ON A FOSSIL SPECIES OF *DIPLODIA* FROM THE DECCAN INTERTRAPPEAN SERIES, M.P., INDIA

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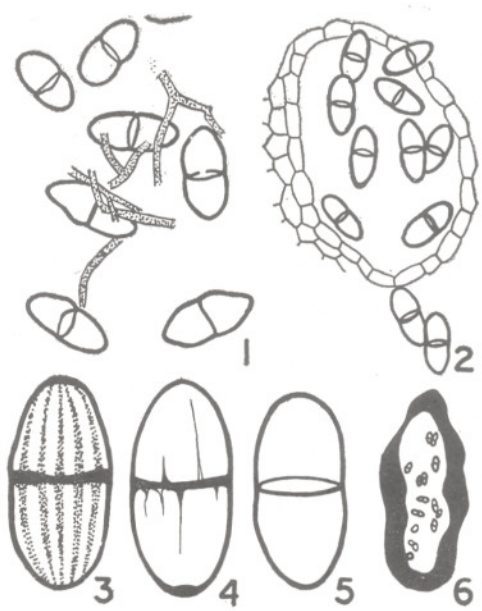
ABSTRACT

Some well preserved two-celled, purple spores of a fossil fungus were found in group in the decaying tissues of leaf and bits of other parts in an intertrappean chert collected at Mohgaon Kalan (Dist. Chhindwara, M.P., Horizon-Tertiary, Age — Eocene). They were 17·5-18 $\mu \times 7{\cdot}5$ μ and seemed to have come out from a pycnidium. They were borne terminally, singly, on septate mycelium. Comparing their characters, double nature, size and colour, so very well preserved in the chert, they seem to have belonged to the genus *Diplodia* and are named as *Diplodia rodei* n. sp. after Professor K. P. Rode of the University of Udaipur*.

A PIECE of chert from the Deccan Intertrappean Series, measuring $4.5 \times 3 \times 5$ cm., having olivaceous brown colour was collected at Mohgaon Kalan (Dist. Chhindwara, M.P.) at the classical locality of Dr. Rode. Externally it showed a few bits of leaves, mostly monocots, with parallel venation. A few fragments of wood were also embedded in the matrix. Externally the chert looked rather unpromising, but when it was cut to see the structure of the embedded leaves, it turned out to be interesting and showed a group of fungal spores which form the subject matter of this paper.

The tissues of leaves were all decayed but an assemblage of extraordinarily well preserved, dark purple-coloured spores of a fungus were seen in them in what looked a pycnidium (TEXT-FIGS. 2 & 6; PL. 1, FIG. 1). The fungal spores were enclosed in the matrix of a loose tissue unevenly thickened externally. Septate hyphae were seen here and there (TEXT-FIG. 1). But as the organ containing them was cut obliquely, its full structure could not be made out. Possibly it was a pycnidium. The spores themselves however, were exceedingly well preserved and nice looking. Each spore was purple, two-celled, oval and elongated, having a mean diameter of 17.8×7.50 μ (TEXT-FIGS. 1, 2 & 5; PL. 1, FIGS. 1, 2, & 6). Occasionally under high power one could see that each spore was borne terminally by a conidium which did not appear to have been much branched (TEXT-FIG. 1), a character of *Diplodia* not shared by *Botryodiplodia*. The outer spore wall was thick and also the mediam wall (PL. 1, FIGS. 2 & 6). The striations on the spore wall of *Diplodia* in living spores, e.g. of those



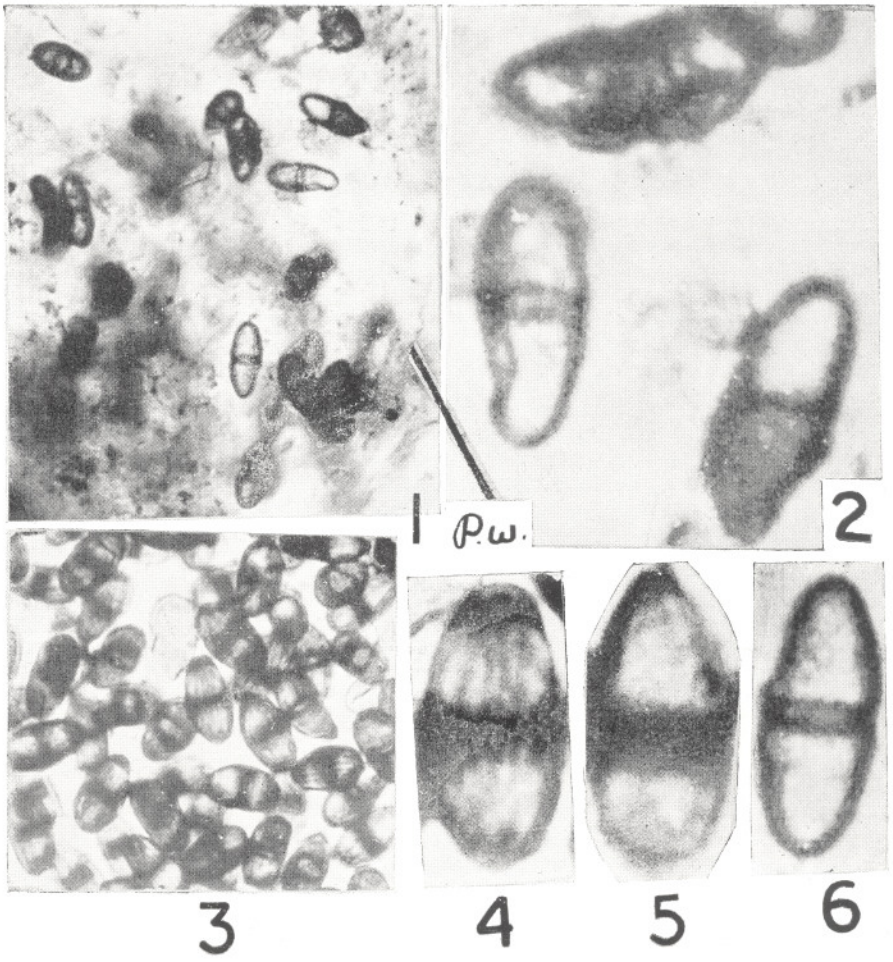
TEXT-FIGS. 1-6 — Fossil and living *Diplodia* spores. Fig. 1. Spores and hyphae in the fossil *Diplodia* embedded in chert × 1285. Fig. 2. An oblique section of the pycnidium with double spores typical of *Diplodia*; Note that some are outside pyncidium × 860. Fig. 3. A single spore of living *Diplodia* with striations in younger stages × 3210. Fig. 4. The same showing a spore with indistinct striations on spore wall × 3210. Fig. 5. A two-celled spore of fossil *Diplodia* without striations × 3210. Fig. 6. V.S. of pycnidium in chert rather oblique and compressed. Note the thick wall × 225.

*Another fungus somewhat similar was also obtained from a Leguminosaceous wood collected in the Siwaliks near Chandigarh. It also has similarly coloured spores but not diplodial. It possibly represents another fungus or the younger stage of *Diplodia*, as the young spores in living *Diplodia* are sometimes single. Hence it is not included in this paper.

that found on *Musa* leaf, are clear in some spores, but not in all spores (TEXT-FIG. 3; PL. 1, FIG. 4). The fossil spores here do not have striations (TEXT-FIG. 5; PL. 1, EIGS. 2 & 6). But this may not be a constant character in all spores in all living species. The spore-bearing organ was seen to be in association with the surrounding bits of leaves (PL. 1, FIG. 1-*p.w.*). From the characters of the spore of the fossil fungus and that of its conidium, it seemed to belong to the genus *Diplodia* or *Botryodiplodia* both of which have somewhat similar spores. For example, the spores of living genera *Botryodiplodia*, *Diplodia* and of the fossil fungus studied here are 10×5.5 μ, 19.5×11.00 μ and $17.5\text{-}18.00\times7.5$ μ respectively (TEXT-FIGS. 1, 3, 4, 5; PL. 1, FIGS. 2-6). In point of size the fossil fungus species, therefore, has larger spores than those of *Botryodiplodia* and seems to be nearer to the genus *Diplodia*, as its spores agree in size, shape and colour with those in the living *Diplodia*. Besides this, the living *Diplodia* species and this fossil fungus are epiphytic on leaves and are saprophytic. Both the genera *Botryodiplodia* and *Diplodia* have similar spores but the conidia are not branched in *Diplodia* as in the former. Both of them belong to the order Sphaeropsidales. Both are cosmopolitan and imperfect, and on this account, species of one genus have frequently been transferred to an other, as, in many *Fungi Imperfecti* all stages in the life cycle are not known. The living species occur on the leaves of a large number of wild and cultivated plants like Apple, *Acer*, Maize, *Musa*, palms such as *Phoenix* and *Cocos*, etc.

The genus *Diplodia* was created by Saccardo (1884) to embody such double-spored cosmopolitan species found all over the world, and named them by their host specialization. He had created about 650 species of *Diplodia* and about 87 of *Botryodiplodia*. Fries (1829) reduced them to 30 which have now been further reduced to 24 for *Diplodia* and 17 for *Botryodiplodia* by Ainsworth (1961). This is mainly because Saccardo's classification was largely based on the host plants. However, both being '*Imperfect fungi*', whenever, a perfect stage of a species or the other is obtained, they are again transferred to other genera, e.g. to some species of *Physalospora*, *Tryblidiella*, *Sphaeropsis*, etc. Naturally this creates a lot of confusion in taxonomy. But broadly speaking *Botryodiplodia* is found in large numbers on woody plants in the tropics, and *Diplodia* on woody as well as herbaceous plants such as *Zea*, *Crotolaria* etc. Shape of the pycnidium also in *Diplodia* and *Botryodiplodia* is different. It is oval-oblong in *Diplodia* and round in *Botryodiplodia*. I am not in a position to say exactly what shape the pycnidium of this fossil species had. But judging from the spores, their size and shape, branched and unbranched nature of the conidia and taking into consideration the uncertainity of taxonomic wall between the two genera, it would not be correct to refer it to the genus *Botryodiplodia* which has more definite characters than *Diplodia*. The genus *Diplodia*, on the other hand, is a large genus and more acceptable for such double spore forms. It is, therefore, referred to here to that genus, viz., *Diplodia*. To the best of my knowledge no such fossil member of this genus has been so far reported in the past from plants of the Deccan Intertrappean Series. However, it should be remembered that the presence of mycelia in plant fossils or a few definitely identifiable fungi with fructifications have been found in the fossil plants of the Deccan Intertrappean Series by Sahni and Rao (1943). They have described *Perisporiacites varians* and *Palaeosordaria lagena* in the cherts at Sausar, and Mrs. Chitaley (1950) has described 4-celled fungal spores comparable with those of a *Chaetosphaerites* sp. Another fungal genus *Shuklania dwivedii* is described by Dwivedi (1953), and a rust fungus by Lakhanpal, Dayal and Jain (1967).

The genus *Botryodiplodia* is represented in India by 17 living species and *Diplodia* by 24 occurring on monocots including palms such as *Cocos*, *Phoenix* or on *Musa*, *Typha* etc. It is not unlikely, therefore, that the present fossil species may be related to some of them. In the present day fungal flora of Bombay there are 10 species of *Diplodia* and one of *Botryodiplodia* on Mango. Judging from all the direct and circumstancial evidence, I am, inclinded to think that this ancient Tertiary species of *Diplodia* may have been growing on leaves of some marsh-loving monocot such as *Musa* or a palm and is new. I have great pleasure in naming it after Professor K. P. Rode of the Udaipur University, Udaipur. My best thanks are due to Dr H. Santapau, Director, Botanical Survey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P.w.
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of India for Latin rendering of the diagnosis of the species.

*Diplodia rodei**, n. sp.

Diagnosis — Well preserved two-celled, oval-oblong spores, 17.5-18 × 7.5 μ, smooth, thick-walled, purple, placed in a thick-walled pycnidium embedded in decaying tissues, preserved in a small Intertrappean chert of olivaceous brown colour. The mycelium septate, conidium terminal and unbranched.

Holotype — Specimen No. Mk 1/65, Slide No. MK 1/65(1) deposited in the Botany Department, Poona University, Poona, India.

Locality — Mohgaon Kalan (Dist. Chhindawara M.P.).

Horizon — Tertiary.

Age — Eocene.

Leg. T. S. Mahabalé, 19-10-65.

The species has been named after Professor K. P. Rode of the University of Udaipur, whose discovery of this classical Tertiary locality of India at Mohgaon Kalan (M.P.) has added materially to our knowledge of the flora of the Deccan Intertrappean Series.

Latin diagnosis:

Diplodia rodei spec. nov.

Sporae bene servatae, bicellulares, ovato-oblongae, purpureae, 17.5-18 × 7.5 μ crassis parietibus, locatae in pycnidio crasso immerso in foliorum textus plantae monocotyledoneae, inventae in fragmento Intertrapeano olivaceo-brunneo.

Typus positus in sectione botanica universitatis Poonensis, in India.

Locus Mohgaon Kalan, dist. Chindwara, M.P. India in horizonte tertiario, aetate eocea. Leg. T. S. Mahabalé, 19-10-65.

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EXPLANAAION OF PLATES

Plate 1

1. T.S. of a chert showing spores enclosed in a pycnidium (*p.w.* pycnidium wall) × 10.
2. Spores magnified to show two-celled nature × 35.
3. Living *Diplodia* spores scrapped off from *Musa* leaf × 12.
4. A single spore of living *Diplodia* showing presence of striations × 40.
5. The same without striations × 40.
6. A single spore of fossil *Diplodia* showing two-celled nature and smooth wall × 35.