



Distribution and Mapping of *Ficus neriifolia* Smith: A Multipurpose Agroforestry Tree in Chamoli District, Uttarakhand, India

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Abstract: *Ficus neriifolia* locally called as *Dudhla*, *Thilook*, *Dudhoi* is one of the most important leaf fodder species in North- Western Himalaya, India during lean period. Keeping the importance of the species, the present study was conducted on distribution and mapping of *Ficus neriifolia* in Chamoli district in North –Western Himalaya, India. Based on the field survey we identified 33 sites/villages in eight development blocks at different altitudes in Chamoli district. The potential distribution sites occurred in the district from 1100-2200 m asl. In all 33 sites/villages, GPS locations were noted and distribution map was prepared with the help of GIS software. Every selected village/site in each block, natural habitat/occurrence of the species was identified at each altitude. During the survey, maximum (07) potential sites/villages were identified in Dewal block followed by 05 sites/villages in Tharali block and minimum (02) potential sites/villages were identified in Dasholi block. As far as the altitudinal variations is concerned, the occurrence of the species at highest elevation (2205 m) in Kandai village (Dewal) and at lowest elevation (1042 m) in Kaleshwar village (Karnaparyag). In each site, population density of the species was also recorded. Maximum tree density (11.0 tree/200 m²) was recorded at Talwari site/village and minimum (2.0 tree/200 m²) at Senti site/village.

Keywords: *Ficus neriifolia*, Chamoli district, Altitudinal, Sites/Villages, Density, *Grewia oppositifolia*

Genus *Ficus*, commonly known as Figs are considered as a keystone species in sub-tropical and tropical rain forests as it plays a very fundamental role in the ecosystem, due to its fruits which are eaten by insects, birds and animals throughout the year. The genus *Ficus* is an exceptionally large pan tropical genus with over 700 species (Berg 1989) and belongs to the family Moraceae. The genus is distributed throughout the world primarily in subtropical and tropical regions (Corner 1965, Berg 1989, Berg and Corner 2005). Many species of *Ficus* are very common in different biogeographic regions. Although, the great majority of the species grow in lowlands but some of them reach up to about 2,000 m altitudes (Chaudhary et al 2012, Gaur 1999). Only about 10 species chiefly occurring in the North Western Himalaya extend their distribution towards Westward of Pakistan (Chaudhary et al 2012).

It is distributed in India (Arunachal Pradesh, Assam, Meghalaya, Mizoram, Nagaland, Uttarakhand, and Western to Eastern Himalayas from 500 - 2200 m. *F. neriifolia* often planted near villages for cattle fodder in Bhutan, China, Indochina, Myanmar, Nepal (Corner 1965). *Ficus* species are the most interesting group of trees in Nepal, not only of their useful value but also of their growth habits and religious significance. It is retained as a single, large genus because it is well defined by its unique reproductive system, involving *Syconia* fig- and specialized pollinator wasps (Novotny et al

2002). *F. neriifolia* (*Dudhla/Thilook/Dudhoi*) is the common tree species which are being cultivated in and around farmlands and they provide a source of leaves fodder during the dry season and very high animal feed in Nepal (Panday 1982).

Agriculture with animal husbandry is the main profession of rural people of this Himalayan region. Livestock plays an important role in the economy of Uttarakhand as it is the important source of income of rural people. There is a vast diversity of fodder plants. Demand for fodder is uniform throughout the year although unavailability of green forage during winter has always remained a serious issue resulting in nutritional deficiency in mulching animals. Thus, there is a need to explore fodder plants in Uttarakhand Himalayas. Keeping in views this genus is one of the most important leaf fodder species in North–Western Himalaya India during fodder scarcity period has been selected for the present study. There was no information regarding distribution of *F. neriifolia* species in the Chamoli district.

MATERIAL AND METHODS

The present study was conducted in Chamoli district in the North-Western part of Uttarakhand. Geographically the district is located between 29° 55'00" to 31°03'45" N Latitude and 79°02'39" to 80°03'29" E Longitude and altitudinal varies from 800-8000 above sea level. The climate in the study area can be divided into three distinct seasons, cool and relatively dry winter

(November to March), warm and dry summer (mid-April to June) and rainy (July to mid-September). District Chamoli has six tehsils, viz., Joshimath, Chamoli, Karnaprayag, Pokhari, Gairsain and Tharali. It is divided into nine development blocks which are Joshimath, Dasoli, Pokhari, Ghat, Karnaprayag, Tharali, Narayanbagar, Dewal and Gairsain.

A reconnaissance field survey was carried out to collect information of the species in the district during 2020 to 2021. Stratified random sampling was used for detailed surveys in each site. In the first stage, out of nine developmental blocks, the species occurrence in eight blocks out of nine development blocks (Dasoli, Pokhari, Ghat, Karnaprayag, Tharali, Narayanbagar, Dewal and Gairsain) representing altitudinal variation i.e. (1100-2200 m) were selected in the district. Seven villages/sites from Dewal, five villages from Tharali, four villages from Ghat, Pokhari, Karanprayag & Gairsain each, three villages from Narayanbagar, two villages from Dasholi block considering the altitudinal variation. In the second stage of sampling, a detailed questionnaire based survey in each selected village was conducted. Thus, a total thirty three villages/sites were selected randomly from eight developmental blocks in the district. Every selected village/site in each block, natural habitat/occurrence of the species has been identified at each altitude. In each site five and six sample plots were laid out for estimation of tree density. The size of plot was 200 m².

Semi structured open ended questionnaire survey was conducted during the field visit. During the survey, various questions related to importance, how to use, time and season to use, about fodder quality etc. of this species were asked to the villagers. Attempts were made to collect all possible information regarding GPS points at each site, the traditional use of the plants, mode of usage and part (s) used.

Information regarding locality, seasonal availability, and mode of use was also recorded by interviewing the villagers, elderly people, and shepherds of these villages. The specimens were collected and identified with the help of herbarium from Botany department at HNB Garhwal (Central) University and through previous works (Duthie 1906, Gaur 1999).

Identification of the natural growing sites of *Ficus neriifolia* across the Chamoli Garhwal district was conducted in different places. Based on reconnaissance field surveys potential natural habitat sites were identified in the district. Habitat mapping of *Ficus neriifolia* across the Chamoli region was conducted. During the field survey, the GPS point to take the reference point of habitat location of *Ficus neriifolia* in different areas in the district was noted. Wherever the species occurred GPS locations were noted. After taking of GPS location from different areas georeferencing and mapping was conducted in the Department GIS laboratory through the using of QGIS 3.14 GIS software (SOI 2022). With the help of GPS locations and using GIS software of QGIS 3.14, distribution map of *Ficus neriifolia* was prepared of the Chamoli district.

RESULTS AND DISCUSSIONS

Based on the available literature from India Gaur (1999) and from Nepal Kunwar and Bussmen (2006) the following characteristics were noticed of the *Ficus neriifolia* species in Table 1.

We surveyed all the 9 blocks in Chamoli District and the species occurrence was observed in 8 blocks. Out 8 blocks the species found in total 33 villages (Table 2). With the help of GPS point and QGIS Software distribution map was prepared and all the 33 surveyed villages/site were plotted in

Table 1. Characteristics and uses of *Ficus neriifolia*



Species name	Characteristics	fodder plant species	Uses
<p><i>Ficus neriifolia</i></p> 	<p><i>Ficus</i> grows as a tree up to 15 m (50 ft) tall with smooth, dark grey bark on its trunk. The hairless, leathery oval to lanceolate (spear-shaped) leaves is up to 8–18 cm long by 3–6.5 cm wide, and often asymmetrical in shape. The 8–10 cm diameter figs are rounded, oval, or cylindrical and grow in pairs off older branches</p>	<p>The foliage of <i>Ficus neriifolia</i> is used as fodder and its wood used as fuel in North-Western Himalaya</p>	<p>The juice of the stem bark is used as a folk remedy for conjunctivitis and boils. This fig tree is considered good for indoor bonsai in temperate climates, and it is easily shaped and pruned.</p> 

Table 2. Distribution, density and associated species of *Ficus neriifolia* in Chamoli district

Block name	Village name	Mode of use	Density (trees/200 m ²)	Associated tree species	Latitude	Longitude
Gairsain	Mehalchari	Leaves used as fodder	6	<i>Celtis australis</i> , <i>Morus alba</i> , <i>Acer</i> spp., <i>Grewia oppositifolia</i> , <i>Quercus glauca</i> , <i>Citrus sinensis</i>	29°59'03"	79°19'17"
	Dhargar	Leaves used as fodder	5	<i>Ficus palmata</i> , <i>Celtis australis</i> , <i>Grewia oppositifolia</i> , <i>Melia azedarach</i> , <i>Bauhinia purpurea</i> , <i>Citrus sinensis</i>	29°59'44"	79°19'01"
	Panchali	Leaves used as fodder	6	<i>Bombax cebia</i> , <i>Aesculus indica</i> , <i>Bauhinia variegata</i> , <i>Bamboo</i> spp.	30°01'22"	79°17'42"
	Ganwali	Leaves used as fodder	4	<i>Melia azedarach</i> , <i>Toona serrata</i> , <i>Acacia catechu</i> , <i>Citrus sinensis</i>	30°02'51"	79°17'19"
Karanparyag	Kaleshwar	Leaves used as fodder	4	<i>Acacia catechu</i> , <i>Melia azedarach</i> , <i>Grewia oppositifolia</i>	30°17'00"	79°14'53"
	Langasu	Leaves used as fodder	3	<i>Ficus palmata</i> , <i>F. sarmentosa</i> , <i>Grewia oppositifolia</i> , <i>Celtis australis</i>	30°17'21"	79°17'18"
	Biroli	Leaves used as fodder	4	<i>Acacia catechu</i> , <i>Bombax cebia</i> , <i>Celtis australis</i> , <i>Grewia oppositifolia</i>	30°17'35"	79°18'09"
	Sonla	Leaves used as fodder	5	<i>Grewia oppositifolia</i> , <i>Quercus leucotrichophora</i> , <i>Ficus palmata</i> , <i>Alnus nepalensis</i>	30°19'02"	79°18'27"
Ghat	Sarpani	Leaves used as fodder	3	<i>Grewia oppositifolia</i> , <i>Morus alba</i> , <i>Celtis australis</i> ,	30°14'26"	79°27'27"
	phali	Leaves used as fodder	4	<i>Ficus auriculata</i> , <i>Quercus leucotrichophora</i> , <i>Melia azedarach</i> , <i>Cinnamomum tamala</i>	30°14'32"	79°26'41"
	Senti	Leaves used as fodder	2	<i>Pinus roxburghii</i> , <i>Melia azedarach</i> , <i>Alnus nepalensis</i> ,	30°14'12"	79°26'55"
	Narangi	Leaves used as fodder	4	<i>Ficus palmata</i> , <i>Grewia oppositifolia</i> , <i>Quercus leucotrichophora</i>	30°15'50"	79°27'52"
Pokhari	Pokhari	Leaves used as fodder	3	<i>Prunus cersoides</i> , <i>Quercus leucotrichophora</i> , <i>Rhododendron arboreum</i> , <i>Citrus sinensis</i>	30°20'40"	79°11'43"
	Devsthan	Leaves used as fodder	4	<i>Alnus nepalensis</i> , <i>Toona serrata</i> , <i>Pyrus pashia</i> , <i>Ficus palmata</i> , <i>Citrus sinensis</i>	30°20'22"	79°12'07"
	Vishal	Leaves used as fodder	8	<i>Ficus palmata</i> , <i>Prunus cersoides</i> , <i>Quercus leucotrichophora</i> , <i>Grewia oppositifolia</i> , <i>Bombax cebia</i> , <i>Citrus sinensis</i>	30°20'39"	79°12'34"
	Devartalla	Leaves used as fodder	4	<i>Ficus auriculata</i> , <i>Grewia oppositifolia</i> , <i>Bombax cebia</i> , <i>Bauhinia purpurea</i> , <i>Citrus sinensis</i>	30°20'02"	79°12'39"
Dasholi	Gair	Leaves used as fodder	7	<i>Prunus cersoides</i> , <i>Grewia oppositifolia</i> , <i>Celtis australis</i> , <i>Quercus leucotrichophora</i> , <i>Citrus sinensis</i>	30°24'57.2"	79°18'29"
	Mandal	Leaves used as fodder	5	<i>Grewia oppositifolia</i> , <i>Celtis australis</i> , <i>Ficus auriculata</i> , <i>Ficus palmata</i> , <i>Citrus sinensis</i>	30°27'48"	79°16'08"
Narainbagar	panti	Leaves used as fodder	5	<i>Myrica esculenta</i> , <i>Pinus roxburghii</i> , <i>Alnus nepalensis</i> , <i>Aesculus indica</i>	30°07'33"	79°23'18"
	Bedula	Leaves used as fodder	6	<i>Ficus palmata</i> , <i>Grewia oppositifolia</i> , <i>Ficus auriculata</i>	30°08'15"	79°22'29"
	Paithani	Leaves used as fodder	7	<i>Prunus cersoides</i> , <i>Ficus palmata</i> , <i>Grewia oppositifolia</i> , <i>Toona serrata</i> .	30°07'16"	79°25'21"
Tharali	Gwaldam	Leaves used as fodder	8	<i>Quercus wallichiana</i> , <i>Ficus auriculata</i> , <i>Grewia oppositifolia</i> , <i>Bombax cebia</i> , <i>Bauhinia purpurea</i> , <i>Citrus sinensis</i>	30°01'28"	79°34'34"
	Loda	Leaves used as fodder	9	<i>Ficus palmata</i> , <i>Grewia oppositifolia</i> , <i>Pinus roxburghii</i> , <i>Citrus sinensis</i>	30°00'27"	79°31'24"
	Talwari	Leaves used as fodder	11	<i>Prunus pashia</i> , <i>Myrica esculenta</i> , <i>Citrus sinensis</i>	30°02'01"	79°31'54"
	Lolti	Leaves used as fodder	7	<i>Ficus palmata</i> , <i>Bahunia purpurea</i> , <i>Prunus pashia</i> , <i>Quercus leucotrichophora</i> , <i>Citrus sinensis</i>	30°02'42"	79°30'00"
	Kulsari	Leaves used as fodder	9	<i>Malus domestica</i> , <i>Toona serrata</i> , <i>Celtis australis</i> , <i>Quercus leucotrichophora</i> .	30°05'09"	79°27'28"
Dewal	Dewal	Leaves used as fodder, Bark latex is applied on swelling and joint pains	6	<i>Alnus nepalensis</i> , <i>Ficus palmata</i> , <i>Myrica esculenta</i> , <i>Pinus roxburghii</i> , <i>Malus domestica</i> , <i>Pyrus pashia</i> , <i>Aesculus indica</i> , <i>Quercus glauca</i> , <i>Citrus sinensis</i>	30°02'52"	79°35'27"

Cont...

Table 2. Distribution, density and associated species of *Ficus neriifolia* in Chamoli district

Block name	Village name	Mode of use	Density (trees/200 m)	Associated tree species	Latitude	Longitude
Purna		Leaves used as fodder	8	<i>Prunus pashia, Alnus nepalensis, Toona serrata, Grewia oppositifolia, Bombax cebia, Citrus sinensis, Malus domestica</i>	30°03'09"	79°34'48"
Kandai		Leaves used as fodder	6	<i>Celtis australis, Morus alba, Grewia oppositifolia, Myrica esculenta.</i>	30°04'08"	79°37'09"
Talor		Leaves used as fodder	7	<i>Myrica esculenta, Pinus roxburghii, Alnus nepalensis, Aesculus indica</i>	30°02'12"	79°36'00"
Deosari		Leaves used as fodder	8	<i>Morus alba, Quercus leuchotrichophora, Ficus auriculata, Rhododendron arboreum, Myrica esculenta</i>	30°02'07"	79°35'42"
Kail		Leaves used as fodder	5	<i>Pines roxburghii, Toona serrata, Grewia oppositifolia, Celtis australis, Quercus glauca, Citrus sinensis</i>	30°03'22"	79°35'50"
Sawad		Leaves used as fodder	8	<i>Rhododendron, Grewia oppositifolia, Pinus roxburghii, Quercus leuchotrichophora, Citrus sinensis</i>	30°04'11"	79°36'54"

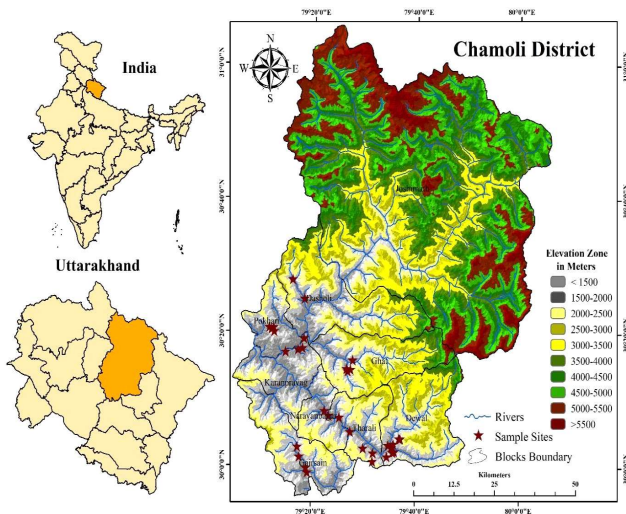


Fig. 1. Identified potential sites/villages locations of *Ficus neriifolia* in Chamoli district

the map (Fig. 1). The locations of the species in the surveyed site were highlighted as red stars in the map.

During the survey, maximum (07) potential sites/villages were identified in Dewal block followed by 05 sites/villages in Tharali block and minimum (02) potential sites/villages were identified in Dasholi block (Table 2). As far as the altitudinal variations is concerned, the occurrence of the species at highest elevation (2205 m) in Kandai village (Dewal) and at lowest elevation (1042m) in Kaleshwar village (Karnaparyag). The geographical locations of these sites are 30°04'08" N Latitude and 79°37'09" E Longitude and 30°17'00" N Latitude and 79°14'53" E Longitude respectively at Kandai and Kaleshwar village. The associated species are *Celtis australis, Morus alba, Acer spp., Grewia oppositifolia, Pinus roxburghii, Myrica esculenta, Desmodium laxiflorum, Prunus cersiodes and Prunus persia* found in these sites/villages (Table 2).

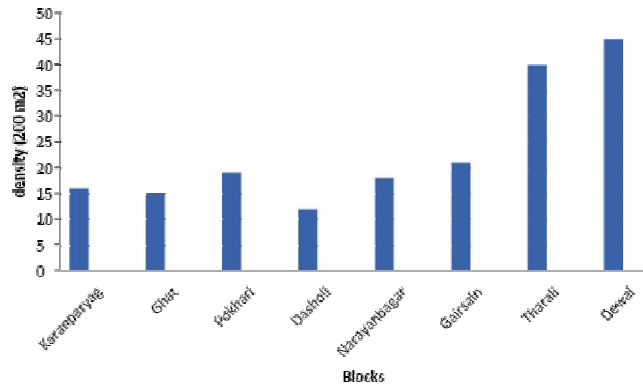


Fig. 2. Tree density of *Ficus neriifolia* at different blocks in Chamoli district

As for as tree population of *Ficus neriifolia* is concerned, maximum density (45 tree/200 m²) population was recorded, at Dewal block followed by (44 tree/200 m²) at Tharali block, while minimum density (12 tree/200 m²) at Dasholi block (Fig. 2). The associated species are *Grewia oppositifolia, Toona serrata, Alnus nepalensis, Ficus auriculata, Myrica esculenta, Malus domestica, Citrus sinensis, Prunus pashia, Aesculus indica, Bombax cebia, Quercus glauca, Quercus leuchotrichophora and Prunus cersiodes* in these sites.

Ficus neriifolia tree density in each surveyed site was concerned, maximum tree density (11.0 tree/200 m²) was recorded at Talwari site/village followed by (9.0 tree/200 m²) at Kulsari and Loda site/village in Tharali block respectively. Whereas, minimum (2.0 tree/200 m²) tree density was recorded at Senti site/village (Ghat block), followed by (3.0 tree/200 m²) at Langasu site/village (Karnaparyag block), Sarpani site/village (Ghat block) and Pokhari site/village (Pokhari block) respectively (Table 1). The higher density in Talwari site may be due to higher altitude and low temperature for suitable habitat conditions for its growth and

development. While lower density may occur in these sites due to lower altitude and high temperature. The associated species in these sites/villages are *Grewia oppositifolia*, *Toona serrata*, *Alnus nepalensis*, *Ficus auriculata*, *F. palmata*, *F. Sarmentosa*, *Myrica esculenta*, *Malus domestica*, *Citrus sinensis*, *Prunus pashia*, *Aesculus indica*, *Bombax cebia*, *Quercus glauca*, *Quercus leuchotrichophora*, *Melia azedarach*, *Cinnamomum tamala* and *Morus alba*.

Ficus neriifolia is considered very good for leaf fodder. Good quality fodder is characterised by high dry matter, good level of crude protein, high palatability, high digestibility, low lignin content, adequate carotene and vitamin levels, high mineral content, low levels or lack of anti-nutritional substances for animal growth and performance (Kaithwas et al 2020). The villagers use *Ficus neriifolia* leaves as good fodder because the thickness of cow's milk is also in good quantity.

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