

A new species of *Bauhinia* from the Kasauli Formation (Lower Miocene), Kasauli, Himachal Pradesh

Ritesh Arya* & N. Awasthi**

*Department of Advance Studies in Geology, Punjab University, Chandigarh

**Birbal Sahni Institute of Palaeobotany, 53 University Road, Lucknow 226007

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Based on leaf-impressions, a new species of *Bauhinia*, *B. kasaulica* sp. nov., is described from the type area of Kasauli Formation, Kasauli, Himachal Pradesh. The leaf impressions show close similarity with the leaves of *Bauhinia variegata* Linn. This species continues to occur in deciduous forest of the sub-Himalayan tract, eastward to Assam and Myanmar.

Key-words – Fossil leaf, *Bauhinia*, Fabaceae, Kasauli Formation (Lower Miocene), Himachal Pradesh.

INTRODUCTION

THE Kasauli Formation is one of the important sedimentary sequences of the Himalayan foreland basin overlain by the molasse Siwalik Group. It is massively developed in Himachal Pradesh (Text-fig. 1) and consists of rich deposits of plant and animal remains (Sahni & Arya, 1993). Occurrence of plant fossils in the Kasauli sediments is known ever since Medicott (1864) discovered leaf-impressions from the Kasauli type area, Kasauli, which were later figured and referred to *Sabal major* Heer by Feistmantel (1882, Figs 3-5). Sahni (1953), in a posthumous paper, described a parallel-ribbed impression probably belonging to fan palm and a few ill-preserved dicotyledonous leaves from near Kasauli Club. These monocotyledonous leaves were described again by Sahni (1964) as *Sabalites microphylla* and *Sabalites* sp. Chaudhri (1969) also made an attempt to study a few badly preserved leaves and referred them to *Poacites* sp., *Palmophyllum* sp. (monocotyledons) and dicotyledons in general. Mehra *et al.* (1990) reported a few angiospermous flower and flower buds of uncertain affinities from near Barog, Kalka-Simla Road.

During last five years, one of us (R.A.) undertook extensive field work around Kasauli Town (longitude 30° 0' 37" N, Latitude 77° 0' 1") and collected a large number of plant fossils comprising impressions of leaves, flowers, fruits and seeds of angiosperms.

The Kasauli Formation in the type area is marked by distinct lithology, characterised by massive grey sandstone, and greenish-grey silty shales and sandstone, measuring more than 2100 m in thickness (Chaudhri, 1969). A gradual contact can be seen between Kasauli and underlying Subathu and Dagshai formations as one traverses from Kalka and Kasauli via Jangeshu. The main Boundary Thrust (MBT) separating the Lesser Himalaya from the Siwaliks is distinctly marked near Taksal where they are overthrust on Siwalik sediments (Fig.1).

The Kasauli sediments are distinctly marked by underlying Dagshai sediments because of difference in colour and increase in arenaceous contents in the sediments. On the northern side, a traverse from Garkhal to Kasauli, a tectonic contact between Subathu and Kasauli can be seen where the whole Dagshai sequence is missing. The two formations are separated by Koti/Surajpur thrust. Here the green shales containing foraminifera and gastropods are in direct contact with Kasauli sandstone.

The material for the present study, comprising a dozen leaf-impressions, was collected from the type area of the Kasauli Formation. They are preserved in the fine-grained silty shale beds overlying the coarse-grained green fossiliferous sandstone. Fineness of the sediments makes it a good matrix for preservation of fossils.

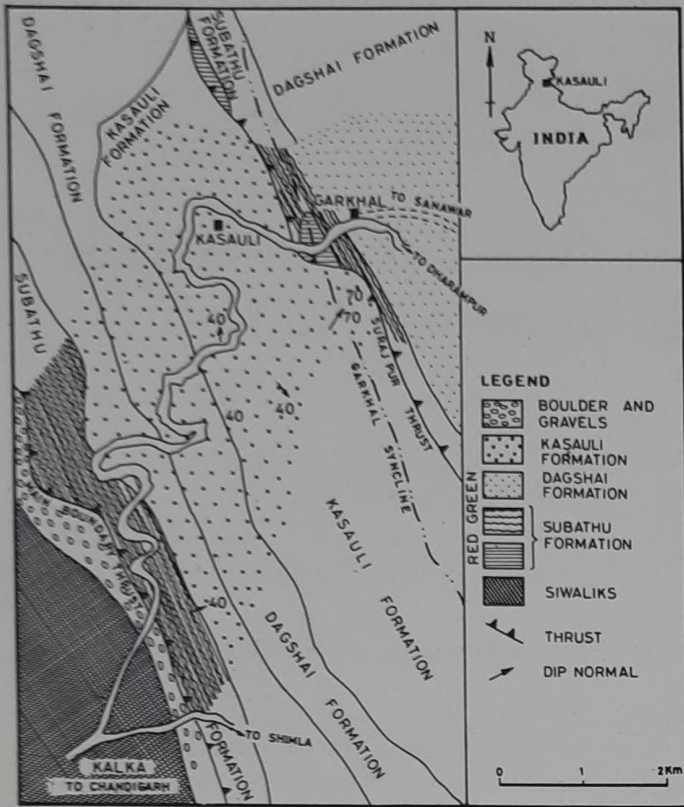


Figure 1. Geological map showing Tertiary formations exposed along Kalka-Kasauli-Shimla Road (After Kapoor & Singh 1987).



Figure 2. Fossil leaf, *Bauhinia kasaulica* sp. nov. Natural size.

DESCRIPTION

Family - Fabaceae
 Genus - *Bauhinia* Linn.

Bauhinia kasaulica sp. nov.

Figs. 2,3

This species is represented by a dozen specimens of leaf-impresions. The following description is, however, based on a better preserved and slightly bigger specimen.

Leaf bilobed, lobes folded and overlapped, seemingly symmetrical, marginal portion of upper half broken, lobes wide elliptic, length and width of preserved part 8.0 x 6.0 cm, apex missing; base lobate; normal, equilateral, margin entire, texture chartaceous, petiole normal, preserved length 2.2 cm, venation acrodromous, perfect, basal, 7-8 primary veins arising from base and given off to each lobe, veins prominent, moderate and equal in thickness, curving and converging towards apical region, secondary veins numerous, joining adjacent secondaries, fine, curved, wavy, tertiary veins well developed, numerous, mostly arising at right angle (RR) joining superadjacent veins, orthogonal reticulate, quaternary veins thick, orthogonal, areoles



Figure 3. An enlarged portion showing details of venation pattern.

well developed oriented, quadangular to pentagonal, veinlets probably linear.

DISCUSSION

Affinities - The most characteristic feature of fossil leaves is that they are bilobed with 7-8 primary veins in each lobe. In this feature the leaves are closely comparable to those of the genus *Bauhinia*. Among the extant species of *Bauhinia*, *B. malabarica* Roxb., *B. monandra* Kurz, *B. nervosa* Wall., *B. phoenicea* Linn., *B. polycarpa* Wall., *B. purpurea* Linn., *B. racemosa* Lam., *B. retusa* Ham., *B. tomentosa* Linn., *B. vahlii* Wight et Arn., *B. variegata* Linn., *B. velutina* Wall., etc. were examined critically in order to find out the nearest modern counterpart of the fossil leaves. In shape, size and venation pattern the fossil leaves show resemblance with most of the species of *Bauhinia*. However, in having 7-8 secondary veins given off to each lobe and their courses, the fossil leaves resemble closely to *Bauhinia variegata* and differ from other species. A number of herbarium specimens of *B. variegata* were further examined critically to confirm whether the number of primary vein in the leaves is a variable feature. It was found that 6-7 primary veins in each lobe is a constant feature of the leaves of *B. variegata*. Although 7 primary veins also observed in *B. vahlii*, the leaves are very big as compared to *B. variegata* and the present fossil leaves. In other species of *Bauhinia* the primary veins in each lobe are generally 3-4 or 5.

Holotype - No. VPL/A-1, Laboratory of the Centre of Advance Studies in Geology, Punjab University, Chandigarh.

Locality - Kasauli, Himachal Pradesh.

Horizon - Kasauli Formation

Age - Lower Miocene

Comparison with fossil species - The genus *Bauhinia* is of common occurrence in the Neogene sediments of India. It occurs in the form of petrified woods and leaf-impressions (see Awasthi, 1992; Guleria, 1992). The leaf impression of *Bauhinia* described so far are: *Bauhinia kachchhensis* Lakhanpal & Guleria (1982) from the Lower Miocene of Geola-Mokra, Kutch; *Bauhinia siwalika* Lakhanpal & Awasthi (1984), *B. nepalensis* Awasthi & Prasad (1990) and *B. ramthiensis* Antal & Awasthi (1994), from the Siwalik sediments of Bhikhathoree, West Champaran District, Bihar-Nepal border; Surai Khola, Nepal, and near Oodlabari, Darjeeling District, West Bengal, respectively. Besides, a leaf-impression of *Bauhinia* cf. *B. purpurea* Linn. is known from the Late Cenozoic beds of Mahuadanr, Palamu District, Bihar (Bande & Srivastava, 1990). The present fossil leaves of

Bauhinia differ from the known species in having primary veins 7-8 in each lobe as against 4-5 or 6. Therefore the present fossil leaves are assigned to a new species *Bauhinia kasaulica* sp. nov. The specific name is after Kasauli Town.

Bauhinia variegata, with which the fossil leaves resemble most, is a deciduous middle-sized tree occurring in the sub-Himalayan tract from the Indus eastward, Assam, Myanmar and western peninsula (Brandis, 1906).

From the solitary record and the known fragmentary monocotyledonous leaves it is too early to draw inferences regarding palaeoecology and palaeoenvironment of the area during the deposition of Kasauli sediments. However, the collection of large number of plant remains comprising a variety leaves, flowers, fruits and seeds from the Kasauli type area, which are being studied, suggests the existence of tropical evergreen to deciduous forest in the vicinity of the depositional site during Lower Miocene.

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