A Review on Some Gymnospermous Fructifications from the Triassic of Nidpur, Madhya Pradesh, India

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Abstract. The Nidpur bed was discovered near Nidpur village, Sidhi District, Madhya Pradesh, India. The carbonized fossils of Nidpur beds comprise plant remains assignable to different groups of the plant kingdom like algae, bryophytes, pteridophytes and gymnosperms. The gymnospermous remains often occur as detached fragments on the shale surface. The most common megafossil on Nidpur shale is the leaf genus Dicroidium which is represented by several species. The review article describes diversity in structurally preserved gymnospermous fructifications *Nidistrobus*, *Nidianthus*, *Nidpuria*, *Chakrea*, *Rugatheca* and *Lelestrobus* from the same Triassic beds of Nidpur, Madhya Pradesh, India. All the fructifications differed in morphological and anatomical features.

Keywords: gymnosperm · in situ pollen grains · papillate · pollen organ · Triassic

1 Introduction

Satsangi in 1964 discovered the Nidpur Triassic beds a rich haul of fossiliferous plant material assignable to different groups including algae, bryophytes, pteridophytes and gymnosperms. Leaves of *Dicroidium*, *Lepidopteris* [45], *Glandulataenia* [28], and occasionally *Glossopteris* [14] is littered in the Nidpur shale. Diversity of microsporangiate organs are found including *Pteruchus* [43], *Nidistrobus* [7, 12] *Nidianthus* [6] *Nidpuria* [33, 35] and *Lelestrobus* [38]). The beds also yielded a diverse collection of well-preserved mesofossils comprising seeds, synangia, and megaspores [16, 26, 29, 31–34, 40, 42, 42].

2 Geology

In the Gopad River section of the western part of Singrauli Coalfield, Sidhi District, Madhya Pradesh, India Triassic Nidpur beds is occur. This beds is located between 2 faults, F2 and F3 (Fig. 1, after Raja Rao, 1983). Sediments are exposed downstream on the bank of the Gopad River about 2 km NE of the village of Nidpur (24°7′N, 81°53′E.

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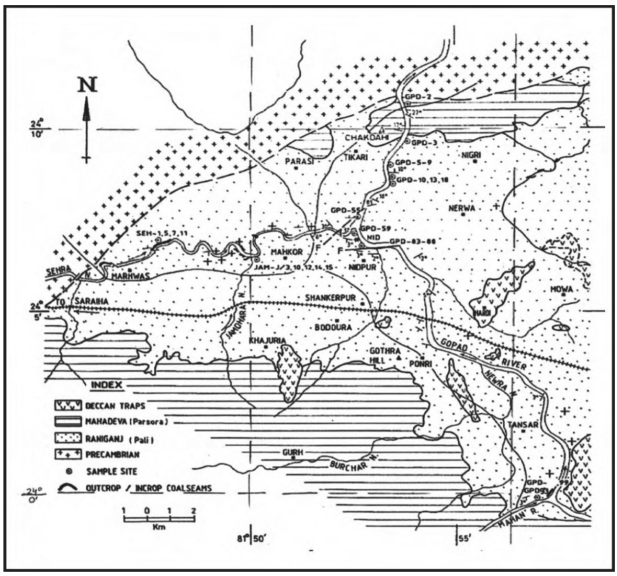

Fig. 1. Map of the study area: geological map of the north-west section of Singrauli Coalfield,showingMarhwas area, where the Nidpur beds (asterisk) are situated. The yielding samples, marked by dots within a circle, are indicated along the traverses taken. NID (asterisk) indicates the position of Sample Nos. NID-4, 5, 8, 10 [36].

The area south of the confluence of Sehra Nala with the Gopad River has been considered to be the "Nidpur beds," and the area is known as the "Marhwas area" [44]. Nidpur beds occupy the western portion of the basin, occurring at the junction of the Damodar, Satpura, and Son-Mahanadi grabens. The countryside around Marhwas and Nidpur is a flat alluvial plain with exposed Triassic sediments in the river cuttings. The Nidpur bed along the Gopad River cuttings contains carbonaceous compressions preserved on grey, medium-grained [25], micaceous shale. The sediments above and below the Nidpur beds have yet to be exposed. The plant remains of the bed appear to be allochthonous and are not buried in situ.

3 Description

3.1 *Genus: Nidpuria gen nov.* [33]

3.1.1 Type Species: *Nidpuria problematica sp.* nov (Fig. 2.H)

Systematic Description:

Class Coniferopsida.

Order Voltziales.

Male fructification *Nidpuria* is described by [33] from the Nidpur beds as a lax fructification with branched or unbranched stalked. Fructification axis is dorsiventral having unequally thickened cuticles on two faces and clearly demarcated nodes and internodes. Nodes are bearing dorsiventral, pinna-like simple, somewhat boat shaped

appendages which is hollow above and a median longitudinal ridge below. Appendages are slightly decurrent and subtending sporangia or branches of fructifications. Sporangium is shortly stalked or unstalked showing two sub-marginal longitudinal folds or ridges, dehiscence is apical. Cuticle of all parts is tough except sporangium. Stomata arehaplocheilic, monocyclic or partly amphicyclic. Sporangia containing two-winged pollen grains but occasionally three to four winged pollen grains are also present.

3.1.2 *Nidpuriafalcatumsp.* nov. [35]

(Fig. 2.F, G Holotype: specimen no. 52,201).

Repository: Divya Darshan Pant collection, Botany Department, University of Allahabad, Allahabad, India

Etymology: *falcatum*, after the characteristic hook-like hairs occurring abundantly on all parts of the pollen cone.

*Nidpuriafalcatum*sp. Nov described as a new species of genus *Nidpuria* by [35]. Microsporangiate fructification is lax to loosely compact.Fructification axis distinctly or indistinctly demarcated into nodes and internodes. It islongitudinally striated, dorsiventral, margins are smooth to hairy with broadly flattened stalk. Nodes are bearing narrowly towidelyspreading, distantly to closely placed microsporophylls or appendages which are arranged in opposite-decussatelymanner. Microsporophylls or appendages are sessile, ovate-lanceolate to boat-shaped univeined, base broadly decurrent.Apices are obtuse to shortly mucronate, entire marginis smooth to hairy. Adaxial surface is concave with median longitudinal ridge. Microsporophyll or appendage is subtending two stalked or unstalked ovate to subulate weakly striated adaxial microsporangiahaving broadly tapering base and acutely pointed apex often extended to forma shortlymucronate tip to prolonged beak. Cuticles of axis is non-stomatiferous, unequally thickened, upper thicker than lower. Cells of upper cuticle is medianlypapillate.Cells of lower cuticle with unicellular median hairs. Appendage or microsporophyll is bifacial, unequally thickened, upper thicker than lower and amphistomatic. Cells of upper cuticle is medianly papillate. Cells of lower cuticle with median unicellular hairs. Marginal cells of both cuticles comparatively narrower, upper cuticle cells hairy, hairs are falcate and multicellular. Stomata in both cuticles irregularly scattered, haplocheilic, subsidiary cells 5–7. Microsporangia is yielding two cuticles, outer stomatiferousthicker than inner. Stomata obliquely orientated, guard cell outlines obscure, stomatal pore elliptical. Cells of both cuticles are medianly papillate to hairy. Dehiscence line lateral, cells along lateral line profusely hairy. Pollen grains are bisaccate but rarely three to four winged also present. Bisaccate grains usually of two sizes. Corpus and saccus exine is infrareticulate.

Comparison

Nidpuriafalcatum resembles the lax strobilus *Nidpuriaproblematica* [33], reported from the same Nidpur Triassic beds in a number of features like having boat shaped hairy lateral appendages or microsporophylls subtending adaxial microsporangia but differs from it in having an unbranched fructification axis, two stalked microsporangia, uni-multicellular falcate hairs on lateral appendages or microsporophylls and a non-stomatiferous inner

cuticle of the microsporangium. While the fructification of *N. problematica* is reportedly branched, microsporophylls subtend single unstalked microsporangia and hairs on different organs are unicellular and both cuticles of microsporangium are stomatiferous.

Nidpuria are also comparable with male strobilus *Lelestrobus* [42] described from the Triassic beds of Nidpur. *Nidpuria* and *Lelestrobus*are quite distinct. *Lelestrobus*consists of compactly placed, spirally arranged quill-like, sessile microsporophylls bearing a single abaxially inserted oblong-ovoid microsporangium containing similar non-striate, bisaccate pollen.

a. **Genus: *Chakrea*** [38] (Fig. 2.E)

Chakreapapillosa, has been described as a wheel-shaped plant organ by [38] 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 had compared *Chakrea*, externally to an equisetalean leaf sheath but to *Dicroidium papillosum* [11] in cuticular feature.

b. **Genus**: ***Rugathecagen* nov** [31] (Fig. 2.J)

Type species: *Rugathecanidpurensissp*.nov.

Rugathecanidpurensis described by Pant and Basu in 1977 as a unstalked, detached compressed synangia. Synangia having 5–6 oval elongated to oval sporangia measuring from 1.2 mm × 2.8 mm long × 0.8 mm wide. Outer cuticle of synangia about 7 μm thick, cells polygonal, 57 μm long × 21 μm wide. Cells showing well defined median papillae. Pollen sac cuticle delicate about 3 μm thick, straight walled elongated cells measuring 89 μm long × 13 μm wide. Pollen sacs in synangia placed parallel to each other and ultimately separating from each other and dehisces by longitudinal slit. Two cuticles yielded after maceration, outer tough, non-stomatiferous and Inner cuticle enclosing masses of *Rugapites*pollen grain.

*Rugatheca*compared with *Polythecaelongata*) [30] in the parallel arrangement of pollen sacs but both are differs in having different types of pollen grains. They also compared with *Caytonanthus* [19] 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, *Masculostrobusrishra* [2] and *Masculostrobusclathratus* [1] from Chinle Formation of Arizona but their sporangia and pollen grains are different.

c. **Genus: *Nidianthus gen nov*** [6] (Fig. 2.K).

Systematic Description: Pteridosperm.

Type species: *Nidianthus indicus* sp.nov.

Nidianthus indicus is a synangiate pollen organ described by [6] 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 have prominent attenuated tips and broadly tapering bases. Pollen sacs surface are longitudinally striated, sacs separating from one another longitudinally along axis of synangium and dehiscing inwards but remaining attached basally. Pollen sac wall is single layered and cutinized. Cuticle is delicate consisting of elongated, rectangular to polygonal thin-walled cells. Some cells of pollen sac wall near apex medianly papillate or bearing unicellular hairs. Each pollen sac has single pollen mass. Pollen-grains are bisaccate.

*Nidianthus*is comparablewith pollen organ *Caytonanthus C. oncodes* [19, 21] *C. tyrmensis* [23] members of Caytoniales. The Order showed widespread distribution in northern hemisphere, from Upper Triassic to Middle Cretaceous Ages.

It is also compared with *Idanothekion* [27] reported from Middle Pennsylvanian of Illinois and *Kachchhia* [10] 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. *Nidianthus* is also compared with *Permotheca*from the Late Permian (Tatarian) of KullarovoCisuralin 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-bilobedandbisaccate conditions are met within a single sporangium [22].

*Nidianthus*may also be compared with another pollen organ, *Perezlariaoaxacensis*described by [17] from Middle Jurassic of Oaxaca, Mexico.

According to [6], 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 [10], 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 [15].

i. **Genus – *Nidistrobusgen* nov.** [12]
ii. Type species*: Nidistrobusharrisianussp.*nov (Fig. 2.A)

Systematic Description: *Incertaesedis.*

Male fructification with broad axis, elliptical in outline. Axis bearing spirally arranged, short or long stalked pad-shaped pollen bearing bodies or microsporophylls, forming a tightly closed unit. Cone size measuring 15 cm × 7.5 cm in diameter. Each microsporophyll bearing a single row of 6–10 sessile, elliptic, oval pollen sacs attached across its adaxial side and perhaps embedded in its substance. Cuticle of pad-shaped body thick, stomata mostly confined to abaxial or lower surface. Stomata haplocheilic, subsidiary cells 5–8 (usually 6 or 7) generally arranged in a ring or amphicyclic, encircling cells common. Guard cells thinly cutinized, sunken in rectangular to rhomboidal or

circular stomatal pit. Abaxial surface of microsporophyll irregularly thickened showing elongated to polygonal cells. Cuticle of pollen sac extremely thin, delicate, occasionally preserved, cells polygonal. Pollen sacs with large pollen masses of bisaccate, non-striate pollen-grains measuring 71–88 μm long. Central body of pollen-grains rhomboidal or broadly vertically oval. On proximal side sacci equatorially attached but distally much inclined, closely placed, leaving a narrow vertically elongated fusiform sulcus with a median groove extending along entire length.

iii. ***Nidistrobus indicus*** **sp. Nov** [7] (Fig. 2.B, C, D)

A new species of *Nidistrobus N. indicus* is described byBhowmik and Parveen, 2009 from the same beds. Compressed male fructification or male cone of unknown length is about 5.5 cm in maximum diameter. Outline of cone axis elliptical, about 4 cm in diameter, and 7 mm thick. Microsporophyll is long or shortly stalked, spirally disposed around cone axis, about 7–12 per spiral, microsporophylls closely placed, stalk narrowly attached to axis increasing in width distally to form a flattened lamina or fan-shaped head. Length of stalk is ranging from 3–7 mm long, widest near base of head being approximately 2–7 mm wide. Adaxial surface of stalk showing fine longitudinal striations, abaxial surface is uneven and rough. Adaxial surface of head comparatively smooth bearing 7–10 shortly stalked bell-shaped pollen sacs attached or perhaps embedded in substance of head, lying horizontally across microsporophyll. Pollen sacs separated from one another by sterile tissue of ribs, occasionally preserved, usually disintegrating leaving bell-shaped spaces 1.0–4.5 mm long and 0.5–1 mm broad. Abaxial surface is rugose with irregularly distributed raised and depressed areas but marginally becoming lobed. Cuticles of various parts are varying in thickness, those obtained from adaxial and abaxial surfaces of stalk about 12–20 μm thick. Both adaxial and abaxial surfaces of stalk and head is stomatiferous. Cuticle of pollen sac is thin, delicate about 2 μm thick, occasionally preserved. Cells of pollen sac straight-walled, polygonal with obscure cross walls. Cuticle of stalk is thick, resistant, amphistomatic distinct on abaxial and adaxial surfaces. Cells of abaxial surface of stalk are similar to cells of abaxial surface of head. Adaxial surface of stalk showing alternating bands of thick and thin-walled cells arranged in longitudinal files. Cells are rectangular to polygonoid, elongated, with lateral and end walls straight. Stomata confined to bands of thin-walled cells and usually absent in alternating bands of thick-walled cells. Stomata is longitudinally orientated, each stoma consists of a rectangular to circular stomatal cavity surrounded by 5–7 thin-walled squarish to polygonal, rectangular subsidiary cells. Guard cells sunken, often unpreserved. Cuticle of abaxial surface thicker, uneven, comprised of raised and depressed areas. Cells polygonal with straight, very thick, often pitted lateral and cross walls. In raised areas, some cells medianly papillate. Stomata irregularly scattered usually surrounded by 5–8 thin-walled subsidiary cells. Poral walls of subsidiaries thick, papillate, and overarching stomatal cavity. Guard cells sunken, stomatal pore obscure.

Abaxial and adaxial surfaces of fan-shaped head is distinct. Abaxial surface rough, uneven, rugose with many folds. Adaxial surface comparatively smooth, bearing a horizontal row of 7–10 pollen sacs across, appearing to lie embedded in substance of head or frequently pollen sacs unpreserved leaving bell-shaped empty spaces demarcated by narrow strips of rib – like tissue radiating outwards from the stalk. Abaxial cuticle thick,

warty, uneven, often mottled, made up of regularly arranged rectangular to polygonal straight to wavy, medianly papillate, thick-walled cells, measuring about 36-63 μm long × 18–30 μm in width. Stomata numerous irregularly disposed, haplocheilic, monocyclic to amphicyclic having 5–7 subsidiary cells resembling ordinary epidermal cells but very often radially or tangentially elongated. Abaxial surface of cuticle showing a number of small to large sized almost circular secretory bodies lined by rings of thin-walled tangentially elongated cells. Cuticle of adaxial surface is thinner almost similar to abaxial surface. Cells rectangular to polygonal arranged regularly, lateral and end walls straight to wavy, sometimes pitted. Surface of cells usually smooth but sometimes medianly papillate. Stomata abundant closely distributed, longitudinally or obliquely orientated. Subsidiary cells 5–8, thin-walled, arranged in a ring, surface unspecialized. Guard cells sunken in a pit. Stomatal pit elliptical to narrowly rectangular. Inner wall of subsidiary cells slightly thickened to form a rim around stomatal cavity. Cuticle of radiating ribs very thick, non- stomatiferous, consisting of small sized, thick-walled, rectangular to polygonal cells usually arranged serially in transverse direction. Pollen grains numerous, bisaccate and non-striate.

The pollen cone of *Nidistrobus*seems to be a unique plant fossil whose placement in already known taxonomic categories remains uncertain. Bose and Srivastava had suggested similarities with *Harrisiotheciummarsilioides* [24] which was thought to be borne on the same plant as leaves of *Ptilozamitesnilssonii* [18] on the basis of associational evidence and similarities in cuticular structure. Later, Srivastava (1979) had placed a number of vegetative and fertile plant organs of Nidpur Triassic beds under the group *incertae-sedis* on account of their affinities being unknown or their being not sufficiently well preserved to indicate assignment to a particular group. Amidst such fossils he had also included fructifications of the microsporangiate cone *Nidistrobus* Bose and Srivastava. Earlier [39] too, had compared the cone with*Harrisiotheciummarsilioides* [24] recorded from the Rhaetic of Scania, Sweden. Still later[3], reported the arrangement of pollen sacs in *Nidistrobus*and *Harrisiothecium* to be similar to that found in *Pteroma thomasii* [20]. *Pteroma* bore fertile oval or rounded laminae, where each lamina had a ring of about 10 pollen sacs embedded in its under surface. The pollen sacs contained bisaccate pollen. However *Pteroma* is believed to be the pollen organ of the plant that produced leaves of *Pachypterispapillosa* type which was assigned to the Corystospermaceae by [20]. Besides uncertain systematic position discussed earlier, the male fructification of *Nidistrobus*,to the best of my knowledge, is not closely comparable to any other male cone so far reported from the Nidpur beds, except for some of its detached microsporophylls remotely resembling the genera *Chakrea* [38]. *Chakrea papillosa*, has been described as a wheel-shaped plant organ measuring about 2.9 cm in diameter, bearing 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 on adaxial surface of head of *Nidistrobus* microsporophyll. In addition to external resemblance structural details of *Chakrea,* like presence of a tough cuticle, amphistomaticepidermides, papillate cells, stomata being surrounded by 5–7 subsidiary cells, sunken guard cells etc. are found in *Nidistrobus* too. [38] had compared *Chakrea*, externally to an equisetalean leaf sheath but to *Dicroidiumpapillosum* in cuticular features. Considering the similarities between *Chakrea* and detached fan-shaped

heads of *Nidistrobus*, the possibility of the former being a slightly larger unit of the cone of *Nidistrobus* cannot be ruled out.

Nidistrobusindicus resembled the earlier described species of *Nidistrobus, N. harrisianus* [12] in many respects. But differs in a number of important features. While the length of cone was unknown in both the species, the diameter of cone varies in the two species. In *N. indicus* it seems to be narrower, with a diameter of 5.5 cm along middle, while the diameter of *N. harrisianus* [12, 13] cone seems to be wider, measuring about 7.5 cm. The number of microsporophylls per spiral varied from about 6–10 in the latter species and about 7–12 in the former.

In *N. indicus* microsporophyll is reported as being amphistomatic, while it is hypostomatic in *N. harrisianus.* Besides this the pollen sacs are apparently stalked in *N. indicus* (as indicated by elongated stalk-like spaces below pollen sacs) and sessile in *N. harrisianus* [12]. The abaxial surface in *N. harrisianus* has been described as being smooth or mottled. But in the presently described species abaxial surface is rough and uneven often showing elevated and depressed areas. The cellular details of the elevated areas show groups of thick-walled cells with median and terminal papillae while the shallow depression shows thin-walled cells which too are papillate. Papillate cells have not been reported in the microsporophyll head of *N. harrisianus* [12].

c. ***Lelestrobus gen nov*** [44] (Fig. 2.I)

Systematic Description:*Coniferales.*

Type species: ***Lelestrobuspennatus* sp. Nov.**

Male strobilus *Lelestrobus* [44] also described from the Triassic beds of Nidpur, consists of compactly placed, spirally arranged, quill-like, sessile microsporophylls bearing a single abaxially inserted oblong-ovoid microsporangium. Sporangium accentuated by flap or wing like structure.Pollen non-striate andbisaccate. Detached strobilus is about 1.5 cm long.Sporophyll cuticle is differentiated into stomatic and non-stomatic surfaces, non-stomatic surface slightly thicker composed of serially arranged rectangular narrower, polygonal cells with straight walls, surface generally smooth. Stomatic surface is thinner bearing a few stomata, usually marked in tapering part of sporophyll, cells polygonal, cell walls extremely thin, at times inconspicuous, lateral-walls straight, end-walls usually oblique, at places straight, surface smooth or unsculptured. Stomata is longitudinally orientated, subsidiary cells 5, stomatal aperture indistinct. Sporangial-wall is membranous, cells elongated rectangular or polygonal, cell-walls thin, at times not clearly distinct, surface smooth. Pollen grains non-striate, bisaccate, *Lelestrobuspennatus* is a compact strobilus bearing abaxial sporangia with nonstriate-bisaccate pollen grains. These characters are suggestive of its relationship with Coniferales. In having quilllikemicrosporophylls, *L. pennatus* seemingly approaches the genus *Isoetes* but it is clearly different because of the aforesaid characters. *Lebachiapiniformis* described by differs in having two microsporangia on each sporophyll and monosaccate pollen grains with baloon-like sacci completely surrounding the central body except at distal pole.

Lelestrobuspennatus markedly differs from the extant conifers in its microsporophylls exhibiting only a single sporangium abaxially inserted in the basal region while in the latter the microsporophylls bear two to many, fused or free sporangia.

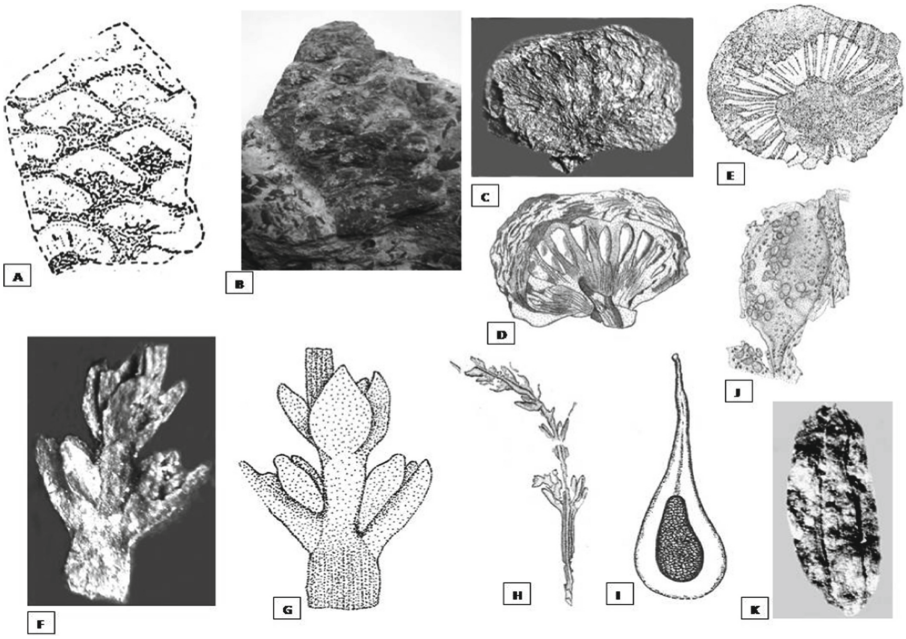

Fig. 2. Showing a variety of gymnospermous fructifications A.*Nidistrobusharrisianus*x6.5 after [12], B, C, D. *Nidianthus indicus*x7.2 after [7], E. *Chakrea*x21 after [38], F,G..*Nidpuria falcatum*x12.5 after [35]. H. *Nidpuriaproblematica*x6 after [33], I. *Lelestrobuspennatus*x4.6 after [44], J. *Rugathecanidpurensis*x 22 after [31] K. *Nidianthus indicus* x13.5 after [6].

Upto date, a number of gymnospermous fructifications are known from the Triassic period of Indian peninsula but the best known assemblage are those of Middle Triassic of Nidpur, occurring in the South Rewa basin. Nidpur Triassic flora, not only indicated luxuriant growth of vegetation around the basin but also indicated existence of drier climates in isolated areas where some fructifications like *Nidistrobus*sps, *Nidianthus*, *Chakrea* and *Rugatheca*exhibited xeric features of epidermis, like having very thick cuticles, deeply sunken stomata, hairy to papillate epidermal cells, secretory bodies etc. However, reports of coniferous remains like *Nidpuria*indicated a mild, drier climate, as the plants were not large trees, but were of shrubby nature, with ridged hairy stems and reduced scale-like leaves having profusely papillate epidermis. *Lelestrobuspennatus* probably represents an early phase in the evolutionary history of conifersdue to presence of a single sporangium.

4 Conclusion

The Triassic bed of Nidpur has yielded a diversified flora with the dominanance of gymnospermous fossil plants including taxonomic group like Pteridospermales and Coniferales. Epidermal features of plant showing xeromorphic characters like excessively hairy organ, Cutinizedcells, sunken stomata, papillae and reduced evaporating

surface indicating fluctuating climatic condition during the Triassic period of Nidpur.The coniferophytic remains also indicated cool dry conditions prevailing in the Triassic.

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