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FILE: ■ Horseradish Tree (*Moringa oleifera*)

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RE: Review of Horseradish Tree

Anwar F, Latif S, Ashraf M, Gilani AH. *Moringa oleifera*: a food plant with multiple medicinal uses. *Phytother Res.* Jan 2007;21(1):17-25.

The horseradish tree (*Moringa oleifera*) is one of the most cultivated food plants in the world. It can grow in a wide range of climates and grows in India, Pakistan, Africa, the Philippines, North and South America, Central America, and the Caribbean. The leaves, fruit, flowers, and immature pods of horseradish tree are all highly nutritious foods. This review covers the phytochemistry, medicinal uses, and pharmacology of this popular medicinal and food plant.

Horseradish tree is rich in compounds containing rhamnose, glucosinolates, and isothiocyanates. The stem bark contains two alkaloids: moringine and moringinine. The stem contains vanillin, beta-sitosterol, and octacosanoic acid. The flowers contain compounds including nine amino acids, sucrose, quercetin, and flavonoid pigments. The antihypertensive compounds thiocarbamate and isothiocyanate glycosides have been isolated from horseradish tree pods. The cytokinins are found in the fruit. Recent research has focused on isolating hormones and growth promoters from horseradish tree leaves.

Horseradish tree has a long history of use in the Ayurvedic and Unani systems of medicine. Isothiocyanate and thiocarbamate glycosides found in the leaves have been shown to lower blood pressure. Bioassay-guide fractionation has revealed that these effects can be attributed to the following constituents: niazinin A, niazinin B, and niazimicin, which may exert a calcium antagonist effect. Horseradish seeds also exert a hypotensive effect, and isothiocyanate and thiocarbamate glycosides have been isolated from the whole pods. Two other compounds found in the pods demonstrate hypotensive effects: methyl-p-hydroxybenzoate and beta-sitosterol. Horseradish tree roots, leaves, flowers, gum, and aqueous seed extracts have diuretic effects, which complement the blood pressure-lowering effects. In vivo studies show that the crude leaf extract lowers cholesterol. This effect may be attributed to beta-sitosterol and other active constituents. Horseradish tree roots and leaves have antispasmodic effects. The antispasmodic effect of the leaves may be mediated through calcium channel blockade and has been attributed to 4-[alpha-(L-rhamnosyloxy)-benzyl]-o-methyl thiocarbamate. The antispasmodic effect supports the traditional use of horseradish tree in the treatment of diarrhea. The leaf extract demonstrates antiulcerogenic and hepatoprotective effects. The roots and flowers also demonstrate a hepatoprotective effect.

Horseradish roots and flowers have antibacterial activity, which can be attributed to pterygospermin, having antibacterial and fungicidal effects. The root bark, bark extract, stem bark juice, and fresh leaf juice possess antimicrobial effects, including antibacterial and antifungal effects. Horseradish leaves contain several constituents that inhibit the Epstein-Barr virus, indicating antitumor activity. These constituents include niazimicin and 3-*O*-(6'-*O*-oleoyl-beta-D-glucopyranosyl)-beta-sitosterol. Niazimicin also has cancer chemopreventative effects. Horseradish seed extract shows anticancer effects.

Horseradish tree has several other reported biological activities. The aqueous leaf extract has an antioxidant effect and a regulatory effect on the thyroid hormone. An *in vivo* study has shown that the methanol leaf extract has a protective effect against radiation. Horseradish tree leaves may also be useful in the treatment and prevention of herpes simplex virus type 1 infections, including the acyclovir-resistant strain. The flowers and leaves are believed to have antihelminthic activity. One *in vivo* study indicates that the leaf juice lowers glucose levels.

Besides its medicinal uses, horseradish tree also has cosmetic and water-purifying applications. Purisoft® (Laboratoires Serobiologiques, France) contains peptides isolated from horseradish tree seeds; and its purported anti-aging effects. The seed extract is used to protect, condition, and strengthen hair and is said to protect it against pollution damage. Horseradish tree seeds are also extremely effective natural coagulants; and the crude seed extract is traditionally used to clear turbid water along the Nile River. The crushed seeds show water-clearing coagulant effects comparable to alum. Horseradish tree seeds also soften and buffer the pH of water; and they can be used as antiseptics for drinking water, due to their antimicrobial activities. A recombinant protein in the seeds flocculates gram-positive and gram-negative bacteria and may also inhibit the growth of microorganisms. Horseradish tree seeds also contain a compound that inhibits the replication of bacteriophages: 4-(alpha-L-rhamnosyloxy) benzyl isothiocyanate. The seeds can also be used as a biosorbent for removing cadmium from aqueous media.

The horseradish tree possesses many biological activities and medicinal uses. Further investigation of these properties, including antitumor and anticancer activities and constituents, and antispasmodic, diuretic, and hepatoprotective effects, is warranted. In addition, further investigation of horseradish tree seeds' coagulant effect and the use of the leaves as a protein source is also warranted.

—*Marissa N. Oppel, MS*

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