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Status, distribution and concentration of *Morus* species in North Kashmir

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Abstract
The present study entitled **"**Status, distribution and concentration of *Morus* species in North Kashmir" was carried out at Faculty of Forestry, SKUASTK, Benihama, Ganderbal J&K during the year 2018-19. A detailed survey at village level of all the districts of North Kashmir revealed that 13 varieties of *Morus alba* are grown in North Kashmir. Of these 13 varieties, six are reportedly exotic and rest are indigenous. The species were found growing in all the districts of North Kashmir at an altitudinal range of 1550-1996 m. The concentration of *Morus* trees on per ha basis varied from district to district. It was found more in district Baramulla (17 ha^{-1}) followed by 11 ha^{-1} in district Kupwara and lowest 10 ha^{-1} in district Bandipora. Socio-economic studies revealed that Baramulla district had maximum average land holding of 0.63 ha per family followed by Bandipora and Kupwara with average land holding of 0.47 and 0.46 hectares per family, respectively. The studies also revealed that *Morus* trees contributed its share in average estimated annual income per ha of land holding in North Kashmir. As far as North Kashmir is concerned average income of farmers was Rs 1,71,555 in which contribution of *Morus* trees was Rs 1,126 which accounted for 0.65% of the total income. The studies further revealed that *Morus* species has multiple uses in North Kashmir. 41.46% of farmers use it as fodder, 34.72% for fruits, 12.52% for fuel and 11.30% of farmers use it for silkworm rearing respectively. It was observed that most of people in North Kashmir were using this species for household purposes (83.69%) while as least number of people for commercial purposes (16.31%).

Keywords: *Morus alba*, survey, status, North Kashmir

Introduction
The Union Territory of Jammu and Kashmir, which lies in the Western extremity of Himalayan mountain chain has different agro climatic zones comprising subtropical, intermediate, temperate and cold arid zones. The Valley of Kashmir falls under temperate zone and its forests consists of various conifers as well as broad leaved tree species (Anonymous, 2005) [1]. The principle conifer species found in Kashmir Valley mainly includes, *Cedrus deodara*, *Pinus walliachiana*, *Abies* p*indrow*, *Picea simithiana*, *Cupressus torulosa* etc. Among broad leaved species and various multi-purpose tree species, *Populus deltoides*, *Salix alba*, *Juglanas regia*, *Ulmus villosa*, *Ulmus walliachiana*, *Morus alba*, *Robinia pseudocacia* etc are found in Kashmir Valley (Nautiyal and Kaul, 1999) [6].
Morus alba, one of the important multipurpose tree species, commonly known as tul or shahtul is a best known representative of family *Moracea*. *Morus alba* is a short lived, fast growing, small to medium sized mulberry tree which grows up to 10-20 m in height. This species in native to warm temperate and subtropical regions of Asia, Africa and America with majority of species native to Asia (Yilmaz *et al*., 2012) [12].
Mulberry is recognized as "Kalpa Vruksha" (wish-fulfilling tree) in India as all parts of plant have multiple uses. It produces large amount of renewable biomass in the form of branches, shoots, leaves and fruits. In sericulture it is widely used for its foliage, constituting the sole feed for silkworm, *Bombyx mori*. In most European Countries, mulberry fruits are used for human consumption either in raw form or in the form of various confectionary products such as jams, pulp, juice, wine (Soufleros *et al.*, 2004) [11]. It is also used as fodder for animals since it is highly palatable, nutritious and digestable (70-90 percent) (Benavides, 2000) [2].
Morus alba is found in Kashmir. A number of authors have described this as being indigenous to Kashmir but there is little information available with respect to its status, concentartion and distribution under temperate conditions of Kashmir. Since under Valley conditions there was little information available about the species, therefore in order to collect some basic information with respect to its status, distribution and concentration in North Kashmir, this study was conducted.

Materials and Methods

Experimental site; location, physiography and climate

Kashmir valley is located in the north-western extremity of India, between 33° North latitude and 75° East longitude. The valley is located in the northern most latitude of the country holds almost central position in the continent of Asia. Average altitude of Kashmir valley (valley zone) ranges between 1, 500 to 2, 300 m above sea level. The geographical expanse of kashmir is 15, 948.00 sqkm (excluding the part under Pakistan). Survey was conducted in North Kashmir. North Kashmir comprises of three districts i, e Bandipora, Baramulla and Kupwara. District Bandipora lies in extreme north of the valley, situated between 34° 25' 12" North latitude and 74° 39' 00" East longitude. Bandipora district comprises of 7 Tehsils and 12 Blocks. District Baramulla lies in extreme north of the valley, situated between 34.19° North latitude and 74.36° East longitude. Baramulla district comprises of 16 Tehsils and 26 Blocks. District Kupwara lies in etreme north of the valley, situated between 34° 31' 12" North latitude and 74° 15' 00" East longitude. District kupwara comprises of 14 Tehsils and 24 Blocks. The elevation is 6070 feet amsl and the climate of the region is moist temperate with mean annual precipitation of 730 mm in the form of snow in winter and rains in March to April. The mean temperature of 13.3° C with maximum reaching upto 35° C in summer and may dip to -10° C in winter. Soils are dominantly alluvial which suffer from impeded drainage.

Species identification

In the first instance efforts were made to identify various species of *Morus* in North kashmir. For this purpose a detailed survey was conducted at village level of all districts of the North Kashmir. Survey was conducted in 2018 and 2019. In order to identify various species of *Morus*, help was taken from the taxonomist as a well as people who were shown samples of leaves as well as fruits for its identification.

Status and distribution of *Morus* species in North Kashmir

This study was achieved through stratified random sampling where in a detailed survey at village level of all districts of North Kashmir was conducted and observation with regard to its status and distribution was recorded on a well devised questionnaire. For collection of data three blocks were selected in each district. In each block, four Panchayats and subsequently four households from each panchayat were selected randomly for taking observations. Altitude of all villages was recorded with the help of Global Positioning System (GPS).

During surveys information was collected through following methods

a) **Questionnaire method:** A questionnaire prepared for the purpose was filled through onspot interaction with farmers. Questionnaire consisted of both open ended and close ended questions (Annexure I).
b) **Informal interview:** Information was also collected during informal interviews with farmers, old respectable citizens of the concerned areas. Generally open ended questions were asked for getting the information.
c) **Transit walk:** Information was collected during transit walk of villages. Transit walk gave more scope to discuss with farmers in their farm lands while walking through their farms. Problems and prospects of Agroforestry farming were discussed.

Results and Discussion

Species identification

Extensive survey conducted revealed that 13 varieties of *Morus alba* were found growing throughout North Kashmir. Among them 7 varieties were indigenous to Kashmir while as 6 varieties were exotic. Indigenous varieties include Shahtul, Chatatul, Zagtul, Robesh sernal, Botatul, Brentul and Local mulberry while as exotic species identified include Chinese white, Goshoerami, Ichinose, Kanva, Kokuso and Rokokuyaso (Table 1).

Status and distribution

The species were found growing in all the blocks of Bandipora, Baramulla and Kupwara districts at an altitudinal range of 1550-1996 m (a.m.s.l). The trees were found on private lands as they were planted by farmers for household and commercial purposes, however maximum among them were using this species for household purposes. Trees were also found growing on government and public lands. Bindroo *et al. (*2012) [5] reported occurrence of *Morus alba L*, throughout India from plains to an altitude of 3, 500 m above M.S.L. The most common local varieties of mulberry prevalent in Kashmir are Chatatul (Mirgund), Chatatul (Zaniger), Bruntul, Botatul, Zagtul and Pt Saritul. Tikander (2001) reported occurrence of *Morus alba*, *Morus indica*, *Morus lavigata* and *Morus serrata* under natural conditions in Punjab, Himachal Pradesh and Kashmir. Ravindran *et al.* (1997) [8] reported that in India main species of *Morus* include *Morus indica*, *Morus alba*, *Morus serrata* and *Morus lavigata*, which grow naturally in the North of the Country. Hooker (1885) reported occurrence of *Morus nigra* (black mulberrry) and *Morus rubra* in Jammu and Kashmir. *Morus nigra* commonly known as Shahtul is sparsely found throughout Kashmir.

While conducting survey it was found that tree had wide range of uses in North Kashmir. It was found that 11.30% use this species for silkworm rearing, 34.72% for fruits, 41.46% for fodder and 12.52% for fuel. Least number of people were using this species for fuel wood because felling of *Morus* species is banned in Jammu and Kashmir. In Sericulture it is widely used for its foliage to feed the silkworm *Bombyx mori*. Its fruits are used for human consumption either in the raw form or in the form of various confectionary products such as jams, pulp, juice etc (Souflerous *et al*., 2004) [11]. It is also used as fodder for animals, since it is highly palatable, nutritious and digestable (Benavides, 2000) [2].

An attempt was made to find out average land holdings of farmers in North Kashmir. Studies conducted showed that, maximum average land holdings (0.63 ha) per farmer was recorded highest in district Baramulla followed by district Bandipora (0.47 ha) and lowest land holdings (0.46 ha) in district Kupwara. In district Bandipora, block Bandipora recorded highest land holdings (0.55 ha) while as Sumbal block recorded lowest land holdings (0.42 ha). In district Kupwara, it was seen that farmers of block Kupwara have highest land holdings (0.52 ha) while as farmers of block Trehgam have lowest land holdings (0.37 ha). In district Baramulla, farmers of Sopore block have highest land holdings (0.75 ha) while as farmers of block Tangmarg recorded lowest land holdings (0.45 ha). Singh (2006) [10] reported that Pulwama district had maximum average land holding of 0.65 ha per family and minimum for Srinagar with 0.10 hectare per family. Shoaib (2008) [9] reported that Pulwama district had maximum average land holding of 0.69 ha followed by Budgam, Anatnang, Baramulla, Kupwara and

Srinagar with average land holding of 0.30, 0.29, 0.29, 0.29, 0.10 hectares respectively. Bhat (2005) [3] reported that average land holding was maximum in district Pulwama with 0.70 ha/family, followed by Budgam, Anantnag, Kupwara, Baramulla and Srinagar with 0.31, 0.30, 0.29, 0.29 and 0.22 hectares, respectively.

The highest estimated income of household per year (Rs 2, 05, 333) was recorded in Baramulla district followed by (Rs 1, 64, 000) in Bandipora district and (Rs 1, 45, 333) in Kupwara district. In district Kupwara, average income of household per year (Rs 1, 70, 000) was recorded highest in block Kupwara while as lowest income of household (Rs 1, 01, 000) was recorded in block Trehgam. In Bandipora district, average income of household per year (Rs 1, 80, 000) was recorded highest in block Bandipora while as lowest income of household (Rs 1, 50, 000) was recorded in block Sumbal. In district Baramulla, average income of household per year (Rs 2, 50, 000) was recorded highest in Sopore block while as lowest income of household (Rs 1, 56, 000) was recorded in block Tangmarg).

In order to find out concentration i, e number of *Morus* trees per hectare and its contribution to total income of farmers a socio economic study of farmers in each district was conducted. It was found that average number of *Morus* trees 17 ha^{-1} was recorded highest in district Baramulla followed by 11 ha^{-1} in district Kupwara and lowest 10 ha^{-1} in district Bandipora. In district Bandipora, average number of *Morus* trees owned 19 ha^{-1} was recorded highest in block Bandipora while as lowest trees 5 ha^{-1} was recorded in block Hajin. In district Kupwara, Trehgam block recorded highest number of *Morus* trees 17 ha^{-1} while as Langate block recorded lowest number of *Morus* trees 4 ha^{-1}. In district Baramulla, average number of *Morus* trees 24 ha^{-1} was recorded highest in block Tangmarg while as block Sopore recorded lowest number of *Morus* trees 4 ha^{-1}. The findings of present study showed that concentration of *Morus* species in North Kashmir varied from place to place. On an average North Kashmir recorded 13 trees ha^{-1} Different authors have reported about concentration of various tree species in Kashmir Valley. Singh (2006) [10] reported that concentration of *Celtis australis* trees varied from district to district. It was found more in Kupwara district with 11.00 trees ha^{-1} and minimum of 1.25 trees ha^{-1} in Srinagar district. Bhat *et al*. (2007) [4] reported that Elm (*Ulmus wallichiana* Planchen), one of the broad leaved endangered tree species was growing in every district of Kashmir valley having its higher concentration in the Southern districts. Shoaib (2008) [9] reported that Ash tree (*Fraxunus floribunda* Wall.), an important tree species of Kashmir valley was growing in private land holdings only in Anantnag and Pulwama district with concentration of 0.25 and
0.10 ha^{-1} respectively. Paray (2012) [7] reported that Sour cherry (*Prunus cerasus* L.) was found growing sporadically on the farm bunds/ boundaries, village common lands, graveyards, roadsides etc, in all the districts of Kashmir valley with its higher concentration (number of trees) in South Kashmir followed by North and Central Kashmir respectively. Bhat (2005) [3] reported that in district Anantnag on an average 78 number of Elm (*Ulmus wallichiana*) trees were found growing on per hectare of land, whereas in Pulwama, Budgam and Srinagar concentration of Elm trees was
49.75 ha^{-1}, 30.00 ha^{-1} and 2.33 ha^{-1}, respectively.

Attempts were also made to find out the percentage of income generated from the tree in North Kashmir. It was seen that average income generated from the tree was recorded highest (Rs 1, 720) in district Baramulla, contributing 0.91% to the total income of per household while as lowest income generated from the tree (Rs 800) was recorded in district Kupwara, contributing 0.66% to the total income of household. In district Bandipora, average income generated from the tree (Rs 2, 000) was recorded highest in block Bandipora while as lowest income generated from the tree (Rs 280) was recorded in block Sumbal. In district Kupwara, average income generated from the tree (Rs 1, 450) was recorded highest in block Trehgam while as lowest income generated from the tree (Rs 250) was recorded in block Langate. In district Baramulla, average income generated from the tree (Rs 2, 600) was recorded highest in block Pattan while as lowest income generated from the tree (Rs 460) was recorded in block Sopore. As far as North Kashmir is concerned average income of farmers was Rs 1, 71, 555 in which contribution of *Morus alba* was Rs 1, 126 which accounted for 0.65 % of the total income. Shoaib (2008) [9] reported that the average percentage of income contributed by Ash trees (*Fraxunus floribunda* Wall.) annually to a family was highest in Anantnag with 0.31 per cent followed by 0.15 per cent in Pulwama district, while as in other four districts, the tree was absent on private lands. Singh (2006) [10] reported that Hackberry (Celtis spp) also contributed to share in average estimated annual income ha^{-1} of land holdings. Depending upon average annual income from Hackberry, trees contributed about
5.25 per cent to the farmers average annual income in Kashmir. Bhat (2010) reported that Black Locust (*Robinia pseudoacacia*) was growing sparsely on the farm lands in Kashmir valley. The trees were found in abundance on wastelands in all districts of Kashmir valley and contributed significantly to economy of the farmers. Bhat *et al*. (2007) [3] reported that Elm (*Ulmus wallichiana* Planchen) contributed its share to the farmers total average annual income. In district Anantnag, Elm trees contributed about 6.69 per cent to the farmers total average annual income whereas in Pulwama, Budgam, Srinagar, Baramulla and Kupwara districts trees contributed about 6.67, 5.70, 2.33, 0.28 and 1.26 per cent to the farmers total average annual income, respectively.

The species were found growing throughout North Kashmir at an altitudinal range of 1550-1996 m, having concentration of 13 trees per hectare in North Kashmir and generating an income of Rs 1, 126 per farmer. The species contributes 0.65% to the total income of households in North Kashmir. It was seen that most of people in North Kashmir were using this species for household purposes (83.69%) while as least number of people for commercial purposes (16.31%).

Table 1: *Morus alba* varieties identified in North Kashmir

S. No.	Variety	Species	Indigenous/ Exotic	Identification	Altitude (m) {a.m.s.l}
1	Shahtul	*Morus alba*	Indigenous	Fruits/Leaves	1550-1996
2	Chatatul	*Morus alba*	Indigenous	Leaves	1582-1614
3	Zagtul	*Morus alba*	Indigenous	Leaves	1650-1996
4	Robesh sernal	*Morus alba*	Indigenous	Leaves	1573-1996
5	Botatul	*Morus alba*	Indigenous	Fruits/Leaves	1550-1996
6	Brentul	*Morus alba*	Indigenous	Leaves	1582-1614
7	Chinese white	*Morus alba*	Exotic	Leaves	1650-1696
8	Goshoerami	*Morus alba*	Exotic	Fruits/Leaves	1573-1996
9	Ichinose	*Morus alba*	Exotic	Leaves	1614-1996
10	Kokuso	*Morus alba*	Exotic	Leaves	1582-1614
11	Kanva	*Morus alba*	Exotic	Leaves	1564-1650
12	Rokokuyaso	*Morus alba*	Exotic	Leaves	1573-1996
13	Local mulberry	*Morus alba*	Indigenous	Fruits/Leaves	1550-1996

Table 2: Status of *Morus* species in North Kashmir

District	Block Surveyed	Approx. Altitude (amsl) (m)	Average land Holdings (ha)	Average income of household per year (Rs)	Average No. of *Morus* Trees owned per ha	Type of Plantation	Income generated from tree (Rs)/ Percentage of total income	uses	Purpose of growing tree
Bandipora	Bandipora	1650	0.55	180, 000	19	Block/Boundary	2000 (1.11%)	Silkworm rearing, Fruits, Fodder	Commercial, Household
	Hajin	1549	0.45	162, 000	5	Canal/Boundary	300 (0.18%)	Fodder, Fruits, Fuel	Household
	Sumbal	1554	0.42	150, 000	7	Canal/Boundary	280 (0.17%)	Fodder, Fruits, Fuel	Household
	Average	1549-1650	0.47	164, 000	10	Block/Boundary/ Canal	860 (0.52%)	Silkworm rearing, Fruits, Fodder, Fuel	Commercial, Household
Kupwara	Langate	1582	0.50	165, 000	4	Boundary/canal	250 (0.15%)	Fruits, Fodder, Fuel	Household
	Kupwara	1564	0.52	170, 000	14	Block/Boundary/Canal	700 (0.41%)	Silkworm rearing, Fruits, Fodder, Fuel	Commercial, Household
	Trehgam	1614	0.37	101, 000	17	Boundary/Bl ock /Canal	1450 (1.43%)	Silkworm rearing, Fruits, Fodder, Fuel	Commercial, Household
	Average	1564-1614	0.46	145, 333	11	Block/ Boundary/ Canal	800 (0.55%)	Silkworm rearing, Fodder, Fruits, Fuel	Commercial, Household

Table 2: contd…

District	Block Surveyed	Approx. Altitude (amsl) (m)	Average land Holdings (ha)	Average income of household per year (Rs)	Average No. of *Morus* Trees owned per ha	Type of Plantation	Income generated from tree (Rs)/ Percentage of total income	uses	Purpose of growing tree
Baramulla	Tangmarg	1996	0.45	156, 000	24	Block/Boundary /Canal	2100 (1.34%)	Silkworm rearing, Fodder, Fruits, Fuel,	Commercial, Household
	Sopore	1582	0.75	250, 000	4	Boundary	460 (0.18%)	Fodder, Fruits, Fuel	Household
	Pattan	1573	0.70	210, 000	23	Block/Canal /Boundary	2600 (1.23%)	Silkworm rearing, Fodder, Fruits, Fuel	Commercial, Household
	Average	1573-1996	0.63	205333	17	Boundary/ Block/ Canal	1720 (0.83%)	Silkworm rearing, Fodder, Fruits, Fuel	Commercial, Household
North Kashmir	Average	1550-1996	0.52	171,555	13	Boundary/ Block/ Canal	1126 (0.65%)	Silkworm rearing, Fodder, Fruits, Fuel	Commercial, Household

Annexure I: Questionnarie

District:	
Block:	
Panchayat:	
Site:	
Altitude:	
1.	Name of house hold with parentage
2.	Total land holdings of house hold
3.	Income of house hold
4.	Do you grow *Morus* species Yes/No

5.	Would you like to grow *Morus* species Yes/no
6.	Number of *Morus* species owned:
7.	Type of plantation (Block/Boundary/Canal)
8.	Purpose of growing these trees (Commercial/household/other)
9.	Uses of *Morus* Fuel/ Fodder/ Silkworm rearing/ fruits etc.
10.	Approximate income generated from tree
11.	Any problem in growing these trees
12.	Trees grown on farm lands

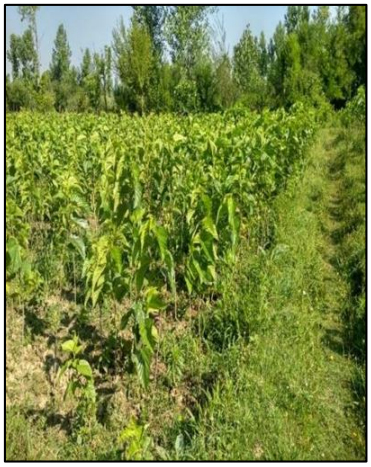

(a) Local mulberry


(b) Shahtul


(c) Ichinose


(d) Goshoerami


(e) Robesh sernal


(f) Kanva


(g) Kokosu


`(h) Chatatul


(i) Zagtul


(j) Botatul `


(k) Chinese white


(l) Brentul


(m) Rokokuyaso

Plate I: Varieties of *Morus alba* in North Kashmir

Conclusion

Studies conducted reveals that *Morus* species is found growing throughout North Kashmir. Extensive survey conducted revealed that 13 varieties of *Morus alba* are commonly grown in North Kashmir. Of these 13 varieties, six are reportedly exotic and rest are indigenous. The species were found growing in all the blocks of Bandipora, Baramulla and Kupwara districts at an altitudinal range of 1550-1996 m (a.m.s.l). The trees were found on private lands as they were planted by farmers for commercial and household purposes. Trees were also found growing on government and public lands. The present study revealed that *Morus* species has multiple uses in North Kashmir. Species is used for fodder, fuel, fruits and for silkworm rearing. The concentration of *Morus* trees on per ha basis varied from district to district. The studies conducted also revealed that *Morus* trees contributed its share in average estimated annual income per ha of land holding in North Kashmir and its contribution varied from district to district.

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