

SOME PLANT REMAINS OF THE CORNACEAE FROM THE KAREWA DEPOSITS OF THE KASHMIR VALLEY, INDIA¹

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ABSTRACT

The paper figures and describes plant remains belonging to *Cornus macrophylla*, *C. capitata*(?) and *Marlea begoniaefolia* from the Karewa deposits of Kashmir. The present distribution of the fossil species is given in detail. A comparison of the past and present distribution of the fossil species on the whole confirms earlier conclusions of the author regarding changes in the forest, climate and altitude in the Kashmir Valley since the Pleistocene.

INTRODUCTION

THE specimens referred to the *Cornaceae* were collected from Ningal Nullah and Liddarmarg on the Pir Panjal Range, in Kashmir. A detailed description of the localities has already been given (PURI, 1948) and a brief description of the fossils will now be taken up.

DESCRIPTION

Except for one impression of a fruit, provisionally identified with *Cornus* sp., all the specimens are leaf impressions, which are somewhat poorly preserved and fragmentary. They are, in addition, poorly represented in the fossil beds, numerically. This may be due to the thin texture of living leaves, which feature helps in their quick decomposition and breaking up easily into fragments while on their way to the site of decomposition by water or wind.

Living leaves of these fossil species were experimentally rotted in laboratory along with leaves of other fossil species. The leaves of *Cornus macrophylla* and *Marlea begoniaefolia* were completely decomposed in a two-week period, leaving a skeletal network of larger veins. At this stage these compared favourably with fossil impressions shown in photographs.

FAMILY CORNACEAE

The fossil fragments are referred to two different genera — *Cornus* and *Marlea*.

Key to the genera:

Venation pinnate *Cornus*
Venation pseudo-palmate-pinnate *Marlea*

GENUS *Cornus* Linn.

In addition to leaf fragments one specimen of fruit is also identified as belonging to *Cornus capitata* Wall.(?). The leaf impressions seem to belong to at least two distinct species.

Key to the species:

Venation pinnate-arcuate
(a) leaf large, ovate-oblong, 6 to 7 pairs of laterals arising at acute angles *C. macrophylla*
(b) leaf small, oblong, 4 to 5 pairs of laterals arising at somewhat obtuse angles *Cornus* sp.
Venation strict-pinnate, leaf small, elliptic, 5 to 6 pairs of laterals arising at acute angles *C. capitata*(?)

Cornus macrophylla Wall.

Fig. 1 is a natural size photograph of two leaf fragments, one of which is lying on the apical part of the other. The leaf-lamina, which apparently has an ovate-oblong shape, measures 2.2 in. long by 1.4 in. in the broadest part in the larger leaf. The apex seems to have been probably acute. The margins, though not well defined, seem to be entire. The base is rounded and bears 0.25 in. long petiole in both leaves.

The venation is pinnate-arcuate and reticulate. A strong midrib runs straight in the lamina, slightly thinning out towards the apical part. Six to seven pairs of secondaries, which are about half as thick as the midrib, arise from it at acute angles, in an opposite, or, in some cases, in an alternate manner. The lower pairs of secondaries arise closer than the upper pairs. These curve gradually and end in the margins without making

1. This work was done at Lucknow during 1940-42 under the guidance of the late Professor B. Sahni, F.R.S., to whom the author wishes to record his indebtedness.

any loops. The upper pairs of laterals tend to converge near the apical end. Tertiary veins, though not well preserved in the leaves, can be seen at some places forming cross-ties. The finer reticulation is not preserved.

Occurrence — Ningal Nullah at 9,500 ft.

Number of Specimens — One only

Type Specimen — Loc. 1 N. 490

Collections — G. S. Puri, 1940

The specimen is preserved in the Botany Museum, Khalsa College, Amritsar.

The fossil leaves resemble living leaves of *Cornus macrophylla* Wall. with which they are identified.

Cornus capitata(?) Wall.

Fig. 2 is a natural size photograph of a leaf which has been heavily coated with rubber solution in field. This has obscured the venation which has not been satisfactorily brought out in the photograph. The leaf-lamina, which is elliptic in outline, is slightly torn off on right margin near the basal region. It measures 1.6 in. long by 0.73 in. in the broadest part. It gets narrowed towards the upper side into an acute apex and into a rounded wedge-shaped base towards the lower end. The margins are entire.

The venation is strict-pinnate and reticulate, consisting of a thin midrib and 5 to 6 pairs of laterals, which are almost of the same calibre as the midrib and arise from it at acute angles. Second lateral from the base, on the right side in the photograph, gives off two thin branches near the margin. Tertiary veins are not well preserved. The finer reticulations also are not preserved.

Occurrence — Liddarmarg at 10,600 ft.

Number of Specimens — One only

Type Specimen — Loc. 3 L. 90

Collections — H. de Terra, 1932

The specimen is preserved in the Botany Museum, University of Lucknow.

The fossil resembles living leaves of *Cornus capitata* Wall. in most of the features that are visible, but on account of its rather inconspicuous venation it is identified provisionally with this species.

Another leaf fragment shown in Fig. 3 seems to show some resemblance to *Cornus capitata*, and in the absence of any better comparison this is provisionally identified as *Cornus* sp.

The fruit specimen, shown in the natural size photograph 4, seems to match favourably with fruits of *Cornus capitata*, and as

the leaves and the fruit were found in the same block of rock, they may belong to this species. It is, however, difficult to identify such fragmentary structures with certainty with any one species.

Marlea begoniaefolia Roxb.

This species is based on two leaf fragments one of which is more or less complete. The leaf-lamina is ovate or ovate-oblong with a broad and cordate base. The margins are wavy with broad teeth. The apex is acute. The venation is pseudo-palmate and reticulate, consisting of one main rib and two basal laterals, which may give the venation a pseudo-palmati-pinnate appearance. The primary rib gives off a number of secondary veins and from some of them, especially the two at the base, a few smaller branches arise. The secondaries and the primaries are almost of the same calibre. Tertiary ribs are well preserved and form rectangular meshes. The finer reticulation is seen at some places in the leaves.

Occurrence — Ningal Nullah at 9,000 ft., and 9,800 ft.

Number of Specimens — Two only

Type Specimens — N. 120 (FIG. 5) and N. 201 (FIG. 6)

Collections — The specimens were collected by the author in 1940 and are preserved in the Botany Museum, Khalsa College, Amritsar

The fossils resemble living leaves of *Marlea begoniaefolia* Roxb. in shape, margins and all details of venation, and are identified with this species.

Another leaf fragment shown in Figs. 7 and 8 was found by R. R. Stewart from Ningal Nullah near one of the localities of the author. This specimen shows some resemblance to *Marlea*, but in the absence of definite clear features it is not considered safe to identify it with this species.

MODERN DISTRIBUTION OF THE FOSSIL SPECIES

Cornus macrophylla Wall. grows in the Himalayas between the Indus and Bhutan at the altitudes of 4,000-8,000 ft. in conifer forests. It occurs on finely decomposed, rich and moist soils, along streams, or in depressions, along with *Juglans regia*, *Aesculus indica*, cherry, poplar, etc. Sometimes it is distributed in spruce and silver fir forests in gullies along with maples, mostly *Acer caesium*.

It occurs in the Samana Range, North-West Frontier; Malkandi, Kagan Valley, Hazara, at 6,000 ft.; Bagnotar, Hazara; and in the Murree Hills commonly at 6,000-7,000 ft. In Kashmir, it occurs in the Tawi Valley, Jammu, at 6,000 ft. in 'ban' oak (*Quercus incana*) forests; and in the forests of Keran, Kishtwar, Marwa Dacchan, Ramban and Udhampur. It is present today in the Kashmir Valley near the fossiliferous localities in gullies and depressions. Eastwards, it occurs in the Parbatti Valley, Kulu, and is recorded from Salori to Bhandal, Chamba, at 5,000-7,000 ft.; below Sungri, Bashahr, at 8,300 ft.; Teklech, Bashahr, at 4,500 ft.; Mushobra, Simla; and the Glen, Simla, at 6,000 ft. It occurs at Landour, Mussoorie, at 7,000 ft. commonly. Further eastwards, it grows at China Range, Garhwal, at 6,000 ft.; Tala Kaliphat, Garhwal, at 4,500-8,000 ft.; and in Doti district, Nepal.

Cornus capitata Wall. grows in the Himalayas, between the Beas and Bhutan, at altitudes of 3,500-8,000 ft. This species, unlike the first, occurs mostly in forests of *Quercus incana* and is found even in *Chir pine* community. It affects outer sunny slopes and occurs on hard dry soils.

It does not grow anywhere in Hazara or Murree Hills, but is recorded from Muzaffarabad in Kashmir. It is absent from the Kashmir Valley proper. Eastwards, it occurs in the Parbatti Valley, Kulu, at 6,000 ft. It grows at Chor-Pubaha Road, Simla; and in the Bashahr State, at 6,000 ft. In the Mussoorie Hills, this species is found commonly in the ban oak forests on the outer slopes between 3,500 and 7,000 ft. above sea-level. It extends to Garhwal, at 4,000-6,000 ft.; Gangolihat, Almora, in Kumaon; West Almora, Kumaon; Deota, Tehri-Garhwal, at 8,000 ft.; and in Phallaloong Forest, Darjeeling, at 8,000 ft.

Marlea begoniaefolia Roxb. grows in the outer Himalayas from the Indus to Bhutan, ascending to the altitude of 6,000 ft., but is

recorded from Sikkim at 9,000 ft. It grows in Kagan, Hazara, between 3,800 and 8,000 ft.; and is recorded between Ramsu and Banihal, Chenab Valley, Jammu. In the Kashmir Himalayas it grows in Chineni, Keran, Kishtwar, Marwa Dachhan, Muzaffarabad, Ramban and Udhampur. It is present in the Kashmir Valley proper. Eastwards, it occurs in the Beas Valley, Kulu, at 4,000 ft.; Tons Valley, Jaunsar, at 3,000 ft.; Bashahr, at 7,000 ft.; the Glen, Simla, at 6,000 ft. In the Mussoorie Hills it grows at 5,000 ft. and extends further eastwards to Garhwal; Malla Nagpur, Naini Tal, at 5,500 ft.; and East Almora, Kumaon division.

This species grows in moist shady ravines and in dense shady forests. The fossil leaves of this species have been found from Ningal Nullah, the place from where a rich mesophytic flora consisting of an abundance of willows and poplars, which now grow on river banks or moist ravines, is discovered. This species seems to fit in well with the ecological picture given by the Ningal Nullah flora. Ordinarily parts of trees occurring in moist ravines should be better fitted to reach the site of deposition, if they are sufficiently resistant to decay. But the leaves of this species have been found to be unsuitable on account of their thin texture and easy decay in water. The leaves completely rotted after two weeks in the laboratory experiments conducted by the author during the months of November-December 1941 at Lucknow.

CONCLUSIONS

A comparison of the past and present distribution of the fossil species seems to confirm the author's earlier conclusions (see PURI, 1945-1951a) regarding the conditions of forest, climate and altitude during the Pleistocene in the Kashmir Himalayas. These conclusions may not be repeated here.

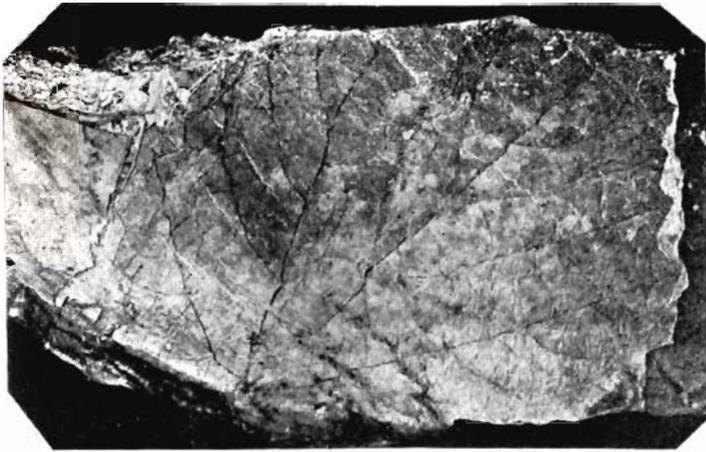
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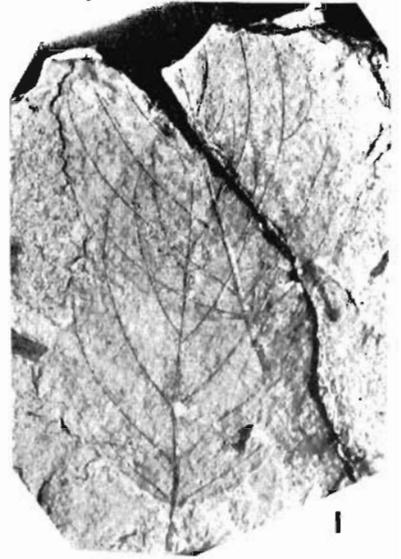
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EXPLANATION OF PLATE 1

1. Leaf of *Cornus macrophylla*. × 1.
2. Leaf of *Cornus capitata*(?). × 1.
3. Leaf of *Cornus* sp. × 1. 4. *Cornus* sp. A fruit. × 1.
5. Leaf of *Marlea begoniaefolia*. × 1.
6. Leaf of *Marlea begoniaefolia*. × 1.
7. *Marlea*, leaf fragment. × 1.
8. *Marlea*, part of leaf fragment in Fig. 7, enlarged. × ca. 5.



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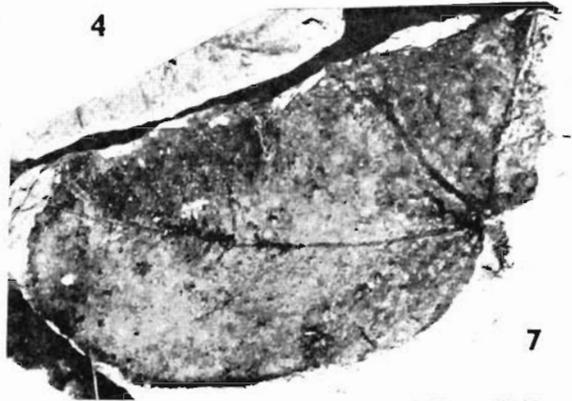
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