

A new species of *Pseudoctenis* Seward from Lower Gondwana of India

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A new species of *Pseudoctenis* Seward viz., *Pseudoctenis nautiyalii* is described from Kamthi Formation of Handappa village of Hinzirda Ghati, Orissa. The specimen is preserved as impression of complete leaf from apex to base. The species is characterized by rectangular shaped compound leaf. Pinnæ are laterally attached at right angles to the axis, showing parallel veins, which dichotomize once or twice and show occasional cross connections.

Key-words—*Pseudoctenis nautiyalii*, New species, Kamthi Formation, Lower Gondwana.

INTRODUCTION

Only few compound leaves are known from Lower Gondwana of India viz., *Pseudoctenis ballii*, *Pterophyllum burdwanense* (Feistmantel 1877, 1881, 1886, Arber 1905) and *Pteronilssonina gopalii* (Pant & Mehra 1963). Feistmantel (1881) described a compound leaf from Barakar Formation of Auranga Coalfield and assigned to the genus *Anomozamites* but in 1886 he transferred this genus to *Platypterigium*. Later, Zeiller (1902) placed the form under *Pterophyllum ballii* but Seward (1917) and Seward and Sahni (1920) described this fossil under *Pseudoctenis ballii*. Lele (1962) discovered *Pseudoctenis ballii* from Trassic sediments of South Rewa Gondwana Basin. Maithy (1971) redescribed original specimen of *Pseudoctenis ballii* and designated lectotype for *Pseudoctenis ballii* (specimen no. 5505, Geological Survey of India, Kolkata). In 1981 Chandra and Rigby described some fronds of *Pseudoctenis ballii* from Hinzirda Ghati, Orissa. The Lower Gondwana forms of *Pseudoctenis* and *Pterophyllum* are based on fragmentary specimens of which exact size are unknown due to absence of apex and base but the present species *Pseudoctenis nautiyalii* sp. nov. shows complete leaf from apex to base.

MATERIAL AND METHOD

The material was 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. 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 is completely oxidized often leaving a reddish brown ferruginous replica. They are altogether lacking any carbonaceous matter. The specimens were observed under strong unilateral illuminations.

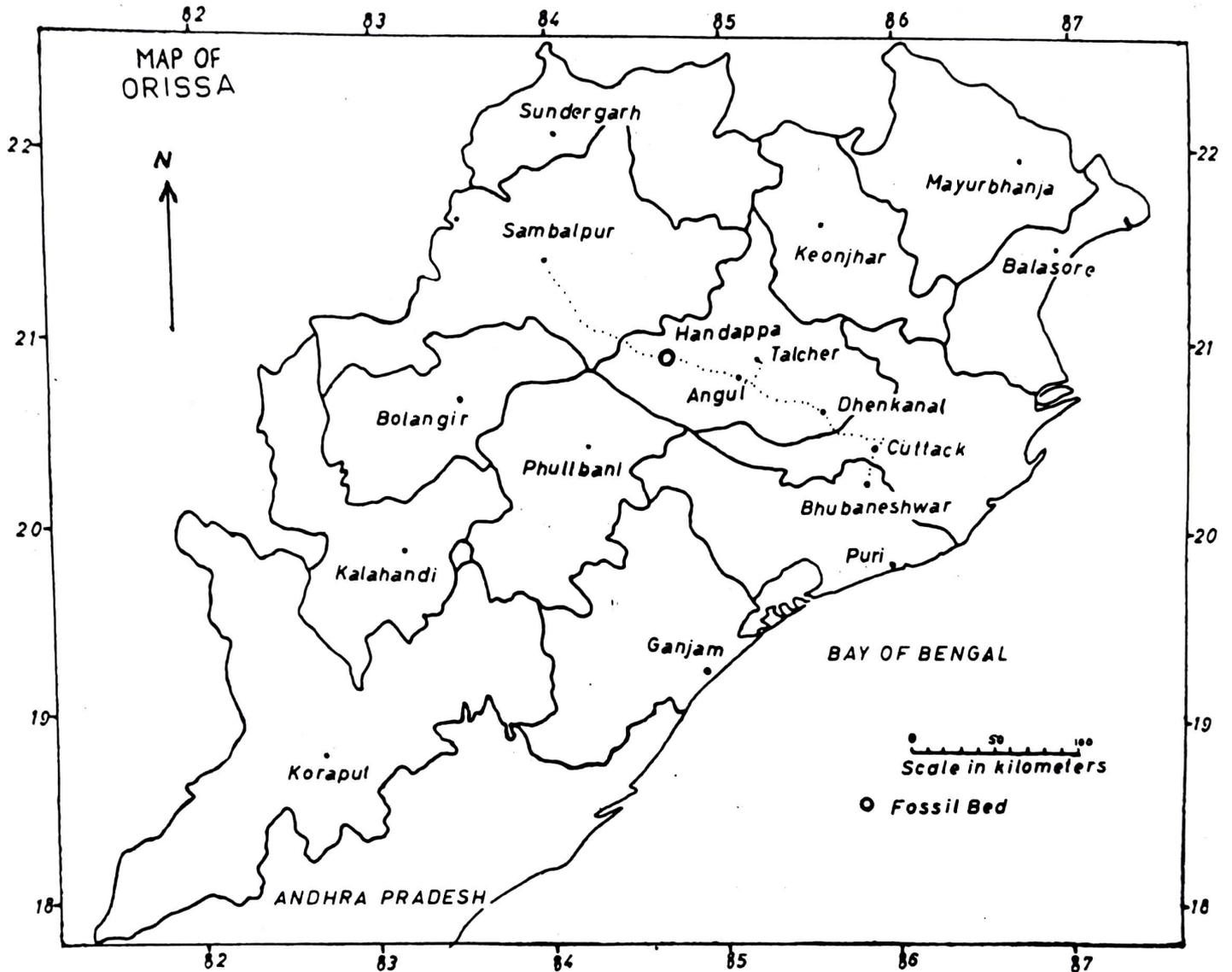
Genus - *Pseudoctenis* Seward

Pseudoctenis nautiyalii sp. nov.

(Pl. 1, Figs. 1-3; Text figs. 1, A-D)

Diagnosis : Leaf compound, pinnæ opposite, laterally attached, pinnæ bases widely attached at right angles to the axis. Veins parallel, raised on the lower surface of pinnæ. Individual vein simple or forked once or twice, forking is generally observed at the base and in some places veins show cross connections.

Length of leaf 12.5 cm, width more than 5.4 cm in widest part, rachis up to 5 mm thick at the basal part and 3 mm thick in the middle part, stripped bearing laterally attached opposite pinnæ. Pinnæ more or less rectangular of equal width, margin entire, nearly parallel, pinnæ bases slightly expanded and attached at right angles to the rachis by their whole width. Pinnæ at basal side somewhat smaller in size. Pinnæ on the same side of the rachis about 3 to 4 cm. in length, apices of pinna more or less obtuse or



Map 1. Map of Orissa showing the location of Handappa village.

truncated. In some pinnae the apex is bifid with shallow notch. Pinnae parallel to each other. Length of the shortest pinna 1 cm (near base) and 3.2 cm in middle. Length of largest pinna 4.2 cm (in middle). The lower most pairs of pinnae length is 1.1 cm, width 3 mm (in middle), veins simple or forked once or twice, parallel, rarely fused to form meshes, veins of pinnae somewhat arched near apex, concentration of veins 10-11 / cm. Number of veins in individual pinnae is 20-24. Average ratio of unforked and forked veins is 7:3, distance between veins up to 1 mm, thickness of veins up to 0.5 mm. Some pinnae show forking of veins at base, rachis with elongated striations of which basal part is more thicker.

Holotype : Specimen No. T-1005 of the Agharkar Museum, Botany Department, University of Allahabad, Allahabad, India.

Locality and Horizon : Hinzirda Ghati, Orissa, India. Kamthi Formation, Upper Permian (Lower Gondwana), India.

Etymology : The species is named in honour of Professor D.D. Nautiyal, a renowned palaeobotanist who has worked on Lower Gondwana fossils.

Description : The species is based on one complete specimen, which is preserved as impression. The apex and base of the leaf are fully preserved and pinnae are attached oppositely to the middle part of

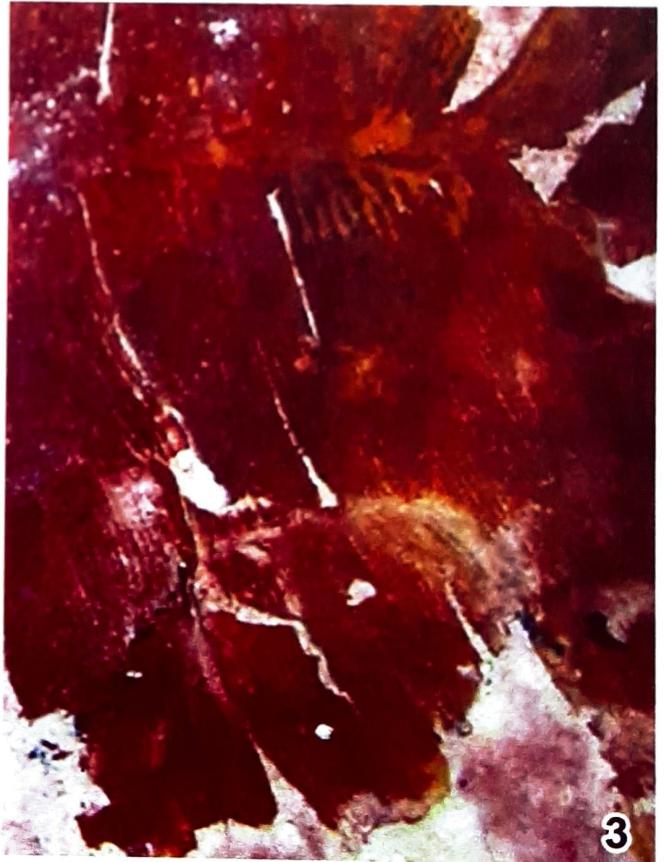
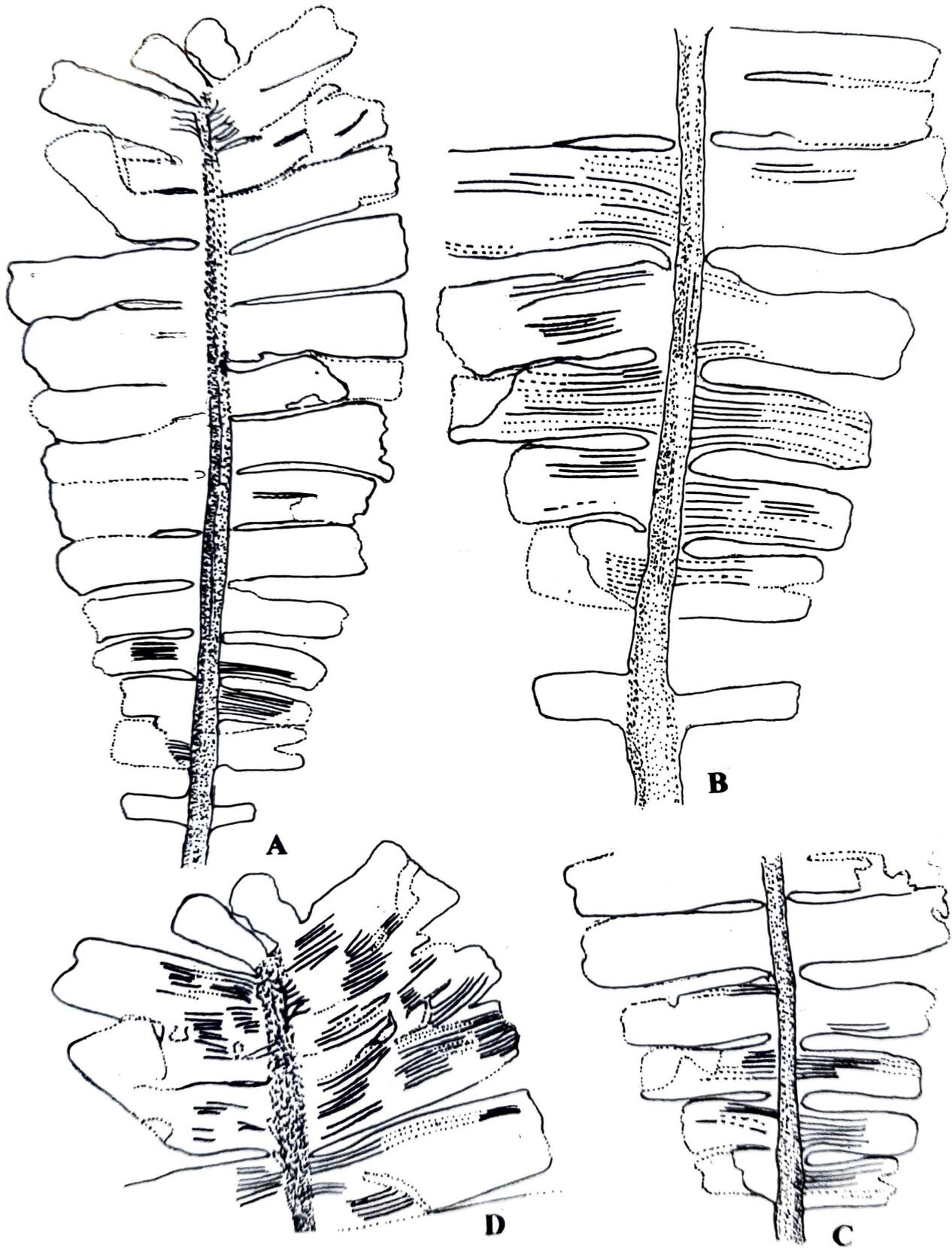


PLATE - 1

Pseudoctenis nautiyalii sp. nov.

1. Leaf showing laterally attached pinnae. Holotype, Specimen no. T-1005 X 1.1.
2. Pinnae of one side enlarged showing parallel venation. Specimen no. T-1005 X 3.
3. Apical part of the leaf enlarged showing forking of veins at the origin from the rachis in the pinnae. Specimen no. T-1005 X 4.



Text-Figure 1. *Pseudoctenis nautiyalii* sp. nov., A, Complete leaf showing laterally attached pinnae. Holotype. Specimen no. T-1005 X 1.3. B and C, Basal part of the leaf with laterally attached pinnae, showing parallel veins. Specimen no. T-1005. B X 2. C X 2. D, Apical part of the leaf with pinnae showing forking of veins near origin from the rachis. Specimen no. T-1005 X 2.

the rachis. The rachis is 5 mm wide at base, 3 mm wide in middle and about 1 mm wide at the apex. It shows longitudinal striations and the basal part of the rachis is thicker. The length of the leaf is 12.5 cm and width at base is 0.6 cm-1.3 cm. 15 pairs of pinnae are present in the specimen. The pinnules are linear, almost of equal breadth attached by the whole width of the base and with a truncate apex. In some pinnules bases are enlarged. The apex of pinnae may be truncated, rounded or occasionally notched. The margins of the pinnules are almost parallel and entire. The width of the pinna ranges between 0.6 and 1.3 cm. The number of veins ranges 11-14 per pinna, which are parallel simple, or more often dichotomizing. The first dichotomy takes place near the base of the segment. The veins are forked once or twice and form meshes or cross connections. The number of unforked veins is however, considerably high. The ratio of unforked and forked veins being 7:3. A vein may be forked soon after it comes out of the rachis or at various distances in the lamina.

Comparison : The leaf of *Pseudoctenis nautiyalii* apparently looks alike with the leaves of *Pteronilssonina* and *Nilssonina* but can easily be distinguished from each other. The lateral attachment of the pinnae of *Pseudoctenis nautiyalii* differs from that of pinnae of *Nilssonina* (where they are attached more towards adaxial side of the rachis) and resembles that of *Pteronilssonina* (Pant & Mehra 1963). This is also similar in form of pinnae with other species of *Pseudoctenis* but in most species of *Pseudoctenis* (Harris 1950), there are decurrent margins of pinnae while in *Pseudoctenis nautiyalii* it is non-decurrent. The pinnae in *Pseudoctenis nautiyalii* is opposite while in *Pteronilssonina* it is alternate. There is difference between these two leaves in venation also. In *Pseudoctenis nautiyalii* the veins are forked on their point of origin from the rachis, while in *Pteronilssonina* veins fork anywhere in the pinnae. Further comparison is not possible because in *Pteronilssonina* the cuticular details are known whereas cuticle is absent in *Pseudoctenis nautiyalii*.

The apical part of pinnae in *Pseudoctenis nautiyalii* is truncated and in some it is notched. The

leaf of *Pseudoctenis nautiyalii* is also similar to *Anomozamites*. However, the segments of *Anomozamites* are shorter and often of irregular width but the segments of *Pseudoctenis nautiyalii* are larger, rectangular with regular width.

The leaf of *Pseudoctenis nautiyalii* is similar to northern Palaeozoic forms described by Zeiller (1906) and Thomas (1930) under the name *Pterophyllum grandeuryi* and *Pterophyllum fayolie*. The leaf of *Pseudoctenis nautiyalii* may also be compared with some very fragmentary specimens of *Pterophyllum burdwanense* and *Pseudoctenis ballii* from the Lower Gondwana (Feistmantel 1877, 1881, 1886; Arber 1905). The form of pinnae having parallel venation is similar to that of *Pseudoctenis nautiyalii* but the pinnae of *Pterophyllum burdwanense* are continuous and arise at an acute angle from a thin rachis (the pinnae in *Pseudoctenis nautiyalii* arise almost at right angles from the rachis). In the type specimen of *Pterophyllum burdwanense*, which is kept at Geological Survey of India Museum at Kolkata, the apices of pinnae are lost and none of their veins are forked, while in *Pseudoctenis nautiyalii* veins are forked, show occasional cross connection and apices are well preserved. *Pseudoctenis ballii* shows close similarities with *Pseudoctenis nautiyalii* in the attachment of its pinnae almost at right angles to the rachis, but in *Pseudoctenis ballii* it is alternate while in *Pseudoctenis nautiyalii* it is opposite. The apices of pinnae in *Pseudoctenis ballii* are rounded and truncated but in *Pseudoctenis nautiyalii* it is truncated and in some it is notched.

DISCUSSION

There are three genera in Lower Gondwana formations of India viz., *Rhabdotaenia*, *Pteronilssonina* and *Pseudoctenis* with similar type of parallel venation. In *Pseudoctenis* it is forked near the origin from the rachis. The forking is once or twice and at some places form meshes or cross connections. In others it may be forked anywhere in the leaf pinna but there is no anastomosing or cross connections. At the same time *Rhabdotaenia* is a simple leaf while *Pseudoctenis* and *Pteronilssonina* are compound leaves.

As far as the affinity of *Pseudoctenis nautiyalii* sp. nov. is concerned it comes closest to Cycadales on the basis of pinnately compound nature of the frond with multiple parallel veins in the pinnae. In the absence of structural features of the leaf it is not possible to ascertain the exact affinity of the leaf.

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