

## **DIVERSITY AND DISTRIBUTION OF FAMILY MELIACEAE IN UTTARAKHAND, INDIA**

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### **ABSTRACT**

Meliaceae has important forest species of various potential uses. In past literature, no precise locality of different species of family Meliaceae has been mentioned. In the present study, extensive survey was made in the different locations of the Uttarakhand to trace the diversity and distribution Meliaceae. Earlier 09 species and one sub-species were reported from the state. In the present study, only 07 species have been reported from the state. Most the species are distributed in the lower altitude in the tropical part and one species i.e *Toona serrata* exists in the temperate region. *Melia azedarach* and *Toona ciliata* are widely distributed species of the family. Study is of immense use for researchers, students, state forest department officials etc. for tracing locations of the different species of Meliaceae in Uttarakhand.

**Key Words:** *Species diversity, Distribution, Conservation*

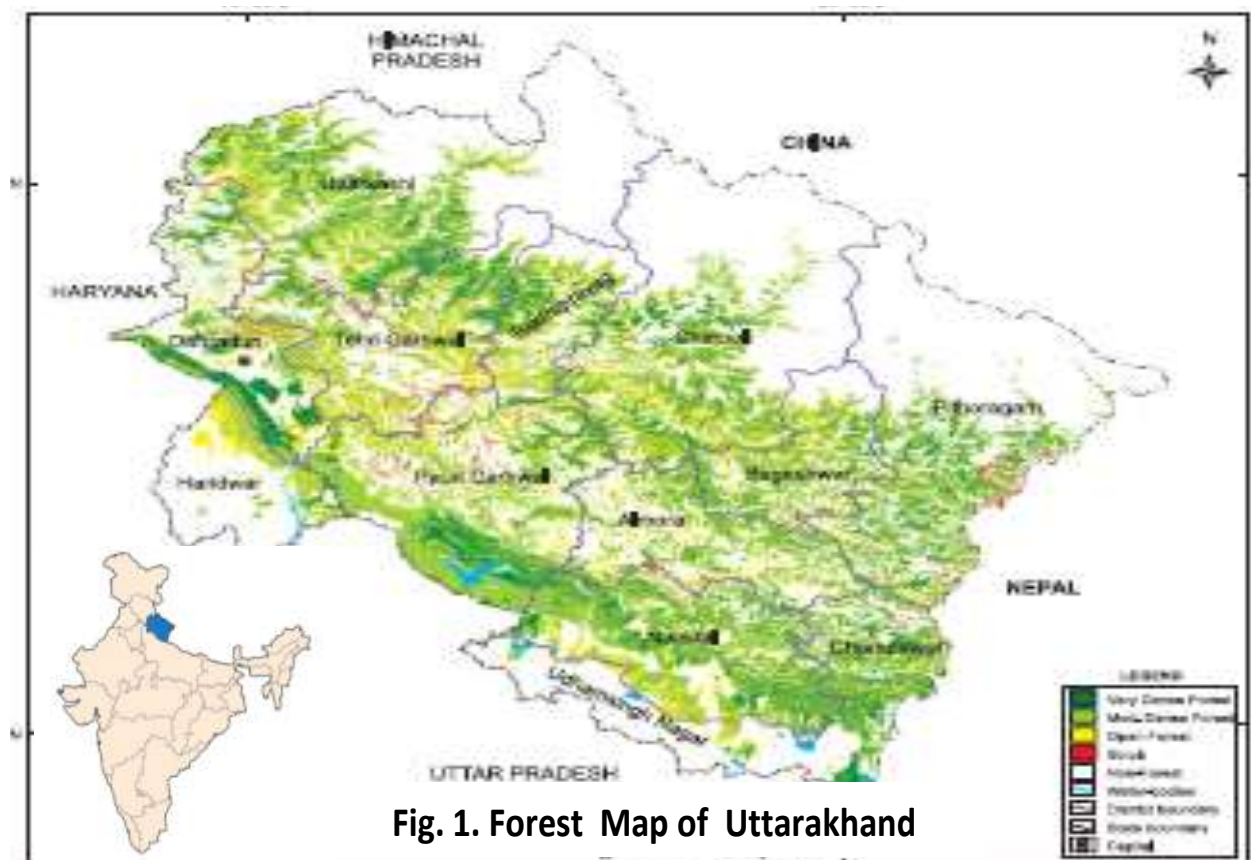
### **INTRODUCTION**

Meliaceae is one of the most useful families of Angiosperms. It has been utilized for its various products since time immemorial. The family is also known as Mahogany family distributed throughout the tropics and subtropics. The family comprises mainly of trees and shrubs in the order Sapindales. Meliaceae are of great importance from the point of view of forestry. Some of the best known examples in the international timber trade are American or true mahogany (*Swietenia* spp.); African mahogany (*Haya* spp.); Sapele or utile (*Entandrophragma* spp.); American cedar (*Cedrela* spp.); Burma cedar, Indian toon or Australian red cedar (*Toona* spp.) and Chickrassy or Chittagong wood (*Chukrasia* spp.) besides several other from various parts of the world (Bahadur, 1988). Some of the members are good sources of biologically active compounds having insect repellent, antifungal, antiviral and bacteriocidal properties (Muellner *et al.* 2003).

In India, family is distributed in tropical and subtropical part of the country and is well represented by very important Genera such as *Toona*, *Azadiracta*, *Melia*, *Aphanamixis*, *Churasia*, *Dysoxylum*, *Soymida*, *Xylocarpus* etc. Uttarakhand is one the states of India. The total geographical area of the state is 53,483 km<sup>2</sup> which accounts 1.69 per cent area of the country (FSI, 2019). The state has great physical and climatic diversity. Meliaceae is distributed throughout Himalayan foot hills and tropical regions of the state. Exact location of species is not only useful to trace the distribution of species but also assist in collection of material for study of systematic and in other plant related disciplines. Precise locations of different species of Meliaceae are not mentioned in the existing literatures. Therefore, in the present study efforts have been made to assess the diversity and distribution of members of family Meliaceae in Uttarakhand.

### **MATERIALS AND METHODS**

The state of Uttarakhand is situated in the eastern most part of the Western Himalaya. It shares its borders with Himachal Pradesh on the West, Uttar Pradesh in South, Nepal in the East and China in North. It lies between the longitudes of 77°35'3" – 81°2'25" E and the latitudes of 28°43'45" – 31°8'10" N. The state has recorded forest area of 38,000 km<sup>2</sup>, which is 71% of its geographical area. The Reserve, Protected and Unclassified Forests are 69.86%, 26.01% and 4.13% respectively of the recorded forest



area (Fig. 1). The forest cover in the state is 24,295 km<sup>2</sup> which is 45.43% of the total geographical area of the state. On the basis of density classes, 4,969 km<sup>2</sup> is under very dense forest, 12,884 km<sup>2</sup> under moderately dense forests and 6,442 km<sup>2</sup> under open forest (FSI, 2019).

Comprehensive review of literature was concerned Extensive field survey was carried out throughout the Uttarakhand state. Species occurring in the area were collected and Herbarium records were prepared with geo-coordinates following Jain and Rao (1977). The species were identified with the help of concerned floras (Kanjilal, 1928, Osmaston, 1921) and matched with DD Herbarium specimens. Plant nomenclature was updated as per latest available literature (Uniyal *et al.*, 2007; Plantlist, 2013).

## RESULTS AND DISCUSSION

Various works have placed the family Meliaceae under different orders viz. Geraniales ( Bentham and Hooker, 1862-1883; Engler and Prantl, 1887-1905), Meliales (Hutchinson, 1973), Rurales (Takhtajan, 2009; Thorne and Reveal, 2007) and Sapindales (Cronquist, 1988; Reveal, 2012 and AGP-IV, 2016).

Species diversity of Meliaceae has also been reported by various workers and groups like Adulla, 1972 and Nayar, 1984 (50 genera, 1400 species); Christenhusz and Byng, 2016 (53 genera, 600 species); Mabberley, 2017 (51 genera, 700 species); the Plant List 2013 (52 genera 669 species ) etc. These species are widely distributed in pantropical belt i.e. West Africa, America, West Indies, Myanmar, East Australia, West Pakistan and India.

Hiern (1875) described more than 20 genera and 100 species from India. Jain and Bennet (1997) revised the Indian Meliaceae and reported 51 genera and about 575 species distributed in the tropical and subtropical parts of world. In India, 19 genera and 70 species have been mentioned.

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**Meliaceae in Uttarakhand**

In Uttarakhand, Meliaceae is distributed in the foot hills Himalaya and plain areas. *Toona serrata* is the only species which has its presence in the hilly region of the state. Uniyal *et al.* (2007) reported 09 species and 01 variety belonging to 6 genera. However, in the present study only 07 species have been traced from all over the Uttarakhand. In existing literature, no precise localities of the members of Meliaceae have not been mentioned. Therefore, in the present study efforts were made to record and collect the species with their precise locations. Species with their local name and geo-coordinate surveyed locations of Uttarakhand is presented in the table no.1. *Azadirachta indica* is reported only from the Haridwar Forest Division. Trees have been planted in the garden and homestead in Dehradun. *Dysoxylum gotadhora* is confined to Jaulasal Range of Haldwani Forest Division. *Heynea trijuga* is found in Champawat Forest Division. *Melia azedarach* and *Toona cilata* are widely distributed species

**Table 1: Meliaceae species with location and geo-coordinate of the surveyed area of Uttarakhand**

S. N.	Botanical Name	Locations	Latitude	Longitude	Altitude
1.	<i>Azadirachta indica</i> A. Juss. <b>Synonym:</b> <i>Melia azadirachta</i> L. <b>Vern. Name:</b> Neem	• Rajaji National Park, Haridwar: Near Mansa Devi	N29°57'41.6 "	E78°10'10. 9"	337 m
2.	<i>Dysoxylum gotadhora</i> (Buch.-Ham.) Mabb <b>Synonym:</b> <i>Dysoxylum binectariferum</i> (Roxb.) Hook.f.ex Bedd. <i>Amoora ficiformis</i> Wight <b>Vern. Name:</b> Bandor-dima	• Haldwani Forest Division: Jaulasal Range	N29°04'33.7 "	E79°49'28. 5"	254 m
3.	<i>Heynea trijuga</i> Roxb. ex Sims <b>Synonym:</b> <i>Trichilia connaroides</i> (Wight & Arn.) Benth. <i>Walsura trijuga</i> (Roxb. ex Sims) Kurz <b>Vern. Name:</b> Aankh Taruwa	• Champawat Forest Division, Amori near Chelthi	N29°12'59.9 "	E80°02'49. 8"	642 m
4.	<i>Melia azedarach</i> L. <b>Synonym:</b> <i>Azedarach speciosa</i> Raf. <i>Azedarach sempervirens</i> Kuntze <i>Melia birmanica</i> Kurz. <b>Vern. Name:</b> Darek	• Pithoragarh Forest Division: Ghat Range (Near Gurana) • Uttarkashi Forest Division • Uttarkashi Forest Division: Dunda Range (Nouliya Sour) (Very good population) • Bageshwar Forest Division: Kapkot Range • Chakrata Forest Division: Deogarh Range: Tunj	N29°29'37.1 " 30 <sup>0</sup> 45' 15.3" 30 <sup>0</sup> 40' 52.7" N29°54'32.1 " N30°92'97.0 3"	E80°07'43. 7" 78 <sup>0</sup> 33' 54.8" 78 <sup>0</sup> 21' 00.3" E079°49'29 .1" E77°84'22. 55"	575 m 1391m 973m 975 m

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	•	Badrinath Forest	N30°13'07.3	E79°18'01.	913 m
		Division: Nand Prayag Range	."	7"	
	•	Kedarnath Wildlife Sanctuary: Gopeshwar Range: Mandal	N30°27'23."	E79°16'45.8"	1514m
	•	Badrinath Forest	N30°13'07.3	E79°18'01.	913 m
		Division: Nand Prayag Range	."	7"	
	•	Chakrata Forest	N30°94'82.29"	E77°84'76.26"	
		Division: Deogarh Range: Tuni			
5.		Champawat: Kali Kumaon Range (Asedi Gaon-Riverine Forest)	N29°31'13.18"	E080°05'05.3"	551 m
		<i>Toona ciliata</i> M. Roem. <b>Synonym:</b> <i>Cedrela toona</i> Roxb. ex Rottl. <i>Cedrela microcarpa</i> C.DC. <i>Toona microcarpa</i> (C.DC.) Harms <b>Vern. Name:</b> Tun			
	•	Mussoorie Forest	N30°20'53.1	E78°08'11.8"	
		Divison: Raipur Range: Maldevata (Sherki Village)	"	"	
	•	Tehri Forest	N30°19'30.5	E78°09'27.3"	559 m
		Divison: Saklana Range	"	"	
	•	Champawat: Lohaghat Range (Purvi Dungra Beat, Com. 13)	N29°20'59.2	E080°14'47.2"	1431m
	•	Champawat: Lohaghat Range( Near Mayavati Ashram)	N29°22'43.1	E080°03'56.9"	1840m
	•	East Tarai Division: Surai Range (Jhankaiya Block)	N28°53'27.5	E79°59'13.7"	206 m
	•	East Tarai Division: Kishanpur Range (Dolly, Khot Kharra, Block -A)	N29°04'19.8	E79°35'25.9"	244 m
	•	Pithoragarh: Ghat Range (Dhumbakot Bendi)	N29°31'11.3	E80°08'50.8"	1212 m
	•	Pithoragarh: Ghat Range (Dhumbakot Bendi)	N29°33'18.1	E80°11'48.3"	1349 m
	•	Pithoragarh Forest Division : Didihat Range	N29°43'24.8	E80°16'44.8"	1321 m
	•	Pithoragarh Forest Division : Didihat Range (Sandev Forest: Devchula RF)	N29°48'30.1	E80°14'11.2"	1779 m
	•	Nainital: Ram Nagar Forest Division:	N29°22'08.8	E79°14'30.4"	468 m

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Dehchauri Range, Dabaka Block				
•	Nainital: Ram Nagar Forest Division: Dehchauri Range: Border Kota –Dechauri Range	N29°24'17.6 " "	E79°15'22. 6" "	545 m
•	Nainital: Ram Nagar Forest Division: Dehchauri Range: Lacchampur Beat, Hathigaliyara	N29°23'38.0 0" "	E79°15'33. 00" "	561 m
•	Ram Nagar Forest Division: Dehchauri Range (Temple Area)	N29°22'22.3 "	E79°15'36. 0"	562 m
•	Ram Nagar Forest Division: Kota Range, Beat: Bhalon, com. 5, Kakrad Nala (Bhandarpani)	N29°27'5.3" "	E79°13'12. 7"	601 m
•	Ram Nagar Forest Division: Kota Range, Beat: Bhandarpani (Bhalon), Com.: Kalimad River	N29°25'24.4 "	E79°13'00. 3"	561 m
•	Ram Nagar Forest Division: Kosi Range (Near Kotta Rrange )	N29°27'33.7 "	E79°09'28. 2"	409m
•	Ram Nagar Forest Division: Kaladungi Range, Narani Block, Tilor Beat, Comp. 7.	N29°19'08.3 "	E79°21'34. 6"	609m
•	Ram Nagar Forest Division: Kaladungi Range , Corbett fall	N29°17'28.4 "	E79°19'07. 9"	372 m
•	Champawat Forest Division: From Tanakpur 4 km before Shukhi Dang (Good population)	N29°9'5.0" "	E80°5'21.2 9"	1063m
•	Uttarkashi Forest Division	N30 <sup>0</sup> 46' 32.6" "	78 <sup>0</sup> 36' 15.1" "	1493m
•	Tons Forest Division: Devta Range (In between Tuni and Mori, Near Sandra	N30°59'39.4 ."	E78°01'06. 1"	1137m
•	Chakrata Forest Division: Molta Range	N30°58'36.0 ."	E77°58'09. 0"	1077m
•	Uttarkashi Forest Division, Badahat (Way to Dodital)	N 30 <sup>0</sup> 48' 31.1" "	E78 <sup>0</sup> 27' 02.4" "	1493m

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• Bageshwar Forest Division: Kapkot Range	N29°54'32.1 "	E079°49'29 .1"	975 m
• Bageshwar Forest Division: Glacier Range, Saling	N30°01'15.4 "	E079°57'.0 0.3"	1337m
• Bageshwar Forest Division: Kapkot Range, 5 km before Kapkot	N29 <sup>0</sup> 54' 57.8"	79 <sup>0</sup> 51' 09.5"	997 m
• Pithoragarh Forest Division: Bageshwar Range, Paudi Dhar	N29°47'57.4 "	E079°46'18 .5"	1221m
• Nandhaur Wildlife Sanctuary, Nainital: Machaliovan	N29°09'17.1 "	E79°42'33. 0"	369m
• Nainital: After Kathgodam: 4 Km (Turn)	N29°17'42.5 "	E79°32'26. 1"	619m
• Nainital Forest Division: Manora Range (Patwadangar)	N29°20'05.8 "	E79°27'00. 4"	1580m
• Kedarnath Wildlife Sanctuary: Dhanpur Range Gauchar	N30°17'09.6 ."	E79°07'34. 5"	802m
• Rajaji National Park: Shyampur Range: Chidiapur	N29°48'39.5 "	E79°14'21. 9"	282m
• Chakrata Forest Division: River Range: Sahia	N30°61'96. 08"	E77°87'26. 34"	
• Tehri Forest Divison: Saklana Range (After Bridge on way to Kaddukhal)	N30°19'30.5 "	E78°09'27. 3"	559m
• Rudraprayag Forest Division: Kankhara Range	N30°14'35.3 ."	E78°52'15. 2"	631m
• Rudraprayag Forest Division: Kankhara Range	N30°14'35.3 ."	E78°52'15. 2"	631m
• Alaknanda Soil Conservation	N30°23'59.5 "	E79°19'47. 5"	1027m
• Rudraprayag Forest Division: Agastaumunia Range : Narkota towards Kedarnath	N30°15'00.8 ."	E78°55'39. 8"	721 m
• Kedarnath Wildlife Sanctuary: Gopeshwar Range, Mandal	N30°27'23." "	E79°16'45. 8"	1514m
• Tehri Dam –I Forest Division: Nailchami	N30°23'05.1 ."	E78°46'29. 3"	1586 m

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		Dam Range						
		• Rudraprayag Forest	N30°24'30.3	E78°52'22.	1706m			
		Division: South Jakholi Range, Budana II Beat, (Launga, Com. 18	."	4"				
		• Badrinath Forest	N30°13'07.3	E79°18'01.	913m			
		Division: Nand Prayag Range	."	7"				
		• Alaknanda Soil Conservation, Patiyaldhar	N30°24'17.8	E79°18'45.	1251m			
		• Uttarkashi Forest	30 <sup>0</sup> 40'	78 <sup>0</sup> 21'	973m			
		Division, Dunda Range , Noulia Sour (Very good population)	52.7"	00.3"				
6.	<i>Toona sinensis</i> (Juss.) M. Roem	• Uttarkashi Forest	30 <sup>0</sup> 53'	78 <sup>0</sup> 40'	1889m			
	<b>Synonym:</b>	Division: Taknor Range, Tihar, Comp. – 1A (Sungar River)	32.3"	22.5"				
	<i>Toona serrata</i> (Royle) M. Roem.	• Binsar Wildlife Sanctuary , Almora	N29°41'45.0	E079°45'38	2118m			
	<i>Cedrela sinensis</i> Juss.	• Chakrata Forest	N30°08'92.	E77°76'47.				
	<i>Surenus serrata</i> (Royle) Kuntze	Division: Bawar Range	41"	02"				
	<b>Vern. Name:</b> Darlu, Darli, Darloi	• Tons Forest	N31°02'37.8	E78°03'51.	1189 m			
		Division: Mori to Natwar	."	0"				
		• Govind Pashu Vihar Division : Rupin Range	N31°04'04.2	E78°06'11.	1382 m			
			."	4"				

of the family. Both species have been reported upto 1800m. *Toona sinensis* was found above 1800m. *Churasia tabularis* could not be traced in the wild state. Huge trees of *Chukrasia* exist in Forest Research Institute, Dehradun. *Melia dubia* reported by Uniyal *et al.* (2007) could not be traced. It is a species of south India. In Uttarakhand only *Melia azedarach* is present. *Toona microcarpa* is the synonym of *Toona ciliata* (Table 1).

Meliaceae is one the important families of angiosperm of high timber and medicinal value. Taxonomical and other plant based studies of different discipline like ecology, climate change, genetic, physiology, pathology, etc. precise location of different species was essentially required. Hence, present study will be immense use for the students, researchers, state forest department etc. for tracing the exact locations of different members of Meliaceae. It is recommended that similar kind of studies should be under taken for different species for diversity and distribution assessment.

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