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Applied Zoology, Profitable Animal Production, and Health: Current Status and Future  
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# Recent Trends in Applied Zoology

Dr.D.S.Rathod  
Editor

Associate Editors  
Dr. K.S.Raut  
Mr.Datta Nalle

National Edited Book

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Recent Trends in Applied Zoology

**Edited by:** Dr.D.S.Rathod

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**Editor**

**Dr.D.S.Rathod**

Head

Department of Zoology and Fishery Science,  
Rajarshi Shahu Mahavidyalaya (Autonomous),

Latur- 413531, Maharashtra

**Associate Editors**

**Dr. K.S.Raut**

**Mr.Datta Nalle**

Department of Zoology and Fishery Science, Rajarshi Shahu Mahavidyalaya (Autonomous),  
Latur- 413531, Maharashtra

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## Chapter -13

### Importance of Mulberry plant in Sericulture

D.R. Awad

Rajarshi Shahu Mahavidyalaya (Autonomous), Latur

#### Introduction

Mulberry is a fast growing deciduous woody perennial plant. It has a deep root system. The leaves are simple, alternate, stipulate, petiolate, entire or lobed. The number of lobes varies from one to five. Plants are generally dioecious. Inflorescence is catkin with pendent or drooping peduncle bearing unisexual flowers. Inflorescence is always auxiliary. Male catkins are usually longer than the female catkins. Male flowers are loosely arranged and after shedding the pollen, the inflorescence dries and falls off. These are four persistent perianth lobes and four stamens implexed in bud. Female inflorescence is usually short and the flowers are very compactly arranged. There are four persistent perianth lobes. The ovary is one-celled and the stigma is bifid. The chief pollinating agent in mulberry is wind. Mulberry fruit is a sorosis, mainly violet black in colour.

Most of the species of the genus *Morus* and cultivated varieties are diploid, with 28 chromosomes. However, triploids ( $2n=(3x)=42$ ) are also extensively cultivated for their adaptability, vigorous growth and quality of leaves.

#### Climatic condition required for growth

Mulberry thrives under various climatic conditions ranging from temperate to tropical located north of the equator between 28° N and 55°N latitude. The ideal range of temperature is from 24 to 28°C. Mulberry grows well in places with an annual rainfall ranging from 600 to 2 500 mm. In areas with low rainfall, growth is limited through moisture stress, resulting in low yields. On average, mulberry requires 340m<sup>3</sup>/ha of water every ten days in case of loamy soils and 15 days in clayey soils. Atmospheric humidity in the range of 65-80 percent is ideal for mulberry growth. Sunshine is one of the important factors controlling growth and leaf quality. In the tropics, mulberry grows with a sunshine range of nine to 13 hours a day. Mulberry can be cultivated from sea level up to an elevation of 1 000 m.

#### Soil condition

Mulberry flourishes well in soils that are flat, deep, fertile, well drained, loamy to clayey, and porous with good moisture holding capacity. The ideal range of soil pH is 6.2 to 6.8, the optimum being 6.5 to 6.8. Soil amendments may be used to correct the soil to obtain the required pH. The quantities of gypsum or lime to be applied in different cases to bring the pH to 6.8 are given below

#### GYMPSUN:

pH range	Gypsum/ha
7.4 to 7.8	2.0 tonnes
7.9 to 8.4	5.0 tonnes
8.5 to 9.0	9.0 tonnes
9.1 and above	14.0 tonnes

## LIME:

pH range	Lime/ha		
	Plain	Hilly areas	Soil type
5.5 to 6.5	1.25 tonnes	2.5 tonnes	Sandy
	2.50 tonnes	5.0 tonnes	Sandy loamy
	5.0 tonnes	7.5 tonnes	Loamy
	7.5 tonnes	8.75 tonnes	Clay loamy

The powdered gypsum/lime is mixed well with garden of soil and irrigated to stagnation for 48-72 hours. Later the water is leached out by drainage and dried .

## Establishment of mulberry

### Land Preparation:

Land for mulberry cultivation is ploughed deep with a heavy mould board plough up to a depth of 30-35 cm. Thereafter the land is repeatedly ploughed two or three times with a country plough to bring the soil to a fine tilth. The land should be properly leveled. A basal dose of well decomposed farmyard manure (FYM) or compost is applied at the rate of 10 tonnes/ha and thoroughly incorporated into the soil.

### Spacing:

The spacing commonly followed for a rainfed garden is 90 x 90 cm Pits of 35 x 35 cm are prepared. About 1 kg FYM/pit should be added.

### Stakes and planting:

Branches of 8-10 months old and about 50 mm in diameter should be used for the preparation of stakes of 22-25 cm length with five to six healthy buds. Three stakes are planted per pit in a triangular form with a spacing of 15 cm, leaving only one bud exposed above soil surface. If planting is done with saplings, then one sapling is sufficient per pit. Planting should be done during June/July after the onset of the monsoon.

### Intercultivation:

During the first year, intercultivation should be done manually. Once mulberry plants are established, bullock ploughing is carried out.

### Fertilization:

50N:25P:25K (kg/ha/year) in two doses. First dose: suphala (15:15:15) 167 kg, after 2 months of planting. Second dose: urea 55 kg or cam (100 kg) or ammonium sulfonate (125 kg), at end of September or early October before cessation of monsoon rains.

### Pruning and leaf harvest:

The first crop should be harvested six months after plantation when the mulberry is well established. Two more crops are harvested during the first year by the leaf picking method. Mulberry should be pruned after one year at the onset of the next monsoon. Pruning is done by sharp sickle or pruning saw at a height of 25-30 cm from the ground.



### **Green manuring and mulching:**

Green manure crops can be grown as an intercrop with mulberry during the monsoon only. Green manure crops (cowpea, horse gram, *dhaincha*) should be incorporated into soil by ploughing before the flowering starts and well before the rains cease. Subsequently, plots may be mulched with any dry material or plants that will not cause needs.

### **Maintenance under rain fed conditions (second year onwards)**

Recommended inputs (per ha per year) for gardens maintained under rainfed conditions at a spacing of 90 cm x 90 cm:

- FYM or compost, 10 tonnes in a single dose at the onset of monsoon
- Azotobacter biofertilizer, 4 kg/crop, twice a year (during rainy season)
- VAM inoculum, 1 000 kg, once in mulberry lifespan (inoculation through maize rootlets)
- Suphala, 167 kg, first crop
- Single super phosphate, 156 kg, first crop
- Muriate of potash, 42 kg, first crop
- Urea (55 kg) or cam (100 kg), third crop
- Green manuring, 15 kg

Crops such as horse gram, cowpea, sun hemp and *dhaincha* should be incorporated into the soil by ploughing before flowering and cessation of the monsoon.

### **Leaf harvest:**

Individual leaf harvesting should be carried out. The expected yield (tonnes/ha/year) for different varieties is: Kanva-2, 10-12; S-13, 14-15; S-34, 14-15.

## **ANIMAL FEEDING PRACTICES AND OTHER TRADITIONAL USES**

Mulberry is known in India as "Kalpa Vruksha" as all the parts of the plant have many uses. It is essential to sericulture as the foliage constitutes the sole feed of the mulberry silkworm. Mulberry is a fast-growing tree which, for the convenience of sericulture practices, is maintained as a bush. It produces very large amounts of renewable biomass in the form of branches, shoots, leaves and fruit. If mulberry is used for silkworm rearing it is possible to obtain 30-35 tonnes/ha of leaf every year. By growing mulberry, a farmer obtains fodder, fuel and fertilizer. With regard to fodder for animals, farmers in India feed their cows and goats with leftover branches and leaves from silkworm rearing. Many farmers feed their animals with surplus foliage but always mix it with straw. Farmers also use the mulberry branches for fuel after pruning. Leftover twigs are allowed to dry in the garden itself. Residues of rearing are also converted to valuable FYM for mulberry gardeners by putting them in a pit for four to five months prior to use. As mulberry is mainly propagated by cuttings in the tropics and sub-tropics, a certain quantity of pruned branches can be used for the preparation of cuttings and the remainder as fuel. One hectare of mulberry garden yields about 12.1 tonnes of mulberry sticks. The energy generated/ha (50 percent moisture loss) is 27 830 Kcal (@ 4 600 calories/kg of mulberry wood). Mulberry could be exploited as an "energy crop" in cultivable, wasteland, low-lying areas, canal bunds, by roadsides and at fringe areas of the forest, etc. under various afforestation, watershed development and soil conservation programmes.

The uses of the various species of the genus *Morus* are enumerated below:



### ***M. laevigata***

The trees of this species produce sweet fruits that are used in juice and jam making in central India. In northeast India the wood is utilized as firewood; in house building and furniture making; for making stocks, spokes, poles, shafts of carriages and casts. The wood is suitable for plywood making and panelling, carving and making of toys and tea chests. It is also used for making tennis rackets. The straight log of the tree is used as a support in house-building work.

### ***M. serrata***

The wood is used for furniture making and carving, toy making, sports goods, agricultural implements and cheap types of rifles and guns.

### ***M. alba***

This species is cultivated in the hilly and plain areas of India (Himalayan region) for silkworm rearing. It is also used as a tree in roads and in social forestry. The fruit are made into juice, liquor and stews. The wood is used in the sports goods industry. It is also used for house building; agricultural implements; furniture; for making spokes, poles, shafts and bent parts of carriages and carts. The stem bark is used for making paper.

### ***M. indica***

The cultivated forms that are utilized in silkworm rearing belong to *M. indica*. There are a few profuse fruiting varieties occurring in Maharashtra and Meghalaya that can be utilized as the female parent in breeding programmes. The fruit is used for jam, jelly and juice making in Maharashtra. The pruned branches are used as fuel.

### **Medicinal uses**

The various parts of the mulberry plant find use in Ayurvedic preparations. The leaves have diaphoretic and emollient effects and are used for making a decoction that can be used as a gargle that throat inflammation. The fruits are used to treat sore throat, depression, high fever and are both a coolant and laxative. The root extract has hypoglycaemic properties. The root bark is used as an anthelmintic, purgative and vermifuge. Mulberry root juice is administered to patients with high blood pressure. The Chinese use the leaf tips from young leaves to boil with tea to control blood pressure. The milky latex is used as a plaster for sores and for the preparation of dermal creams.

### **FRUITING HABIT**

In South India, fruits are observed in two seasons a year: during October-November and during March-May. However, whenever mulberry is pruned or defoliate flowering takes place together with sprouting of auxiliary buds followed by fruit formation. This feature of mulberry is utilized in mulberry breeding programmes. The immature fruits are green in colour but change to purplish to violet black. In certain species such as *M. alba* the fruits are white to pinkish and very sweet. In *M. laevigata* the fruits are very long, sometimes measuring up to 18 cm.

### **LEAF CHEMICAL COMPOSITION**

This differs according to variety and maturity. However, on the basis of the analysis carried out at CSRTI (Mysore), the chemical composition of the leaf is as follows:

Component	Range
Moisture	65 - 78 percent
Protein	19 - 25 percent
Minerals	10 - 15 percent
Reducing sugars	1.2 - 1.9
Sugars	10 - 15 percent

## MULBERRY MAIN PESTS AND DISEASES OF

### Key pests of mulberry

*Maconellicoccus hirsutus* (mealy bug) - causing tukra in mulberry

*Diaphania pulverulentalis* - Leaf roller

*Spilarctia obliqua* - Bihar hairy caterpillar (sporadic pest)

### Minor pests of mulberry

Thrips, jassids, scale insects, short horned grasshopper.

### Tolerance of varieties to pests

The tukra incidence in rainfed areas was found to be maximum in the S-34 variety followed by MR-2, Berc 776, MS-7 and S-13 (Srinivas *et al.*, 1996). The spread of tukra in the V-1 variety is less compared to other varieties such as Local, K-2, S-13, S-34, S-36, suggesting that the V-1 variety is relatively tolerant to tukra (Anony. 1998; Sujatha, 1997). Screening of germplasm maintained at CSRTI indicated the variety TOGHWASE - Acc. No. 257 was found to be tolerant to pest attack (unpublished data).

### Main diseases of mulberry

**Foliar-** Leaf spot, leaf rust, powdery mildew, leaf blight and bacterial blight

**Soil borne.** Root rot and root knot

**Nursery diseases.** Stem canker, cutting rot, collar rot and dieback

### Important ace for health:

They taste a lot like grapes and their structure is very similar to that of blackberry. Also known as shahtoot, they are full of nutrients and vitamins and a cup of raw mulberries only accounts for 60 calories which makes it an ideal snack.

The carbohydrates in mulberries convert sugar into glucose, thereby providing energy to the cells. Consuming mulberries also increases your iron intake and gives tissues the oxygen they

need. They also contain Riboflavin which protects tissues from free radicals and helps in transferring oxygen throughout the body

### **1. Improves digestive health**

Mulberries contain a good amount of dietary fibre that our body needs for facilitating proper digestion. It bulks up the stool in the stomach and facilitates the movement of food through the digestive tract. This process relieves us from issues of constipation, bloating, and stomach cramps.

### **2. Controls blood sugar levels**

If you want to keep a check on your body sugar levels, white mulberries are your go-to solution. Studies indicate that some of the chemicals present in white mulberries resemble that of medicines used to treat type-2 diabetes.

### **3. Reduces cancer risk**

Mulberries are filled with anthocyanins that keep cancer cells at bay. They also contain resveratrol, which is known to have anti-cancer properties and thus helps to fight colon cancer, skin cancer, prostate cancer, and thyroid.

### **4. Improves blood circulation**

Mulberries are rich in antioxidants that improve the functioning of the blood vessels by dilating them. This leads to a free flow of blood from the heart to other parts of the body thus ensuring blood pressure control. Mulberries are rich in iron and the presence of iron encourages the production of red blood cells.

The polyphenols present in mulberries keep the blood vessels healthy and their potassium content keeps the blood pressure low.

### **5. Improves immunity**

Mulberries use the alkaloids present in the macrophages to activate them, which is said to boost our immunity. They keep the immune system alert. Vitamin C present in mulberries is another immunity strengthening element.

### **6. Builds bone tissue**

The combination of vitamin K, calcium, and iron is the best combination of nutrients for building strong bone tissues and bones. And guess what? Mulberry is rich in all of them. These nutrients help reverse the signs of bone degradation and prevent bone disorders such as osteoporosis and arthritis.

## **7. Promotes brain health**

To ensure a healthy brain, mulberries provide the body with the calcium that it seeks. They age-proof our brain, keeps it young and alert, and even keeps Alzheimer's at bay.

## **8. Promotes liver health**

Mulberries have the ability to strengthen the liver and contain iron that is useful to maintain liver health. Upon consumption, they nourish and purify the blood in the liver.

## **9. Prevents flu and cold**

If you often come down with the flu, then eating mulberries can help. White mulberries are astringent in nature and are known to kill bacteria, which is how they prevent and treat flu and cold.

## **10. Rich in anti-inflammatory agents**

Mulberries have resveratrol that has anti-inflammatory properties in it. Anthocyanins present in them help in preventing inflammation and hence can be used as an alternative to allopathic drug.

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