

# PALYNOLOGY OF THE NORTH KARANPURA BASIN, BIHAR, INDIA — 3. RANIGANJ EXPOSURE NEAR LUNGATOO, HAZARIBAGH DISTRICT

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## ABSTRACT

The present paper consists of palynological investigation of a Raniganj exposure near Lungatoo, in Hazaribagh district, Bihar, India. 34 dispersed spore-pollen genera and 47 species have been recovered from the material and only the new species have been systematically described. The histograms have been drawn to show the distribution of different spore-pollen genera in the assemblage and have been compared with the other known Indian Upper Permian assemblages.

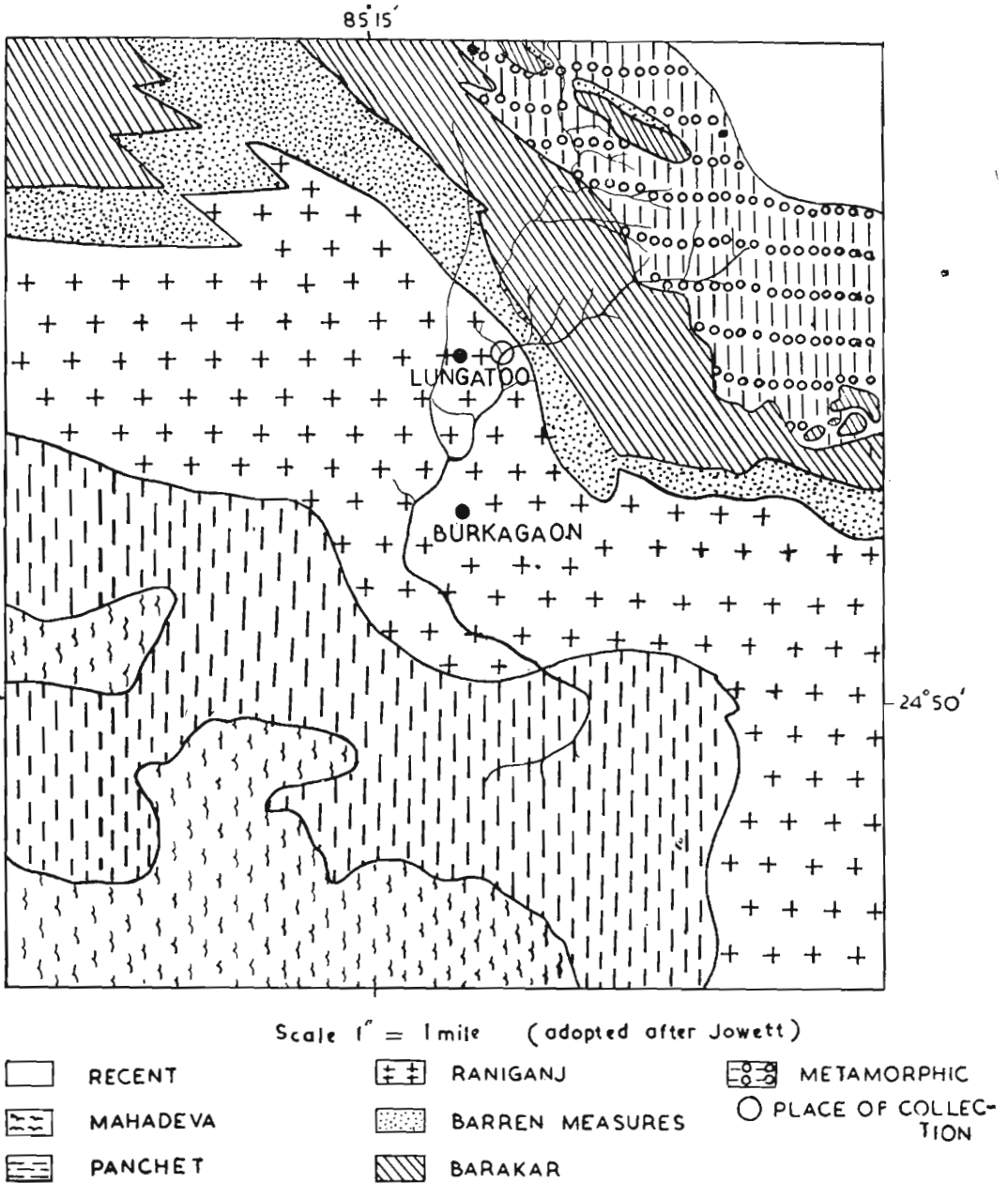
## INTRODUCTION

THE material for the present investigation was collected from a Raniganj exposure near the bend of the river running across Lungatoo — Burkagaon village about two miles north, north-east of Burkagaon Police Station (see TEXT-FIG. 1). The outcrop is exposed on the west side of the river and its lithology is as follows:

(beds dipping $\pm 12^\circ$ W. see TEXT-FIG. 2).	
Alluvium	2'-3'
Massive, coarse grained, micaceous sandstone	28'-30'
Micaceous, greyish, buff coloured shale (C <sub>2</sub> A)	1'
Massive, compact, sandstone	3'
Carbonaceous, compact shale (C <sub>2</sub> B)	6"
Massive, coarse grained sandstone	8'-6"
Micaceous, dark-greyish, loose shale intergrading into sandstone (C <sub>2</sub> C)	1'-6"
Micaceous sandstone with sandy shale	1'-9"
Micaceous shale occasionally with fine clay (C <sub>3</sub> D)	2'-2"
Light-dark brown, ferruginous shale with compact sandy nature	2"-3"
Compact carbonaceous shale with plant impressions (C <sub>3</sub> E)	8"-10"
Yellow, reddish yellow, ferruginous, compact silt-stone	4"

Shale, upper part compact, carbonaceous, lower part micaceous (C <sub>3</sub> F)	8"-1'-2"
Fine grained sandstone	2'-4"
Compact, carbonaceous shale with micaceous particles (C <sub>3</sub> G)	2'-2'-5"
Fine grained sandstone	2'-5"
Compact, carbonaceous shale (C <sub>3</sub> H)	2'
Carbonaceous shale with occasional ferruginous partings (C <sub>3</sub> I <sub>1</sub> -C <sub>3</sub> I <sub>3</sub> )	5'-6'
Medium grained sandstone	2'
Carbonaceous shale with interspersed bands of sandy shale (C <sub>3</sub> J <sub>1</sub> -C <sub>3</sub> J <sub>4</sub> )	4'
Coarse grained, micaceous sandstone	4'
Carbonaceous shale (C <sub>3</sub> K)	2'
Fine grained sandstone	1'
Carbonaceous shale (C <sub>3</sub> L)	1'
Buff-coloured, micaceous shale (C <sub>3</sub> M)	6"
Fine grained sandstone	1'
Carbonaceous shale (C <sub>3</sub> N)	3"
Fine grained sandstone (lense)	1'
Carbonaceous shale, rich in mica (C <sub>3</sub> O)	3"-8"
Buff-coloured shale (C <sub>3</sub> P)	1'-1'-5"
Coarse grained, massive sandstone	4'
Carbonaceous shale (total thickness unknown), exposed (C <sub>3</sub> Q)	1'-1'-5"

About 20-30 grams of material was treated with commercial Nitric acid (40%) for 3-10 days. When the material was fully macerated it was further treated with Potassium hydroxide solution (5%) for 3-5 minutes. Siliceous elements in the macerates were dissolved with Hydrofluoric acid (40%) by standing the material for 3-7 days. The residues were washed several times in water and was centrifuged and dried on cover glass with Polyvenyl alcohol. The cover glass was finally mounted in

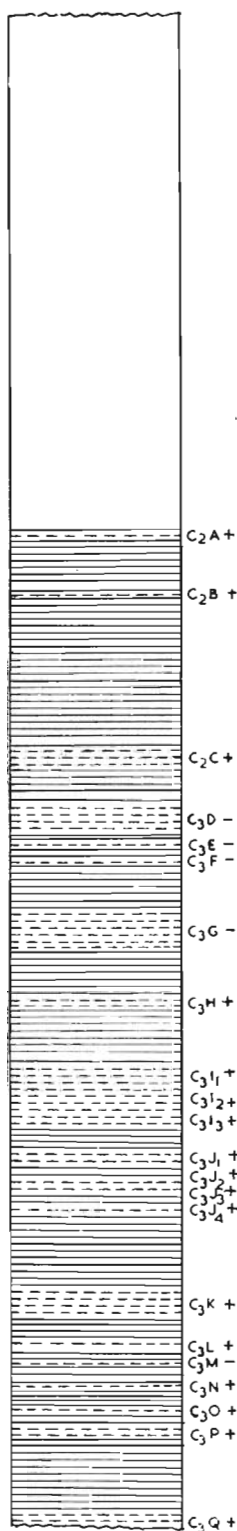


TEXT-FIG. 1—Location of the exposure from where the material was collected.

Canada balsam. The slides and unused material have been deposited at the repository of the Birbal Sahni Institute of Palaeobotany, Lucknow, India.

#### SYSTEMATIC PALYNOLOGY

The species of the dispersed spore-pollen genera recovered from the present material



have been systematically arranged as follows:

- Anteturma — *Sporites* H. Potonié, 1893
- Turma — *Triletes* (Reinsch) Potonié & Kremp, 1954
- Subturma — *Azonotriletes* Luber, 1935
- Infraturma — *Laevigati* (Bennie & Kidston) Potonié, 1956

**Genus *Punctatisporites* (Ibrahim) Potonié & Kremp, 1955**

Species recorded here:

1. *Punctatisporites gretensis* Balme & Hennelly, 1956.

- Infraturma — *Apiculati* (Bennie & Kidston) Potonié, 1956

**Genus *Apiculatisporis* Potonié & Kremp, 1956**

Species recorded here:

1. *Apiculatisporis levis* Balme & Hennelly, 1956.
2. *A. secretus* Venkatachala & Kar, 1968b.

**Genus *Cyclogranisporites* Potonié & Kremp, 1954**

Species recorded here:

1. *Cyclogranisporites gondwanensis* Bharadwaj & Salujha, 1964.

**Genus *Cyclobaculisporites* Bharadwaj, 1955**

Species recorded here:

1. *Cyclobaculisporites minutus* Bharadwaj & Salujha, 1964.
2. *C. minimus* Kar, 1968.

**Genus *Lophotriletes* (Naumova) Potonié & Kremp, 1954**

Species recorded here:

1. *Lophotriletes rectus* Bharadwaj & Salujha, 1964.

**Genus *Anapiculatisporites* Potonié & Kremp, 1954**

Species recorded here:

1. *Anapiculatisporites veritas* Venkatachala & Kar, 1968a.
2. *A. consonus* Venkatachala & Kar, 1968a.

←

TEXT-FIG. 2 — Lithology of the exposure.

- Turma — *Monoletes* Ibrahim, 1933  
 Subturma — *Azonomonoletes* Luber, 1935  
 Infraturma — *Psilamonoleti* Van der Hammen, 1955

**Genus *Laevigatosporites* (Ibrahim)  
 Schopf, Wilson & Bentall, 1944**

Species recorded here:

1. *Laevigatosporites colliensis* (Balme & Hennelly) Venkatachala & Kar, 1968a.

**Genus *Punctatosporites* Ibrahim, 1933**

Species recorded here:

1. *Punctatosporites morosus* Venkatachala & Kar, 1968a.

**Genus *Thymospora* (Kosanke) Wilson & Venkatachala, 1963**

Species recorded here:

1. *Thymospora raniganjensis* sp. nov. (Pl. 1, Fig. 7).

*Holotype* — Pl. 1, Fig. 7. Size  $22 \times 18 \mu$ .

*Type Locality* — Lungatoo, North Karanpura basin, Bihar; Raniganj Stage (Permian).

*Diagnosis* — Spores oval,  $18-27 \mu \times 22-41 \mu$ , exine verrucose, verrucae well developed,  $2-4 \mu$  long. Monolete extending three-fourths along the longitudinal axis.

*Description* — Spores mostly oval, sometime subcircular or bean shaped; exine  $1.5-2 \mu$  thick, verrucose, verrucae  $2-4 \mu$  long, closely placed, evenly distributed. Monolete mostly well developed, sometime obscured by sculptural elements, generally not extending more than three-fourths longitudinally.

*Comparison* — *Thymospora thiesseii* (Kosanke) Wilson & Venkatachala (1963) is comparable to the present species in size range but is distinguished by its nature of sculptural elements. *T. gondwanensis* Bharadwaj & Saluja (1964) is distinguished by its subcircular shape and comparatively smaller size of the verrucae.

*Remarks* — *Thymospora* sp. described by Venkatachala and Kar (1968a) from the Barakar exposures near Badam, North Karanpura basin seems to belong to the present species.

- Anteturma — *Pollenites* R. Potonié, 1931  
 Turma — *Saccites* Erdtman, 1947  
 Subturma — *Monosaccites* (Chitale) Potonié & Kremp, 1954  
 Infraturma — *Apertacorpiti* Lele, 1964

**Genus *Plicatipollenites* Lele, 1964**

Species recorded here:

1. *Plicatipollenites indicus* Lele, 1964.

**Genus *Virkkipollenites* Lele, 1964**

Species recorded here:

1. *Virkkipollenites obscurus* Lele, 1964.

**Infraturma — *Monosaccireticuloidi* Tiwari, 1965**

**Genus *Barakarites* Bharadwaj & Tiwari, 1964**

Species recorded here:

1. *Barakarites dubius* Venkatachala & Kar, 1968a.

**Genus *Divarisaccus* Venkatachala & Kar, 1966a**

Species recorded here:

1. *Divarisaccus lelei* Venkatachala & Kar, 1966a.

**Infraturma — *Vesiculomonoradites* (Pant) Bharadwaj, 1965**

**Genus *Potonieisporites* (Bharadwaj) Bharadwaj, 1964**

Species recorded here:

1. *Potonieisporites raniganjensis* sp. nov. (Pl. 1, Figs. 8-9).

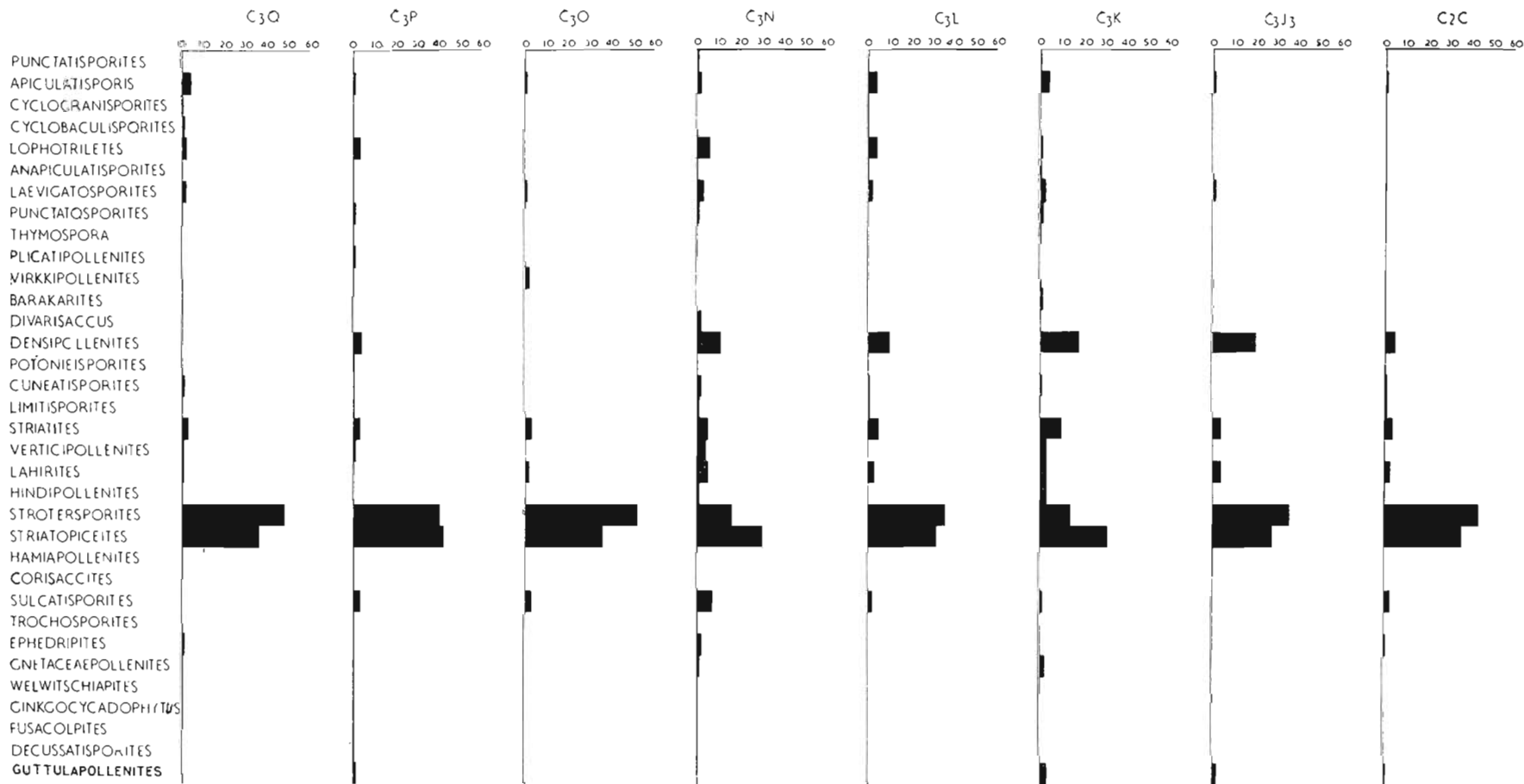
*Holotype* — Pl. 1, Fig. 9. Size  $110 \times 54 \mu$ , central body  $72 \times 54 \mu$ .

*Type Locality* — Lungatoo, North Karanpura basin, Bihar; Raniganj Stage (Permian).

*Diagnosis* — Monosaccate, oval-elliptical, central body strongly horizontally oval, granulose — laevigate, monolete not extending more than half of central body, semilunar folds present on each side. Saccus intrareticulate.

*Description* — Pollen grains mostly oval with slight constriction in one of the lateral sides in some specimens,  $54-60 \mu \times 96-110 \mu$ . Central body dense,  $50-54 \mu \times 70-72 \mu$ , exine  $1.5-2 \mu$  thick, mostly granulose, grana  $\pm .5 \mu$ , more or less closely placed. Monolete ill developed, surrounding semilunar folds present on both sides in most of the specimens. Proximal attachment of saccus to central body equatorial, distally saccus enclosing the central body completely. Saccus coarsely intrareticulate, mesh-size  $1.5-2.5 \mu$ .

*Comparison* — *Potonieisporites concinnus* Tiwari (1965), *P. triangulatus* Tiwari (1965)



TEXT-FIG. 3 — Distribution of the various spore-pollen genera recovered from the present material.

and *P. barrelis* Tiwari (1965) are distinguished from the present species by their larger size, subcircular-oval shape and in the absence of strongly horizontally oval central body.

**Infraturma — *Aletisacciti* Leschik, 1956**

**Genus *Densipollenites* Bharadwaj, 1962**

Species recorded here:

1. *Densipollenites indicus* Bharadwaj, 1962.
2. *D. invisus* Bharadwaj & Salujha, 1964.

**Subturma — *Disaccites* Cookson, 1947**

**Infraturma — *Podocarpoiditi* Potonié, Thomson & Thiergart, 1950**

**Genus *Cuneatisporites* Leschik, 1955**

Species recorded here:

1. *Cuneatisporites rarus* Kar, 1968.

**Infraturma — *Disaccimonoletes* Klaus, 1963**

**Genus *Limitisporites* Leschik, 1956**

Species recorded here:

1. *Limitisporites directus* (Hart) Bharadwaj & Salujha, 1965a.

**Infraturma — *Striatiti* (Pant) Bharadwaj, 1962**

**Genus *Striatites* (Pant) Bharadwaj, 1962**

Species recorded here:

1. *Striatites solitus* Bharadwaj & Salujha, 1964.
2. *S. communis* Bharadwaj & Salujha, 1964.
3. *S. ornatus* Venkatachala & Kar, 1968a.
4. *S. tectus* Venkatachala & Kar, 1968a.
5. *S. varius* Kar, 1968.

**Genus *Verticypollenites* Bharadwaj, 1962**

Species recorded here:

1. *Verticypollenites gibbosus* Bharadwaj, 1962.

**Genus *Lahirites* Bharadwaj, 1962**

Species recorded here:

1. *Lahirites rarus* Bharadwaj & Salujha, 1964.
2. *L. parvus* Bharadwaj & Salujha, 1964.
3. *L. lepidus* Bharadwaj & Salujha, 1964.
4. *L. minutus* Venkatachala & Kar, 1968a.

**Genus *Hindipollenites* Bharadwaj, 1962**

Species recorded here:

1. *Hindipollenites indicus* Bharadwaj, 1962.
2. *H. globosus* Kar, 1968.

**Genus *Strotersporites* Wilson, 1962**

Species recorded here:

1. *Strotersporites decorus* (Bharadwaj & Salujha) Venkatachala & Kar, 1964.
2. *S. diffusus* (Bharadwaj & Salujha) Venkatachala & Kar, 1964.

**Genus *Striatopiceites* (Zoricheva & Sedova) Sedova, 1956**

Species recorded here:

1. *Striatopiceites minutus* Venkatachala & Kar, 1968a.

**Genus *Hamiapollenites* Wilson, 1962.**

Species recorded here:

1. *Hamiapollenites incestus* Venkatachala & Kar, 1968b.

**Genus *Corisaccites* Venkatachala & Kar, 1966b**

Species recorded here:

1. *Corisaccites alutas* Venkatachala & Kar, 1966b.
2. *C. distinctus* Venkatachala & Kar, 1968b.

**Genus *Sulcatisporites* (Leschik) Bharadwaj, 1962**

Species recorded here:

1. *Sulcatisporites ovatus* (Balme & Hennelly) Bharadwaj, 1962.

**Subturma — *Polysaccites* Cookson, 1947**

**Genus *Trochosporites* Wilson, 1962**

Species recorded here:

1. *Trochosporites tripus* Venkatachala & Kar, 1968a.

**Turma — *Plicates* (Naumova) Potonié, 1960**

**Subturma — *Polyplificates* Erdtman, 1952**

**Genus *Ephedripites* Bolkhovitina, 1953**

Species recorded here:

1. *Ephedripites ellipticus* Kar, 1968.

**Genus *Gnetaceaepollenites* Thiergart, 1938**

Species recorded here:

1. *Gnetaceaepollenites sinuous* (Balme & Hennelly) Bharadwaj, 1962.

**Genus *Welwitschiapites* Bolkovitina, 1953**

Species recorded here:

1. *Welwitschiapites tenuis* Bharadwaj & Salujha, 1964.

Turma — *Monocolpates* Iversen & Troels-Smith, 1950

Subturma — *Intortes* (Naumova) Potonié, 1958

**Genus *Ginkgocycadophytus* Samoilovich, 1953**

Species recorded here:

1. *Ginkgocycadophytus cymbatus* (Balme & Hennelly) Potonié & Lele, 1961.

Subturma — *Striacolpites* Bose & Kar, 1966

Infraturma — *Monostriocolpites* Bose & Kar 1966

**Genus *Fusacolpites* Bose & Kar, 1966**

Species recorded here:

1. *Fusacolpites fusus* Bose & Kar, 1966.

Infraturma — *Distriocolpites* Bose & Kar, 1966

**Genus *Decussatisporites* Leschik, 1955**

Species recorded here:

1. *Decussatisporites lucifer* Bharadwaj & Salujha, 1964.

***Incertae Sedis***

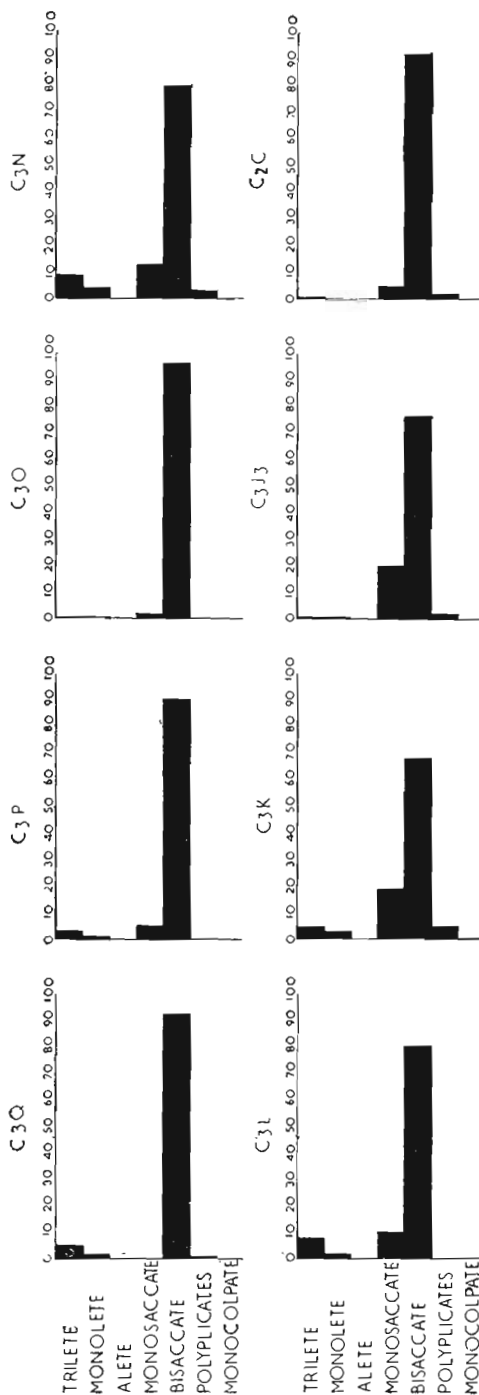
**Genus *Guttulapollenites* (Goubin) Venkatachala, Goubin & Kar, 1967**

Species recorded here:

1. *Guttulapollenites hannonicus* (Goubin) Venkatachala, Goubin & Kar, 1967.

**DISCUSSION**

*Palynological composition* —The present palynological assemblage comprises 34 spore-pollen genera representing trilete, monolete, monosaccate, bisaccate, polysaccate, polyplicate and monocolpate pollen. In all the eight samples counted here (TEXT-FIGS. 3 & 4) there is an overwhelming dominance of bisaccate pollen contributing 68-96 per cent. Among them, the striate bisaccate genera like *Strotersporites*, *Striatopiceites*,



TEXT-FIG. 4. Distribution of the different spore-pollen groups in the assemblage.

*Striatites* and *Lahiritites* are more frequent than the nonstriate ones. Monosaccate pollen grains except in one sample ( $C_3Q$ ) are fairly well represented (5-20 per cent). *Densipollenites* is most common while *Plicatipollenites*, *Virkkipollenites*, *Barakarites*, *Divarisaccus* and *Potonieisporites* are rare. Trilete spores are not very common and they do not represent more than 9 per cent in any of the samples studied here. *Apiculatisporis*, *Cyclobaculisporites* and *Lophotriletes* are generally met within the count. Monolete spores are rare and their contribution varies from 0-4 per cent in the assemblage. Among them *Laevigatosporites* seems to be more common than *Punctatosporites* and *Thymospora*. Polyplicate pollen are also rare (0-5 per cent) and represented by *Ephedripites*, *Gnetaceaepollenites*, *Welwitschiapites* and *Guttulapollenites*. Monocolpate pollen do not come within the count though *Ginkgocycadophytus*, *Fusacolpites* and *Decussatisporites* have been recovered.

*Palynological comparison* — A comparison of the present palynological composition with that of the Raniganj Coalfield described by Bharadwaj (1962), Bharadwaj and Salujha (1964, 1965a, 1965b) and Salujha (1965) shows that the genera like *Eupunctisporites*, *Ricaspora*, *Indospora* and *Gondisporites* are conspicuous by their absence in the material studied here. Moreover, the trilete spores in the various seams studied by them are very well represented both in quality as well as quantity while they are insignificant in the present assemblage. The bisaccate pollen in both the assemblages are quite dominant and most of the genera are common. Mention may,

however, be made here that the bisaccate pollen are absolutely dominant in the present assemblage (as high as 96 per cent) while they have not been recorded in such prolific percentage in the Raniganj Coalfield. Monosaccate pollen grains are also found comparatively in less number in the latter while the monolete spores provide a far better representation.

These facts perhaps point out that the present assemblage does not closely resemble with that of the Raniganj assemblage of the Raniganj Coalfield studied by Bharadwaj *et al.* (*l.c.*). The present assemblage, however, approximates in the percentage frequency of the spore-pollen genera histogrammed by Bharadwaj, Sah and Tiwari (1965) from the Barren Measures Succession of Jharia Coalfield, Bihar. Mention may, however, be made here that the genera like *Leiotriletes*, *Gondisporites*, *Indotriradites*, *Rhizomaspora* and *Vesicaspora* recorded by them are not found in the present material.

From these comparisons it appears that the palynological composition of the section at Lungatoo closely resembles the Barren Measures Succession (*l.c.*) than that of the Raniganj Coalfield (Raniganj Stage) of the Lower Gondwanas of India. It may be possible that this represents the lowermost part of the Raniganj Stage.

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### EXPLANATION OF PLATE

(All photomicrographs are enlarged ca.  $\times$  500)

#### PLATE 1

- 1-2. *Lophotriletes rectus* Bharadwaj & Salujha. Slide nos. 2465 & 2452.
3. *Cyclobaculisporites minimus*. Kar. Slide no. 2478.
4. *Cyclogranisporites gondwanensis* Bharadwaj & Salujha. Slide no. 2450.
5. *Anapiculatisporites consonus* Venkatachala & Kar. Slide no. 2443.
6. *Laevigatosporites colliensis* (Balme & Hennesly) Venkatachala & Kar. Slide no. 2481.
7. *Thymospora raniganjensis* sp. nov. Slide no. 2448.
- 8-9. *Potonieisporites raniganjensis* sp. nov. Slide nos. 2478 & 2483.
10. *Densipollenites indicus* Bharadwaj. Slide no. 2442.
- 11-12. *Corisaccites distinctus* Venkatachala & Kar. Slide Nos. 2474 & 2465.
13. *Cuneatisporites rarus* Kar. Slide no. 2461.
14. *Striatites tectus* Venkatachala & Kar. Slide no. 2454.
15. *Lahirites minutus* Venkatachala & Kar. Slide no. 2447.
16. *Verticypollenites gibbosus* Bharadwaj. Slide no. 2447.
17. *Trochosporites tripus* Venkatachala & Kar. Slide no. 2443.
18. *Welwitschiapites tenuis* Bharadwaj & Salujha. Slide no. 2442.
- 19-20. *Gnetaceapollenites sinuous* (Balme & Hennesly) Bharadwaj. Slide no. 2439,
21. *Ephedripites ellipticus* Kar. Slide no. 2467.
22. *Fusacolpites fusus* Bose & Kar. Slide no. 2442.
- 23-24. *Guttulapollenites hannonicus* (Goubin) Venkatachala, Goubin & Kar. Slide nos. 2469 & 2467.

