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DISTRIBUTION OF MULBERRY SPECIES IN INDIA AND ITS UTILIZATION

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Silkworm and Mulberry Germplasm Station (SMGS), Hosur (Tamil Nadu) has taken up systematic explorations of *Morus* species germplasm during spring and autumn seasons throughout India with the objective to map the naturally occurring mulberry genetic resources as these are of considerable importance in breeding programmes. So far 31 explorations covering 46 districts in 16 states and one union territory resulted in 279 collections. In India, *M. serrata* and *M. laevigata* are the wild forms with the distribution of former confined to North-West India and the latter distributed throughout India including Andaman & Nicobar islands. Considerable diversity was observed in *M. laevigata* with maximum leaf area recorded from Andaman & Nicobar collections compared to mainland forms. The leaves of this species are used for late age silkworm rearing and as fodder. The fruit is used for juice and jam making. The wood is used for furniture, sports goods and house building. *M. serrata* showed wide variation in its leaf lobation. The leaves of this species is utilised for silkworm rearing in Urgam valley (UP). The various *M. indica* forms collected are diversed in growth and yield attributes. The present paper further emphasises on various economic utility and medicinal uses of mulberry.

Key words : Mulberry spp., distribution, utilization

Mulberry belonging to the genus *Morus* L. of the family Moraceae is vital to sericulture industry and also used in agroforestry. It is extensively cultivated for silkworm rearing in tropical, sub-tropical and temperate zones, most of it to the north of equator and ranging from 50° North latitude to 10° South latitude (Yokoyama, 1962). Vavilov (1926) placed the centre of origin of the genus *Morus* in "China-Japan" region which includes East China, Korea and Japan. There are about 68 species recognised in the genus, of which 24 species are represented in China, 19 in Japan, 6 in Korea, 4 each in Taiwan and India, 3 each in Myanmar and Indonesia, 2 each in Thailand, Vietnam and Afghanisthan and 1 each in Arabia, Oman and Muscat. Further, 14 species are found in North America and 7 in Central and South America (Sanjappa, 1989). In India the genus *Morus* is represented by four species viz., *M. indica, M. alba, M. serrata* and *M. laevigata* (Hooker, 1885). The occurrence of *M. laevigata* from Andaman & Nicobar islands was recorded by Parkinson (1923). The occurrence of mulberry is reported in different regions of India (Kanjilal *et al.*, 1940; Gamble and Fischer, 1957; Nair, 1977). The widespread incidence of **jhum** cultivation and exploitation of forest areas for agricultural purposes has resulted in denudation of forest areas thereby threatening the habitats where wild mulberry resources occur. Thus, there is an urgent need to survey and collect the mulberry as the wild

mulberry resources are of considerable importance in mulberry improvement programmes.

MATERIALS AND METHODS

The genus *Morus* is distributed naturally in the Sub-Himalayan regions up to an altitude of 2100 m extending between Indus and Brahmaputra rivers and with climate varying from temperate to sub-tropical. Various geographical regions of the country were surveyed in two different seasons every year, viz., spring (February to April) and autumn (September to October). The regions covered are indicated in Fig. 1. Several morphological data were recorded on the basis of visual observations and measurements on locating the mulberry resources in natural habitats as follows : bark colour, lenticel characters, leaf characters such as lobation, texture, shape, margin, surface and size (l × b), phyllotaxy, internodal distance, sex, catkin length and fruit length. The plants were sampled based on distinct morphological features. Herbarium specimens were made of the plants collected. Mature shoots with dormant and healthy buds were collected for further propagation through grafting/cutting to ensure survival and later transplanted from nursery to base collection for ex- situ conservation.

RESULTS AND DISCUSSION

A total of 279 mulberry resources were collected in 31 explorations covering 46 districts in 16 states and one union territory (Table 1).

Distribution of mulberry resources

In India the two species *M. laevigata* and *M. serrata* occur as wild trees with the former distributed throughout India including Andaman & Nicobar islands and the latter confined to north-west India. Cultivated forms observed belonged to *M. indica* and *M. alba*. Wild trees of *M. laevigata* were observed along the streams

Table 1. Mulberry genetic resources collected during survey and exploration in different states

Sl. No.	Explored Area	State	Total mulberry collection
1.	North-west India	Himachal Pradesh	2
		Uttar Pradesh	80
2.	North-East India	Assam	5
		Arunachal Pradesh	6
		Manipur	4
		Meghalaya	30
		Nagaland	1
		Sikkim	10
		West Bengal	14
3.	Central India	Madhya Pradesh	14
		Orissa	1
4.	Western India	Maharashtra	3
5.	South India	Tamil Nadu	47
		Karnataka	16
		Kerala	40
		Andaman & Nicobar Islands	06
		Total	279

in the moist deciduous forest of Doormarnalli and littoral forest of Lamia bay growing in close proximity from the sea and in forest ranges of John Lawrence and Karmatang. Further, a large population of *M. laevigata* with plants in all stages of growth and development from small seedlings to huge trees were observed for the first time in Havelock island. The occurrence of *M. laevigata* was earlier reported in Andaman by Parkinson (1923). Its availability was also recorded by Vasudeva Rao (1986) but no specimen was examined. In North-western India, it is found in natural habitats in Dehra dun, Haridwar and Laxman-Jhula (Pauri-Garhwal). Exploration conducted revealed natural distribution of *M. laevigata* trees in Eastern Himalayan wet temperate forests of namly, Rhenock, Tarpin

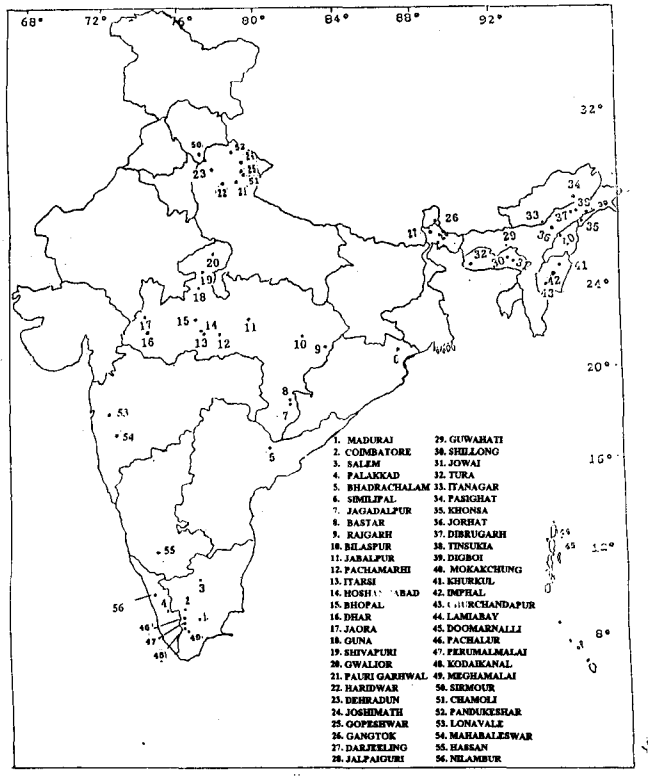

Fig. 1. Exploration sites for *Morus* species in India

(East Sikkim) Manring, Turung, Sipshu (South Sikkim), Jume, Chakung and Phuncheybong (West Sikkim).

Naturally occurring *M. laevigata* trees were observed in West Bengal in eastern sub-montane semi evergreen forests, Lava and Algara in Kalimpong sub-division, sub Himalayan secondary wet mixed forests of Murthy and Imdong in Jalpaiguri, forested areas in Assam, mixed deciduous type in Pengaree, Dibrunadhi near Digboi, trees of this species were found to occur in tropical evergreen forests of umpling and Nongpoh (Ribhoi district) in Meghalaya, along a stream in the forest of Sung Valley, Mynso and Jowai, Khurkhul in Manipur and trees with unlobed leaves in Churachandpur.

In Central India, trees of *M. laevigata* are exploited for its sweet fruits which have a good commercial value. Thus in tropical moist deciduous forests of Jaora, Dhar, Shivpuri, Gwalior, Pachamarhi, Jabalpur and Rajgarh districts, developed gene pool reserves were located. In South India, *M. laevigata* is mainly grown as a shade tree in coffee estates of Shevaroy hills in Yercaud.

M. serrata resources were confined to North-western India. The sacred mulberry tree at Joshimath is the oldest and almost 1200 years old (Rau, 1967). The trees of this species were distributed in natural habitats in Salna (700 m), Urgam valley and Chakra situated at an altitude of 2200 m. This species grows in association with oak, pines and conifers. Watt (1891) reported this species at higher elevations between 1200 to 2750 m in North-western Himalayas. Balakrishna and Ramesh (1989) have observed these resources growing in association with oak up to 1800 m. The distribution of this species in Rajouri, Sundarbani, Poonch and Batote regions of Jammu Division; Kangra, Chamba, Nahan and Kullu districts of Himachal Pradesh and Garhwal Himalayas of Uttar Pradesh at an elevation of 1100 to 2200 m has been recorded by Dandin *et al.* (1993).

M. alba a deciduous, monoecious tree is cultivated in Punjab, North-west Himalayas and Western Tibet ascending to 3350 m. According to Watt (1891) and Parker (1956) this species is indigenous to China and extensively cultivated throughout the plains of India and in the hilly areas of Himalayas upto an elevation of 3300 m. A tree belonging to this species was located in Surari at an altitude of 1365 m. This area was earlier covered under forest. In Central India a developed gene pool of *M. alba* was observed in Guna.

M. indica is commonly cultivated for sericultural purposes from temperate to sub-tropical Himalayas, from Kashmir to Sikkim up to 2100m. Most of the cultivated forms are commonly distributed in Uttar Pradesh, West Bengal, Sikkim,

Assam, Meghalaya, Manipur, Arunachal Pradesh, Maharashtra, Orissa, Karnataka, Tamil Nadu, Kerala and Andhra Pradesh, Sikkim and West Bengal. Probably distribution of natural resources of *M. indica* might have restricted due to widespread introduction of improved varieties and intensive farming practices.

Utilisation of mulberry (*Morus* spp.)

Mulberry is a multipurpose tree, probably known as "Kalpa vruksha". It is a fast growing tree and produces large quantity of renewable biomass in the form of branches, shoots, leaves and fruits. As mulberry is propagated by cuttings, certain quantity of pruned branches can be used as seed material and the remaining as fuel wood. One hectare of mulberry garden yields 12.1 tons of mulberry sticks. The energy generated/ha (50% moisture loss) is 27940 K calories (@ 4600 calories/kg of mulberry wood). Accordingly mulberry can be utilised by raising it as "energy plantation" in cultivable/ wasteland/ watershed/ canal bund/roadside, etc. under various developmental and conservation programmes (Chinnaswamy and Hariprasad, 1995). It can be extensively used for social forestry as it plays an important role in soil conservation and prevention of soil erosion. Further, mulberry cultivation and silk production from one hectare results in employment for 12 persons throughout the year. The various economic and medicinal uses of mulberry (*Morus* spp.) are enumerated as follows:

a) Economic utility

i) *M. laevigata* : The leaves of this species is utilized for late age silkworm rearing in Chalsa (Jalpaiguri) and Dehra dun (Uttar Pradesh). The leaves are also used as fodder for cattle and goats in Sikkim. In Central India, the trees are utilised for juice and jam making. In Sikkim, West Bengal, Arunachal Pradesh, Assam and Meghalaya, the wood is utilized for firewood, house building, furniture making, planting and for making oars, stocks, spokes, poles, shafts of carriages and carts. The wood is also suitable for use as plywood and for paneling, carving and making of tea boxes and toys and tennis rackets. In Andaman and Nicobar islands, the trees occurring in littoral areas may be saline tolerant and are exploited in stress breeding. The straight bole of the tree, which is termite resistant, is used as support in house building work.

ii) *M. serrata* : The leaves of *M. serrata* are used in Urgam Valley for silkworm rearing. The wood is used for furniture and carving, toys making, sports goods, agricultural implements and cheap types of rifles and guns. The disease and frost resistant characters can be utilized for mulberry improvement through biotechnology.

iii) *M. alba* : It is cultivated in the plains of India and in hilly areas of Himalayas for silkworm rearing. It is also used as a avenue tree and in social forestry. Leaves are also used as fodder for cattle. Fruits are eaten fresh and also made into juice, stews and tarts. It can be used in making liquors. The wood is much valued in sports goods industry chiefly for making hockey sticks, tennis and badminton rackets, racket presses, cricket bats, stumps, etc. The wood is suitable for house building, agricultural implements, furniture and turnery, especially kicker arms, bobbins and tool handles. It is also used for making spokes, poles, shafts and bent parts of carriages and carts. The stem bark is used for paper making.

iv) *M. indica* : Most of the local varieties belong to *M. indica*. Thus "satin" variety (*M. indica*) in widely cultivated in Khasi and Jaintia hills of Meghalaya for rearing bivoltine silkworm races. Profuse fruiting varieties have been collected from Maharashtra and Meghalaya which can be utilized as female parent in breeding programmes. The fruits are also used for jam,

jelly and juice making in Maharashtra. The pruned branches are used as firewood.

b) Medicinal uses

The various parts of mulberry plant are used in ayurvedic preparations. Mulberry leaves have diaphoretic emollient effects. A decoction of the leaves is used as a gargle to get relief from throat inflammation. The fruit is cooling and laxative. The fruits are used to treat sore throat, dyspepsia and meloncholia (mental depression). The fruits are also used for treatment of high fever. The root extract have hypoglycemic properties and are used in treatment of diabetes. The root bark is used as an anthelminctic and also used as purgative and vermifuge. Mulberry root juice is administered to patients with high blood pressure. The shoot contains latex which is used as blaster for sores and for preparation of skin ointment.

M. laevigata has high adaptability and is distributed throughout the country. Because of its wide genetic base, characteristic features like big, wide ovate leaves, long sized fruits and adaptability to diverse environments including saline habitats it could be utilized in mulberry improvement programmes. *M. serrata* is confined to North-western Himalayas. The disease and frost resistance ability of this species can be exploited in mulberry breeding. *M. alba* can be utilised in social forestry and the developed genepool at Guna (M.P.) deserves to be conserved *ex-situ*. "Satin" variety belonging to *M. indica* with glossy and coriaceous leaves can be introduced after initial evaluation. Some of the profuse fruiting varieties belonging to this species and occurring in Meghalaya and Maharashtra can be utilised as female parents in hybridization programmes. Legislation to protect *M. laevigata* in Arunachal Pradesh needs to be taken up by other states also in order to conserve and protect these resources both in *in-situ* and *ex-situ* conditions.

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