Geographical Distribution of Indian Mulberry Species

A Tikader, A Ananda Rao and K Thangavelu
Central Sericultural Germplasm Resources Centre, Hosur-635 109 (Tamil Nadu)

Extensive explorations were undertaken in different regions of India. A total of 367 mulberry germplasm were collected through 38 explorations covering 5 zones, 21 states and 58 districts. The wild collections of *Morus serrata* was confined to North-western Himalaya. *M. laevigata* in natural forms are available in North-eastern, North-western and South India including Andaman and Nicobar Islands. Introduced genepool of mulberry were collected from Madhya Pradesh, Chhattisgarh, Tamil nadu, Kerala, Karnataka, Maharashtra and other parts of India which are maintained as avenue trees, shade trees, social forestry and fruit trees mainly in coffee and tea estates. *M. alba* and *M. indica* are mostly found in cultivated forms throughout India. Considerable diversity was observed in *Morus* germplasm collected through explorations. The variability in the Indian collections of *Morus* germplasm and the scope of utilization are discussed.

Key Words: Geographical Distribution, Mulberry Species, Utilization, Variation

In India, the genus *Morus* is represented by four species *viz., M. indica, M. alba, M. serrata* and *M. laevigata* (Hooker, 1885; Brandis, 1906). The natural distribution of the genus has considerably changed because of its extensive cultivation for silkworm rearing. Vavilov (1926) while reviewing the centres of origin of crop plants placed the genus *Morus* in "China-Japan" region which includes East China, Korea and Japan. There are about 68 species recognized 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 Afghanistan 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). Parkinson (1923) reported the availability of *M. leavigata* in Andaman and Nicobar Islands. The occurrence of mulberry is reported in different regions of India (Kanjilal *et al.,* 1940; Gamble and Fischer, 1957; Nair, 1977).

Explorations for mulberry genetic resources were undertaken in Central Himalayas (Balakrishna and Ramesh, 1989), North-eastern India (Jain and Kumar, 1989; Ravindran *et al.,* 1997), North-western Himalayas (Dhar and Ahsan, 1989); reported the distribution of *M. indica, M. serrata* and *M. laevigata* in forest flora of Kumaon region and North-eastern India, respectively, (Sreekumar *et al.,* 1995) have extensively explored Kerala for mulberry resources and collected from farm backyard/cultivated gardens, tea and coffee estates. Widespread urbanization, agricultural uses and denudation of forest areas threatens the natural habitats of mulberry particularly the primitive and obsolete varieties available in different parts of the country. Explorations are essential to identify the locations of mulberry resources available in natural and cultivated habitats and to document the diversity of mulberry for further utilization in mulberry crop improvement programme.

Materials and Methods

Regular surveys and explorations were conducted in various geographical regions of the country in two different seasons (February-April and September-November) every year during 1993-2000. The exploration sites are indicated in Fig. 1. Before conducting the survey, the published literature and herbarium records of Botanical Survey of India at Shillong, Dehradun, Port Blair, Pune, Coimbatore, Forest Research Institute, Dehradun, Institute of Forest Genetics and Tree Breeding, Coimbatore, State Forest Research Institute, Itanagar and North-eastern Hill University, Shillong were consulted. The genus *Morus* is distributed naturally in the Sub-Himalayan regions up to an altitude of 2200 m extending between Indus and Brahmaputra rivers with varying climate from temperate to tropical. To expedite the process of exploration in different areas, the geographical regions of the country were grouped into 5 zones, *viz.,* North-east, North-west, Central and South India. Accordingly, the zones were covered to identify the natural, cultivated, primitive landraces and obsolete varieties of mulberry germplasm. In addition, passport data, ethnobotanical notes on special uses with sericultural utilization were recorded in standard collection format. The same collection format was used by each team member. The plants were sampled based on distinct morphological, reproductive and other features. Random sampling in case of wild forms and biased sampling procedure were used when the population was more in number *i.e.,* at least 10% of

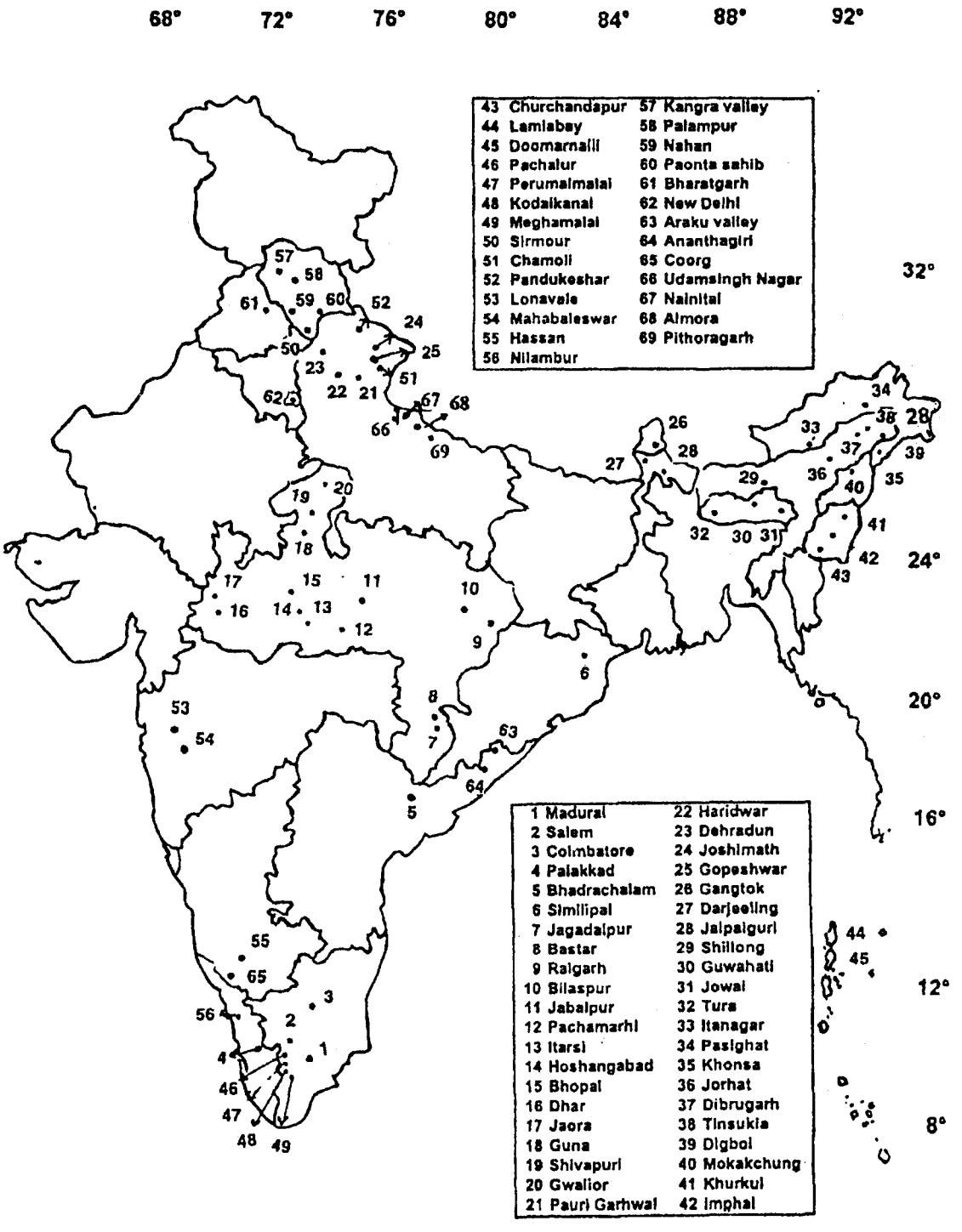

Fig. 1. Exploration sites of Morus spp. in India

the population was sampled. Herbarium specimens were made from the collected samples. Healthy, mature, disease-free shoots with dormant buds were collected for further multiplication in nursery and subsequent establishment from nursery to field genebank for *ex situ* conservation and utilization.

Results and Discussion

A total of 367 mulberry germplasm were collected from different zones and states which are presented in Table 1. The distribution of *Morus* species is indicated in Fig. 2. The distribution pattern revealed that in India the two species *M. laevigata* and *M. serrata* are available

Table 1. Mulberry collections in different states of India (1993-2000)

North-east India	West Bengal	11
	Sikkim	06
	Assam	08
	Manipur	07
	Meghalaya	30
	Nagaland	01
	Arunachal Pradesh	06
North-west India	Uttaranchal	105
	Uttar Pradesh	01
	Himachal Pradesh	12
	Punjab	01
	New Delhi	03
	Haryana	02
Central India	Madhya Pradesh	14
	Orissa	01
	Maharastra	03
South India	Tamil Nadu	63
	Karnataka	14
	Kerala	30
	Andhra Pradesh	03
	Andaman and Nicobar Islands	46
Total		367

as wild trees. *M. serrata* is available in North-western India at a higher altitude (Dandin *et al.*, 1993; Tikader *et al.*, 1999, 2000). *M. laevigata* is available throughout the country both in natural and as developed genopool. In Andaman and Nicobar Islands, wild trees of *M. laevigata* are abundantly available which differs in characteristics from main land forms (Ravindran *et al.*, 1997). Wild form of *M. laevigata* was recorded earlier in Andaman and Nicobar islands and reported by Parkinson (1923). The distribution of mulberry species is presented in Table 2. It is observed that *M. alba, M. Indica* and *M. laevigata* represent North-east, North-west, Central and South India except Andaman and Nicobar Islands. In Andaman and Nicobar Islands, only natural resource of *M. laevigata* is available. *M.serrata* is the only representative of North- west India and confined to higher altitude in Sub-Himalayan belt (800-2200 m).

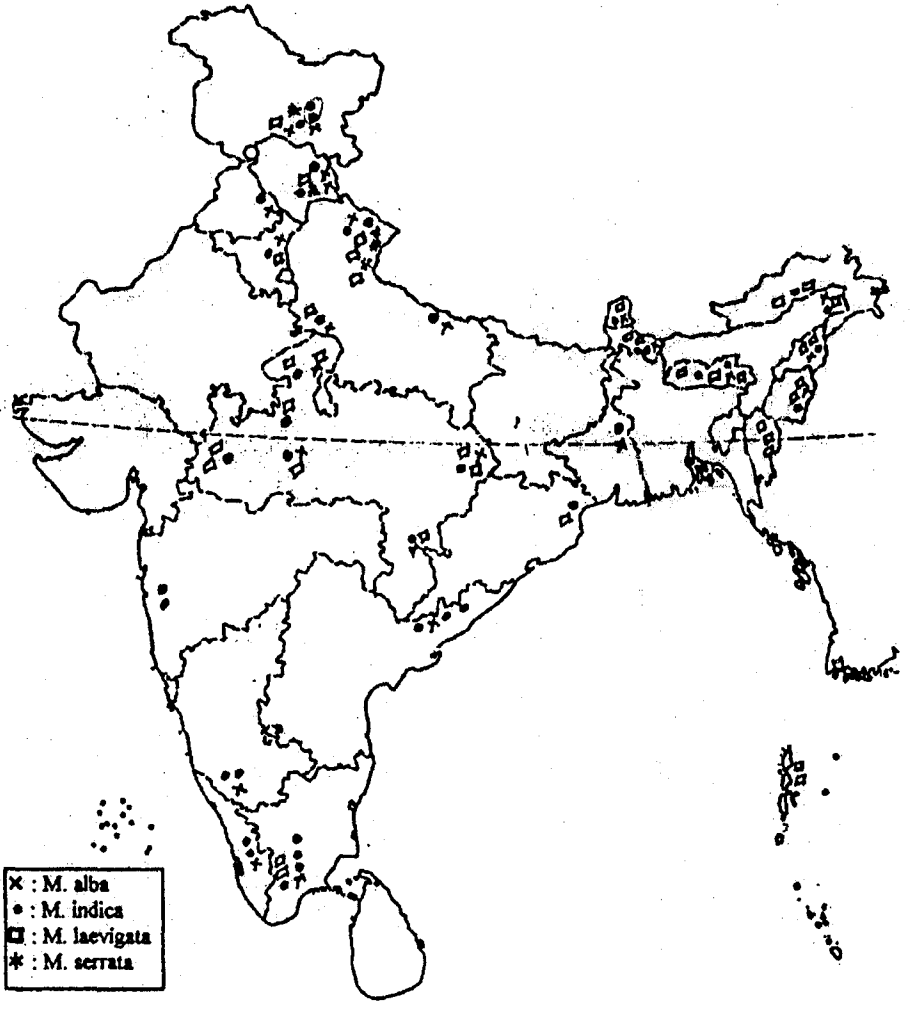

Fig. 2. Distribution of Morus species in India

Table 2. Species-wise distribution in mulberry collection (1993-2000)

Zone	Species					
	M. alba	*M. indica*	*M. laevigata*	*M. serrata*	Unidentified	Total
North-east India	—	32	33	—	04	69
North-west India	16	60	14	34	—	124
Central India	02	08	08	—	—	18
South India (A & N Islands)	02	49	57	—	46	110
Total	20	151	112	34	50	367

The natural distribution of *M. laevigata* was observed in Eastern Himalaya wet temperate forests in Rhenok, Tarpin (East Sikkim), Mamring, Turung, Sipsu (South Sikkim), Jume and Chakung (West Sikkim). *M. laevigata* trees were observed in West Bengal in Kalimpong sub-division (Lava and Algara), Jalpaiguri district (Murthy and Imdong forest). It was also observed in Pengaree, Dibrunadhi near Digboi in Assam, Umpling and Nongpoh in Meghalaya, Sung Valley, Mynso, Jowai, Khurkhul and Churchandapur are the places from where *M. laevigata* was collected in Manipur State (Ravindran *et al.*, 1990).

In central India developed genepool of *M. laevigata* is observed in Jaora, Shivpuri, Gwalior, Panchmari, Jabalpur and Raigarh districts of Chhattisgarh and Madhya Pradesh States. It is utilized for fruit purposes. In South India, *M. laevigata* is mainly grown as shade tree in tea and coffee estates of Tamil Nadu and Kerala (Yadav and Pavan Kumar, 1996). It is also grown as fruit tree.

M. serrata also called Himalayan mulberry is confined to Uttaranchal, Himachal Pradesh and Jammu and Kashmir in natural habitats. The sacred mulberry tree at Joshimath is the oldest and about 1200 years old (Rau, 1967; Tikadar *et al.*, 1999). *M. serrata* is naturally distributed at Salna, Urgam Valley, Chakrata, Pandukeshar, Almora, Pithoragarh, Nainital at higher altitude. This species is grown in association with oak, pines and conifers. Watt (1891) reported the species at higher altitudes in North-western Himalayas. The distribution of *M. serrata* was also reported in Rajouri, Sunderbani, Poonch, Batote in Jammu and Kashmir, Kangra, Chamba, Nahan and Kullu of Himachal Pradesh and Garhwal and Kumaon Himalayas of Uttaranchal (Balakrishna and Ramesh, 1989; Dandin *et al.*, 1993).

M. indica, is the most domesticated species and commonly cultivated for sericultural purposes from Kashmir to Sikkim. Most of the cultivated forms are distributed in the states of West Bengal, Assam, Meghalaya, Manipur, Arunachal Pradesh, Maharashtra, Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, Uttar Pradesh, Uttaranchal, Delhi and Punjab. The survey and exploration revealed that the distribution of natural resources of *M. indica* have reduced due to introduction of improved varieties.

Morus alba is indigenous of China (Watt, 1891; Parker, 1956) and extensively cultivated throughout the plains of India and the hilly areas of Himalayas. It is not exactly known how the variety was introduced in India. *M. alba* is widely cultivated for sericulture and fruit purposes besides avenue, fodder and other uses. The different mulberry species collected during the explorations are maintained in field genebank for further studies and utilization in mulberry crop improvement programme.

References

Balakrishna R and SR Ramesh (1989) Mulberry species and their distribution at Central Himalaya. *In:* Sengupta K and SB Dandin (eds) *Genetic Resources of Mulberry and Utilization,* Central Sericultural Research and Training Institute, Mysore, pp 33-35.

Brandis D (1906) *Indian Trees.* London, pp 612-613.

Dandin SB, R Basavaiah Kumar and HV Venkateshaiah (1993) Phytogeographical studies in genus *Morus* L. I Geographical distribution and natural variation of *Morus serrata* Roxb. *Indian J. Pl. Genet. Resour.* **7:** 223-226.

Dhar A and M Ahsan (1989) Mulberry species and distribution in North-western Himalayas. *In:* Sengupta K and SB Dandin (eds) *Genetic Resources of Mulberry and Utilization,* Central Sericultural Research and Training Institute, Mysore, pp 33-35.

Gamble JS and CEC Fischer (1957) *Flora of Presidency of Madras.* Vol II, London, pp 946-958.

Hooker JD (1885) *Flora of British India.* V: 491-493. (Reprinted). Bishen Singh, Mahendra Pal Singh, Dehradun.

Jain AK and R Kumar (1989) Mulberry species and their distribution in North-eastern India. *In:* Sengupta K and SB Dandin (eds) *Genetic Resources of Mulberry and Utilization,* Central Sericultural Research and Training Institute, Mysore, pp 37-42.

Kanjilal UN, PC Kanjilal, A Das, RN De and NL Bor (1940) *Flora of Assam.* Vol. 4, Government Printing Press, Shillong, pp 272-274.

Nair NC (1977) *Flora of Bushahr Himalayas.* International Bio-Science Publishers, Hisar.

Parkinson CE (1923) *A Forest Flora of Andaman Islands.* Bishen Singh and Mahendra Pal Singh, Dehradun.

Parker RN (1956) Forest flora for the Punjab with Hazara and Delhi. 3rd edn. Government Printing Press, Lahore, West Pakistan, pp 471-473.

Rau MA (1967) The sacred mulberry tree of Joshimath, U.P. *Indian Forester* **93:** 333-335.

Ravindran S, AA Rao, VG Naik, A Tikader, P Mukherjee and K Thangavelu (1997) Distribution and variation in mulberry germplasm. *Indian J. Plant Genet. Resour.* **10:** 233-242.

Sanjappa M (1989) Geographical distribution and exploration of the genus *Morus* L. (Moraceae). *In:* Sengupta K and SB Dandin (eds) *Genetic Resources of Mulberry and its Utilization,* Central Sericultural Research and Training Institute, Mysore, 407p.

SreeKumar H, S Kumaresan, JC Jose, SK Jayalakshmi, R Satheesh and PKK Nair (1995) Exploration and collection of mulberry genetic resources in Kerala. *J. Environ. Resour.* **3:** 14-17.

Tikader A, AS Rao and P Mukherjee (1999) *Ex situ* conservation of the oldest mulberry tree. *Indian Silk* **38:** 17-18.

Tikader A, S Ravindran, V Girish Naik, A Ananda Rao, SB Dandin, P Mukherjee and SR Ramesh (2000) Geographical distribution and variation in Indian mulberry genetic resources. Paper presented at "National Conference on Strategy for Sericulture Research and Development", held at Central Sericultural Research and Training Institute, Mysore, November 16-18, 2000, 13p.

Vavilov NI (1926) Studies on the origin of cultivated plants. *Trudy Byuro Prikl. Bot.* **16:** 139-248.

Yadav BRD and T Pavan Kumar (1996) Occurrence of a new distributional range of *Morus laevigata* wall and its variants in south India. *Indian J. Seric.* **35:** 163-164.

Watt G (1891) Dictionary of Economic Products of India, Vol. 5. Periodical Experts, Delhi, pp 279-284.