

# SIDHIPHYLLITES: A NEW GINKGOPHYTIC LEAF GENUS FROM THE TRIASSIC OF NIDPUR, INDIA

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## ABSTRACT

Ginkgophytic leaves with carbonified crust, collected from Nidpur, have been designated as *Sidhiphyllites flabellatus* gen. et sp. nov. Though the cuticle lacks the constant cuticular characters of a ginkgoalean leaf, yet, morphographically the leaves conform to the genus *Ginkgoites* Seward.

*Key-words* — Ginkgophytic leaf, *Sidhiphyllites*, Nidpur, Triassic (India).

## सारांश

भारत में निदपुर के त्रिस्थी युग से एक नवीन गिन्कगोफ़ाइटी पत्ती : सिधीफिल्लाइटिस - श्याम चन्द्र श्रीवास्तव

निदपुर से एकत्रित गिन्कगोफ़ाइटी पत्तियों को सिधीफिल्लाइटिस फ्लेबेलैटस नव वंश व नव जाति से नामांकित किया गया है। ये पत्तियाँ कार्बनी पपड़ी से युक्त हैं। हालाँकि गिन्कगोली पत्ती की उपचर्म में स्थायी उपचर्मी लक्षणों का अभाव है, तथापि बाह्य-आकारिकीय दृष्टि से ये पत्तियाँ गिन्कगोइटिस सिवर्ड वंश के अनुरूप हैं।

## INTRODUCTION

ALL the hitherto reported remains of ginkgoalean leaves from India are impressions. The leaves described here are the first record of compressions where the epidermal structure is preserved. Ginkgophytes were not known from the Indian Triassic until Lele (1961) who reported *Baiera indica* from the Triassic of Parsora region in South Rewa Gondwana Basin. Lele (1961) also referred some isolated segments of a frond to ginkgophytes but their fragmentary nature makes identification extremely difficult. Quite recently, Maheshwari and Banerji (1978) described a ginkgoalean leaf impression, *Ginkgoites goiraensis*, from the Triassic sediments of Kamtadand in Parsora region.

The generic name *Ginkgoites* has here been used again in view of Harris' (1976) observation that fossil *Ginkgo* or *Ginkgoites* are similar looking leaves of considerably different plants. Maheshwari and Banerji (1978) had also followed the same procedure but in 1979, Zeba-Bano, Maheshwari and Bose referring to Harris (1974) readopted the name *Ginkgo* for their forms. However, in the present paper the generic name *Ginkgoites* is revived.

Four leaf fossils revealing ginkgoalean affiliations are being described which have been collected from the Triassic sediments of Nidpur where remains of *Dicroidium* predominate and other fossils include remains of Bryophytes, Glossopteridales, Pteridosperms, Cycadales, Coniferales associated with characteristic unclassified leaves, scale-leaves, seeds and fructifications. These leaves are rather quite rare. In external form, the leaves conform to the genus *Ginkgoites* instituted by Seward (1919) but the cuticle lacks not only the remarkably constant epidermal features found in Ginkgoales but also of Czekanowskiales.

Hence, keeping in view the significance of epidermal characters which constitute the best and only safe criterion for generic assignment, the leaves are with good reason being described as *Sidhiphyllites* gen. nov.

*Genus* — *Sidhiphyllites* gen. nov.

*Sidhiphyllites* gen. nov.

*Diagnosis* — Leaf fan-shaped, lamina segmented, incision deep throughout, almost reaching to base, segments lanceolate, base slightly contracted, apex obtuse, margin

entire. Veins bifurcating near base, fine, extending upwards, dichotomising repeatedly at acute angles, closely set, parallel to sub-parallel.

Lower surface slightly thicker, consisting of stomatiferous and non-stomatiferous zones, cells along the nonstomatiferous zones over the veins rectangular, serially arranged, interveinal zones wider than veinal zones, cells of interveinal bands polygonal, anticlinal walls straight or almost straight with undulations, periclinal walls generally smooth or thickened more often finely marked by ridges; stomata irregularly distributed, sparse, variably orientated, stomatal pit narrowly elongated or sometimes rhomboidal or more or less rounded,

subsidiary cells scarcely different from adjoining cells, at places diffused with ordinary epidermal cells, 4-6 in number, inner margin of subsidiary cells thinly cutinized, guard-cells feebly thickened, aperture slit-like.

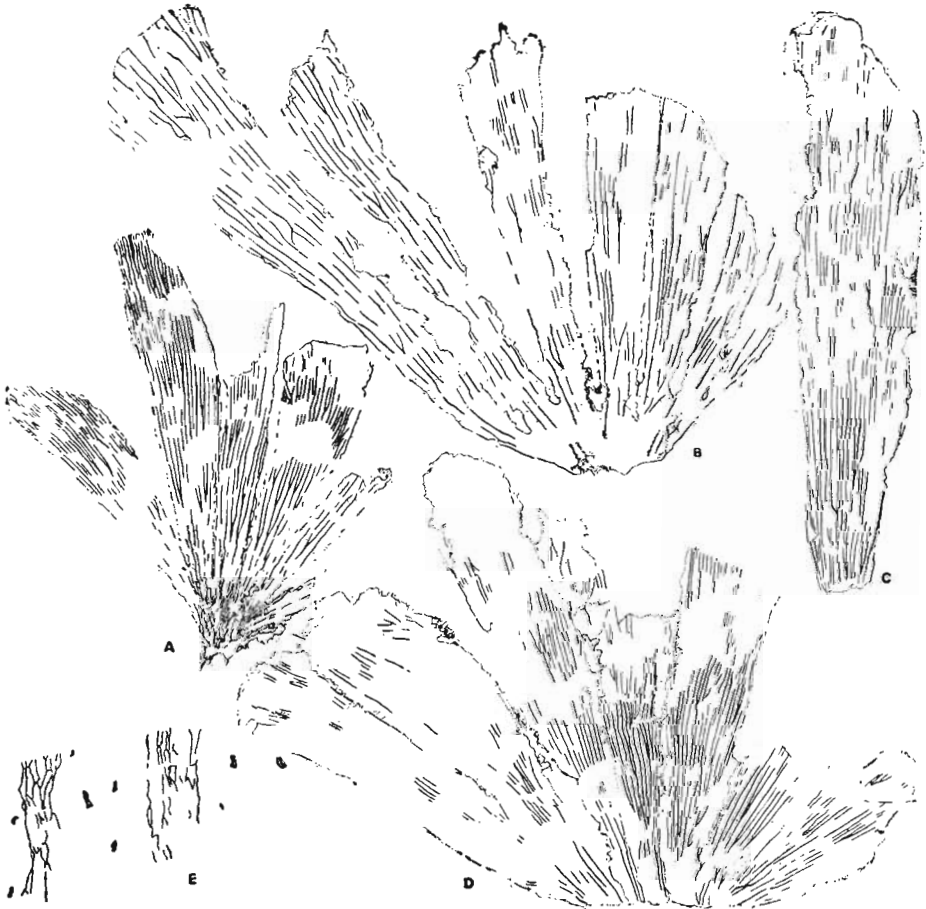
*Type Species* — *Sidhiphyllites flabellatus* sp. nov.

*Sidhiphyllites flabellatus* sp. nov.

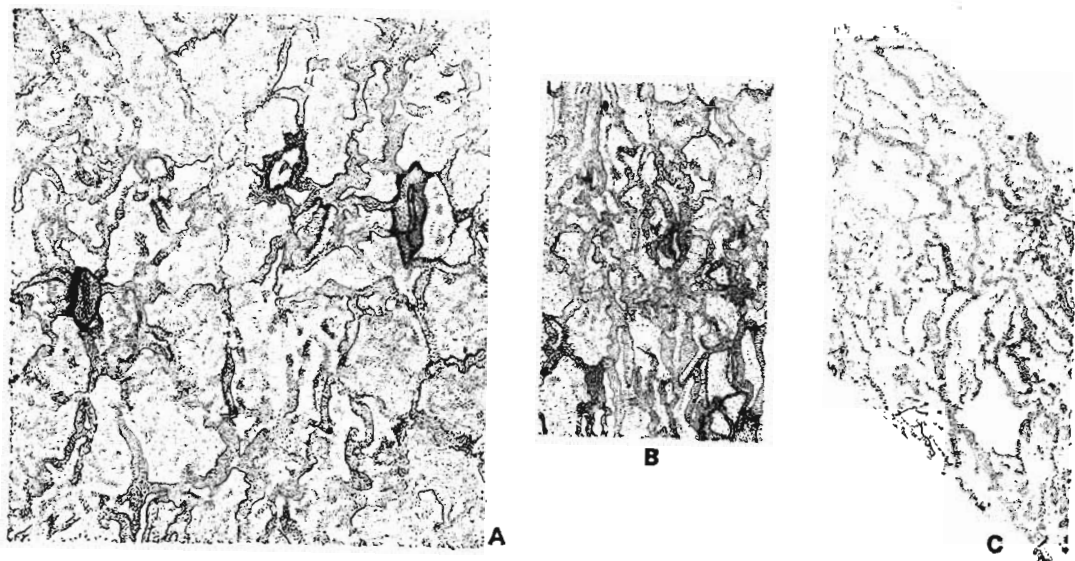
Pl. 1, figs 1-8; Text-figs 1A-E, 2A-C

1971 *Noeggerathiosis* sp. Srivastava, p. 291, pl. 6, figs 6, 7; text-fig. 7A-B.

*Diagnosis* — Leaf fan-shaped, incompletely known, 3-5 cm long, petiole and



TEXT-FIG. 1 — *Sidhiphyllites flabellatus* gen. et sp. nov. A-D, showing venation; A, holotype no. 35444,  $\times 3$ ; B, specimen no. 35445,  $\times 5$ ; C, B.S.I.P. no. 33974,  $\times 2$ ; D, specimen no. 35446,  $\times 2$ ; E, slide no. 35444/6534, showing distribution of stomata; stomatiferous and non-stomatiferous zones; non-stomatiferous zones over the veins,  $\times 250$ .



TEXT-FIG. 2 — A, showing a few stomata, slide no. 35444/6534,  $\times 500$ ; B, showing a stoma, slide no. 35444/6535,  $\times 500$ ; C, showing epidermal cells from thinner side, slide no. 35444/6534,  $\times 500$ .

apex broken, slightly wider, lamina segmented, incision equally deep throughout, almost reaching to base, segments 6 or more, symmetrically arranged, lanceolate; base slightly contracted or more or less tapering 2-3 mm in width; apex mostly imperfect, in a detached segment somewhat rounded or obtuse, margin entire. Veins fine, conspicuous, bifurcating near the base, in upper half fairly close, concentration near middle 12-16 per cm.

Cuticle about  $1 \mu\text{m}$  thick, hypostomatic. Upper surface thin, veins not marked, cell outlines occasionally distinct, usually with faint undulations or sometimes inconspicuous, cells rectangular or slightly elongated, anticlinal walls more or less straight with exceedingly fine sinuosities, periclinal walls unsculptured.

Lower surface relatively thick, stomatiferous zones alternating with non-stomatiferous zones, cells along the course of veins elongate-rectangular, serially arranged; zones between veins about 2-3 times as wide as zones along veins, cells between veins polygonal, occasionally isodiametric, anticlinal walls straight or almost straight with undulations, cell outlines often ill-marked sometimes wall sinuosity obscured by thickenings, periclinal walls smooth

or showing variously-shaped thickenings, often marked by fine ridges, at places cells partly thickened; stomata irregularly distributed, well-spaced, variably orientated, stomatal pit narrow-elongate, subsidiary cells scarcely different from adjoining cells, 4-6 in number, inner margin of subsidiary cells feebly thickened; guard-cells thinly cutinized, aperture slit-like.

*Holotype* — No. 35444 of the Birbal Sahni Institute of Palaeobotany, Lucknow.

*Locality* — Gopad River near Nidpur, Sidhi District, Madhya Pradesh, India.

*Age* — Triassic.

*Comparison & Discussion* — The presence of ginkgoalean forms in the fossil flora of Nidpur is not striking because leaves like those of *Ginkgo biloba* occurred as far back as the Triassic. The genus *Ginkgo* is, however, recognized with certainty first only in the Jurassic rocks, a time when the family Ginkgoaceae is believed to have reached its widest geographic distribution in numbers and diversity. In India, too, although the record is far from complete, the genus attained its prominence during the Jurassic period.

*Sidhiphyllites flabellatus* has been recognized in its essential architecture with other Mesozoic ginkgoalean leaves because these

are built upon a similar plan of repeated dichotomies, segmented lamina and divergent veins. But the cuticle of *S. flabellatus* lacks the constantly occurring ginkgoalean character, i.e. prominent papillae or cutinized lappets overhanging or overarching the sunken guard-cells or that appearing as a slightly raised rim. However, since the cuticular characters have proven to be more stable indicators of affinity, especially in the case of polymorphic leaves as frequent among ginkgophytes, here too, much stress has been placed on its distinctive epidermal feature.

In Krassilov's (1970) classification, *S. flabellatus* tends towards the morphological group (*Ginkgoites* & *Baiera*) which consists of fan-shaped and lobed lamina, bearing stomata only on one surface. This identity of *S. flabellatus* with the above mentioned grouping is strengthened further through close match in consistently divided lamina. However, some species like *Ginkgoites sibirica* Heer (1876), *Ginkgoites hermilinii* Harris (1935), *Ginkgoites tigrensis* Archangelsky (1965) and *Ginkgoites cascadenis* Brown (1975) are comparable to *S. flabellatus* in the incisions of lamina reaching almost or quite up to the base.

Apart from these aforesaid morphographic similarities, the two genera, *Sidhiphyllites* and *Ginkgoites*, demonstrate fundamental differences in cuticular structure. The subsidiary cells around the guard cells in the cuticles of *Ginkgoites* species show a varying degree of development of papillae projecting over the stomatal pits, a feature absent in the new genus *Sidhiphyllites*. However, *S. flabellatus* in its epidermal structure approaches closely *Baierophyllites florinii* described by Jain and Delevoryas (1967) from the Middle Triassic of Argentina in the smooth nature of epidermal and subsidiary cells and lacking the cutinized lappets overarching guard-cells. But in ex-

ternal morphology, *B. florinii* differs from *S. flabellatus* having linear leaves without distinction into petiole and lamina.

Of the Indian species of Ginkgoales, *G. goiraensis* Maheshwari & Banerji (1978) differs from *S. flabellatus* in having asymmetrically incised lamina along with sparse veins; *Ginkgoites lobata* (Feistmantel) Seward & Sahni (1920) in its wedge-shaped lamina; *Ginkgoites crassipes* Feistmantel (1879) in possessing undivided lamina; *Ginkgoites feistmantelii* Bose & Dev (1959) in bearing more or less reniform lamina and *Ginkgoites rajmahalensis* Sah & Jain (1965) (= *Ginkgo rajmahalensis* of Zeba Bano, Maheshwari & Bose, 1979) in having linear, club-shaped asymmetrically placed segments with veins converging towards apex.

Of the above mentioned *Ginkgoites* species only *G. feistmantelii* and *G. rajmahalensis* have yielded cuticles but their structural details are not adequately known because of imperfect preservation and hence no comparison could be made with *S. flabellatus*.

*Affinity*—The evidences at hand amply support the assignment of *S. flabellatus* to a new genus. Further, its morphographic data constitutes a convincing argument to settle its relationship to Ginkgoales with equal certainty. However, differences in epidermal structure of *Sidhiphyllites flabellatus* with those of other Ginkgoalean forms seem significant enough to preclude its identification with existing forms of Ginkgoaceae.

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### EXPLANATION OF PLATES

#### *Sidhiphyllites flabellatus* gen. et sp. nov.

1. Segmented leaf, showing symmetrically dissected lamina. Holotype no. 35444. × 1.
2. Holotype enlarged, showing repeatedly dichotomising veins. Specimen no. 35444. × 2.
3. Specimen BSIP no. 35445. × 1.
4. Specimen figured in no. 3 enlarged, showing venation. Specimen no. 35445. × 3.
5. Specimen no. 35446. × 1.
6. Cuticle of thicker side showing a few stomata. Slide no. 35444/6534. × 500.
7. A stoma. Slide no. 35444/6535. × 500.
8. Epidermal cells of thicker side showing unusually thickened anticlinal-walls. Slide no. 35444/6536. × 500.

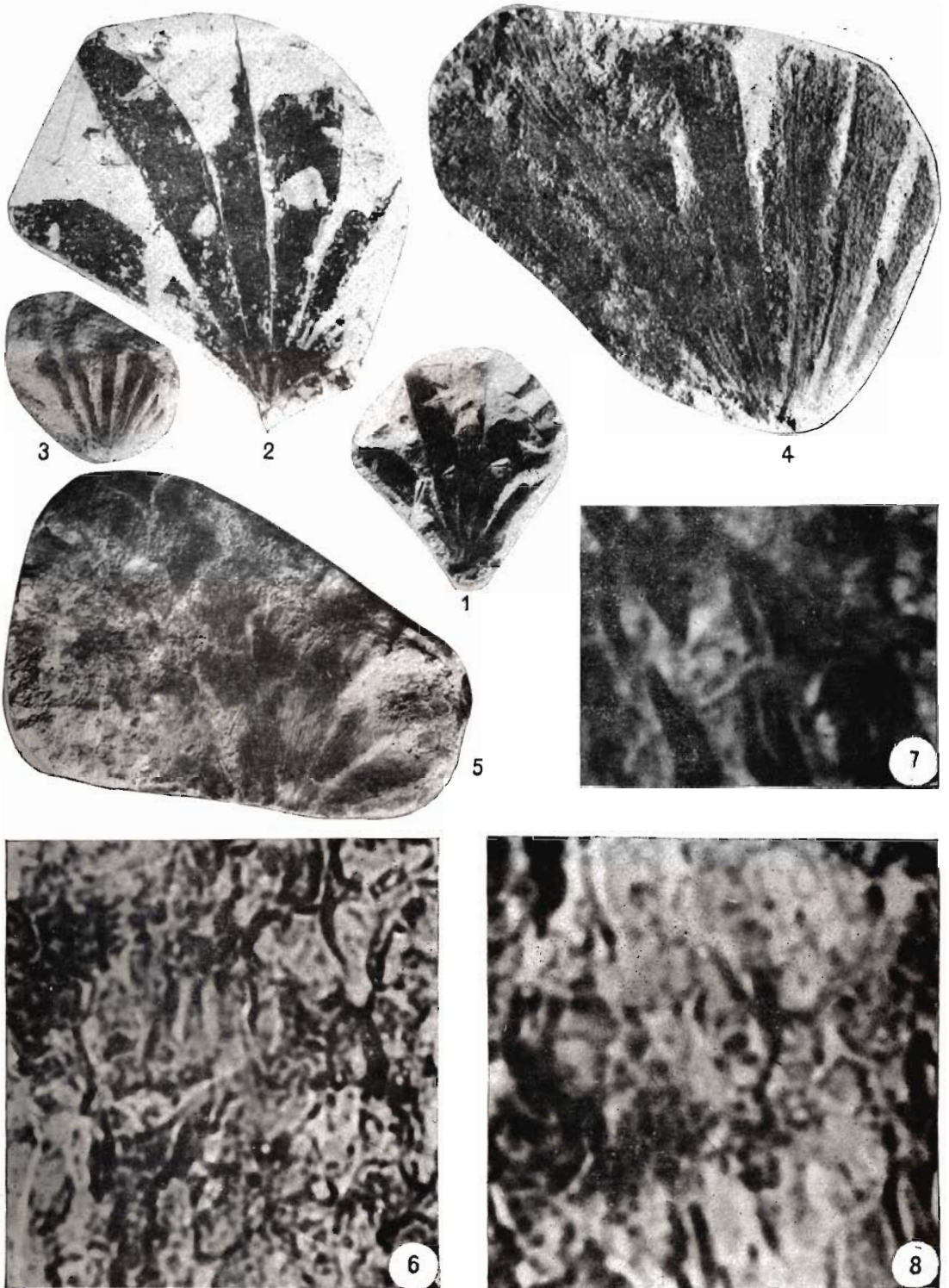


PLATE 1