

# SOME FOSSIL LEAVES BELONGING TO THE ANACARDIACEAE FROM PLEISTOCENE OF INDIA

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## ABSTRACT

The paper describes four species of the Anacardiaceae from the Karewa beds at Gogajipathri and Laredura. They are *Rhus punjabensis*, *R. cotinus*, *R. succedanea* and *Odina wodier*. Their distribution in the Himalayas is given in some detail. The conclusions derived from the comparison of the past and present distribution of these species agree in a general way with that already expressed by the author (PURI, 1943, 1945a, 1945b, 1946) on changes in the physical and vegetational conditions of the Kashmir valley since the Pleistocene.

## INTRODUCTION

THE specimens described here were collected by H. de Terra, R. R. Stewart and the author from the Karewas of Kashmir at Laredura and Gogajipathri. A detailed geological and geographical account of the fossiliferous deposits has already been given by Puri (1948a, 1948b) and the description of the fossils belonging to the Anacardiaceae is considered here.

## DESCRIPTION

### *Rhus punjabensis* J. L. Stewart

The leaflet figured in Fig. 1 is linear oblong in outline, with an oblique base and acute apex. It gradually tapers towards both ends from the middle and measures 3.94 cm. long by 1.65 cm. in the broadest part. The margins are entire.

The venation is strict-pinnate and reticulate with a strong midrib that gives off 8-9 pairs of secondaries at acute angles in an alternate and sub-opposite manner. They run parallel, gradually thinning out towards the margins, where they finally end. The tertiary ribs arising from the two opposite laterals meet midway to form cross-ties or large rectangular meshes, both of which are clearly seen in a part of the leaflet magnified to five diameters in Fig. 2. There is a well-preserved finer reticulation, which consists of a network of small polygonal meshes.

*Occurrence* — Laredura at 6,000 ft.

*Number of specimens* — One only

*Type specimen* — L. 290.

*Collection* — R. R. Stewart, 1935

The specimen is preserved in the Botany Museum, Gordon College, Rawalpindi.

The fossil nicely matches the leaflets of the living *Rhus punjabensis* J. L. Stewart and in absence of any difference between the two it is identified with this species.

*Distribution* — *Rhus punjabensis* grows in the North-western Himalayas between Kashmir and Kumaon usually at altitudes of 3,000-8,500 ft.; however, it may be found at elevations as low as 2,500 ft. It is found in Kagan, Hazara at 6,000 ft.; Dungagali, Murree Hills region; Kamraj, Jhelum Valley, Kashmir at 6,500 ft.; Keran; Kishtwar; Marwa Dacchan; Muzaffarabad and Ramban. Eastwards, it grows at Chamba at 5,000 ft.; Kotgarh at 7,000 ft.; Matigana at 8,000 ft.; in Simla, Kathian, Jaunsar at 8,000 ft. and in Bashahr at 5,000 ft. It is not recorded from the Mussoorie Hills but is found further eastwards from Dasoli, Malla Garhwal at 7,300 ft.; and Deota, Tehri Garhwal at 8,000 ft.

This species is common in the inner ranges of the North-western Himalayas and does not grow in the outer Himalayan ranges, such as Murree, Dhaula Dhar and Mussoorie. In inner ranges it grows in moist valleys and ravines, or in moist, humid places in mixed forests. I have seen it growing gregariously in dense forests of Kashmir Valley, a little below Gulmarg, in association with *Acer caesium* Wall., *Acer pictum* Thunb., *Aesculus indica* Colebr., *Populus ciliata* Wall., *Rhamnus purpureus* Edgw. and such conifers as *Abies*, *Picea*, *Taxus* and *Pinus excelsa* Wall. At Dungagali the associates of this species are usually *Taxus baccata* Linn., *Aesculus indica* Colebr. and *Pinus excelsa* Wall.

Its gregarious occurrence in the Kashmir Valley may partly be due to the presence of a poisonous alkaloid in leaves which raises

blisters on the skin when touched, thus scaring away animals and man, who are the chief enemies of vegetation. A Kashmiri labourer once told me that the skin gets blistered even by passing under the trees.

*Rhus cotinus* Linn.

This species is based on a fossil fragment, representing the basal half of the leaf, and measures 4.95 cm. long by 4.70 cm. in the broadest part. The leaf lamina, which probably had an oblong shape, gradually narrows down to a rounded base. The margins are entire.

The venation is strict-pinnate and reticulate, with a strong midrib that gives off 8 pairs of secondaries at straight angles. The upper two pairs are alternate but the others tend to become opposite and run straight to the margins in which they abruptly end. The tertiaries are not well preserved. The finer reticulation is inconspicuous and can be seen only in a part of the leaf enlarged to five diameters in Fig. 4.

*Occurrence* — Gogajipathri at 8,800 ft.

*Number of specimens* — Two (counterparts)

*Type specimen* — Loc. 2 G. 80.

*Collection* — H. de Terra, 1932

The specimens are preserved in the Botany Museum, University of Lucknow.

The fossil fragment resembles living leaves of *Rhus cotinus* Linn. in shape, size, margins and all details of venation, and there being no difference between the two it is identified with this species.

*Distribution* — *Rhus cotinus* grows in the Western Himalayas between the Sulaiman Range and Kumaon and ascends from the plains to the altitude of 6,000 ft. In the North-western Himalayas it occurs very commonly from the Trans-Indus to Sarda river at altitudes of 3,000-6,000 ft. It grows at Shalizan, Kurram Valley, Afghanistan at 7,000-8,000 ft.; Kagan Valley, Hazara at 4,800 ft. and in Abbotabad at 4,000 ft. In the Murree Hills it is found at Dungagali. In Kashmir it is recorded from Muzaffarabad forests at 4,000-5,000 ft.; Jammu, Keran, Kishtwar, Marwa Dacchan, Mirpur, Ramban, Riasi, and Udampur. Eastwards, it is found above Jari, Parbatti Valley, Kulu at 6,500 ft.; Chamba at 4,000 ft., and Jaunsar at 5,000 ft. It is recorded from Fagu-Sainji Road, Simla State

Hills, at 7,500 ft. and valleys below Simla and is common in the Glen and Bhajji at 6,000 ft.

In the Mussoorie Hills it occurs at 5,000-6,000 ft. usually in sunny places. Further eastwards, it is recorded from Talla Kaliphat, Garhwal, between 4,000 and 6,000 ft. and in the Naini Tal Division at 5,500 ft.

This species is a small shrub occurring in low spreading patches. I have seen it growing on the Jhelum Valley Road near Domel (Kashmir) overhanging from hillsides. It forms an undergrowth in chir and pine forests mostly in outer slopes of the Himalayas and has not been recorded from the Kashmir Valley.

*Rhus succedanea* Linn.

This species is based on one poorly preserved leaflet, measuring 5.33 cm. long by 2.54 cm. in the broadest part. The lamina is asymmetrically ovate in outline with an oblique broad base and acute apex. It is broadest in the region a little above the base and gradually narrows upwards into the pointed apex. The margins are entire.

The venation is strict-pinnate and reticulate, with a fairly strong midrib that gives off 6-7 pairs of secondary veins at almost straight angles. Excepting the lower two pairs, which are almost opposite, all secondaries arise in an alternate manner. The tertiaries and finer reticulation are inconspicuous being poorly developed even in living leaflets of this species.

*Occurrence* — Laredura at 6,000 ft.

*Number of specimens* — One only

*Type specimen* — L. 210

*Collection* — R. R. Stewart, 1935

The specimen is preserved in the Botany Museum, Gordon College, Rawalpindi.

The fossil resembles leaflets of *Rhus succedanea* Linn. in shape, size, margins and all details of venation but it being not identical is provisionally identified with species.

*Distribution* — *Rhus succedanea* Linn. grows in the temperate Himalayas at altitudes of 2,000-8,000 ft. from the Jhelum extending as far east as Assam. It may be found up to the Indus in the west. It grows at Kagan, Hazara at 6,000 ft.; and at Dungagali in the Murree Hills. In Kashmir

	LOCALITY	ALTITUDE OF THE LOCALITY ft.	COLLECTOR
<i>Rhus punjabensis</i>	Laredura	6,000	R. R. Stewart, 1935
<i>Rhus continus</i>	Gogajipathri	8,800	H. de Terra, 1932
<i>Rhus succedanea</i>	Laredura	6,000	R. R. Stewart, 1932
<i>Odina wodier</i>	Laredura	6,500	G. S. Puri, 1940

it occurs at Kamraj, Jhelum Valley, Liddar Valley at 6,000-7,000 ft.; Gulmarg at 8,000 ft.; Kashmir Valley, Keran, Kishtwar, Marwa Dacchan, Muzaffarabad, Ramban, Sind and Udhampur. Eastwards, it grows in the Parbatti Valley, Kulu at 7,500 ft.; Narkanda, Simla at 7,000 ft. It is not recorded from Mussoorie or its vicinity. This small tree of the temperate Himalayas grows like *Rhus punjabensis* in inner ranges in moist ravines.

#### *Odina wodier* Roxb.

This species is based on a complete leaflet and its counterpart, one of which is shown in natural size in Fig. 7. The leaflet lamina, which is oblong in outline and uniformly broad in its greater part, abruptly tapers upwards into an acuminate apex into a rounded base. It measures 6.60 cm. long by 3.81 cm. in the broadest part. The margins are entire.

The venation is pinnate-looped and reticulate, with a strong midrib that gives off 5-6 pairs of secondaries at acute angles. The secondaries, on reaching the margins curve upwards and inwards to form a series of simple loops. Tertiary veins arising from the laterals form more or less cross-ties or large rectangular meshes. Finer reticulation is not well preserved.

*Occurrence* — Laredura at 6,500 ft.

*Number of specimens* — Two (counterparts)

*Collection* — G. S. Puri, 1940

The specimens are preserved in Birbal Sahni Institute of Palaeobotany, Lucknow.

The fossils are identical with leaflets of the living *Odina wodier* Roxb. resembling in all details of venation (see FIG. 8).

*Distribution* — *Odina wodier* Roxb. grows in dry forests in lower Himalayas east of the Indus ascending to the altitude of 4,000 ft. It grows in the Salt Range, Siwalik Hills, sometimes even in plains and other sub-Himalayan regions lying east of the Indus. In the Simla Hills, it ascends to 5,000 ft. It is not so far recorded from Hazara and Murree Hills, but grows in Billawa, Jammu (Kashmir), at 2,500 ft. and has been recorded from Mirpur and Udhampur. Eastwards, it is found in the Sutlej Valley at 2,500 ft., and Chaura bridge, Bashahr at 4,500 ft. It grows in the Mussoorie Hills ascending from Dehra Dun to the altitude of 5,000 ft. and extends to Naini Tal at 3,000 ft., Tehri Garhwal at 4,000-5,000 ft., Bamunpokri, Darjeeling Tarai, Kumaon, and Lansdowne Division at 1,400 ft. This species grows in deciduous forests of the outer ranges mostly in drier localities.

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## EXPLANATION OF THE PLATE

( All figures, except otherwise stated, are of natural size )

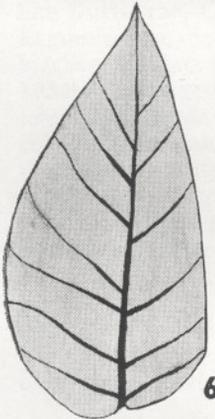
1. *Rhus punjabensis* J. L. Stewart, Leaflet impression.
2. *Rhus punjabensis* J. L. Stewart, a part of the leaflet enlarged.  $\times ca. 5$ .
3. *Rhus cotinus* Linn., leaf fragment.
4. *Rhus cotinus* Linn., a part of the leaf enlarged.  $\times ca. 5$ .
5. *Rhus succedanea* Linn., leaflet impression.
6. *Rhus succedanea* Linn., a sketch of the fossil.
7. *Odina wodier* Roxb., leaflet impression.
8. *Odina wodier* Roxb., a leaflet of the living species partially rotted, for comparison with the fossil.



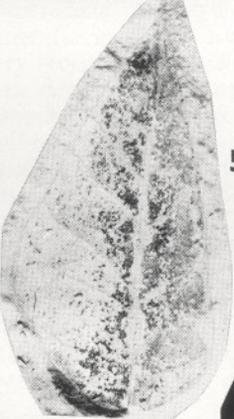
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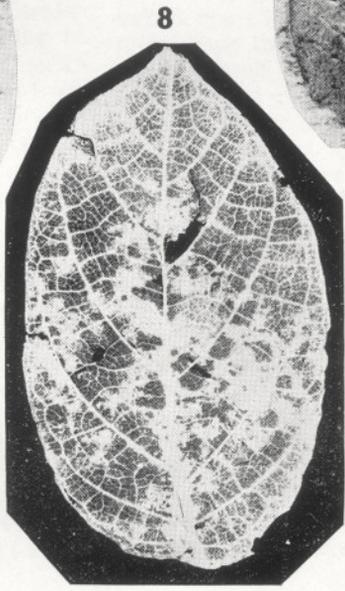
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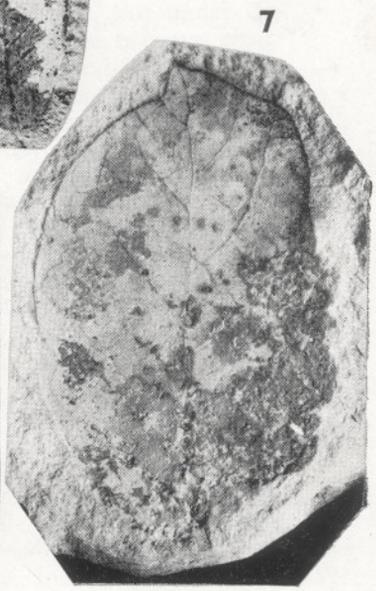
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