National Journal of Multidisciplinary Research and Development
ISSN: 2455-9040
Impact Factor: RJIF 5.22
www.nationaljournals.com
Volume 2; Issue 3; September 2017; Page No. 190-192

Detached synangiate pollen organs from the Triassic of Nidpur, Madhya Pradesh, India

Shabnam Parveen
Department of Botany, University of Allahabad, Allahabad, Uttar Pradesh, India

Abstract
The review article describes diversity in structurally preserved, detached synangiate pollen organs *Chakrea* (Srivastava, 1974), *Rugatheca* (Pant & Basu, 1977) and *Nidianthus* (Bhowmik & Parveen, 2008) from the same Triassic beds of Nidpur, Madhya Pradesh, India. In *Rugatheca*, *Rugapites* (Pant & Basu, 1977) pollen grain is found inside the pollen sac which are striate and unwinged while *Chakrea* and *Nidianthus* have bisaccate pollen grains.

Keywords: gymnosperm, *In situ* pollen grains, papillate, pollen organ, triassic

Introduction
The Nidpur Triassic beds discovered by Satsangi (1964) [28] have yielded a rich haul of fossiliferous plant material assignable to different groups including algae, bryophytes, pteridophytes and gymnosperms. Variety of microsporangiate organs are found including *Pteruchus* (Thomas, 1933) [33], *Nidistrobus* (Bose & Srivastava, 1973a; Bhowmik & Parveen, 2009) [5, 10], *Nidianthus* (Bhowmik & Parveen, 2008) [4] *Nidpuria* (Pant & Basu, 1979b; Parveen & Bhowmik, 2016) [27, 25] and *Lelestrobus* (Srivastava, 1984) [29]. The Nidpur shale is also littered with leaves of *Dicroidium* (Gothan, 1912) [14], *Lepidopteris* (Townrow, 1960) [34], *Glandulataenia* (Pant, 1990) [21], occasionally *Glossopteris* (Brongniart, 1828) [11]. 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; Bhowmik *et al.*, 2014; Bose & Srivastava, 1973; Manik, 1987; Srivastava & Manik, 1990, 1993, 1996) [23, 30, 8].
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
Chakrea Srivastava (1974)
Chakrea papillosa, has been described as a wheel-shaped plant organ by Srivastava in 1974 from the same Triassic bed. The pollen organ measured about 2.9 cm in diameter and bears radiating ribs from centre to periphery. Ribs enclosing elongated, conical or triangular areas apparently similar to the cavities demarcated by ribs left after pollen sac disintegration. Cuticles are tough, cells papillate, amphistomatic, stomata surrounded by 5-7 subsidiary cells, sunken guard cells. Srivastava (1974) had compared *Chakrea*, externally to an equisetalean leaf sheath but to *Dicroidium papillosum* (Bose & Srivastava, 1971) in cuticular features.

Rugatheca Pant & Basu (1977) [23]
Rugatheca nidpurensis described by Pant & Basu in 1977 [23] as a unstalked, detached compressed synangia. Pollen sacs in synangia placed parallel to each other and ultimately separating from each other and dehisces by longitudinal slit. After maceration two cuticles yielded outer tough, non-stomatiferous and Inner cuticle enclosing masses of *Rugapites* pollen grain.
They compared *Rugatheca* with *Polytheca elongata (*Pant & Nautiyal, 1960) [26] in the parallel arrangement of pollen sacs but both are differs in having different types of pollen grains. They also compared with *Caytonanthus* (Harris, 1941) [15] both shows cutinized unicellular hairs near the apex but *Caytonanthus* have bisaccate grain whereas *Rugatheca* have unwinged *Rugapites* grain. They also compared *Rugatheca* with *Bosea indica* (Srivastava) from the same bed, *Masculostrobus rishra* (Barnard, 1968) [2] and *Masculostrobus clathratus* (Ash, 1972) [1] from Chinle Formation of Arizona but their sporangia and pollen grains are different.

Nidianthus Bhowmik & Parveen (2008) [23]
Nidianthus indicus is a synangiate pollen organ described by Bhowmik & Parveen from the Triassic bed of Nidpur. The compressed synangia is cylindrical to elongate, radially symmetrical, basally attached to short axis or ultimate branchlet and composed of 4 pollen sacs. Pollen sacs fused at base but appearing attached or free in the middle and apical regions. Individual pollen sacs of synangia with prominent attenuated tips and broadly tapering bases. Surface of pollen sacs are longitudinally striated, sacs separating from one another longitudinally along axis of synangium and dehiscing inwards but remaining attached basally. Pollen sac wall cutinized and single layered. Cuticle was delicate consisting of elongated, rectangular to polygonal thin-walled cells. Some cells of pollen sac wall medianly papillate or bearing unicellular hairs near apex. Pollen forming a single pollen mass in each pollen sac. Pollen-grains are bisaccate.
They compare *Nidianthus* with pollen organ *Caytonanthus C. oncodes* Harris (1941, 1951) [15] *C. tyrmensis* Krassilov (1977)

members of Caytoniales. The Order showed widespread distribution in northern hemisphere, from Upper Triassic to Middle Cretaceous Ages.

Nidianthus also compared with *Idanothekion* (Millay & Eggert, 1970) reported from Middle Pennsylvanian of Illinois and *Kachchhia* Bose & Banerji (1984) from Bhuj Formation of Kachchh, Gujarat. *Kachchhia* bore bilocular sporangium having two elliptic masses of spores within while the synangium of *Nidianthus*, bore four pollen sacs and within each pollen sacs was a single mass of two-winged pollen-grains.

They also compared with *Permotheca* from the Late Permian (Tatarian) of Kullarovo Cisuralin Russia. *Permotheca* resembled *Nidianthus*, in being semisynangiate and in having sporangia of about the same size, but differed from it in a number of features like., *Nidianthus*, is based on dispersed, cylindrical to elongated synangia where pollen sacs appeared closely adherent for almost their entire length while being fused only at base whereas in *Permotheca*, pollen sacs were arranged in a wide arc from base of sacs. Inside the pollen sacs of *Nidianthus* single masses of only two-winged pollen-grains, while in case of *Permotheca* both monosaccate-bilobed and bisaccate conditions are met within a single sporangium (Krassilov, *et al.* 1999). *Nidianthus* may also be compared with another pollen organ, *Perezlaria oaxacensis* described by Delevoryas and Gould (1971) from Middle Jurassic of Oaxaca, Mexico.

According to Bhowmik & Parveen (2008), the report of *Caytonanthus* - like *Nidianthus*, from the Indian Triassic and its association with *Glossopteris* foliage, together with reported occurence of *Caytonia* "fruits" and *Sagenopteris* leaves from fossil flora of Kachchh (Bose and Banerji, 1984), not only indicated the occurrence of *Caytonia* -like plants in the southern hemisphere as well as northern hemisphere but also lent support to the speculation of *Caytonia*, having evolved from the Permian glossopterids of the old southern continent Gondwana (Crane *et al.*, 2004).

Acknowledgments

The authors are thankful to the members of Palaeobotanty lab, Botany Department, University of Allahabad, for help in the collection of fossil material. The author is grateful to her esteemed Supervisor Dr. Nupur Bhowmik for providing guidance and encouragement.

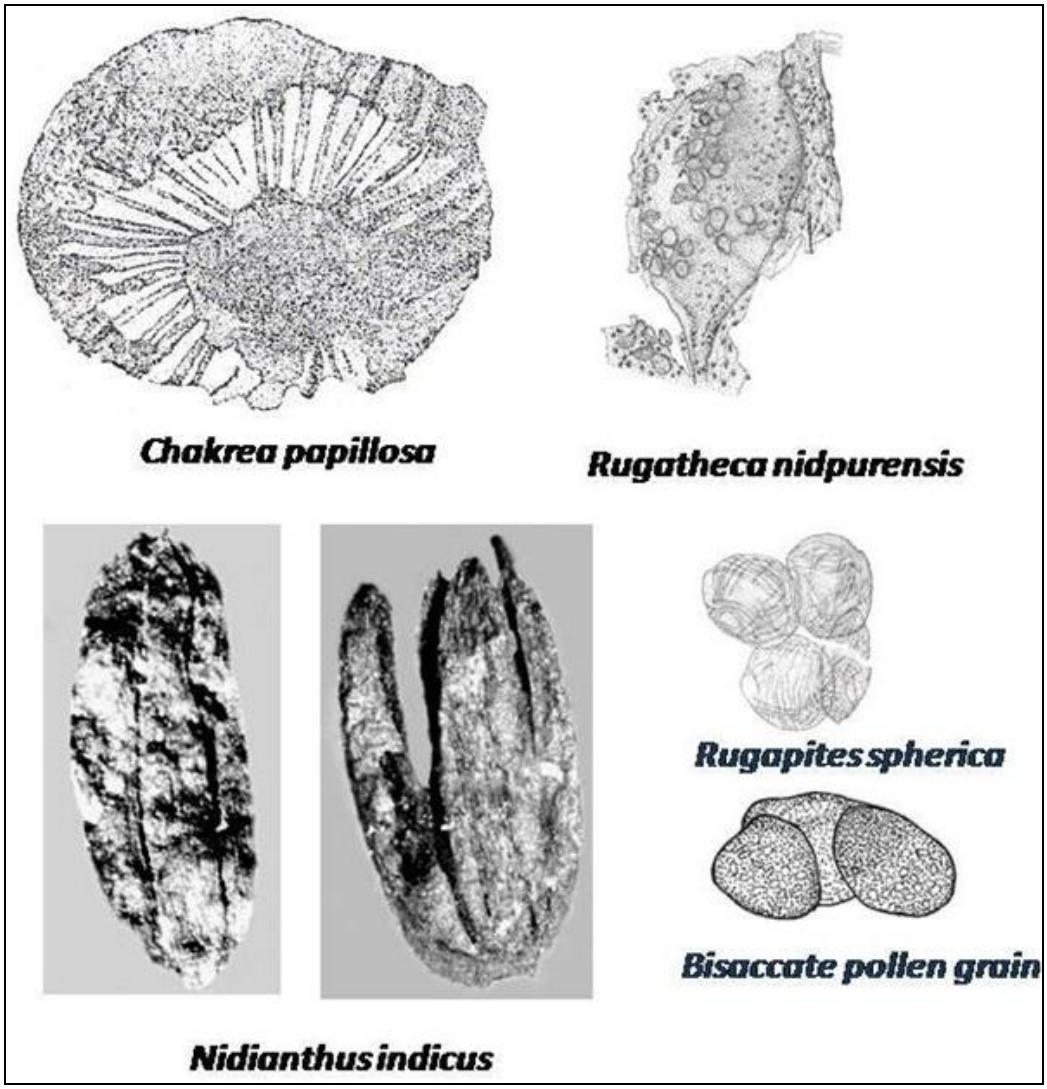

Fig 1: Showing diversity in structurally preserved synangiate pollen organs and pollen grains from the same Nidpur beds.

References

1. Ash SR. Late Triassic plants from the Chinle formation in north-eastern Arizona. Palaeontology. 1972; 15(4):598-618.
2. Barnard PDW. A new species of *Masculostrobus* Seward producing *Classopollis* pollen from the Jurassic of Iran. Journal of Linnean Society of Botany, 1968; 61:167-176.
3. Bhowmik N, Das N. Further report on megaspores from the Triassic of Nidpur, Madhya Pradesh, India. Acta Palaeobotanica. 2011; 51(2):107-125.
4. Bhowmik N, Parveen S. *Nidianthus* gen. nov. - A *Caytonanthus* - like Pollen organ from the Triassic of Nidpur, MP, India Palaeobotanist. 2008; 57(3):389-398.
5. Bhowmik N, Parveen S. *Nidistrobus indicus* - a new species of the male cone from Triassic of Nidpur MP, India. Proceedings of the National Academy of Scences, India, Sec. B., 2009; 79:289-306.
6. Bhowmik N, Parveen S. *Rugaspermum minuta* - a new species of the seed genus *Rugaspermum* from the Triassic of Nidpur, India. Turkish Journal of Botany. 2012; 36(2):141-150.
7. Bhowmik N, Parveen S. Fossilized pollination droplet in a new seed genus from the Middle Triassic of Nidpur, India. Acta Palaeontogica Polonica. 2014; 59(2):491-503.
8. Bhowmik N, Parveen S, Das N. *Rugaspermum stipitatus* - a new species of the seed genus *Rugaspermum* Pant & Basu from the Triassic of Nidpur, MP, India. Taiwania. 2014; 59(4):374-382.
9. Bose MN, Srivastava SC. The genus *Dicroidium* from the Triassic of Nidpur, Madhya Pradesh, India. Palaeobotanist. 1971; 19(1):41-51.
10. Bose MN, Srivastava SC. *Nidistrobus* gen. nov. a pollen bearing fructification from the Lower Triassic of Gopad River Valley, Nidpur. Geophytology. 1973a; 2:211-212.
11. Brongniart AT. Prodrome d'une histoire des végétaux fossiles. F.G. Levrault, Paris & Strasbourg. 1828; 8:223.
12. Crane PR, Patrick H, Friis EM. Fossils and plant phylogeny. American Journal of Botany. 2004; 91:1683-1699.
13. Delevoryas T, Gould RE. An unusual fossil fuctification from the Jurassic of Oaxaca, Mexico. American Journal of Botany. 1971; 58:616-620.
14. Gothan W. Über die Gattung *Thinnfeldia* Ettingshausen. Abhandlungen der Naturhistorischen Gesellschaft Nürnberg. 1912; 19:67-80.
15. Harris TM. *Caytonanthus*, the microsporophyll of *Caytonia*. Annals of Botany. 1941; 5(17):47-58.
16. Harris TM. The relationships of the Caytoniales. Phytomorphology. 1951; 1:29-39.
17. Krassilov VA. Contributions to the knowledge of the Caytoniales. Review of Palaeobotany and Palynology, 1977; 24:155-178.
18. Krassilov VA, Afonin SA, Naugolnykh SV. *Permotheca* with *In situ* pollen grains from the Lower Permian of the Urals. Palaeobotanist. 1999; 48:19-25.
19. Manik SR. Some new genera of Triassic Seeds. Palaeobotanist. 1987; 36:197-200.
20. Millay MA, Eggert DA. *Idanothekion* gen. n. A synangiate pollen organ with saccate pollen from the Middle Pennsylvanian of Illinois. American Journal of Botany, 57(1):50-61.
21. Pant DD. On the genus *Glandulataenia* nov. from the Triassic of Nidhpuri, India. Memoirs of the New York Botanical Garden, 1990; 57:186-199.
22. Pant DD, Basu N. *Pteruchus indicus* sp. nov. from the Triassic of Nidpur, India. Palaeontographica. 1973; 144B: 11–24.
23. Pant DD, Basu N. On some seeds, synangia and scales from the Triassic of Nidpur, India. Palaeontographica. 1977; 163B:162-178.
24. Pant DD, Basu N. On some megaspore from the Triassic of Nidpur, India. Review of Paeleobotany and Palynology. 1979a; 28:203-221.
25. Pant DD, Basu N. Some further remains of fructifications from the Triassic of Nidpur, India. Palaeontographica. 1979b; 168B:129-146.
26. Pant DD, Nautiyal DD. Some seeds and sporangia of Glossopteris flora from Raniganj Coalfield, India. Palaeontographica. 1960; 107B:41-64.
27. Parveen S, Bhowmik N. *Nidpuria falcatum* sp. nov. and associated vegetative shoots from the Triassic of Nidpur, Madhya Pradesh, India. Review of Palaeobotany and Palynology. 2016; 224:169-180.
28. Satsangi PP. On the occurrence of *Dicroidium* flora in sidhi District, Madhya Pradesh. Current Science. 1964; 33:556.
29. Srivastava SC. *Lelestrobus*: A new microsporangiate organ from the Triassic of Nidpur, India. Palaeobotanist. 1984; 32(1):86-90.
30. Srivastava SC, Manik SR. *Rostrumaspermum venkatachali* gen. et sp. nov., an archegoniate seed from Triassic of Nidpur, India. Palaeobotanist. 1990; 38:98-104.
31. Srivastava SC, Manik SR. Taxonomic diversity of Triassic seeds from India. Proceedings of the eight Gondwana Symposium, Hobart, Australia, in Findlay, Unrag, Banks, Veevers eds, Gondwana eight Assembly, Evolution & dispersal, 1993, 265-275.
32. Srivastava SC, Manik SR. Reconsideration of *Savitrispermum* from Triassic of Gondwanas. Geophytology. 1996; 26(1):1-11.
33. Thomas HH. On some pteridospermous plants from the Mesozoic rocks of South Africa. Philosophical Transactions of the Royal Society of London. 1933; 222B:193-265.
34. Townrow JA. The Peltaspermaceae, a pteridosperm family of Permian and Triassic age. Palaeontology. 1960; 3:333-361.