

CHAPTER

4

RAPID MICROPROPAGATION OF MORINGA

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4.1 INTRODUCTION

Tropical tree *Moringa oleifera*, a member of the Moringaceae family, is acknowledged as one of the most beneficial plants because of its medicinal and nutritional properties. This species originated in the sub-Himalayan region and has since expanded to India, Pakistan, and Bangladesh, as well as many other tropical and subtropical locations across the world. This plant is also native to tropical Asia, Africa and tropical America. Among 13 species of *Moringa*, *Moringa oleifera* is one of the most well-known and widely cultivated Moringaceae species (Table 4.1). *Moringa oleifera* is also known as the ‘drumstick tree’, ‘horse radish tree’, and ‘kelor tree’.

Moringa oleifera can adapt to tropical and subtropical environments. It can live in dry regions since it can be grown using rainwater with well-distributed rainfall around 1000–2000 mm throughout the one year without expensive irrigation techniques. The optimum temperature for the growth of *Moringa oleifera* is 25–30°C (77–86°F) daily (Bayé-Niwah & Mapongmetsem, 2014). The growth rate is usually affected when the temperature drops below 20°C (68°F). It is a fast-growing plant, has drought resistant character, can tolerate poor soils, and respond well to irrigation and fertilisation.

Table 4.1 Taxonomical classification of *Moringa oleifera*

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Capparales
Family	Moringaceae
Genus	<i>Moringa</i>
Species	<i>Moringa oleifera</i>

Moringa oleifera contains a wide range of medicinal properties, including high concentrations of essential minerals, vitamins, and amino acids, as well as being a good source of protein. This plant's bioactivities include anti-inflammatory and antimicrobial properties, and can be utilized to treat cardiovascular, gastrointestinal, and haematological problems. The flowers, leaves, pods, and seeds of the moringa tree are all linked to the existence of at least one benefit. It is one of the most valuable plants, according to the World Health Organization (WHO), because of its great nutritional content and significant medical properties.

4.1.1 Traditional Uses

Moringa oleifera is a plant with numerous nutritional and medicinal benefits. It is high in macro- and micronutrients, as well as other bioactive components that are necessary for optimal body function and illness prevention. The leaves, flowers, seeds, and nearly all other parts of this tree are edible and have a variety of therapeutic benefits, including antidiabetic, anticancer, antiulcer, antibacterial, and antioxidant effects (Sahay et al., 2017).

Asthma, hyperglycemia, dyslipidemia, flu, heartburn, syphilis, malaria, pneumonia, diarrhoea, headaches, scurvy, skin disorders, bronchitis, eye, and ear infections can all be treated with *Moringa oleifera* leaves (Dixit et al., 2016). It also aids in the reduction of blood pressure and cholesterol levels. Hyperthyroidism, Crohn's illness, antiherpes-simplex virus arthritis, rheumatism, gout, cramps, epilepsy, and sexually

transmitted infections can all be treated with *Moringa oleifera* seed. The root bark, on the other hand, can be used as a heart stimulant, as well as an anti-ulcer and anti-inflammatory agent.

Moringa oleifera flowers, on the other hand, operate as hypocholesterolemic, anti-arthritic medicines that also aid with urinary difficulties and colds. Lastly, the pods can be utilised to treat diarrhoea, liver, and spleen issues (Gopalakrishnan et al., 2016).

4.1.2 Therapeutic Properties

Moringa oleifera contains phytochemicals which make it a good medicinal agent to cure numerous diseases. *Moringa oleifera* has anti-diabetic properties where it is proven to be able to cure both Type 1 and Type 2 diabetes. Streptozotocin-induced Type 1 diabetes and insulin resistant Type 2 diabetes can be cured by the *Moringa oleifera* aqueous extracts. The presence of flavonoids, phenolics, and quercetin act as antioxidants which bring about a scavenging effect on reactive oxygen species (ROS). The flavonoids in *Moringa oleifera* are thought to scavenge the ROS emitted by mitochondria, protecting the beta cells, and therefore keeping hyperglycemia under control (Brunetti et al., 2013). High blood glucose triggers glycolysis in beta cells' mitochondria, resulting in ROS. This causes beta cell death, which results in decreased insulin production, hyperglycemia, and eventually Type-2 diabetes. The usage of *Moringa oleifera*, on the other hand, can prevent beta cell apoptosis. It contains antioxidants that work together with ROS to prevent cell damage and other negative outcomes (Gopalakrishnan et al., 2016). Moreover, *Moringa oleifera* is a plant that is used to treat atherosclerosis. Moringa's antioxidant qualities account for its anti-atherogenic properties (Metwally et al., 2017).

Moringa can be utilised as an anticancer agent since it is natural, dependable, and safe when administered at prescribed doses. It can be used as an anti-neo proliferative agent to stop cancer cells from multiplying. Leaf extracts, both soluble and solvent, have been shown to be powerful anticancer agents. Furthermore, moringa's ROS generation