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Amberiwadiacarpon devgarhensis gen. et sp. nov. from Amberiwadi, Sindhudurg District, Maharashtra, India

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ABSTRACT

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A fossil carbonised angiospermous fruit, *Amberiwadiacarpon devgarhensis* gen. et sp. nov. has been recovered for the first time from the Miocene sediments of Amberiwadi Village (Devgarh Taluk), Sindhudurg District, Maharashtra, India. Based on the morphological characters, the affinities of present fossil fruit have been suggested with the extant pantropical family Rubiaceae and more particularly with the taxa *Randia* Houst. ex Linn. and *Psychotria* Linn. of this family.

Key-words—*Amberiwadiacarpon devgarhensis*, Amberiwadi, Sindhudurg District, Maharashtra, Rubiaceae, Miocene.

भारत के महाराष्ट्र प्रान्त के सिन्धुदुर्ग जिले के अम्बेरीवाड़ी नामक स्थान से प्राप्त *अम्बेरिवाड़ियोकार्पन देवगढ़ेन्सिस* वंश नवप्रजाति

अनिल अग्रवाल एवं कृष्ण अम्बवानी

सारांश

भारत के महाराष्ट्र प्रान्त के सिन्धुदुर्ग जिले के अम्बेरीवाड़ी ग्राम (देवगढ़ तालुक) के मायोसीन अवसादों से पहली बार एक अश्मित कार्बनीकृत आवृतबीजी फल *अम्बेरीवाड़ियोकार्पन देवगढ़ेन्सिस* वंश नवप्रजाति प्राप्त किया गया है। संरचनात्मक अभिलक्षणों के आधार पर वर्तमान अश्मित फल की विद्यमान सार्वउष्णकटिबन्धीय रूबिएसी कुल तथा इस कुल के विशेष रूप से *रैण्डिया* एवं *साइकोट्राया* वर्गकों के साथ बन्धुता प्रस्तावित की जाती है।

संकेत शब्द—*अम्बेरीवाड़ियोकार्पन देवगढ़ेन्सिस*, अम्बेरीवाड़ी, सिन्धुदुर्ग जिला, महाराष्ट्र, रूबिएसी, मायोसीन.

INTRODUCTION

AMBERIWADIACARPON DEVGARHENSIS gen. et sp. nov. forms the first record of fossil fruit from the lignitic beds exposed at Amberiwadi Village near Tirlot Village (Latitude 16°30'20" N: longitude 73°23'20" E) (Fig. 1) in Sindhudurg District, Maharashtra. However, the report of fossil fruit, *Canariocarpon ratnagiriensis* from Kalviwadi, Sindhudurg District has been published by Agarwal and Ambwani (2000) showing affinities with the modern taxon *Canarium* of the family Burseraceae. So far a very little information regarding the plant megafossils from the lignite of Maharashtra is known.

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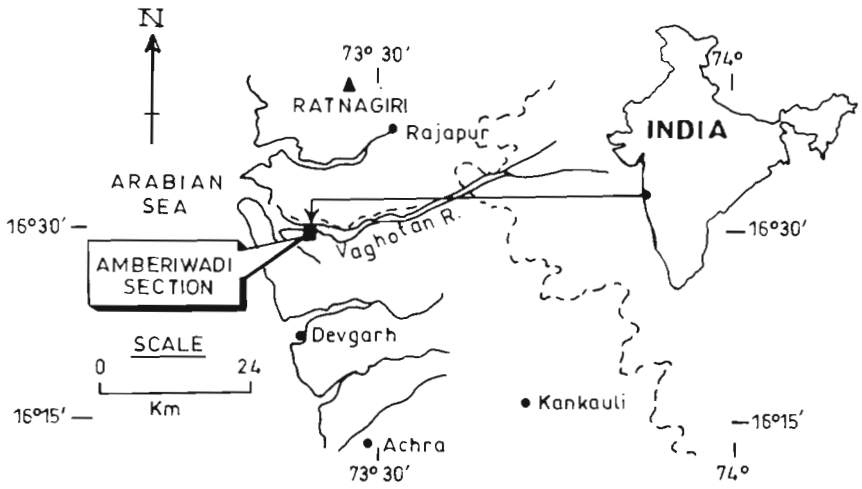

Fig. 1—Map of Sindhudurg District, Maharashtra, India showing Amberiwadi location from where the lignite fruits were collected (after Ramesh *et al.*, 1992)

Reports of pollen, spores and cuticles from Ratnagiri lignites have been published by Dalvi and Kulkarni (1982), Kulkarni and Phadtare (1980, 1983), Kulkarni *et al.* (1985), Phadtare and Kulkarni (1980a, b, 1984a, b), Saxena and Misra (1990), Saxena *et al.* (1992) and Saxena (1995) published the microfossils from Ratnagiri beds of Sindhudurg District. Saxena *et al.* (1992) tentatively reported fossil fruits from the lignite beds of Ratnagiri, Maharashtra without assigning their affinities. Occurrence of *Bouea rediensis* and *Shoreoxylon vayganiensis* of the families Anacardiaceae and Dipterocarpaceae respectively have been recorded by Srivastava and Saxena (1998) from the same beds.

Prasad and Awasthi (1996) described the fossil leaf of *Randia* Houst. ex Linn. in the Siwalik flora of Western Nepal, while other rubiaceous fossil leaves known from Miocene sediments of India are reported by Agarwal (1990) and Prasad (1994a, 1995). However, *Canthiumoxylon neyveliensis* constitutes the only record of rubiaceous wood from the Miocene sediments of India Agarwal (1992).

MATERIAL AND METHODS

The fossil fruit recovered from an exposed section at Amberiwadi shows basal grey clay which is overlain by compact lignitic layer, hard grey clay mixed with ferrugenous matter, ironstone and laterite (Fig. 2). The lignite bearing part

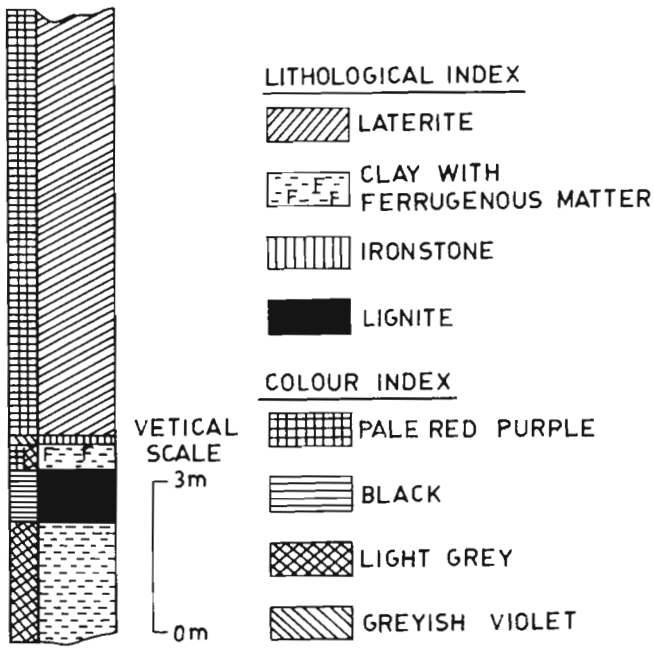

Fig. 2—Lithology of Amberiwadi Section showing sequence of various strata of Ratnagiri Beds, Maharashtra, India (after Ramesh *et al.*, 1992).

PLATE 1

1. Fossil fruit, *Amberiwadiacarpon devgarhensis* gen. et sp. nov. showing prominent rf- ridges and furrows, a- apical, b- basal. Museum Specimen No. 38809.
2. Lateral view of the fruit showing ridges and furrows. Museum Specimen No. 38809.
3. Fruit showing broken area with prominent ridges and furrows. Museum Specimen No. 38809.
4. Cellular details between two ridges showing st- stomata dispersed in the outer wall SEM. x 900.
5. Cross section of the outer wall showing meshwork of fibrous cells below the ridge area SEM. x 200.
6. Inner layer of the fruit showing longitudinal and oblique running fibrous cells SEM. x 110.
7. A single fibre cells enlarged to show fibre pits on its wall SEM. x 3200.
8. Cross-section showing the inner surface of the fruit wall SEM. x 800.
9. Branched fibres and fibre tracheids SEM. x 1200.

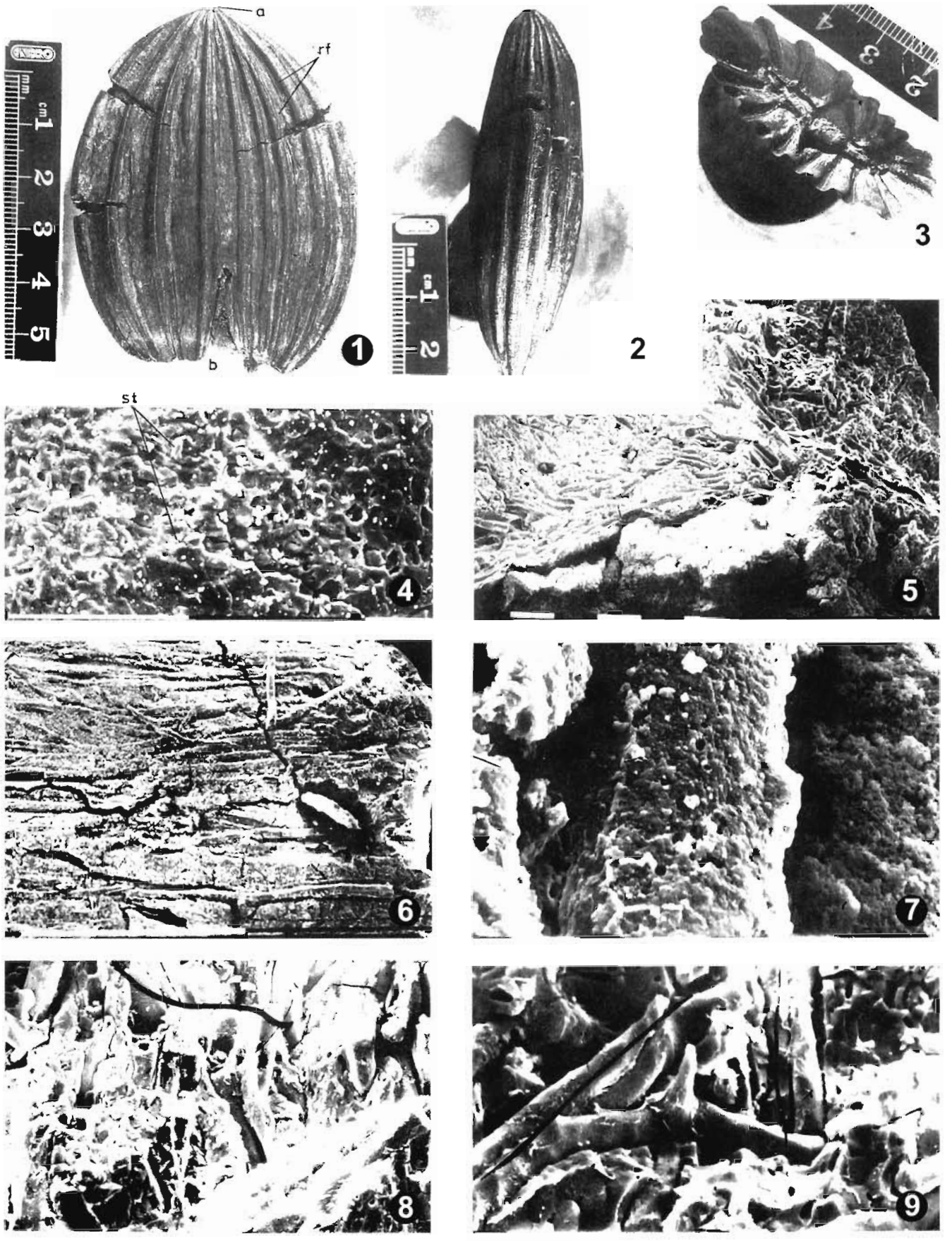

PLATE 1

is mixed with soft clay. Some fragmentary wood pieces partly carbonised were also present associated with the matrix. The fossil fruit was found loosely embedded in the upper part of the lignite associated with brownish red ferrugenous sediments in the section. Only single carbonised fruit was recovered from this section.

SYSTEMATIC DESCRIPTION

Family—RUBIACEAE

Genus—AMBERIWADIACARPON gen. nov.

AMBERIWADIACARPON DEVGARHENSIS gen. et sp. nov.

(Pl. 1·1-9)

The systematic description is based only on single carbonised fruit measuring 7·5 cm in length, 5·5 cm in breadth and 2 mm thick (Pl. 1·1-3). The fruit is dark brown to blackish in colour; brittle, bilaterally compressed probably due to over burden of the sediments, oval (broadly ellipsoidal) in shape, apically dehiscent, apex ruptured, sessile. The fruit appears to be a capsular in nature and highly ribbed at the outer surface due to ridges and furrows; these ribs numbering 20 are very prominent and run from base to apex of the fruit. The thickness of the ridges varies from 1 to 3 mm and they are 4 to 5 mm apart. They converge from base to apex of the fruit. The fruit wall consists of two layers, the outer and inner, it is highly fibrous in nature, the fibres anastomose on the exterior of the fruit wall and run more or less straight in the inner surface (Pl. 1·5). The area between the ridges shows some cellular details and the stomata dispersed are in these areas (Pl. 1·4). The fibres bear pits on their walls (Pl. 1·7). The inner surface of the fruit wall is thin and contains some interwoven fine fibres and tracheids (Pl. 1·8-9). Overall the cellular details were meagerly preserved probably due to high temperature during the fossilisation The cellular details indicate that the middle lamella of these cells seems to have been severely effected showing its absence thereby indicating the action of high temperature on the cell wall. The fruit was cut in cross-section to know the nature of ovary; however, it was found that the fossil fruit comprised only outer shell indicating that it must have been a capsule which led to shed off the seeds after it was mature and fallen down before fossilisation.

Generic Diagnosis—Fruit capsule, dark brown to blackish in colour, internally hollow, filled with sediments, measuring 7.5 cm long; 5.5 cm broad, 2 mm in thickness. Fruit wall divisible in two layers, the outer and inner, highly fibrous, ridges and furrows prominent, 20 in number, vary from 1 to 3 mm thick and 4 to 5 mm apart running from base to apex, convergent, base broken; stomata present between ridges; inner surface of fruit wall fibrous forming fine mesh work.

Specific Diagnosis—Fossil fruit probably capsule, dark brown to black in colour, size of the fruit is 7·5 cm in length, 5·5 cm in breadth and 2 mm in thickness, ribbed, ridges and furrows prominent on the outer surface; 20 in number, some of the ridges do not reach to the full length of the fruit. They are 1-3 mm thick and 4 to 5 mm apart, stomata present between the ribs, ribs extend from base to apex, convergent, basal part broken. The fruit wall distinguishable in 2 layers; the outer highly fibrous, and the inner thin containing fine fibres which run obliquely. The fruit is internally hollow filled with sediments.

Holotype—Pl. 1·1, Museum Specimen No. BSIP 38809.

Horizon—Tertiary.

Age—Miocene.

Type locality—Amberiwadi, Sindhudurg District, Maharashtra, India.

COMPARISON

As far as the authors are aware fossil fruits similar to the present specimen bearing ridges and furrows have so far not been reported from the Tertiary sediments of India and abroad. However, after critically going through the available literature it has been assigned to a new fossil genus *Amberiwadiacarpon*. The generic name has been derived from the locality Amberiwadi from where it has been recovered while the specific name denotes to Devgarh Taluk. Fruits with similar morphological features are known to occur in the extant family Rubiaceae (e.g., *Randia* Houst. ex Linn. and *Psychotria* Linn.). Generally the fruits of this family are smaller in size than the fossil, they are as large as 3 cm wide in *Randia exaltata* Griff. Corner (1952) whereas 3·7 cm long in *Randia maculata* DC. Backer & Brink (1965). The fruits in *Psychotria* Linn. vary from 1·25-1·5 cm long bearing 10-12 ribs which run from base to apex (Backer & Brink, 1965). They are generally capsular in nature. This justifies the nature of the fossil fruit which seems to have shed off its seeds after its maturity. Due to non availability of more anatomical characters in the fossil, it could not be compared in detail with any extant fruits.

The family Rubiaceae growing in tropical to temperate regions of the world consists of 500 genera and as many as 6000 species comprised of trees, shrubs and herbs (Backer & Brink, 1965; Willis, 1973). The members of this family are distributed mainly in the tropical and sub-tropical regions of the world, but a few also occur in temperate and arctic regions. *Randia* Houst. ex. Linn. is a large genus comprising 200-300 species of shrubs and trees which are distributed in the tropical regions of the world. This genus includes 16 species while *Psychotria* has about 40 species, growing in the forests of Martaban, Tenasserim, Sylhet, Assam and Khasi Hills, eastern Bengal, Chittagong, Western Ghats, Konkan, Sri Lanka as well as evergreen forests of Andaman and swampy forest of Pegu etc. Gamble (1972). *Randia exaltata* grows in mangrove swamps of Tenasserim and Andaman Island while the species

of *Psychotria* Linn. occur in all tropical and subtropical habitats of the world (Hooker, 1882). As the members of the family Rubiaceae grows in various ecological conditions so it is difficult to infer about the palaeoecological condition by this fruit alone.

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REFERENCES

Agarwal A 1990. Leaf impressions from the Neyveli Lignite deposits, Tamil Nadu, India. Journal of the Indian Botanical Society 69: 35-38.

Agarwal A 1992. A new carbonised wood of Rubiaceae from the Neyveli lignite deposits, India. Journal of the Indian Botanical Society 71: 181-184.

Agarwal A & Ambwani K 2000. *Canariocarpon ratnagiriensis* gen. et. sp nov. from Sindhudurg District, Maharashtra, India. Palaeobotanist 49 : 93-100.

Backer CA & Brink RCB 1965. Flora of Java. Vol. II: 1- 641. Noordhoff-Groningen, The Netherlands.

Corner EJH 1952. Wayside trees of Malaya, Vol. I: 1-772. Printed at the Government Printing Office, Singapore.

Dalvi NS & Kulkarni AR 1982. Leaf cuticles from lignite beds of Ratnagiri District, Maharashtra. Geophytology 12 : 223-232.

Gamble JS 1972. A Manual of Indian Timbers. Bishen Singh, Mahendra Pal Singh, Dehradun: 1-856.

Hooker JD 1882. The Flora of British India, Vol. 3. L.Reeve and Company Limited. Kent, England.

Kulkarni AR & Phadtare NR 1980. Leaf epidermis of *Nypa* from lignite beds of Ratnagiri District, Maharashtra. Geophytology 10: 125-128.

Kulkarni AR & Phadtare NR 1983. Pollen of *Nypa* from lignite beds of Ratnagiri District, Maharashtra. Phytomorphology 31 : 48-51.

Kulkarni AR, Phadtare NR & Dalvi N 1985. Monocotyledonous pollen grains from Ratnagiri lignite. *In*: Varghease TM (Editor)—Recent Advances in Pollen Research, Allied Publishers Private. Limited : 295-313.

Phadtare NR & Kulkarni AR 1980a. Palynological investigation of Ratnagiri lignite, Maharashtra. Geophytology 10 158-170.

Phadtare NR & Kulkarni AR 1980b. *Laevigatosporites ovalis* Wilson & Webster, with sporangium from lignite beds of Ratnagiri District. Current Science 49: 603p.

Phadtare NR & Kulkarni AR 1984a. Palynological assemblage of lignite exposures of Ratnagiri District. *In*: Badve RM *et al.* (Editors)—Proceedings 10th Indian Colloquium Micropaleontology, Stratigraphy, Pune, 1982. Maharashtra Association for Cultivation of Science, Pune: 515-531.

Phadtare NR & Kulkarni AR 1984b. Woods of Anacardiaceae from lignite beds of Ratnagiri District, Maharashtra. *In*: Tiwari RS *et al.* (Editors)—Proceedings 5th Conference, Lucknow, 1983. Special Publication (1984) : 232-242. Palaeobotanical Society, Lucknow.

Prasad M 1994a. Plant megafossils from the Siwalik sediments of Koilabas, Central Himalaya Nepal and their impact on palaeoenvironment. Palaeobotanist 42 : 126-156.

Prasad M 1994b. Investigations on the Siwalik (Middle Miocene) leaf impressions from the foot-hills of the Himalaya, India. Tertiary Research 15 . 53-90.

Prasad M 1995. Siwalik flora from Koilabas area in the Nepal Himalaya and its significance on palaeoenvironment and phytogeography. Journal of Nepal Geological Society. Kathmandu, 11 Special Issue: 203-216.

Prasad M & Awasthi N 1996. Contributions to the Siwalik flora from Suraikhola sequence, western Nepal and its palaeoecological and phytogeographical implications. Palaeobotanist 43 : 1-42.

Saxena RK 1995. Sindhudurg Formation - a new lithostratigraphic unit in Konkan area of Maharashtra. Geophytology 24 : 229-232.

Saxena RK & Misra NK 1990. Palynological investigation of the Ratnagiri beds of Sindhudurg District, Maharashtra. Palaeobotanist 38: 263-276.

Saxena RK, Misra NK & Khare S 1992. Ratnagiri beds of Maharashtra lithostratigraphy, flora, palaeoclimate and palaeoenvironment of deposition. Indian Journal of Earth Science 19 : 205-213.

Srivastava R & Saxena RK 1998. Carbonised woods from Sindhudurg Formation (Miocene) in Ratnagiri and Sindhudurg District, Maharashtra, India. Geophytology 27: 23-33.

Srivastava NC 1967. A new microfossil genus *Oudhkusumites* from Tertiary of India. Review Micropalaeontology, 10 : 37-41.

Willis JC 1973. *A dictionary of the flowering plants and ferns*. Cambridge University Press, Cambridge. pp. 1245.