over the surface. Exine less than 1 µm thick, subgranulose, grana closely placed.

**Distribution**

This taxon is very common in the Mesozoic sediments. It is abundantly represented in the Lower Cretaceous rocks of Kutch, Gujarat (Singh, Srivastava and Roy, 1964; Venkatachala, 1969) Jurassic sediments of Rajmahal Hills, Bihar (Sah and Jain, 1965) and Upper Gondwana rocks of Tamilnadu (Ramanujam and Srisailam, 1974) and Cretaceous outcrops of South India (Banerjee and Misra, 1968).

*Araucariacites cooksonii* Singh, Srivastava and Roy, 1964

Pl.17, Figs.6,7,8

**Description**

Miospores ± circular in outline; Size range 60-75 µm. Inaperturate. Exine thin, folded, finely granulose, exine thinner towards centre and tends to shrivel at the periphery.

**Distribution**

Present taxon is recorded from the Upper Gondwana rocks of Kutch, Gujarat (Singh, Srivastava and Roy, 1964) and Lower Cretaceous formations of Kutch (Venkatachala, 1969).

**Genus** - *Schizosporis* Cookson and Dettmann, 1959

**Type Species** - *Schizosporis reticulatus* Cookson and Dettmann, 1959
Schizosporis rugulatus Cookson and Dettmann, 1959
Pl.16, Figs.4,7,10

Description
Miospores ± circular - oval in shape, biconvex, circular in polar view and elliptical in equatorial view dividing equatorially into two equal saucer shaped halves; size range 60-108 µm. Exine 1-2 µm thick, intectate, sexine ornamented with sinuous ridges, uniting to form an irregular small meshed, shallow reticulum.

Distribution
This taxon is recorded from the Lower Cretaceous sediments of Kutch, Gujarat (Singh, Srivastava and Roy, 1964) Mesozoic rocks of Jabalpur (Dogra, 1986) and Lower Cretaceous Gangapur beds of Pranhita Godavari Valley (Rao, Ramanujan and Varma, 1983). This is also a common taxon in the Cretaceous deposits of South Australia (Cookson and Dettmann, 1963, Dettmann, 1959).

Genus - Pyrgopites gen nov.
Type species - Pyrgopites mesozoicus gen. et sp. nov.

Generic Diagnosis
Miospore ± circular - oval in shape; size range 47-55 µm. Monocolporate, sulcus/colpus la-longate, equatorial with a single pore present in the periphery, pore rimmed - collar
type. Exine moderately thick with rugulate ornamentation.

Generic comparison

The present genus resembles.

*Schizosporis* Cookson and Dettmann 1959 in shape and equatorial sulcus but can be distinguished by the presence of a distinct germinal aperture in the periphery and rugulate exine ornamentation. The taxon *Proxapertites* v.d Hammen, 1956 approximates the present genus in having equatorial sulcus but differs from it on account of its exinal pattern and absence of pore in the margin. This genus can also be compared with *Nymphiaceaepollenites* Nagy, 1969 as far as its shape and zonosulcate condition is concerned but the latter has spiny projections and without any pore on the longitudinal aperture. The genus *Nymphoipollis* Venkatachala and Kar 1969 is also similar to the present taxon in having similar shape and equatorial sulcus but can be differentiated from the latter by the absence of a distinct pore in the periphery.

*Pyrgopites mesozoicus* sp. nov.

Pl.16, Figs.1,2,3

Text Fig.10

**Holotype:** Pl. 16, Fig.3. Slide No.PbPl/SD8/42: 126. Size 50x47 μm.

**Type Locality:** Dharesi (Bhuj) Korawadi River Section, Lower Cretaceous, Gujarat, India.
TEXT FIG. 10 PYRGOPITES MESOZOICUS gen et sp nov.
(Not to scale)
Specific Diagnosis

Miospore ± circular, 50x47 μm in diameter. Monosulcate/colpate, sulcus equatorial with a single pore present on the periphery, pore rimmed. Exine 2-3 μm thick with rugulate ornamentation.

Turma - Monocolpites Inversen and Troels-smith
Subturma - Rectectines (Malawkina) R. Potonie
Genus - Aranyasporis gen. nov.
Type species - Aranyasporis cretacea gen. et sp. nov.

Aranyasporis cretacea gen. et sp. nov.

Generic Diagnosis

Miospore ± elliptical with pointed ends; Size range 48x50-62x89. Monosulcate, sulcus wide open, reaching from pole to pole. Exine moderately thick with coaresely reticulate ornamentation, lumina of the reticulum large, rounded to polygonal, 10-20 μm across with thin muri.

Generic Comparison

The present genus is comparable to Palmidites (Chitaley) ex Couper, 1953 in overall body shape and general colpate nature but can be distinguished by its distinctly smooth exine. The taxon Aranyasporis gen. nov. also resembles Couperipollis Venkatachala and Kar, 1969 in having an oval, elliptical body and end to end colpus pattern but the latter can be differentiated from the former by its distinct
bacculate to spinose exine sculpture and comparatively larger size. The present genus is also variable from Cycadopites (Wodehouse) Wilson and Webster, 1946 on account of smooth exine ornamentation and dumble shaped colpus. Ginkgocycadophytes Samoilvitz, 1933 is identical in overall shape to the present taxon but can be differentiated on the basis of its variable pattern of sulcul opening and a distinct thickening along the sulcal margin. The genus Liliacidites Couper, 1953 can be distinguished from the Aranyasporis gen. nov. by its clavate, baculate sculpture.

Monolites (Erdtman) Couper, 1953 is a dumping genus with limitless character hence its comparison with the present taxon is deferred. The genus Narbadapollis Dogra, 1986 (in press) approximates the present genus in its shape and size but the former differs in having sulcus wider at the extremities and narrow in the middle and a distinct retibaculate-retipilate ornamentation.

Aranyasporis cretacea sp. nov.
Pl.18, Fig.5,9,10,12
Text Fig.11

Holotype: Pl.18 Fig.5, Slide No.PbPl/SD17/23: 133. Size 80x40 µm.

Type Locality: Dharesi (Bhuj) Korawadi River Section, Lower Cretaceous, Gujarat, India.

Specific Diagnosis

Miospores + elliptical with pointed ends; Size range 75-89 µm in length and 48-62 µm in breadth. Monosulcate,
TEXT FIG. 11 ARANYASPORIS CRETACEA gen et sp nov.
( Not to scale )
sulcus wide open, reaching from pole to pole Exine 1-2 μm thick with coarsely reticulate ornamentation.

Infraturma  -  Intorti (Naumova) Potonie', 1958

Genus  -  Cycadopites (Wodehouse) Ex. Wilson and Webester, 1946
Type species  -  Cycadopites follicularis Wilson and Webester, 1946

Cycadopites sakrigalensis Sah and Jain, 1965
  Pl. 18; Figs. 1,3,4,8

Description

Miospores elliptical; Size range 63-65 μm in length and 40-45 μm in breadth with pointed rounded ends. Monosulcate, sulcus extending from pole to pole, broader at the poles. Exine ± 1-2 μm thick, distinctly granulose.

Distribution

Sah and Jain (1965) have recorded the present taxon from Upper Jurassic sediments of Rajmahal Formation. A few grains of Cycadopites sp. cf. C. sakrigalensis have been recorded by Kumar (1973) and Dogra (1986) from Upper Jurassic rocks of Madhya Pradesh.

Genus  -  Ginkgocycadophytes Samolivitz, 1953
Type species  -  Ginkgocycadophytes detritus (Balme) Dev. 1959

Ginkgocycadophytes detritus (Balme) Dev. 1959
  Pl.19, Figs. 1,2,5,6

Description

Miospores ± oval-elongated in shape; size range 70-90
μm in length and 40-50 μm in width. A long furrow present, which extends from pole to pole. The furrow opens broadly at one end. Exine moderately thick and very finely granulose.

Distribution

Dev (1959) reported this taxon from Jurassic sediments of Madhya Pradesh.

Ginkgocyadophytes sp.
Pl.19, Figs.3,4

Description

Miospores elliptical-oval in shape; size range 70-80 μm in length and 45-55 μm in width. A long sulcus runs from pole to pole. Exine 1-2 μm thick, finely reticulate.

Comparison

The present species can be distinguished from the other known species of the genus by its characteristic very fine reticulum.

Genus Monosulcites Erdtman, 1947, Cookson, 1947 ex Couper, 1953

Type species Monosulcites minimus Cookson, 1947

Monosulcites ellipticus Kumar, 1971
Pl.18, Figs. 2,6,7,11; Pl.19, Fig.7

Description

Miospores oval-elliptical in shape; size range 84-102 μm long and 55-65 μm broad, poles rounded. Monosulcate, sulcus broad, joining the extremities. Exine 1-2 μm thick,
slightly granulose, folded, folds present mostly along the sulcus.

Distribution

Kumar (1971) reported the present taxon from Upper Gondwana rocks of Madhya Pradesh.


Genus Ginkgoretectina Malyavkina, 1953

Type species Ginkgoretectina punctata Malyavkina, 1953

Gingoretectiina jabalpurense sp. nov.
Pl.19, Figs.11,13

Holotype: Pl.19, Fig.11 Slide No.PbPl/SC8/3. Size 225x145
Jabalpur clay, Chui Hill, Jabalpur, Madhya Pradesh, India.

Specific Diagnosis

Miospores oval - elliptical in shape with rounded - pointed poles; size range 215-225 μm. Monocolpate, colpus extends from one end to the other. Exine 10-15 μm thick, microreticulate.

Comparison

The present species can be differentiated from Ginkgoretectina vastus Dev, 1959 on the basis of its microreticulate exine and comparatively of larger size. The polar ends of Ginkgoretectina vastus. Dev, 1959 are tapering comparatively in the present taxon.
Incerti - sedis

Miospore Type I

Pl.16, Fig.12

Description

Miospore ± oval, 140x112 μm in size. Monosaccate, saccus large and broad along the equatorial axis. Central body 100x90 μm in size. Saccus 35 μm wide along the equator and 10 μm across the pole or along the shorter axis, surface ornamentation microreticulate.

Fungal hyphae

Pl. 19, Figs.8,10,12

Description

Hyphae elongate, 80-120 μm in length and 20-24 μm in breadth. Multiseptate, septa distinct, straight. Septa has pores in the central part of each septum connecting the adjacent cell.

Microforaminiferal lining

Pl.17, Fig.9

Trochospiral type 2 Stancliffe,1989

Description

A trochospiral foraminifera with discrete chamber in the primary whorl, while the chamber in the second whorl 60-84 μm in size. Number of chambers variable, wall smooth.