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**NUPURIA gen. nov. A NEW FEMALE FRUCTIFICATION FROM
KAMTHI FORMATION OF INDIAN LOWER GONDWANA**

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ABSTRACT

A new female fructification viz., *Nupuria indica* gen. et sp. nov. is described from Kamthi formation of Handappa village Hinzirda Ghati, Dhenkanal district of Orissa, India. It belongs to Upper Permian of Lower Gondwana of India. The specimen is well preserved as impression from apex to base. The fertliger is spoon shaped with a long stalk. The fructification is attached at the junction of stalk and lamina. The fructification is sessile, circular to oval with a number of small, sessile and orthotropous, *Pterygospermum* type of seeds. The fertliger has strong median veins which are divided in apical region. It is quite different from other previously described fertile scales (fructifications) e.g., *Scutum*, *Ottokaria*, *Dictyopteridium*, *Eretmonia*, *Glossotheca*, *Denkania*, *Partha*, *Lidgettonia* and *Cistella* in morphological details. In this paper the morphological nature of fertligers are also discussed in details.

Key Words: Handappa, Lower Gondwana, Kamthi Formation, *Nupuria indica*, Scale Leaves, Upper Permian

INTRODUCTION

Feistmantel (1881 a, b) described the *Dictyopteteridium sporiferum* from the Raniganj coalfields of India and regarded it as a fertile leaflet of fern. Zeiller (1902) reported *Ottokaria* a fructification consisting of a lobed terminal disc and a slender stalk. According to Seward and Sahni (1920) it “consists of a stalk attached in a slightly eccentric position to an almost orbicular lamina with sub acute teeth and traversed by numerous radially disposed irregular striations. The lamina is slightly concave” and suggested that it is a copular investment. After a long gap of thirty years Plumstead (1952) described many reproductive organs under new generic names, *Scutum* and *Lanceolatus* attached to the *Glossopteris* leaves. Plumstead described *Scutum* as a pedicellate, bilaterally symmetrical cupule which grows from the midrib of a leaf of *Glossopteris*. Later Plumstead (1956) interpreted that this cupule is a bisexual flower, the fertile half contains the seeds and other half bearing bract – like staminate organs. Thomas in 1958 reported some sterile leaves of *Glossopteris* found in association with fertile leaves bearing 2 rows of 4 – 6 small discs like cupule and included them in *Lidgettonia*. *Senotheca murulidihensis* a female reproductive structure was reported by Banerjee (1969). Later on Surange and Maheshwari (1970), Surange and Chandra (1973 a, b, c, 1974 a, b, c, 1975) Chandra and Surange (1977 a, b, c), described a large number of fructifications which were assigned to *Glossopteridales* e.g., *Partha*, *Denkania*, *Lidgettonia*, *Plumsteadiostrobis*, *Jumbadostrobis* and *Venustostrobis*. Banerjee (1984) also described some fructifications – *Ghoshialepis*, *Mahudaea*, *Bankolaea* etc. Most of these fructifications are in the form of impressions but Pant & Nautiyal (1984), Mukherjee *et al.* (1966), Banerjee (1977) studied the compressed fructifications in greater details and described the cuticular details of leaves, fructifications, seeds and the micro sporangia with microspores. As compared to female fructifications, male fructifications are less known and only *Eretmonia* (Du Toit 1932) Surange and Maheshwari (1970), *Glossotheca* Surange and Maheshwari (1970), *Kendostrobis* Surange and Chandra (1974 a), *Nesowalesia* Pant, (1977) are reported. The present fructification is preserved in form of impression, seed bearing and collected from Hinzirda ghati of Handappa, Dhenkanal district of Orissa of Kamthi Formation of Upper Permian (Lower Gondwana) of India and assigned to a new genus *Nupuria indica* gen. et sp. nov. due to its important characters.

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MATERIAL AND METHODS

The fossils were collected from a bed exposed along forest road cutting in the Hinzirda Ghati section (20° 58' N; 84° 43' E) near the village Handappa in the Dhenkanal district of Orissa (Fig.1).

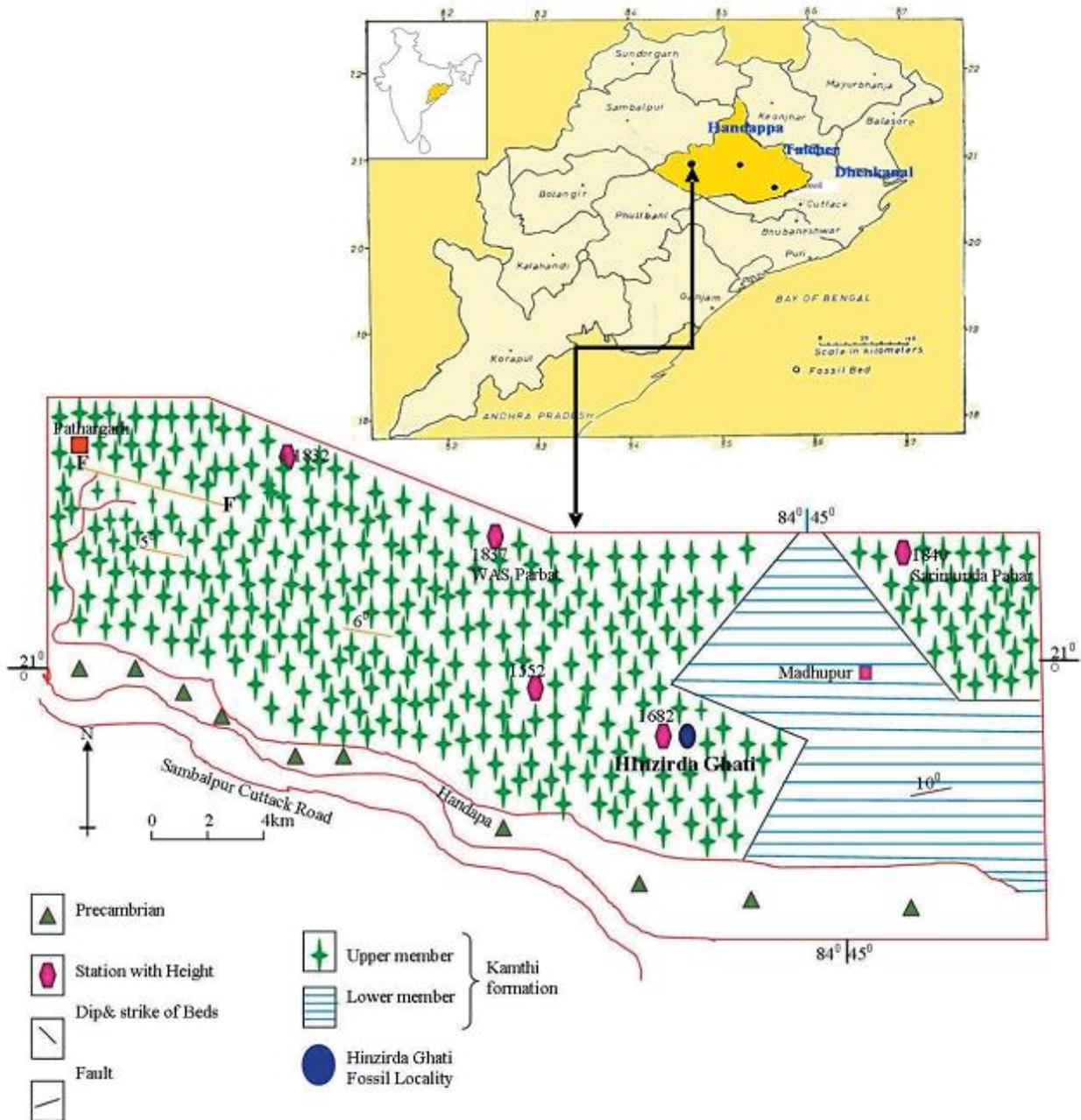


Figure 1: Location map of Orissa (India) showing the Handappa village from where the fossils were collected

The bed is comprised of fine grained, thin layered sandstones and shale, which are cream or buff coloured. The plant fossils are found between the layers of the bed as impressions and the original plant material was completely oxidized often leaving a reddish brown ferruginous replica. The specimens were observed under strong unilateral illuminations.

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Nupuria gen. nov.

Diagnosis: Fertile scale leaf (Fertiliger), large in size with broad and long stalk, shape of lamina oblong, spatulate or oblanceolate, median veins strong, divide in apical region, side veins dichotomise several times and forming meshes, circular to oval fertile structure present at junction of stalk and lamina with a large number of small, sessile, orthotropus ovules.

Type species: *Nupuria indica* n. sp.

Discussion: The new genus *Nupuria* is made for impressions of six fertile scale leaf (Fertiliger) which is spoon shaped with a circular or oval fertile structure which contains small, orthotropus, and sessile ovules. It is similar to *Scutum* in shape but the fertile scale is of typical *Glossopteris* type while in *Nupuria* the midrib in scale leaf is absent and there is no wide marginal sterile flap, which is present in *Scutum*.

Nupuria indica sp. nov.

(Fig. 2 and 3)



Figure 2: *Nupuria indica* gen. et sp. nov. Fructification with a stalk and spoon shaped fertile lamina. At the junction of stalk and lamina a circular fertile structure with small seeds. Holotype. Specimen No. T- 1046 X3.

Diagnosis: Fertiliger spatulate, oblong or oblanceolate with lamina and stalk. Lamina widest in middle part, narrower at apex, apex obtuse, lamina gradually becoming narrower towards base, lamina about 39 mm long x 11 mm wide, midrib absent but several strong median veins present, lateral veins diverging,

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dichotomizing several times and anastomosing to form meshes, stalk 11mm long x 4mm wide, stalked winged, stout with parallel veins, a single large circular to oval fertile structure (disc) present with a large number of small, oval, sessile, winged orthotropus seeds, wing narrow.

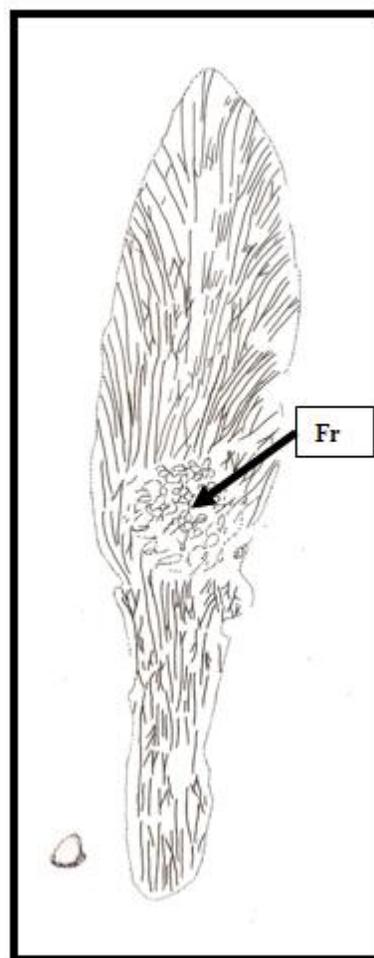


Figure 3: *Nupuria indica* gen. et sp. nov. Line diagram of fertiliger showing seeds and venation. Specimen No. T-1046 X 2.5

Holotype: Specimen No. T -1046 of Divya Darshan Pant Collection, Department of Botany, University of Allahabad, Allahabad, India.

Locality: Hinzrida ghati of Handappa, Dhenkanal district, Orissa, India.

Horizon: Kamthi formation of Upper Permian (Lower Gondwana) India.

Etymology: The genus is named in honour of Professor Nupur Bhowmik who has worked on Gondwana fossils of India and the species is named after the country where the locality of specimen is situated.

DESCRIPTION COMPARISON AND DISCUSSION

The genus is based on four complete specimens out of these three specimens show fertile structure and one specimen is without fertile structure. The specimens are beautifully preserved and they are in the form of impressions. The length of the fertiliger is 50 mm and the width is 11 mm, the stalk of fertiliger is 11 mm long and 4 mm wide. The stalk is long, stout and winged with parallel veins. Lamina of fertiliger is elongated, spatulate or oblanolate with obtuse apex. Midrib in lamina is absent but 6 – 7 prominent veins

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run parallel up to the apex. Lateral veins are diverging and dichotomizing. They form meshes after anastomosing. At the junction of lamina and stalk a circular to oval fertile structure is present which shows a large number of small, sessile orthotropous winged seeds. Wing is narrow and the length of the seed is 2-3 mm and width is 1.5- 2 mm. These seeds are comparable with seeds of *Pterygospermum raniganjense* (Pant and Nautiyal, 1960) but the structural details of these seeds are unknown and the comparison is only on the morphological basis.

Nupuria indica gen. et sp. nov. is comparable in form and shape with previously known fructifications of Lower Gondwana e.g. *Scutum* Plumstead (1952), *Ottokaria* Zeiller (1902), *Dictyopteridium* Feistmantel (1881).

The fertile scale is compared with fertile scale of *Eretmonia* and *Glossotheca*. The shape of stalk and lamina is similar but at the same time *Eretmonia* and *Glossotheca* are male fructifications bearing microsporangia and *Arberiella* type of sporangia while *Nupuria indica* is a female, seed bearing fructification.

Nupuria indica gen. et sp. nov. can be compared with *Scutum* Plumstead (1952) due to its similar shape but *Scutum* is a pedicellate fertile structure with bilateral symmetry and the scale leaf with which it is attached, is typical *Glossopteris* type with midrib while *Nupuria* is a circular or oval, non pedicellate fertile part and the fertile scale leaf is not like typical *Glossopteris* type. There is lack of midrib and meshes are fewer in number. *Scutum* has a conspicuous broad marginal area, forming a broad sterile marginal flap which is absent in *Nupuria*.

Nupuria also comparable with a female fructification *Ottokaria* Zeiller (1902) where the fructification has a large but narrow stalk and have a broad marginal area forming a broad sterile marginal flap. The leaf is of *Glossopteris* type and has a midrib with lateral veins with anastomosing. In *Nupuria* sterile marginal flap is absent and the leaf is without midrib with fewer number of meshes which are formed by lateral veins.

Nupuria indica shows some resemblances with *Dictyopteridium sporiferum* Feistmantel (1881) being a female fructification and seed bearing structure but *Dictyopteridium* is a stalked female cone like organ, oblong to lanceolate in shape showing small rounded tubercles on which seeds are attached in close spiral all round it. It is commonly found preserved as a naked receptacle from which seeds have fallen off but in *Nupuria* the fertile part is oval or circular with small, sessile, orthotropous seeds.

Nupuria indica gen. et sp. nov. is a complete fertile scale leaf which is preserved as impression and described from Kamthi formation of Upper Permian (Lower Gondwana) of India. This fertile scale leaf is stalked with a circular or oval female fructification which contains small, sessile, orthotropous seeds. These seeds are similar to *Pterygospermum raniganjense* Pant and Nautiyal (1960). The seeds have a narrow wing. The scale leaf shows *Glossopteris* type of venation pattern but midrib is absent and instead of midrib there are 6-7 parallel veins running from base to apex. It seems that in younger stage this fructification may be covered at one side by small scale and at other side covered by fertile scale leaf which is elongated stalked with venation like *Glossopteris* but without midrib. At maturity this fertile structure may be shed off from this fertiliger, with seeds and after that seeds may be dispersed from the fructification. The isolated dispersed fructification and the fertile scales with fructifications are found in the rocks where glossopterids are in abundance. The fertile scales also show character of *Glossopteris*. This suggests that *Nupuria indica* is female, seed bearing fructification and it may belong to *Glossopteris* plant.

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