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Detached scale-leaves from the Triassic of Nidpur, Madhya Pradesh, India

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Abstract
The review article describes diversity in structurally preserved, detached scale-leaves *Glottolepis* (Bose & Srivastava, 1970) and *Equitatilepis* (Pant and Basu, 1977) reported from the same Triassic beds of Nidpur, Madhya Pradesh, India. *Glottolepis* have five species: *G. rugosa*, *G. glabrosa*, *G. tuberculata*, *G. ovata* and *G. sidhiensis* (Bose & Srivastava, 1970; Srivastava, 1977) while *Equitatilepis* has only one species *E. elongatus*.

Keywords: gymnosperm, papillate, scale-leaf, triassic

Introduction
The Nidpur Triassic beds discovered by Satsangi (1964) have yielded a rich haul of fossiliferous plant material assignable to different groups including algae, bryophytes, pteridophytes and gymnosperms. Variety of microsporangiate organs including *Pteruchus* (Thomas, 1933) [25], *Nidistrobus* (Bose & Srivastava, 1973a; Bhowmik & Parveen, 2009) [9, 3], *Nidianthus* (Bhowmik & Parveen, 2008) [2] *Nidpuria* (Pant & Basu, 1979b; Parveen & Bhowmik, 2016) [18] and *Lelestrobus* (Srivastava, 1984). The Nidpur shale is also littered with leaves of *Dicroidium* (Gothan, 1912), *Lepidopteris* (Townrow, 1960), *Glandulataenia* (Pant, 1990), occasionally *Glossopteris* (Brongniart, 1828). Besides macrofossils, the beds have also yielded a diverse collection of well-preserved mesofossils comprising seeds, synangia, and megaspores (Pant and Basu, 1973, 1977, 1979 a & b; Bhowmik & Parveen, 2008, 2009, 2012, 2014; Bhowmik & Das, 2011; Bose & Srivastava, 1973; Manik, 1987; Srivastava & Manik, 1990, 1993, 1996) [9, 1, 2, 3, 4, 5, 6, 7, 8, 18].

The Nidpur beds occur in the Gopad River section in the western part of Singrauli Coalfield, Sidhi District, Madhya Pradesh, India and are assigned Middle Triassic (245–235 Ma) age. The fossil locality is about two and a half kms north–west of Nidpur village, on the left bank.

Description
Genus: *Glottolepis* Bose and Srivastava, 1970 [7]
Type species: ***Glottolepis rugosa*** Bose and Srivastava
Genus is characterized by thick veins which are anastomosing variously and forming irregular meshes of varying size and shape all over the surface. Meshes are long and broad at the emergence but gradually shorter towards the margin. Sometimes meshes are squarish or rectangular. Veins are slightly at an angle in apical region forming oblique polygonal meshes, thereafter arching and frequently dichotomizing to form elongated polygonal meshes up to the margin. Stomata are longitudinally orientated and distributed all over the lower surface mostly concentrated at base and apex. Stomata are rare along the margin. *Glottolepis* compared to glossopterid type but it is distinct in having irregular meshes.

Glottolepis glabrosa Srivastava, 1977
Scale-leaf ovoid in shape, margin entire, apex more or less emarginated, surface glabrous and size measured 3.2 × 2.5 cm and venation consisting of short polygonal meshes at base running at right angle up to the margin. It is hypostomatic, stomata sparsely distributed with irregular orientation, subsidiary cells 5 or 6, dicyclic, specialized, surface wall striped or thickened.
It is comparable to *G. rugosa* in shape and smooth texture of lamina. In venation *G. glabrosa* shape of the meshes are defined whereas in *G. rugosa* irregular in appearance.

Glottolepis tuberculata Srivastava, 1977
scale-leaf is tongue shaped, base truncate, both ends are notched, apex obtuse or rounded, tubercles present on the surface, margin entire or wavy and size measured 3.5 × 1.9 cm. venation is obscure. Cuticle is hypostomatic and varied shaped papillae are present on the surface. Stomata distantly distributed and longitudinally orientated, subsidiary cells 5-7, surface wall thickly mottled or with a definite solid papillae.
Glottolepis tuberculata comparable to all the species in having tuberculate surface and notched basal ends.

Glottolepis sidhiensis Srivastava, 1977
This species is tongue shaped, apex obtuse, margin entire, surface uneven and size measured 2.0 × 1.7 cm. Stomata present on lower surface, longitudinally orientated, subsidiary cells 5 or 6, mostly smooth, anticlinal walls papillate. *Glottolepis sidhiensis* differs from all the species in having papillae on its anticlinal walls.

Glottolepis ovata Srivastava, 1977
Scale-leaf is broadly ovate in shape, terminal part is rounded, margin entire and size measured 5.5 × 3.2 cm. Surface is rough bearing minute longitudinal wrinkling which arising

from basal portion and running irregularly in upward direction. Lower surface is thick comparable to upper surface, cells rectangular or elongated polygonal, anticlinal walls beaded or knotted from median region to apex. Cuticle is hypostomatic, stomata distantly distributed and longitudinally orientated, subsidiary cells 5-8, surface wall transversely or longitudinally striated, sometimes strong cutinized, stomatal pit dumble shaped or rhomboidal.

This species differs from all the species in its broadly-ovate shape. It shows similarity with *G. rugosa*, *G. glabrosa* and *G. sidhiensis* in having smooth surface. It is also differ from *G. rugosa*, *G. sidhiensis* and *G. tuberculata* in absence of transverse wrinkling and tubercles on the surface.

Genus: *Equitatilepis* Pant and Basu, 1977

Equitatilepis elongatus

Detached acicular scale-leaf showing a broad base and tapering equitant lamina. Apex acute, margin smooth and scarious, size measured 3.0 - 4.0 mm × 1.0 - 1.5 mm. veins obscure but convex surface showing fine longitudinal striations in incident light. Cuticle is tough, granulose and non-stomatiferous.

It was comparable to tongue shaped scale-leaf *Glottolepis rugosa* (Bose & Srivastava, 1970) [7] but the shape and surface details are different.

Equitatilepis are reported closely associated with the seeds of *Rugaspermum* and may be both are belongs to the same plant.

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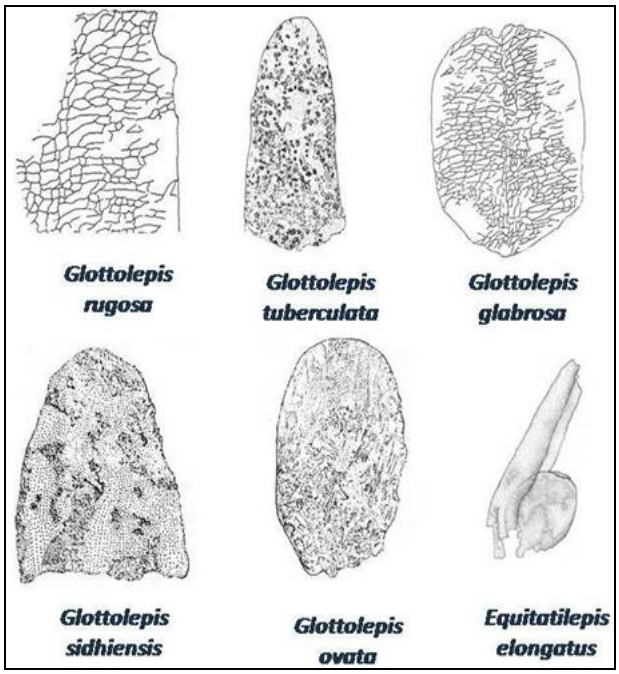

Fig 1: Showing morphological features of all the species of *Glottolepis* (Bose & Srivastava, 1970; Srivastava, 1977) [7] and *Equitatilepis* (Pant & Basu, 1977) scale-leaves.

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