

# SOME FOSSIL LEAFLETS OF *AESCULUS* *INDICA* COLEBR. FROM THE KAREWA BEDS AT LAREDURA AND NINGAL NULLAH, PIR PANJAL, KASHMIR

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## INTRODUCTION

THIS paper is based on a few fossil leaflets collected by the author in 1941 from the Lower Karewa deposits of Kashmir (Lower Pleistocene in age), exposed near Laredura ( $34^{\circ} 7' N.$ ;  $74^{\circ} 21' E.$ ), a small village at an altitude of 6,000 ft., about  $7\frac{1}{2}$  miles from Baramulla. The bridle path leading to Gulmarg at the seventh mile bifurcates into two narrow paths, one of which turns southwest and winds through a thick shrubby growth of *Parrotia jacquemontiana*, *Rosa Webbiana*, *Rubus* spp., etc., in a forest of *Cedrus Deodara* and passes through paddy fields to reach the main huts of the village. The fossiliferous outcrop lies in a steep cliff which is vertically exposed both at top and at the bottom. Our specimens were collected *in situ* from one of the spots lying towards the upper part of the cliff.

The fossil impressions are embedded in a thickly laminated clay, dirty black or yellowish in colour, and splits crudely along the planes of bedding.

This paper has been prepared under the guidance of Prof. B. Sahnì, F.R.S., to whom I am profoundly grateful for helpful criticism and ready help. To the Vice-Chancellor, University of the Panjab, and Principal Jodh Singh of the Khalsa College, Amritsar, I am thankful for a research scholarship from the University and also to the authorities of the Lucknow University for award of a Research Fellowship. I take this opportunity to thank Thakur Harnam Singh, D.F.O. of the Kashmir Forest Service, and Messrs. John Clowsley, and F. Xavier of the St. Joseph College, Baramulla, for helping me in making collections from Laredura.

## DESCRIPTION

*Order* : Sapindales

*Family* : Sapindaceæ

The family is represented in the Karewa Flora by a few leaflet fragments, which are referred to a single species of the genus *Aesculus*;

all the specimens are well preserved impressions. Living plants of this species have compound leaves with 5-7 leaflets arising from a common stalk in a palmate manner. The two lower and outer leaflets are the smallest in size and the one in the middle is the largest. Fossil leaflets of all sizes have been found, but they are all detached and fragmentary specimens.

*Aesculus indica* Colebr.

Figs. 1-5

The specimens described below are two leaflet fragments, one of which (Fig. 1) is almost complete and measures 4.5 inches long by 2.2 inches in the broadest part, which lies a little above the middle. The lamina, which is oblong-lanceolate in shape, gradually narrows down from the middle into cuneate base. It is broadly acute or short acuminate at the apex. The margins are closely sharp serrate; teeth are small and sharply pointed. Fig. 3 is a natural size photograph of another fragment which, though badly preserved as regards details of venation, illustrates a smaller leaflet. The two leaflets figured here show a good deal of difference in size.

The venation is pinnate and reticulate with a tendency to form small loops under and close to the margins. A strong midrib arises from the base and runs in the lamina slightly thinning out in the upper part. 11-12 secondaries which are almost half as thick as the midrib, arise from the latter on either side in an alternate manner at open angles. The laterals in Fig. 1 curve upwards and inwards to form small shallow loops a little beneath and close to the margins. The loops are not well preserved and do not show up conspicuously even in living leaflets (Figs. 4, 5). The tertiary ribs are small and thin; they arise from the two opposite laterals and run in the area enclosed by them; and anastomose variously to form large meshes of different shapes and sizes, seen clearly in Fig. 2, which represents a part of a leaflet shown in Fig. 1 enlarged to five diameters. There is a finer reticulation, which consists of a network of small, rectangular or polygonal meshes (Fig. 2).

The fossil leaflets are identical in all respects with modern leaflets of *Aesculus indica* Colebr. (Figs. 4, 5).

*Number of Specimens.*—Five.

*Occurrence.*—Spot No. 2 and Spot No. 5 Laredura at 6,000 ft., and Ningal Nullah at 9,000 ft., and locality No. 1, Ningal Nullah at 9,500 ft., Pir Panjal, Kashmir.

*Collection.*—G. S. Puri, 1941.

*Registered Nos. of figured Specimens.*—Pl. X, Figs. 1, 2 = L 662/2; Pl. X, Fig 3 = L 814/5.

MODERN DISTRIBUTION OF THE SPECIES

The genus *Aesculus* is included by Hooker in the Sapindaceæ in his *Flora of British India*, but Rendle describes it under the family

Hippocastanaceæ, which contains 2 genera and 18 species, mainly represented at the present time in the United States of America, although they are distributed throughout the north temperate zone.

A very large number of modern species of *Aesculus* occur in North America ; it may be interesting to point out that the species growing on the Atlantic and Pacific sides of the continent are quite different ; one species extends northwards into Canada. In Europe, we have only one species (*A. Hippocastanum*), which is a wild tree of the Albanian and Northern Greece mountains. The Old World is not rich in horse-chestnuts; Japan having two species, while there is only one in Northern China ; and we have two in the Himalayas. The Himalayan species are large handsome deciduous trees, one of which *A. indica* has been found in a fossil state in the Karewas and its modern distribution in India is given below :

The Indian horse-chestnut grows in the Western Himalayas extending westwards from Nepal at an altitude of 4,000–9,000 ft.; it usually grows in moist shady ravines and prefers northerly aspects of hills, which are comparatively cooler. It is often gregarious along moist gorges and grows plentifully in steep ravines and on hill-sides. In Hazara it is fairly common, occurring with *Juglans regia*, *Acer* spp., *Prunus* spp. and other broad-leaved trees together with coniferous species, namely, *Abies Webbiana*, *Taxus baccata*, *Picea* sp., *Cedrus Deodora*, and *Pinus excelsa*.

The species is fairly common in Kashmir and occurs within a radius of one quarter of a mile of the fossiliferous locality ; it is represented both on the Himalayan slopes and the northern slopes of the Pir Panjal Range at Gurez, Jhelum Valley, Kamraj, Keran, Kishtwar, Marwa Dachhan, Muzaffarabad, Ramban, Sindh Valley and Udhampur. In the regions adjoining Kashmir the species occurs in Kafirstan at 7,000–8,000 ft., Chitral at 7,500 ft., Kagan Valley at 9,000 ft. ; and in the Murree Hills it is associated with *Quercus dilatata*, *Q. incana*, *Prunus* sp., *Acer* sp., *Pinus excelsa*, *Taxus baccata*, etc. Eastwards, it extends to the Parbatti Valley (Kulu at 7,500 ft.), Chamba State, Kangra, Simla Hills, Mussoorie, Tehri Garhwal, Kumaon, Naini-Tal and Almora.

In the "western oak-fir forests of Garhwal Himalayas" *Aesculus indica* is associated with *Quercus semecarpifolia*, *Q. dilatata*, *Ulmus Wallichiana*, *Acer Cæcium*, *Corylus colurna*, *Rosa macrophylla*, *Syringa Emodi*, *Viburnum* spp., *Taxus baccata*, *Abies Pindrow*, *Picea Morinda*, etc. (Champion, 1936, p. 245).

It also occurs according to Champion (*loc. cit.*, pp. 257–58) in the moist temperate forests, e.g., in Dwali (W. Almora division, Kumaon, United Provinces) its associates are *Acer Cæcium*, *A. pictum*, *Carpinus viminea*, *Ulmus Wallichiana*, *Betula alnoides*, *Juglans regia*, *Fraxinus micrantha*, *Quercus semecarpifolia*, *Corylus colurna*, *Cornus macrophylla*, *Rhus punjabensis*, *Taxus baccata*, *Berberis* spp., *Rubus repens*, etc., but it is associated with *Pinus excelsa*, *Prunus padus*, *Viburnum fætens*, *Ulmus Wallichiana*, *Acer Cæcium*, *Juglans regia*, etc., in the northwest Himalayas at Saran (Kagan division, Hazara).

## DISCUSSION

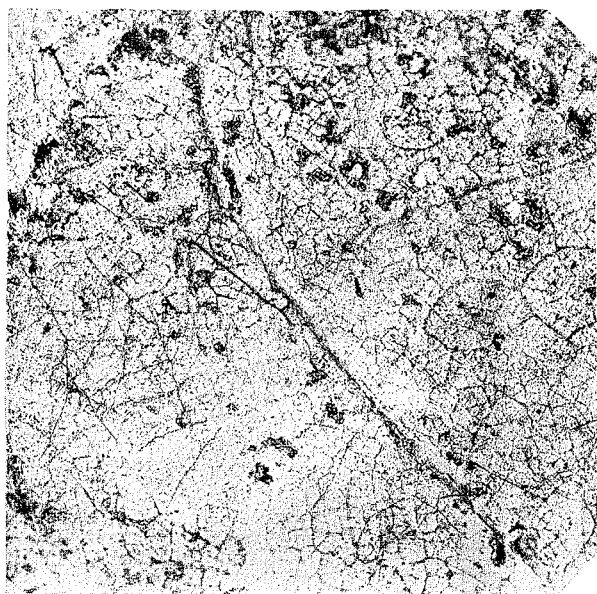
The Indian horse-chestnut occurs in the Western Himalayas at the present time in two different floristic formations, namely (i) in the Kashmir Valley it occurs with *Juglans regia*, *Rhamnus purpurea*, *Populus ciliata*, *Salix Wallichiana*, *Pinus excelsa*, *Abies Webbiana*, etc., and (ii) at another place it is usually associated with conifers and with oaks and other broad-leaved species characteristic of the Western Himalayan rain forests.

From the available evidence concerning the Karewa flora it seems that *Aesculus indica* during the Early Pleistocene existed with oaks, elms, *Betula*, etc., at one place (Laredura) while its common associates at another place (Ningal Nullah) were willows, cherries, poplars, walnut, etc., etc.

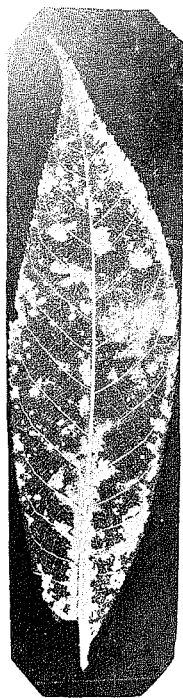
According to Troup (1921, Vol. I, p. 227) the climatic conditions which are most congenial for the growth of *Aesculus indica* under natural habitats include a rainfall varying from 40–100 inches or more; an absolute maximum shade temperatures between 80° and 102° F. and an absolute minimum varying from 25°–10° F. From this it may be conjectured that the Kashmir Valley during the Early Pleistocene may have had at Laredura and Ningal Nullah climatic conditions somewhat corresponding to the above.

## SUMMARY

1. Some leaflets of *Aesculus indica* Colebr. collected by the author from the Lower Karewa deposits (Pleistocene), at Laredura (alt. 6,000 ft.) and Ningal Nullah (alt. 9,000 ft.) are described in detail.
2. The modern distribution of the genus, and of the fossil species is given with special reference to India. At the present time it grows in the Kashmir Valley quite close to the fossiliferous localities and also occurs plentifully at several places in the Kashmir Himalayas and on the Valley slopes of the Pir Panjal Range; also in the regions adjoining the Kashmir and Jammu territories.
3. The fossil associates of *Aesculus indica* at Laredura and Ningal Nullah are quite different; and it is pointed out that the Ningal Nullah associates of the species are still existing in the Kashmir Valley, whereas most of the plants, e.g., oaks, *Mallotus*, *Woodfordia*, etc., which were associated with the Indian horse-chestnut at Laredura during the Pleistocene, have now disappeared from the valley proper and the northern slopes of the Pir Panjal Range; however, the latter occur on the Punjab slopes of the Pir Panjal.



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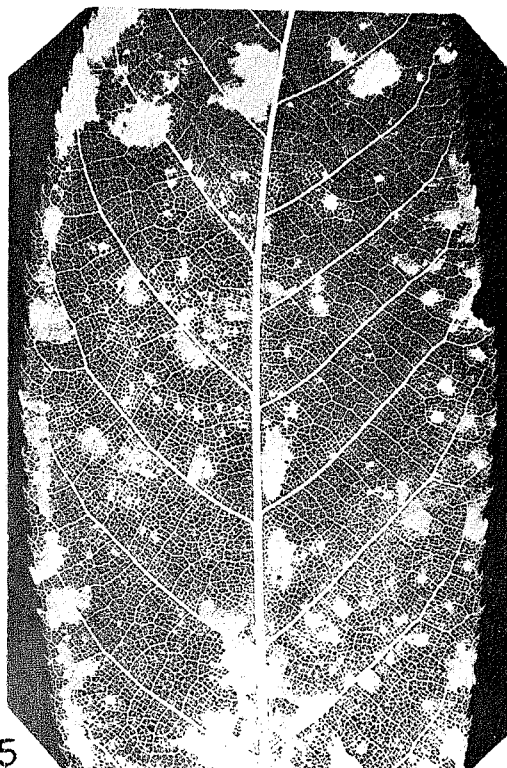
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3



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5

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SOME FOSSIL LEAFLETS OF *AESCULUS INDICA* COLEBR. FROM THE  
KAREWA BEDS AT LAREDURA AND NINGAL NULLAH,  
PIR PANJAL, KASHMIR

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EXPLANATION OF PLATE

All photographs are from untouched negatives. Figured specimens come from G. S. Puri's collection and are preserved in the Botany Museum, University of Lucknow.

*Aesculus indica* Colebr.

- Fig. 1. Fossil leaflet impression. Laredura L 662/3. Nat. size.  
 Fig. 2. A part of the leaflet enlarged to show meshes of tertiary and finer reticulation.  $\times$  Ca. 5.  
 Fig. 3. Fossil leaflet impression. Laredura L 814/5. Nat. size.  
 Fig. 4. Modern leaflet, partially rotted before photographing to show venation for comparison with the fossil leaflet (Fig. 4).  
 Fig. 5. A part of another modern leaflet to show comparison with the fossil leaflet shown in Fig. 1.

