

A Review on a New Exotic Vegetable for Turkey: Malabar Spinach (*Basella alba* L. or *Basella rubra* L.)

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Abstract

Malabar spinach is a vegetable that can be identified as an unknown or exotic vegetable in Turkey, and it can be consumed like the true spinach (*Spinacea oleracea* L.). In the world, the economic value is particularly high in tropical Asia and tropical Africa countries where the leaves, shoots, flowers and even seeds are consumed. Many studies have proven that *Basella alba* L. or *Basella rubra* L. has antibacterial, antiviral, anti-inflammatory, antiulcer and antioxidant properties, while vitamin and mineral content is quite high.

Keywords: Indian; Ceylon or vine spinach; *Basella alba* L. or *Basella rubra* L.; New-Exotic-Vegetable for Turkey; Functional food

Introduction

This review introduces the taxonomic specifications, botanical properties, ecological demands and information about cultivation, some pharmacognosy and some biochemical contents of Malabar spinach.

Malabar spinach (*Basella alba* L., Synonym: *Basella rubra* Roxb.) belongs to the *Basellaceae* family [1]. Linnaeus has named the plant taxonomically and identified two species as *Basella rubra* L. and *Basella alba* L. These two species are differentiated by their leaf characteristics and stem colors [1-4].

Basella alba L. or *Basella rubra* L. is known as Malabar spinach, Indian spinach, Ceylon spinach, climber spinach and vine spinach [5,6]. Common names are Malabar spinach in English, espinaca blanca de Malabar in Spanish, basella in French, spinacio della cina in Italian and indischer spinat in German [1,7]. It is thought to be originated in India and Indonesia and naturally grown in tropical Asia and tropical Africa [8].

Malabar spinach is a perennial plant. Roots are fibrous and show lateral expansion. The stem is fleshy, succulent, thin, smooth and bright and can be in different colors depending on the stem variety properties. The stem can be as high as 8-10 m. The leaves distribute spirally on the stem. Leaf stalk is short and leaf is oblong as the leaf length is longer than its width. Side branching can be observed on the stem. Flowers occur in the leaf seat and can be white, red or pink depending on the variety. Bractea leaves are small and scaly. Fruits are small and can be either red or black. Seeds have black-brown and thick testa whose surface is bright and rough. The seeds can be kept for four years under proper conditions (Figures 1-7) [1,9-12]. (Original pictures belong to *Basella rubra* L.).

Malabar spinach can be grown easily under proper soil and climate conditions [13]. Hot and sun-drenched climate is appropriate and cultivation is recommended to be in long days. High rational humidity is important in cultivation as humidity is essential to inhibit flowering that causes bitterness in the leaves. The plant grows optimum at 32°C and when the temperature drops to 26°C developments is depressed. The optimum temperature for seed germination is 18-23°C. Direct sunlight or penumbra and windproof areas are ideal for production. The plant prefers soils of

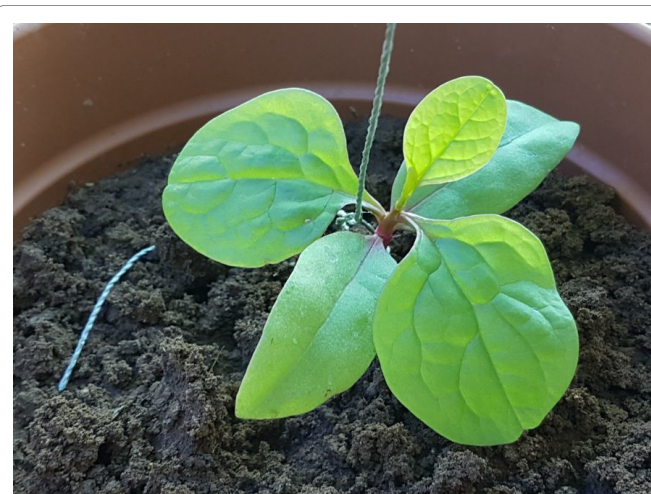


Figure 1: The young plant of Malabar spinach (Original).

warm, highly productive, rich in organics, moist and well drained. The roots develop well in soils of pH 6.5-6.8 [12]. Malabar spinach is responsive to complement chemical and organic fertilizer. A private rate of fertilization is up to 100 t.ha⁻¹ organic manure complement with 250 kg.ha⁻¹ 10:10:20 nitrogen, phosphor, and potassium before planting. Straw mulching is useful particularly in the initial stages of development and during dry periods to preserve water. For seed production, fruits are selected when dry; a seed yield of 1000-2000 kg.ha⁻¹ can be obtained [10].

Malabar spinach requires almost no care except for climber the stem regularly as the stem has a climbing stem structure. The roots are not very strong therefore the root collars should be filled well.

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Figure 2: The general appearance and the stem structure of Malabar spinach (Original).



Figure 4: Flowers shoots of Malabar spinach (Original).



Figure 3: Flower shoots and colorful stem of Malabar spinach (Original).



Figure 5: Root, stem and leaves of Malabar spinach (Original).

Malabar spinach can grow from the seeds or seedling. Soaking for one day is recommended for grown using seeds. Seeds can be germinated in 10-21 days under proper circumstances. The plant is suitable for continuous harvesting. The stem, branches, leaves and young flower sprouts can be harvested during the production season. The yield may be up to 1.5 kg per plant. Harvest keeps on at orderly intervals for up to 6 months, while the leaves happen too small. To reduce corruption the shoots are bonded in bunches. Malabar spinach holds as one day at temperatures of 20-30°C. For longer preservation, the crop should be held in a cool [10].

The true spinach is highly preferred in winter worldwide [12]. However, Malabar spinach prefers warm climate. This can make Malabar spinach to be consumed just like true spinach during summer when true spinach can be found rarely on the market.

Malabar spinach is new for Turkey, besides being healthy and nutritious; it is also a functional food. Functional foods affect health in a positive manner in terms of decreasing disease risks and aiming more than one body functions [14-16].

Prominence, consumption and popularization of this plant which is rich in antioxidants and organics, is important not only because of its nutritious value but also because it can be a functional food for health protection.

Pharmacognosy and biochemical studies of *Basella alba* L. or *Basella rubra* L.

Pharmacognosy is a scientific field studying natural active ingredients and medications. It analyzes the use of these natural ingredients for medical treatments and/or as protective agents [17]. Malabar spinach has been of interest because of its pharmacognosy properties. It has been known as a local medical plant besides consumption of its creeping stem, leaves and young flower sprouts in the countries where it is cultivated [1-18].



Figure 6: Fruits of Malabar spinach (Original).



Figure 7: Appearance of seed of the plant.

It has been indicated that this plant is a good source for health due to some mineral, protein, oil, carbohydrate, fiber, carotenoid, organic acid, vitamins and basellasaponin contents of the freshly consumed ground surface organs [1,10,13,19-22].

Fresh Malabar spinach of 100 g contains 93 g water, 19 kcal energy, 1.8 g protein, 0.3 g fat, 109 mg Ca, 52 mg P, 1.2 g Fe, 65 mg Mg, 510 mg K, 24 mg Na, 0.43 mg Zn, 8000 IU Vitamin A, 0.05 mg thiamin, 0.16 mg riboflavin, 0.50 mg niacin and 102 mg ascorbic acid [23,24]. In the

reference [21], Malabar spinach contains 98.7 mg.100g⁻¹ vitamin C, 5% protein, 1.5% fiber, 0.7% fat, 250.0 mg.100g⁻¹ Ca, 4.0 mg.100g⁻¹ Fe. The reference [25] determined that Malabar spinach contains 15.9 g.100g⁻¹ ash, 27.7 g.100g⁻¹ protein, 3.1 g.100g⁻¹ fat, 42.1 g.100g⁻¹ carbohydrate, 306.7 kcal.100g⁻¹ energy, 400.0 mg.100g⁻¹ Vitamin C, 48.7 mg.100g⁻¹ Ca, 21.5 mg.100g⁻¹ Fe and 11.3 g.100g⁻¹ fiber. Moreover, it was found that daily consumption of Malabar spinach affects storage of vitamin A positively [26].

Malabar spinach was found to be rich in kaempferol which is a flavonoid which is protective against cardiovascular diseases and cancer [23]. This plant has also antioxidant and phenolic compounds [27,28]. Anthocyanin which is a natural color pigment is present in stem, leaves and flowers [29]. The antiradical activity was found to be 0.7 (1/EC50), total phenolic compound was found to be 15.5 (mg GAE/g db) and total flavonoid content was found to be 6.2 (mg RE/g db) [25].

Vegetative parts of Malabar spinach are rich in terms of biochemical properties [1]. Moreover, this plant has wound healing effect [30], antibacterial activity [31] and antiviral activity, especially the ones with red stem [32], anti-inflammatory effect [33] and antiulser effect [34].

Conclusion

Cultivation of Malabar spinach has been carried out especially in summer to replace the true spinach *Spinacea oleracea* L. This plant plays important roles in human health due to its antibacterial, antiviral, antiulser, antioxidant properties and rich vitamin and chemical composition. It has been emphasized in this review that fresh use of this plant, its recognition and popularization in Turkey could be important as it is expected worldwide.

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