OCCURRENCE OF *DUABANGA* IN THE SIWALIK SEDIMENTS

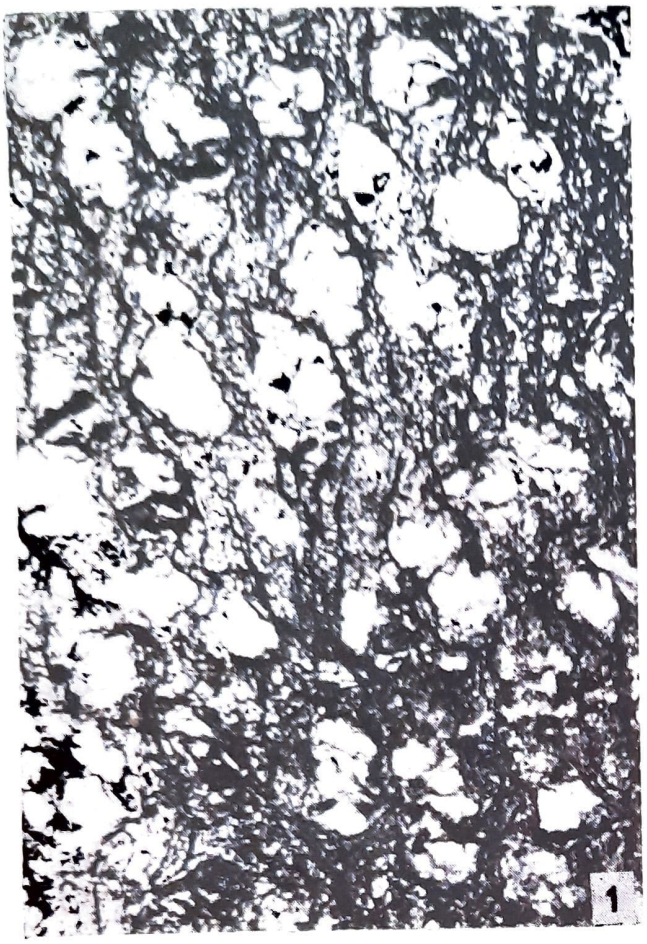
The genus *Duabanga* of the family Sonneratiaceae consists of only three species, viz., *Duabanga grandiflora* (Roxb. ex DC) Walp. (syn. *Duabanga sonneratiodes* (Buch-Ham.), *D. moluccana* Bl. and *D. taylorii* Jayv. (Jayveera, 1967), distributed in the tropical forests of north-east India, Burma and Malaysia. Like dipterocarps, legumes, terminalias and several other tropical dicotyledonous genera, *Duabanga* is also well known by its fossil records of petrified woods and pollen grains distributed widely in India and Malaysia during the Neogene times. The woods are described as *Duabangoxylon tertiarum* Prakash & Awasthi (1970) from the Namsang beds near Deomali, Arunachal Pradesh and from the Tertiary (probably Miocene-Pliocene) of Java and Sumatra by Kramer (1974), and *D. indicum* (Navale) Awasthi (1981) from the Cuddalore Sandstone near Pondicherry. The pollen grains referable to it have been reported by Rao and Ramanujam (1975) from the lignite deposits of Quilon in Kerala coast.

The fossil wood of *Duabanga* reported in the present communication was collected from the Siwalik sediments exposed along the Himalayan foot-hills at Kalagarh, Uttar Pradesh. Already a number of angiospermous woods have been described from this locality by Prakash (1978, 1981), Prakash and Prasad (1984), Prasad (1987), Trivedi and Ahuja (1978a, 1978b, 1978c, 1979), Trivedi and Misra (1978, 1979, 1980) and Trivedi and Panjwani (1986). These sediments have been assigned to the upper part of the Lower Siwalik (Sahni & Mathur, 1964; Sahni, Tiwari & Kumar, 1980).

Description

The wood is small in size, measuring 7 × 8 cm, and its preservation is fairly good. *Wood* diffuse-porous. *Growth rings* indistinct, sometime traceable due to crowding of vessels (Pl. 1, fig. 1). *Vessels* small to medium, solitary and in radial multiples of 2-5 (mostly 2-3), more are less evenly distributed, 10-20 per sq mm, t.d. 60-180 μm, r.d. 80-220 μm; vessel-members 150-520 μm long, usually with truncate ends; perforations simple ; tyloses abundant (Pl. 1, fig. 1); intervessels pits vestured, alternate, 8-10 μm in diameter, orbicular to oval in shape with linear to lenticular apertures. *Parenchyma* scanty paratracheal to vasicentric, forming 1-2 seriate contiguous or incomplete sheath around vessels, thin-walled, 14-20 μm in diameter, 50-125 μm in length. *Xylem rays* fine, mostly uniseriate, occasionally biseriate, 15-30 μm in width and 40 cells in height (Pl. 1, fig. 3); ray tissue heterogeneous, rays homocellular to heterocellular, consisting both upright and procumbent cells; procumbent cells 17-25 μm in vertical height and 25-60 μm in radial length, upright cells 30-50 μm in vertical height and 15-27 μm in radial length (Pl. 1, fig. 5). *Fibres* polygonal in cross section, nonseptate, 10-35 μm in diameter, 600-900 μm in length, pits not seen.

Affinities—In all the above xylotomical characters the fossil wood indicates its close similarity with the woods of *Duabanga*. Of the two modern species available for detailed comparison, *D. grandiflora* and *D. moluccana*, the wood of both these genera is similar to the fossil wood. However, considering the size and distribution of vessels, especially the crowding of the vessels at the beginning of the annual growth, *D. moluccana* appears to be closer.



Awasthi & Prasad—Plate 1

Among the known fossil woods of *Duabanga*, the present fossil is closer to *Duabangoxylon indicum* (Navale) Awasthi, specially in having vessels slightly smaller in size and more frequent than to *Duabangoxylon indicum*.

Specimen—Museum no. B. S. I. P. 36225

Locality—Sukhasot Nala, Kalagarh, Uttar Pradesh; Middle Miocen.

References

Awasthi, N. (1981). Reinvestigation of *Sapindoxylon indicum* Navale from the Cuddalore Series near Pondicherry. *Palaeobotanist*, **27**(2) : 161-165.

Jayaweera Don, M. A. (1967). The genus *Duabanga*. *J. Arnold Arb.*, **48** : 89-100.

Kramer, K. (1974). Die Tertiaren Holzer Südost-Asiens (Unter Auschluss der Dipterocarpaceae). *Palaeontographica*, **B 144** : 45-181.

Prakash, U. (1978). Fossil woods from the Lower Siwalik beds of Uttar Pradesh, India. *Palaeobotanist*, **25** : 376-392.

Prakash, U. (1981). Further occurrence of fossil woods from the Lower Siwalik beds of Uttar Pradesh, India. *Palaeobotanist*, **28-29** : 374-388.

Prakash, U. & Awasthi, N. (1970). Fossil woods from the Tertiary of eastern India. I. *Palaeobotanist*, **18**(1) : 32-44.

Prakash, U. & Prasad, M. (1984). Wood of *Bauhinia* from the Lower Siwalik beds of Uttar Pradesh, India. *Palaeobotanist*, **32**(2) : 140-145.

Prasad, M. (1987). A fossil palm wood from the Lower Siwalik beds of Kalagarh, Uttar Pradesh, India. *Geophytology*, **17**(1) : 114-115.

Rao, K. P. & Ramanujam, C. G. K. (1975). A palynological approach to study the Quilon beds of Kerala State in South India. *Curr. Sci.*, **44** : 730-732.

Sahni, M. R. & Mathur, L. P. (1964). Stratigraphy of the Siwalik Group. *Brochure 22nd Inter. Geol. Cong. India*. New Delhi, pp. 1-24.

Trivedi, B. S. & Ahuja, M. (1980a). *Sterculioxylon kalgarhensis* sp. nov. from Kalagarh (Bijnore District), U. P., India. *Curr. Sci.*, **47**(1) : 24-25.

Trivedi, B. S. & Ahuja, M. (1978b). *Glutoxylon kalagarhensis* sp. nov. from Kalagarh. *Curr. Sci.*, **47**(4) : 135.

Trivedi, B. S. & Ahuja, M. (1978c). *Cynometroxylon siwalicus* n. sp. from Siwalik Range. *Curr Sci.*, **47**(17) : 638-639.

Trivedi, B. S. & Ahuja, M. (1979). *Pentacmoxylon ornatum* gen. et sp. nov. from the Siwalik of Kalagarh. *Curr. Sci.*, **48**(14) : 646-647.

Trivedi, B. S. & Misra, J. P. (1978). *Dialiumoxylon kalagarhense* n. sp. from Mio-Pliocene of Kalagarh, U. P., India. *Indian J. Bot.*, **1**(1 & 2) : 57-60.

Trivedi, B. S. & Misra, J. P. (1979). *Dysodendron kalagarhense* gen. et sp. nov. from Mio-Pliocene of Kalagarh, U. P., India. *J. Indian bot. Soc.*, **58** : 90-94.

Trivedi, B. S. & Misra, J. P. (1980). Two new dipterocarpaceous woods from the Middle Siwalik of Kalagarh, Bijnore District, India. *Palaeobotanist*, **26**(3) : 314-321.

Trivedi, B. S. & Panjwani, M. (1986). Fossil wood of *Bauhinia* from the Siwalik beds of Kalagarh, U. P. *Geophytology*, **16**(1) : 66-69.

Explanation of Plate

Plate 1

1. *Duabangoxylon indicum* : Cross section showing the nature and distribution of vessels and parenchyma. × 40. Slide no. B.S.I.P. 36225/I.
2. *Duabanga malucana* : Cross section showing similar shape, size and distribution of vessels and parenchyma as in the fossil shown in fig. 1 × 40.

3. *Duabangoxylon indicum* : Tangential longitudinal section showing xylem rays. × 90. Slide no. B.S.I.P. 36225/II.
4. *Duabanga moluccana* : Tangential longitudinal section showing similar xylem rays as in fossil shown in fig. 3. × 90.
5. *Duabangoxylon indicum* : Radial longitudinal section showing heterocellular xylem rays. × 90. Slide no B.S.I.P. 36225/III.

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