# Leaf impressions from Kasauli sediments of Himachal Pradesh and their palaeoenvironmental significance

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In the present communication occurrence of fossil leaves belonging to six families and seven genera have been reported from Lower Miocene deposits of Kasauli Formation exposed around Kasauli township, Himachal Pradesh. The genera are: *Semecarpus* (Anacardiaceae), *Chukrasia* and *Heynea* (Meliaceae), *Tephrosia* (Fabaceae), *Mallotus* (Euphorbiaceae), *Donax* (Marantaceae) and *Poacites* (Poaceae). Among these, remains of the first five genera have been reported for the first time from the area. Of the remaining two genera, a new species of *Poacites* has been established and an earlier reported genus *Clinogyne*, which no longer exists, has been nomenclaturally corrected.

***Key-words***—Fossil leaves, Kasauli Formation, Lower Miocene, Himachal Pradesh, India.

## INTRODUCTION

THE Kasauli Formation is one of the important and thickest Tertiary sedimentary deposits around Kasauli area of Himachal Pradesh. It overlies the Dagshai Formation and is succeeded by the molassic Siwalik sediments. The formation is well developed in and around the Kasauli township and measures over 2000 m in thickness (Chaudhri, 1969). The age of the formation has been considered to be Lower Miocene (Sahni 1953; Guleria *et al.* 2000b). The occurrence of plant remains in the Kasauli Formation was first reported by Medlicott (1864). They were ignored till the middle of the twentieth century when late Prof. Birbal Sahni paid attention to them (Sahni 1953). Since then a few publications have come out on plant remains of Kasauli which have been referred by Mathur *et al.* (1996, pp. 2-3) while describing a number of new plant fossils (*op. cit.* pp. 38-56). Some more data have been generated and megafossils belonging to 16 angiospermous and 2 pteridophytic taxa have since been reported which are listed below : *Bauhinia kasaulica* (Arya & Awasthi 1994), *Clinogyne* cf. *C.ovatus, Combretum sahnii, Garcinia kasaulica, Gluta miocenica, Phyllanthus palaeoreticularis* (Arya & Awasthi 1996); *Acrostichum lanzaeanum* (Awasthi *et al.* 1996); *Amesoneuron sahnii, Amoora palaeowallichii, Bambusa siwalica, Bauhinia krishnanunnii, Cassia miosiamea, Dipterocarpus siwalicus, Legumin-ophyllum kasauliensis* (Guleria *et al.* 2000b); *Mitragyna tertiara, M. sahnii* (Guleria *et al.* 2000a; *Arthromeris kasauliensis, Syzygium kasauliensis* (Arya *et al.* 2001).

The material for the present study was collected from the type area of Kasauli Formation. The plant remains are preserved in fine grained silty shales. The lithology of Kasauli Formation is well documented (Chaudhri 1968; Singh 1978; Srivastava & Casshyap 1983; Mathur *et al.* 1996).

## SYSTEMATIC DESCRIPTION

### Dicotyledons

### Family —Anacardiaceae

### Genus— *Semecarpus* Linn.

***Semecarpus palaeoanacardium*** sp. nov.

Pl.1, Fig. 1

*Material* : The species is based on a single specimen and its counterpart.

*Description* : Leaf simple; seemingly symmetrical; only lower half preserved, upper half missing; preserved length about 7.0 cm and width 4.5 cm; base cuneate; texture coriaceous; petiole thick; venation pinnate, eucamptodromous, primary vein or mid vein (1°) thick and prominent, secondaries (2°) moderately

thick, 8 pairs present on preserved portion, sub-opposite or opposite at basal part, alternate from middle part; angle of divergence broad acute, 55° -75°, a few secondaries bifurcated towards margin; tertiary veins (3°) present at few places, almost at right angles to secondaires, weakly purcurrent, higher order venation not seen.

*Affinities*: The important diagnostic features of the fossil leaf are: simple leaf with cuneate base, coriaceous texture, thick petiole, eucamptodromous venation, primary vein thick, secondaries at broad acute angles and tertiaries more or less at right angles. These characters indicate its affinities with the leaves of genera belonging to Anacardiaceae, particularly with *Semecarpus anacardium* (FRI Herbarium sheet no. 18815) and *Anacardium occidentale,* but more with the former in shape, size and venation pattern.

A number of anacardiaceous leaves are known from Tertiary sediments of India and Nepal. They represent the following genera: *Bouea* (Prasad 1994); *Mangifera* (Lakhanpal & Awasthi 1984; Srivastava *et al.*, 1992; Prasad 1994; Awasthi & Mehrotra 1995; Prasad *et al.* 1998; Mehrotra 2000), *Eomangiferophyllum* Mehrotra *et al.* (1998); *Swintonia* (Awasthi & Prasad 1990; Prasad & Awasthi 1996; Konomatsu & Awasthi 1999; Prasad *et al.* 1999) and *Tapiria* (Prasad 1994). The fossil leaf under consideration is different from all the aforesaid genera in its venation pattern and in having broader lamina, thicker mid-rib and cuneate leaf base.

Since the present specimen shows best resemblance with the extant leaves of *Semecarpus anacardium,* it is described as *Semecarpus palaeoanacardium* sp. nov.

*Holotype :* Museum no. BSIP 39076.

*Locality :* Behind Kasauli Bus Stand, Solan District, Himachal Pradesh.

**Family —Meliaceae**

**Genus—*Chukrasia* A. Juss.**

***Chukrasia himachalensis* sp. nov.**

Pl. 1; Fig. 5

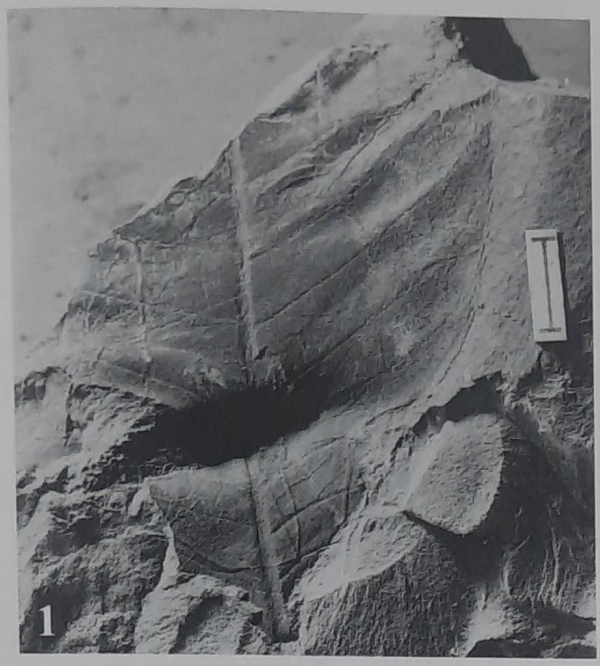
*Material*- The species is based on an impression of a single incomplete leaflet.

*Description*- Leaflet asymmetrical, length about 5 cm, width 1.8 cm, ovate-lanceolate, apex acute; base asymmetrical, cuneate on narrower half and obtuse on broader half; margin entire; texture chartaceous; petiole broken; venation pinnate, semi-craspidodromous; primary vein (1°) slightly curved, secondary veins (2°) alternate, 13-14 pairs preserved, angle of divergence broad acute or almost at right angle towards lower half and broad acute to acute towards upper half (50° - 85°), bifurcating towards margin, at places forming incomplete loops; intersecondaries seem to be present between a few secondaries; tertiaries (3°) veins purcurrent, forked, angle of divergence acute to right angle, higher order venation not seen.

*Affinities*- Asymmetrical leaflet, asymmetrical base, cuneate on narrower half and obtuse on broader half, pinnate semi - craspidodromous venation indicate affinities of the fossil leaflet with members of the family Meliaceae (Brandis 1971; Backer & Van den Brink 1968) particularly with the leaflets of *Chukrasia tabularis* (FRI Herbarium sheet no. 56909) and *Swietenia mahogoni* with some difference in size. *Swietenia mahogoni* possess leaflets of the size of fossils although it is an American species.

**PLATE 1** →

1. *Semecarpus palaeoanacardium* sp. nov. Fossil leaf. Natural size. BSIP Specimen no. 39076.
2. A modern leaf of *Semecarpus anacardium* showing similar shape, size and venation. Natural size.
3. *Heynea kasauliensis* sp. nov. Fossil leaf. Natural size. BSIP Specimen no. 39078.
4. Comparable modern leaf of *Heynea trijuga*. Natural size.
5. *Chukrasia himachalensis* sp. nov. Fossil leaflet. Natural size. BSIP Specimen no. 39077.
6. Comparable modern leaflet of *Chukrasia trijuga*. Natural size.
7. *Tephrosia kasauliensis* sp. nov. Fossil leaflet. Natural size. BSIP Specimen no. 39079.
8. A modern leaflet of *Tephrosia candida*. Natural size.
9. *Tephrosia kasauliensis* sp. nov. Fossil leaflet. X 2. BSIP Specimen no. 39079.





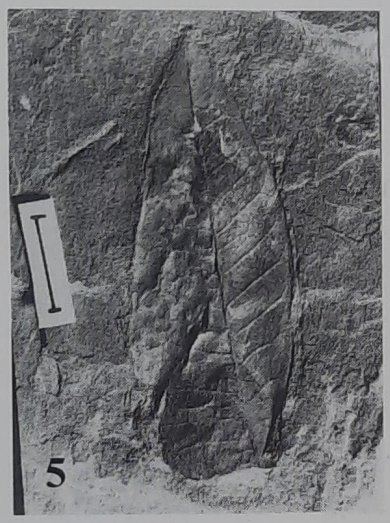









PLATE 1

So far, a few meliaceous leaves / leaflets are reported from Tertiary sediments of India and Nepal. These are: *Heynea trijugoides* Awasthi & Mehrotra (1995) from Oligocene sediments of Assam; *Aglaia nepalensis* Prasad *et al.* (1999) from Siwalik sediments of Nepal; *Toona siwalika* Awasthi and Lakhanpal (1990), Prasad (1994) from Siwaliks of Uttaranchal and Prasad and Tripathi (2000) from Siwaliks of Bhutan; *Amoora palaeowallichii* Guleria *et al.* (2000b) from pre-Siwalik sediments of Kasauli, Himachal Pradesh and *Chukrasia miocenica* from the Siwalik sediments of Kathgodam, Uttaranchal and Nepal (Prasad, 1994; Prasad & Awasthi, 1996).

As the fossil leaflet under consideration is different from all the known fossil Meliaceous leaves in shape, size and venation pattern and shows close resemblance with the leaflets of *Chukrasia,* it is described as *Chukrasia himachalensis* sp. nov.

*Holotype* : Museum no. BSIP 39077.

*Locality* : Adjoining MES Inspection Bungalow, Kasauli, Solan District, Himachal Pradesh.

***Heynea kasauliensis* sp. nov.**

Pl. 1; Fig. 3

*Material*: The description is based on a single incomplete specimen and its counterpart.

*Description*: Leaf incomplete, preserved length 5.5 cm, width at broadest point 3.7 cm., ovate; base broken on oneside of midrib, more or less obtuse; apex broken; margin entire; texture chartaceous; petiole thick, about 1cm in length, normal; venation pinnate; eucamptodromous; primary vein (1°) single, thick, distinct, slightly curved from the base; secondary veins (2°) prominent, 7 preserved at one side of the midrib, alternate, angle of divergence acute, about 80° (broad acute) at basal part and about 50° (narrow acute) at apical part, rarely bifurcating towards margin, uniformly curving upwards; higher order venation not preserved.

*Affinities*: The fossil leaf was compared with a large number of herbarium specimens at Forest Research Institute, Dehradun. It was found that the specimen shows best resemblance with *Heynea trijuga* (FRI Herbarium sheet no. 75/10016) of the family Meliaceae. A survey of fossil record of Meliaceae from the Indian subcontinent revealed that there is only one record of fossil leaf of *Heynea* known from the Oligocene sediments of Assam (Awasthi & Mehrotra, 1995). The present fossil differs from the known species in shape, size and base, and hence assigned to a new species, viz., *Heynea kasauliensis* sp. nov.

*Holotype* : Museum no. 39078.

*Locality* : Behind Kasauli Bus Stand, District, Himachal Pradesh.

**Family—Fabaceae**

**Genus—*Tephrosia* Pers.**

***Tephrosia kasauliensis* sp. nov.**

Pl. 1; Figs 7, 9

*Material*: The description is based on a single incomplete leaflet.

*Description*: Leaflet asymmetrical; shape oblong; preserved length 3.5 cm, width at broadest point 1 cm; apex broken; base acute; margin entire; texture thick chartaceous, probably due to presence of hair (pubescent); petiolule very small, about 1 mm in length, normal; venation pinnate; eucamptodromous; primary vein (1°) single, distinct; secondary veins (2°) numerous, closely placed, very fine or faint, alternate to opposite, angle of divergence acute, about 40°-45°, rarely bifurcated towards margin, very fine intersecondaries present; higher order venation not observed.

*Affinities*: The distinguishing characters of the fossil leaflet are: small size with acute base, very small petiolule, pinnate venation with very fine and closely spaced secondaries arising at moderately acute angles and thick chartaceous texture. These characters collectively indicate its close similarity with the leaflets of *Tephrosia* Persoon, particularly with those of *Tephrosia candida* DC of the family Fabaceae. The authors are not aware of any fossil record of *Tephrosia* leaflets. Hence the fossil is assigned a new name, *Tephrosia kasauliensis* sp. nov., the specific epithet indicating the name of the locality from where the fossil was collected.

*Holotype* : Museum no. BSIP 39079.

*Locality* : Behind Kasauli Bus Stand, Solan District, Himachal Pradesh.

**Family—Euphorbiaceae**

**Genus—*Mallotus*** Lour.

***Mallotus philippensis*** (Lam.) Muell. Arg.

Pl. 2; Figs 3, 4

*Material*: The description is based on a single incomplete specimen and its counterpart. The preserved specimen represents the upper half of the leaf.

*Description*: Leaf simple, incomplete, almost symmetrical; preserved length 7.3 cm, width at broadest point 4.5 cm., seemingly ovate; apex acute; base broken; margin entire; texture chartaceous; venation pinnate; eucamptodromous; point of origin of primaries at base not preserved, seemingly basal acrodromous, imperfect (Hickey, 1973); primary vein (1°) three, one mid primary and two lateral primaries, stout, straight, lateral primaries slightly curved upwards and also give off secondary veins towards margin; secondary veins (2°) arise at acute angles, angle of divergence 50°-55°, alternate to opposite, curved, terminating at margin; tertiary veins (3°) fine, angle of origin RR, purcurrent, seemingly unbranched, predominatly alternate, relationship to midrib right angle to oblique.

*Affinities*: The important features of the fossil are: simple, symmetrical, ovate, entire margined leaf with eucamptodromous and basal imperfect acrodromous venation. These characters collectively show resemblance with the modern leaves of the genus *Mallotus* Muell. of the family Euphorbiaceae. On comparing the fossil with the extant leaves of various species of *Mallotus,* it was found that it shows best resemblance with the leaves of *Mallotus philippensis* (FRI Herbarium sheet no. 9730). The authors are aware of eight records of fossil leaves of *Mallotus* from India and Nepal. They are listed in Table - 1.

Amongst the known records, the present fossil shows best resemblance with the specimen of *Mallotus philippinensis* reported by Puri (1947) from the Lower Karewas of Kashmir. Obviously the fossil is placed under the same species.

*Holotype :* Museum no. BSIP 39080.

*Locality :* Adjoining MES Inspection Bungalow,

**Table -1 Records of fossil leaves of *Mallotus***

| Name | Locality | Horizon and Age | Reference |
|---|---|---|---|
| *Mallotus philippinensis** Muell | Laredura and Liddermarg, Kashmir. | Lower Karewa, Plio - Pleistocene | Puri, 1947 |
| *Mallotus philippinensis** Muell | Mahanadi river section, foothills of Darjeeling District, West Bengal. | Middle Siwalik , Upper Tertiary | Pathak, 1969 |
| *Mallotus* sp. | Near Jawalamukhi, Himachal Pradesh. | Chinji Formation, Lower Siwalik, Middle Miocene | Mathur, 1978 |
| *M.philippensis* | Mahuadanr Valley, Palamu District, Bihar. | Late Cenozoic-Recent | Bande and Srivastava, 1990 |
| *M.kalimpongensis* cf. *M. philippensis* | Near Oodalbari, Darjeeling District, West Bengal | Lower-Middle Siwalik, Middle Miocene-Pliocene | Antal and Awasthi, 1994 |
| *M. venkatachalai* cf. *M. repandus* | Gola river bed, Kathgodam, Uttaranchal<br>Surai Khola area, Nepal | Lower Siwalik, Middle Miocene Lower Siwalik, Middle Miocene | Prasad, 1994<br>Prasad and Awasthi, 1996 |
| *? Mallotus* sp. | Near Kumarhatti, Kalka-Shimla Highway, Himachal Pradesh | Dagshai Formation, Upper Oligocene-Early Miocene | Mathur *et al.*, 1996 |

* *Mallotus philippinensis* and *Mallopus philippensis* are synonymous. In the old literature *M. philippensis* is spelled as *M. philippinensis* (Hooker 1885; Darwin *et al.* 1895), accordingly the earlier workers followed the same. Subsequently the spelling was changed to *M. philippensis* (Sastray, 1962; Willis , 1973; Mabberley 1997) and are being followed now.

Kasauli, Solan District, Himachal Pradesh.

**Monocotyledons**

**Family—Marantaceae**

**Genus—*Donax* Lour.**

***Donax kasauliensis* sp. nov.**

Pl. 2, Fig. 1

*Material*- The species is represented by a single specimen and its counterpart.

*Description*- Lamina preserved along one side of mid-rib. Leaf simple; preserved length 11.5 cm, maximum width along one side of mid-rib 4 cm, seemingly elliptic to ovate; texture thin chartaceous; apex broken; base broken, probably obtuse; margin entire; petiole not preserved; venation pinnate, eucamptodromous; primary vein (1°) prominent, secondaries (2°) or lateral veins numerous and of varying thickness or prominence, 6-7 prominent and numerous finer secondaries running parallel to each other, turning upwards and diminishing at margins, angle of divergence acute, 30°-45°.

*Affinities*: The diagnostic features of the fossil leaf are: chartaceous texture, pinnate venation with two types (a few prominent and numerous fine) of secondaries or parallel lateral veins and thickened midrib from base to ¾ length of lamina. These characters clearly indicate its affinities with the leaves of the genus *Donax* Lour. particularly with *Donax cannaeformis* (FRI Herbarium sheet no. 311) of the family Marantaceae (Hooker, 1894; Backer & Van den Brink, 1968).

So far three fossil leaves of the family Marantaceae have been described under the genus *Clinogyne* Salisb from the Indian sub-continent. They are *Clinogyne ovatus* Awasthi and Prasad (1990) from the Siwalik sediments of Nepal; *Clinogyne* cf. *C. ovatus* Arya and Awasthi (1995) from Kasauli sediments of Himachal Pradesh, and *C. lishensis* Antal and Prasad (1995) from Siwalik sediments of Darjeeling District, West Bengal, India.

The genus *Clinogyne* Salisb ex. Benth., is no longer a valid genus (Mabberely 1997) and has already been split into three genera, viz., *Donax* Lour., *Marantochloa* Brongn. & Gris and *Schumannianthus* Gagnep. (Willis 1973, p. 262). The two modern comparable species of the fossils namely *Clinogyne grandis* and *C. dichotoma* have already been placed under the genus *Donax* Lour. The authors who described the fossil leaves of *Clinogyne* (*op. cit.*) were perhaps ignorant of the fact that *Clinogyne* is no more a valid genus and hence they described their fossils under *Clinogyne*. In view of the latest taxonomic position, the present fossil has been placed under the genus *Donax* Lour. (Backer & Van den Brink 1968; Watson & Dallwitz 1992; Willis 1973; Mabberely 1997).

*Clinogyne ovatus* Awasthi and Prasad (1990) differs from the present specimen in its smaller size and having secondary lateral veins of uniform thickness. In *Clinogyne* cf. *C. ovatus* Arya and Awasthi (1995) finer venation is not clear due to bad preservation. Likewise, *C. lishensis* (Antal & Prasad, 1995) distinctly differs from the present fossil in the curvature and narrow acute angle of divergence of secondaries. Since the present specimen is different from all the fossil species described so far, it is assigned a new name, *Donax kasauliensis* sp. nov.

*Holotype* : Museum no. BSIP 39081.

*Locality* : Near MES Water Works, Kasauli, Solan District, Himachal Pradesh.

**New Combinations of already known species:**

In view of the present invalid taxonomic status of *Clinogyne,* it is considered necessary to make new combinations for the fossils already described under

**PLATE 2** ⟶

1. *Donax kasauliensis* sp. nov. Fossil leaf. Natural size. BSIP Specimen no. 39081.
2. A modern leaflet of *Donax cannaeformis*. Natural size.
3, 4. *Mollotus philippensis*. Fossil leaf specimen and its counterpart. Natural size. BSIP Specimen no. 39080.
5. *Poacites kasauliensis* sp. nov. Natural size. BSIP Specimen no. 39082.
6. Same specimen magnified. X 2. BSIP Specimen no. 39082.
7. Another specimen of *Poacites kasauliensis* sp. nov. Natural size. BSIP Specimen no. 39083.



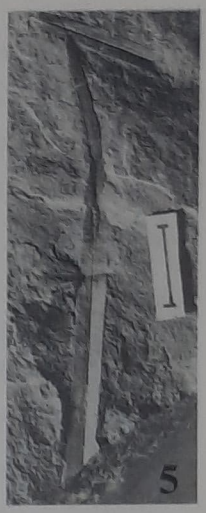







**PLATE 2**

*Clinogyne*. Since the modern corresponding species of the known fossils have been placed under the genus *Donax*, accordingly the fossils have been given new names as under:-

*Donax ovatus* (Awasthi & Prasad) comb. nov.

*Clinogyne ovatus* Awasthi and Prasad, 1990; *Palaeobotanist* **38:** 299, pl. 1, figs 6-8, pl. 2, fig. 1.

*Donax* cf. *D. ovatus* (Arya & Awasthi) comb. nov.

*Clinogyne* cf. *C. ovatus* Arya and Awasthi, 1996: *Proc. Symp. NW Himalaya and Foredeep, Geol. Surv. India, Spec. Pub.* **21:** 271, pl. 1, fig. 1.

*Donax lishensis* (Antal & Prasad) comb. nov. *Clinogyne lishensis* Antal and Prasad, 1995: *Geophytology* **24**(2): 241, pl. 1, figs 1-2.

**Family—Poaceae**

**Genus-*Poacites*** Schlotheim

***Poacites kasauliensis* sp. nov.**

Pl. 2; Figs 5-7

*Material* : The description is based on four fragmentary specimens.

*Description* : Leaves linear, measuring 2.4-5 cm in length and about 0.4 cm in breadth; apex broken, margin entire; texture chartaceous; venation parallelodromous, mid-rib or primary vein (1°) thick, 5-6 thinner veins along one side of mid-rib running parallel to each other, towards apex seemingly converging; cross veins or transfer commissures absent.

*Affinities* : The genus *Poaciets* was proposed by Schlotheim (1820) to include supposed grass like leaves whose exact affinities are not certain. From Tertiary sediments of India, grass like leaves belonging to Poaceae are reported from Jammu & Kashmir (Sahni 1964) Himachal Pradesh (Chaudhri, 1968; Mathur, 1978, Misra *et al.*, 1987; Mathur *et al.*, 1996) and Meghalaya (Bhattacharya, 1983). Amongst them, *Poacites sivalicus* Sahni (1964, p. 8, pl. 1, figs 1, 2) from Poonch District, J & K differs from the above specimen in having broader lamina, apart from mid-rib, parallel veins of different prominence occurring at irregular intervals, while in *P. rajaoriensis* Sahni (1964, pl. 1, fig. 3) mid-rib is absent and prominent veins present at regular intervals. Chaudhri (1968) described a small leaf fragment with parallel veins as *Poacites* sp. from Banog Grahat near Koshaliya river section. Mathur (1978) described three *Poacites* spp., viz., *Poacites* sp. A, B, C, the first two from the Chingi Formation, and the last one from the Tatrot Formation of Siwalik Group of Himachal Pradesh. All the three species have broader lamina than the present fossil, therefore, they are different from the present fossils. Further, *Poacites* sp. A (Pl. 1, fig. 4) and *Poacites* sp. C (Pl. 1, fig. 5) are most likely fragments of palm leaves and may not belong to the genus *Poacites*. A critical examination of the type material of the two species is required for ascertaining their taxonomic position. In 1996 Mathur *et al.* reported three species of *Poacites*, viz., *Poacites* sp. A, B, C, the first two from Dagshai Formation and the third one from Kasauli Formation. Amongst them, *Poacites* sp. C has already been merged in a palm genus *Amesoneuron* by Guleria *et al.* (2000b, p. 49). The present fossil specimens which are better preserved and seem different than the *Poacites* sp. A and B of Mathur *et al.*, they are being described under a new species *Poacites kasauliensis* sp. nov.

*Holotype :* Museum no. BSIP 39082.

*Paratype :* Museum no. BSIP 39083.

*Locality :* Near MES Water Works and Behind Kasauli Bus Stand, Solan District, Himachal Pradesh.

## DISCUSSION

In the light of distribution of modern comparable forms of the reported fossils as shown in Table-2, the overall floristic composition indicates existence of a tropical lowland vegetation during Early Miocene in the Kasauli area.

Thus the plant fossils suggest prevalence of hot and moist conditions during the Early Miocene in the Kasauli area in contrast to the present day cooler climate witnessed in the area due to a subsequent uplift of the Himalaya. Obviously the plant fossils indicate that the area has undergone a large climatic shift since Early Miocene.

Table-2 Distribution of modern comparable taxa

| Fossil species | Modern Comparable Species | Present Day Distribution |
|---|---|---|
| *Semecarpus palaeoanacardium* | *Semecarpus anacardium* Linn. f. | Subhimalayan tract from Bias eastwards, ascending in outer hills to 1200 m in Assam, Khasi hills, Central India and Western Peninsula. Occur also in Bangla Desh (Chittagong). |
| *Chukrasia himachalensis* | *Chukrasia tabularis* A. Juss. | Sikkim, Andamans, in Western Peninsula along Western Ghats, Sandur hills of the Deccan. Also grows in Bangla Desh (Chittagong), and Myanmar. |
| *Heynea kasauliensis* | *Heynea trijuga* Roxb. | Subhimalayan tract from Kumaun eastward, ascending in Sikkim to 1340 m; Khasi Hills, Manipur, Singbhum, Rumpa hills, Godavari District. In Western Ghats from Pune southwards, Nilgiris. Occur also in Myanmar. |
| *Tephrosia kasauliensis* | *Tephrosia candida* DC | A low shrub, distributed in tropical zone of Himalayas, extending from Sutlej eastward to Khasi hills, Assam, Sikkim, ascending up to 1700 m. Found in Bangla Desh (Chittagong) and Martaban in Myanmar. |
| *Mallotus philippensis* | *Mallotus philippensis* Muell. | A low shrub or small tree, found in sub-Himalayan tract ascending to 1500 m from Himachal eastwards to Bengal, Central India and both peninsula. |
| *Donax kasauliensis* | *Donax* Lour. | Found throughout the Indo-malaysian region. |

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