STUDIES IN THE INDIAN MIDDLE GONDWANA FLORA: 3. PLATYSPERMIC SEEDS AND MEGASPORE IMPRESSIONS FROM THE SOUTH REWA GONDWANA BASIN

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ABSTRACT

Platyspermic seeds referable to two new species of *Cordaicarpus* and two new species of *Samaropsis* are described. The interesting occurrence of a large number of megaspores preserved as impressions or moulds is recorded. These megaspores are distinguishable into two distinct types.

INTRODUCTION

THE Indian Gondwana formations are known to contain remains of platyspermic and radiospermic fossil seeds. Feistmantel has recorded a number of seeds from the Talchir-Karharbari beds, the Raniganj group and the Panchet strata. Our knowledge of these records, which are mostly referable to *Samaropsis* or *Cordaicarpus*, is, however, not complete. In recent years, more detailed studies made by Seward & Sahni (1920), Lele (1955), Surange & Lele (1956), Saksena (1955), Surange (1957) and Pant (1960) have brought to light certain well-defined fossil seeds from the various horizons of the Gondwana formations of India. The significant records are:

1. *Cordaicarpus furcata* Surange & Lele; Talchir Stage (Lr. Gond.)
2. *Cordaicarpus* sp. cf. *C. cordai* Sew. & Sahni; Barakar Stage (Lr. Gond.)
3. *Samaropsis goraiensis* Surange & Lele; Talchir stage (Lr. Gond.)
4. *S. milleri* (Zeiller) Sew. & Sahni; Karharbari Stage (Lr. Gond.)
5. *S. indica* (Zeiller) Sew.; Karharbari Stage (Lr. Gond.)
6. *S. johillensis* Saksena; Karharbari or Barakar Stage (Lr. Gond.)
7. *S. gajrensis* Saksena; Karharbari or Barakar Stage (Lr. Good.)
8. *S. raniganjensis* Sew. & Sahni; Raniganj Stage (Lr. Gond.)
9. *S. srivastavai* Lele, Parsora Stage (Mid. Gond.)
10. *Stereocarpus emarginatus* Surange; Raniganj Stage (Lr. Gond.)
11. *Stephanostoma crystallina* Pant;
12. *Pterigospermum raniganjensis* Pant
13. *Pterigospermum* sp. A.
14. *Platycardia bengalensis* Pant

} Horizon unknown Raniganj Coalfield (Lr. Gond.)

To the above list, the present findings would add the following new forms from the Triassic (Mid. Gond.) formations of the South Rewa basin.

11. *Cordaicarpus chichariensis*
12. *C. ovatus*
13. *Samaropsis menisca*
14. *S. surangei*

Thus, we now know at least 9 species of *Samaropsis*, 4 species of *Cordaicarpus*, one species of *Stereocarpus*, 1 species of *Stephanostoma*, 2 species of *Pterigospermum* and 1 species of *Platycardia* from the various horizons of the Indian Gondwana formations. Besides, there are a few records of Lower Gondwana seeds obtained from coal maceration (SURANGE & SINGH, 1953, SRIVASTAVA, 1954).

DESCRIPTION

The collection described below has come from various localities of the South Rewa basin for which reference may be made to the map published in my previous paper (LELE, 1962). A few plant remains belonging to the Aiyengar collection (1929) are also incorporated here.

(A) SEEDS

Genus *Cordaicarpus* Geinitz

1. *Cordaicarpus chichariensis* sp. nov.

Pl. 1, Fig. 1; Text-fig. 1

Diagnosis — Seed more or less circular; 1·7×1·5 cm., nucule 1·4×1·3 cm.; wing

single, uniformly surrounding the nucule, 2 mm. wide, projected into a short conical beak at the apex.

Holotype — 8850 (PL. 1, FIG. 1; TEXT-FIG. 1); India, South Rewa Gondwana basin, Chicharia, Middle Gondwana (Trias.) B.S.I.P. Museum.

Description — There is a single specimen of a seed obtained from Chicharia (LOCALITY 16). The specimen (PL. 1, FIG. 1; TEXT-FIG. 1) is more or less circular, measuring 1·7×1·5 cm. The nucule is 1·4×1·3 cm., surrounded by a single, narrow, uniformly wide wing. It is better seen on the left side where it is 2 mm. wide. The wing is projected at the apex into a single conical beak.

From the Indian strata, a few species of *Cordaicarpus* are known. Zeiller (1902, p. 37; PL. 7, FIGS. 7, 8) has described *C. indicus* from the Karharbari beds. Seward (1917, p. 353) has placed this seed under *Samaropsis*. The seeds are rather large in size, circular and possess an emarginate wing. These characters are not shown by the present specimen. Seward & Sahni (1920, p. 11; PL. 11, FIG. 18) have described *Cordaicarpus* sp. cf. *C. cordai* from the Barakar stage. This seed is characterized by a cordate base, pointed apex and a narrow border. The present specimen is not cordate at the base. Recently Surange & Lele (1956) have described *Cordaicarpus furcata* from the Talchir stage. The seeds are very small and characterized by a distinctly bucuspid apex. These characters distinguish it from the present specimen. For the above reasons the present seed is referred to a new species.

2. *Cordaicarpus ovatus* sp. nov.

Pl. 1, Fig. 2; Text-fig. 2

Diagnosis — Seed oval, 7×5 mm., nucule more or less oval; apex somewhat pointed, outer margin sharply grooved, wing not evident.

Holotype — 9074 (PL. 1, FIG. 2; TEXT-FIG. 2) India, South Rewa Gondwana basin; Salaia, Middle Gondwana (Trias.) B.S.I.P. Museum.

Description — A single specimen in the collection is referred to this genus. The specimen (PL. 1, FIG. 2; TEXT-FIG. 2) measures 7×5 mm. The nucule is more or less oval in shape, although its base is more rounded while near the apex it is somewhat pointed. The outer margin of the nucule is sharply grooved. There is no convincing evidence of a distinct wing, although on the basal side, there are about 1 mm. wide remains of what might have been a border. It is likely that the border is broken and not preserved. However, in want of more specimens it seems safer to include the present seed under the genus *Cordaicarpus* which includes seeds having a less well-marked wing (SEWARD, 1917, p. 354). On the surface of the nucule, a brittle, ferruginous substance is deposited and a few obscure remains of epidermal cells are visible, which are unfortunately too badly preserved for a photograph. The present seed does not compare with the Indian records of *Cordaicarpus*. It is therefore, referred to a new species.

3. ? *Cordaicarpus* sp.

Pl. 1, Figs. 3, 4

At a number of localities there are a few seed-like structures whose precise identification is by no means possible. Amongst these one specimen from Chicharia (Locality 16) is of some interest. The fossil (FIG. 3) is oval and flattened, measuring 2·5×1·4 cm. There is no indication of a wing border. However, the interesting feature of this fossil is the presence of epidermal cells on the surface which can be clearly seen under incident light. The cells (FIG. 4) are narrow, elongated, thin-walled and arranged in longitudinal rows. They measure nearly 40-100×15-30 μ in size.

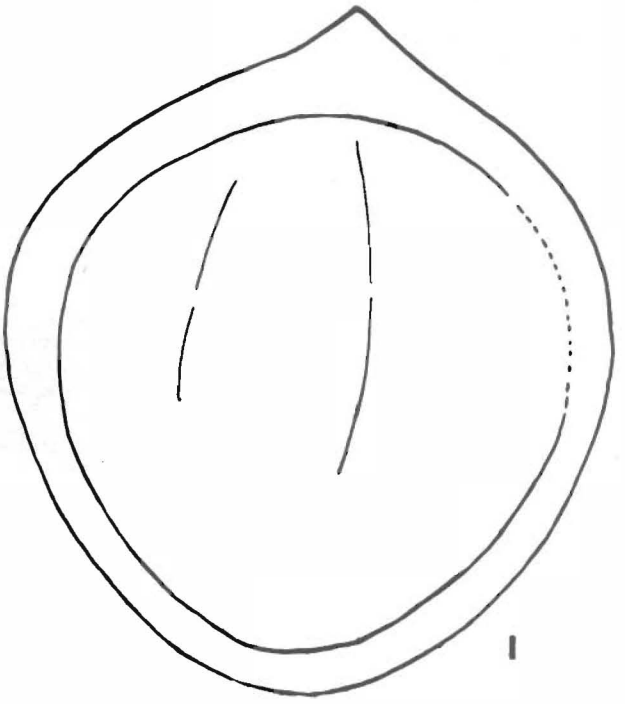
Unfortunately the specimen is single and its generic identification is also somewhat difficult owing to the apparent absence of wing border.

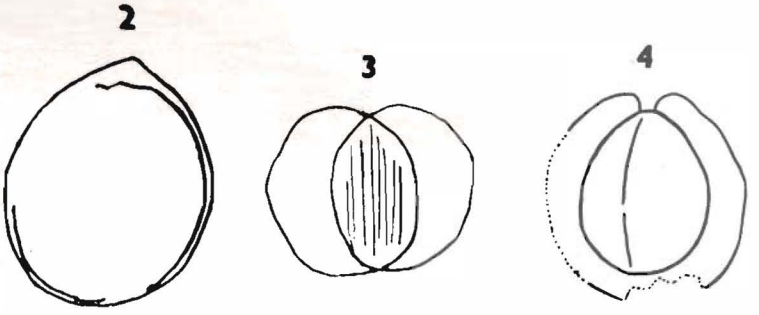
Genus *Samaropsis* Goeppert

4. *Samaropsis* sp. cf. *S. srivastavai* Lele

Pl. 1, Fig. 5

This species was founded by me (LELE, 1955, p. 28) on a large number of seeds obtained from Parsora (Locality 10). The preservation of the Parsora seeds was not always satisfactory; particularly the bicuspid apex was very often not well preserved. However, since a large number of specimens were available for study, the distinguishing characters of these seeds could be made out. From other localities also similar





TEXT-FIGS. 1-4 — *Cordaicarpus chichariensis* sp. nov. The form of the seed (holotype) shown in Pl. 1, Fig. 1. × 5. 2, *Cordaicarpus ovatus* sp. nov. The form of seed (holotype) shown in Pl. 1, Fig. 2. × 5. 3, *Samaropsis menisca* sp. nov. The form of the seed (holotype) shown in Pl. 1, Fig. 6. × 5. 4, *Samaropsis surangei* sp. nov. The form of the seed (holotype) shown in Pl. 1, Fig. 8. × 5.

seeds have been collected, but they are not well preserved. The seeds from Beli (Locality 12) reproduced in Fig. 5 shows a border about 1 mm. wide. The apical horns are not preserved. In the form, size and wing border it is closely comparable with *S. srivastavai*.

5. *Samaropsis menisca* sp. nov.

Pl. 1, Figs. 6, 7; Text-fig. 3

Diagnosis — Seeds commonly circular, 4-5 mm. in diameter; nucule fairly longer than broad, elliptical with pointed ends, 3-4 × 1·5-2 mm.; surface of nucule with

longitudinal striations; wing crescent-shaped on either side of the nucule, wing broadest on the sides where it is 1-1·5 mm. broad and tapering towards both ends.

Holotype — 9068, (PL. 1, FIG. 6; TEXT-FIG. 3); India, South Rewa Gondwana basin, Salaia, Middle Gondwana (Trias.). B.S.I.P. Museum.

Description — The shales at Salaia (Locality 8) contain frequent impressions of small flattened one-winged seeds. The commonest type of seed (PL. 1, FIGS. 6, 7; TEXT-FIG. 3) is more or less round in shape, varying from 4 to 5 mm. in diameter. The nucule is typically elliptical, fairly longer than broad, varying from 3 to 4 mm. in length and from 1·5 to 2 mm. in breadth in the middle region and with pointed ends. The nucule is surrounded by a thin but well-marked wing which is broadest on the two sides where it measures 1-1·5 mm. and gradually narrows down towards apex and base producing at these points a little, often indistinct, depression. Thus, in appearance, the wing on either side of the nucule is crescent-shaped. The surface of the nucule is marked by longitudinal striations.

The species *S. goraiensis* described by Surange & Lele (1956) from the Talchir beds has also an elliptical nucule which is pointed at both ends. However, the wing of this seed is broader towards base which is cordate. Other species known from India and abroad do not compare. The present seeds are, therefore, regarded as new.

6. *Samaropsis surangei* sp. nov.

Pl. 1, Figs. 8-10; Text-fig. 4

Diagnosis — Seed normally circular, 4-5 mm. in diameter; rarely smaller; nucule ovate to obovate, 3-4 × 2·5-3 mm., with a few longitudinal lines on the surface; wing single, more or less uniformly wide around the nucule, 1 mm. wide, with an apical sinus.

Holotype — 9051 (PL. 1, FIG. 8; TEXT-FIG. 4).

Paratype — 9059 (PL. 1, FIG. 9); India, South Rewa Gondwana basin, Salaia, Middle Gondwana (Trias.). B.S.I.P. Museum.

Description — The second type of seed which can be referred to *Samaropsis* is somewhat similar to *S. menisca*, but differs in the shape of the nucule and the border. In the few specimens which have been obtained from Salaia (Locality 8), the seed is normally circular in shape, varying in diameter from 4 to 5 mm. The nucule is more or less ovate (FIG. 8; TEXT-FIG. 4) but in some specimens it may be obovate (FIG. 9), the base being rather flat and the apex pointed. The nucule varies in dimension from 3-4 × 2·5-3 mm. The wing is single, thin, distinctly marked, more or less uniformly wide around the nucule, normally 1 mm. wide. The apex of the wing seems to be emarginate (FIG. 8; TEXT-FIG. 4). This character is, however, not always visible in the seeds due to unsatisfactory preservation. The surface of the nucule is marked with a few longitudinal lines. The two specimens (FIGS. 8, 9) represent the normal types. The third specimen (FIG. 10) is relatively smaller. However, it agrees with the essential characters of this species.

This species differs from *S. menisca* in having uniformly wide wing border around the seed with an apical sinus and in the absence of an elliptical nucule pointed at both ends. The seed *S. raniganjensis* described by Seward & Sahni (1920) is distinguishable by a very clear emarginate apex and an elliptical nucule. For these reasons the present seeds are referred to a new species.

(B) MEGASPORES

Fossil megaspores in the form of impressions or occasionally moulds are found in the ferruginous shale, more specially in the fine-grained and softer types. They occur as brownish impressions, sometimes in groups (PL. 1, FIG. 11) at several localities, but their great abundance near Beli (Locality 12) is specially noteworthy. From here over 250 megaspores have been counted on the shale surface which obviously should be a small fraction of their actual number present inside other layers of the rock. It is also interesting to note that at two spots near Beli (Locality 12 and Locality 13) the megaspores are associated with remains of *Lycopodites* described in an earlier paper. Maceration of the shales did not yield any results.

The mode of preservation of these megaspores is rather interesting and hitherto unknown. In certain cases delicate parts like spines have also been preserved which is less expected in case of a ferruginous

matrix. Sitholey (1943) has described silicified casts of megaspores from the Triassic Gondwana intercalations from the Punjab Salt Range. It is rather striking that what little we at present know about Indian Triassic megaspores is from casts, impressions and moulds.

The large number of known dispersed megaspores have commonly been recovered from maceration and consequently they possess a number of distinct characters which permit their classification into genera and species. However, with impressions or moulds, the study is bound to be much more limited. In fact, the megaspores in the present material do not show enough characters and could be assigned to *Triletes sensu* Pant & Srivastava (1961). However, the best course is to distinguish them into types, pending the piscovery of better preserved material.

TYPE 1

Pl. 1, Figs. 12-16

This type of megaspore is most common. It is commonly round to roundly triangular or occasionally oval in shape. The noted size range is about 420-800 μ or more. The trilete mark is distinct, straight, somewhat raised. The rays are uniform in their width (about 15-25 μ) and extend up to the full radius. Presence of arcuate ridges is sometimes faintly seen (Pl. 1, Fig. 14). The spore coat is unsculptured and apparently lavigate.

The megaspore shown in Fig. 16 is preserved as a mould which is indicated by the fact that both in the hand specimen and its counterpart the spore occurs as semi-spherical concavities. In the figure the outer margin of the cavity is in focus.

TYPE 2

Pl. 1, Fig. 17

Megaspores to be referred to this type are much less common. Four specimens are found in the collection from near Beli (Locality 12). The spores seem to have been originally round but owing to compression they may occur as roundly triangular or oval impressions also. The best specimen (Fig. 17) is roundly triangular, measuring 760 × 657 μ. The trilete is very distinct, the rays being about 30 μ wide and projecting about 40 μ beyond the diameter of the spore. The spore wall appears to be quite thick. Certain imprints of spiny projections are preserved at one place on the left-hand margin of the spore which suggests that the spore coat was originally covered with unbranched, straight, spiny processes. These processes are slightly broader at their base and are finely pointed. The longest process measures about 215 μ in length and 25 μ across near base. Other projections may be smaller and about 100-150 μ in length. A case of such preservation especially in a ferruginous matrix, is rather interesting.

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EXPLANATION OF PLATE 1

(All photographs are from untouched negatives. The specimens are preserved in the Birbal Sahni Institute of Palaeobotany.)

1. *Cordaicarpus chicheriensis* sp. nov. Holotype; Specimen No. 8850, B.S.I.P. Coll; Chicharia (Loc. 16). × 2.

2. *C. ovatus* sp. nov. Holotype; specimen No. 9074; B.S.I.P. collection; Salaia (Loc. 8). × 5.

3. ? *Cordaicarpus* sp. Specimen No. K25/566; Aiyengar coll. (1929); Chicharia (Loc. 16). × Nat. size.

4. Epidermal cells as seen under incident light on the surface of the seed in Fig. 3 × 100.

5. *Samaropsis* sp. cf. *S. srivastavai* Lele; Specimen No. 8941; B.S.I.P. coll., Near Beli (Loc. 13). × 3.

6. *Samaropsis menisca* sp. nov. Holotype; Specimen No. 9068; B.S.I.P. coll., Salaia (Loc. 8). × 5.

7. *S. menisca* sp. nov. Specimen No. 9068; B.S.I.P. coll; Salaia (Loc. 8); another specimen showing a prominent elliptical nucule pointed at both ends. × 5.

8. *Samaropsis surangei* sp. nov. Holotype; Specimen No. 9051; B.S.I.P. coll.; Salaia (Loc. 8). × 5.

9. *S. surangei* sp. nov. Paratype; Specimen No. 9059; B.S.I.P. coll.; Salaia (Loc. 8). The nucule is more obovate in shape. × 5.

10. *S. surangei* sp. nov. Specimen No. 9051; B.S.I.P. coll.; Salaia (Loc. 8); a smaller specimen. × 5.

11. A group of megaspores preserved as impressions. In some a trilete mark is visible. Specimen No. 9013; B.S.I.P. coll.; Near Beli (Loc. 12). × 16.

12. Megaspore, Type 1. Specimen No. K25/722; Aiyengar coll. (1929); Daigaon (Loc. 7); Roundly triangular spore with a distinct trilete mark and unsculptured surface. × 50.

13. Megaspore, Type 1. Specimen No. 8901; B.S.I.P. coll.; Near Beli (Loc. 14). × 50.

14. Megaspore, Type 1. Specimen No. 9016; B.S.I.P. coll.; Near Beli (Loc. 13); the two rays of the trilete mark are apparently connected by an arcuate ridge. × 50.

15. Megaspore, Type 1. Specimen No. 9016; B.S.I.P. coll.; Near Beli (Loc. 13). × 50.

16. Megaspore, Type 1. Specimen No. 8961; B.S.I.P. coll.; Near Beli (Loc. 13). Mould of the megaspore occurring as a hemispherical cavity. The outline is focussed. × 50.

17. Megaspore, Type 2. Specimen No. 9016; B.S.I.P. coll.; Near Beli (Loc. 12); the trilete mark is slightly projected beyond the margin of the spore. On the left-hand side the margin shows a few spiny processes. × 50.


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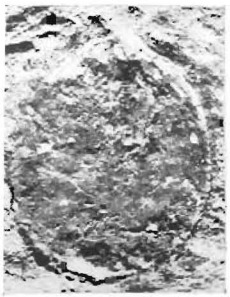
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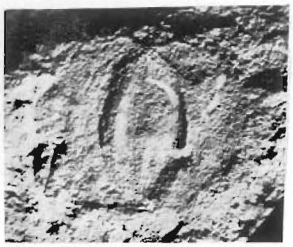
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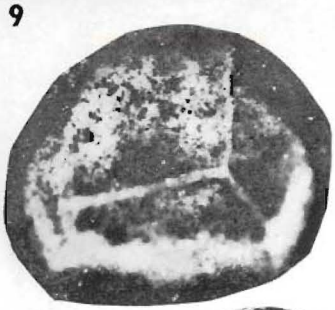
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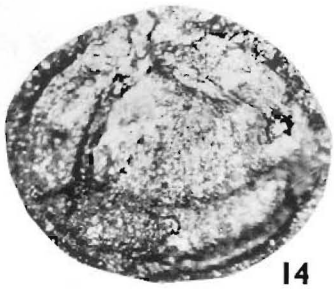
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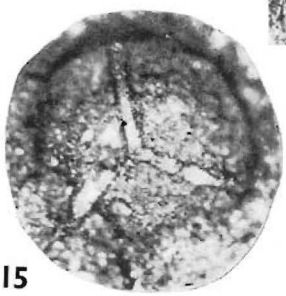
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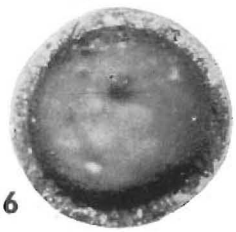
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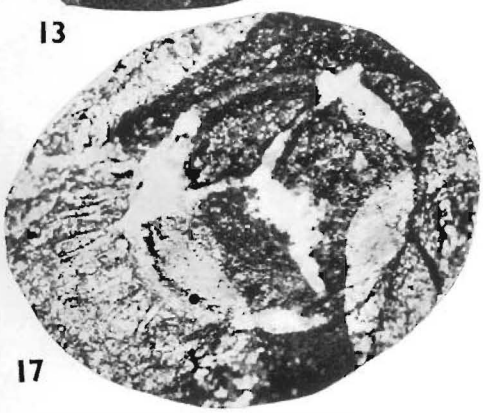
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