

## Noni (*Morinda Citrifolia L.*): A Resilient Medicinal Plant With Diverse Applications

Ramya V., Rajesh K. and Avanija, M.

Department of Plant Pathology, College of Agriculture, Rajendranagar

Professor Jayashankar Telangana State Agricultural University, Hyderabad - 500030

Corresponding Author: ramya.vittal@gmail.com

Manuscript No: KN-V2-07/0011

### Abstract

Noni (*Morinda citrifolia L.*), a tropical evergreen tree from the Rubiaceae family, is renowned for its traditional medicinal applications and nutritional value. It is found in various tropical regions including Polynesia, India, and Southeast Asia, noni is a resilient plant that produces distinct ovoid fruits throughout the year. The fruit, leaves, flowers, roots, and stems of the noni tree have been utilized for their diverse therapeutic benefits, including antibacterial, antifungal, anti-inflammatory, and antioxidant properties. Commercially, noni is available in multiple forms such as juice, powder, capsules, and skincare products. It contains nearly 200 phytochemicals, including amino acids, flavonoids, and vitamins, contributing to its health-promoting attributes. Despite its long history of use, further research is essential to fully understand the bioactive compounds and their mechanisms of action. This review highlights the botanical characteristics, biochemical properties, and multifarious applications of noni, emphasizing its potential in food, pharmaceutical, and cosmetic industries.

### Introduction

Noni (*Morinda citrifolia L.*) is an evergreen tree cultivated in tropical and subtropical countries like India, Vietnam, Malaysia, China, South America etc. (Adilah and Hanani, 2016). It is commonly known as cheese fruit, nuna, mengkudu, noni and painkiller bush (Bui and Bacic, 2006). Noni has been used in Polynesia as traditional folk medicine for over 2000 years.

### Botanical Features

Noni belongs to the family Rubiaceae. Noni is easily propagated by means of seeds. It is a resilient plant adapted to withstand severe weather and soil conditions. It is an evergreen tree or shrub of 3 to 6 m high with bright green ovate and deeply veined leaves which are 10 to 30 cm long. The leaves are large, lanceolate and the stem is straight with white tubular flowers (Figure 1). The fruits are syncarpic and produced throughout the year. The unusual fruit has an ovoid shape covered by polygonal-shaped sections with sizes ranging from 14 cm long and 8 cm diameter. When the fruit is immature, it is bright green in colour and is hard. Upon ripening, the fruits become very soft and turn to translucent yellowish or white color. Once the fruit is ripe, it will attain a soapy taste with an unpleasant butyric and cheesy odour. The ripe fruit has unpleasant butyric and cheesy odour and soapy taste. The seed is oily ovoid, around 4-9 mm long with a distinct air chamber. The width and thickness of the noni seed range from 3.85 to 7.15 mm and 1.57 to 3.36 mm respectively. The seed has cellulose fibers and upon drying, the seed turns light in weight. Noni fruit has up to 260 seeds. The seed has an air sac attached at one end that renders it buoyant. Even after long periods of drifting at sea, the seeds can germinate, which might explain the distribution of noni trees in the Indo-Pacific islands. The tree grows at altitudes up to 400m and bears fruits one year after planting. Mature trees typically produce 120-250 kg of fruits per year, with an average annual fruit yield of 50 tons per hectare equivalent to about 30-35 tons of juice per hectare.

### Multifarious Uses Of Noni

Noni leaves, flowers, fruits, roots and stems are used for food and medicine. They are used for high blood pressure, diabetes, cancer and several other illnesses (Abbot and Shimazu, 1985). They also have antibacterial,

antifungal, antihelminthic, antioxidant, anti-inflammatory, anti-cancer, cardiovascular, wound-healing and immune stimulation functions (Ref.). The fruits and leaves are consumed as healthy food because of the presence of various bioactive compounds. In 2002, the European Commission, Scientific Committee for Food of the European Union has declared noni fruit juice as novel food. In the past decade, noni fruit juice industries have increased substantially to the tune of 6000 metric tons in 2005 in French Polynesia (SCE 2005a) with large exports to the United States (SCE 2005b). Noni fruit juice (concentrated) and puree are used as food ingredients in a variety of food products such as nutritional drinks, food supplements, drink mixes, baking and confectionery, spreads, jellies, jams, condiments, beverages, pickles etc. (European Commission, 2010). More recently, cheese produced from noni puree extract demonstrated the presence of milk-clotting enzymes with caseinolytic and milk-clotting activities that are promising for dairy industry (Farias et al., 2020). Root and bark of the noni tree has been used as natural yellow and red dyes, due to their content in anthraquinones.

### Biochemical Characteristics

Noni fruit has high nutritional value with almost 200 phytochemical compounds with bioactive properties isolated from different parts of the plant (Inada et al., 2017). The ripe fruit of noni is about 90% water and 10% dry matter. The dry matter consists mainly of soluble solids of which 5% are reducing sugars (glucose and fructose) and 1.3% is sucrose. 100 g of fruit powder is composed of approximately 71% carbohydrates, 36% fibre and 5.2% protein. Physical properties and chemical composition of noni fruit is summarized in Table 1.

Table 1: Physical properties and chemical composition of noni fruit:

Properties	Composition
pH	3.72
Dry matter (mass %)	9.8 to 10
Total soluble solids ( Brix )	8.00
Proteins (mass %)	2.5
Glucose (mass %)	3.0 to 4.0
Fructose (mass %)	3.0 to 4.0
Potassium (mg/100 g)	3900
Sodium (mg/L)	214
Total fibers (mass %)	2.40
Titrateable total acidity	0.54
Vitamin C (mass %)	0.25

Several classes of biochemically active compounds such as acids, alcohols, phenols, saccharides, anthraquinones, carotenoids, esters, lignans, triterpenes, flavonoids, glycosides, lactones, ketones, nucleosides, sterols etc. are reported to be present in different parts of noni tree as summarized below ( Almeida et al., 2019)

- Fruit: Amino acids (alanine, arginine, aspartic acid, cysteine, glutamic acid, glycine, leucine, lysine, methionine, phenylalanine, serine, threonine, tryptophan, tyrosine etc.), anthraquinones (lucidin, rubiadin), coumarins (scopoletin), fatty acids (caprylic acid), flavonoids (rutin, quercetin), minerals (iron, phosphorous, molybdenum, potassium, selenium, sodium) Vitamins (ascorbic acid, folic acid, niacin, pyridoxine, riboflavin, thiamine, tocopherol, pantothenic acid, vitamin K) etc.
- Roots: Anthraquinones (rubiadin, rubiadin-dimethyl ether, 1,2-dihydroxy-3-methoxy-anthraquinone, 1,3 -dihydroxy- 2-methoxymethylan-thraquinone, 2-methoxy3-methyl-anthraquinone)

- Leaves: Anthraquinones (damnacanthal), carotenoids ( $\beta$ -carotene), coumarins (scopoletin), flavonoids (kaempferol), iridoids (asperulosidic acid, asperuloside)
- Flower: Flavonoids (5,7-dimethyl-apigenin-4-O- $\beta$ -D glucopyranoside), nucleoside saccharides

#### Commercial forms of Noni

Commercially, noni is available in multiple forms including juice, capsules, tablets, powder etc. (Fig. 2) as mentioned below

- Juice: It is the most popular commercial form. It is extracted from the noni fruit and often combined with other fruit juices (like grape or blueberry) to improve its flavor, as raw noni juice has a strong and somewhat unpleasant taste. It is available in various sizes from small bottles to larger containers and is commonly found in pharmacy stores, online and in supermarkets.
- Noni capsules and tablets: These supplements contain noni fruit extract or powdered noni and are convenient to consume without having to deal with the strong taste of the natural fruit. They are typically sold in bottles ranging from 30 to 120 capsules or tablets.
- Noni powder: It is made by drying and grinding noni fruit into a fine powder. It allows the consumers to add noni to smoothies, shakes or recipes.
- Noni tea: It is made from dried noni leaves or fruit. It is consumed as a herbal tea and is believed to offer a milder way to enjoy noni's benefits.
- Noni skin care products: Noni lotions/creams are available for topical application to soothe skin or address conditions like eczema. Noni soap is used for its skin benefits.

#### Conclusions

Noni is a plant of significant high value with several fields of application. The use of noni is currently found in food, chemical and pharmaceutical industries. It has been in use for more than 2000 years due to its therapeutic properties related to skin diseases, tuberculosis, burns, arthritis among others. More than 200 compounds have been identified in noni such as anthraquinone, damnacanthal, coumarin, scopoletin, vitamins etc. Further studies in the identification of the bioactive compounds present in noni as well as their specific metabolic mechanism are still necessary. Extensive studies are needed on the use of extracts of different plant structures higher standard of quality and safety.

#### References:

- Abbott, I., & Shimazu, C. (1985). *The geographic origin of the plants most commonly used for medicine by Hawaiians. Journal of Ethnopharmacology*, 14, 213–222.
- Adilah, Z. A. M., & Hanani, Z. A. N. (2016). *Active packaging of fish gelatin films with Morinda citrifolia oil. Food Bioscience*, 16, 66–71.
- Almeida et al., 2019: Almeida, E.S., de Oliveira Debora and D. Hotza. 2019. *Properties and applications of Morinda citrifolia (Noni): A review. Comprehensive Reviews in Food Science and Food Safety* 18: 883-909.
- Bui, A. K. T., & Bacic, A. (2006). Pettolino, F. *Polysaccharide composition of the fruit juice of Morinda citrifolia (Noni). Phytochemistry*, 67, 1271–1275.
- Farias, V. A., Lima, A. D. R., Costa, A. S., Freitas, C. D. T., Araújo, I. M. S., Garruti, D. S., et al. (2020). *Noni (Morinda citrifolia L.) fruit as a new source of milk-clotting cysteine proteases. Food Research International*, 127, 108689.
- Inada, A. C., Figueiredo, P. S., dos Santos-Eichler, R. A., Freitas, K., de, C., Hiane, P. A., . . . de, C. A. (2017). *Morinda citrifolia Linn. (noni) and its potential in obesity-related metabolic dysfunction. Nutrients*, 9(6),

1-29. <https://doi.org/10.3390/nu9060540>

SCE (Service du Commerce Exterieur de Polynesie Frances). (2005a). Re'partition des premiers produits locaux exporte's en 2005 <http://www.tahiti-export.pf/downloadb1.php?1176900193-44712+1>.

SCE (Service du Commerce Exterieur de Polynesie Frances). (2005b). U.S.A. - Evolution des produits polyne'siens exporte's vers les Etats-Unis d'Ame'rique [Internet document] <http://www.tahitiexport.pf/downloadb1.php?1176900609-54106+1>.



Figure 1 (Clockwise from top left): Noni leaves, fruit and flower



Figure 2: Commercial products of noni (left to right) - Juice, capsules, powder and tea