MONOGRAPH ON MORINGA OLEIFERA
MORINGA

MORINGA Adans. (Moringaceae)

A small genus of quick-grwoing trees dustributed in India, Arabia, Asia Minor and Africa. Two species are recorded from India, of which one, M. oleifera , is widely cultivated in the tropics for its edible fruits.

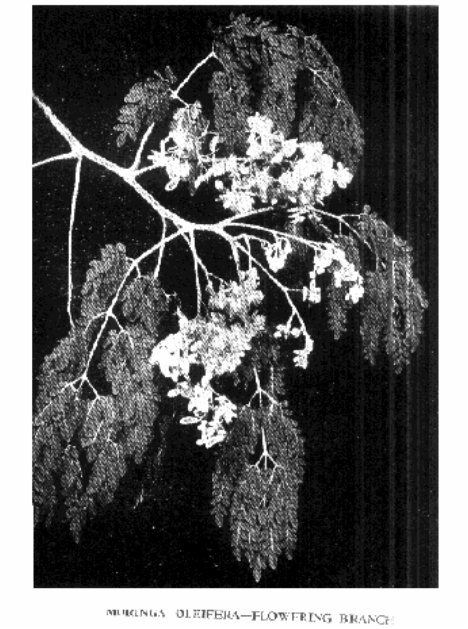
M. oleifera Lam. syn. M. pterygosperma Gaertn.

DRUMSTICK TREE, HORSE RADISH TREE

D.E.P., V, 276; C.P., 784; Fl. Br. Ind., II, 45.

Common Indian Names : SANS.--Shobhanjana; HINDI--Mungana, sainjna, shajna ; BENG.-- Sajina ; MAR.--Achajhada, shevgi ; GUJ.--Midhosaragavo, saragavo; TEL.--Mulaga, munaga, tellamunaga ; TAM.--Murungai ; KAN--Nugge; MAL.--Murinna, sigru, moringa. ASSAM--Saijna, sohjna ; ORISSA--Sajina ; PUNJAB--Sainjna, soanjna ; SANTAL--Munga arak.

A small or medium-sized tree, about 10 m. high, found wild in the sub-Himalayan tract, from Chenab eastwards to Sarda, and cultivated all over the plains of India. Bark thick, soft, corky, deeply fissured: young parts tomentose; leaves usually tri-pinnate : leaflets elliptic; flowers white, fragrant in large panicles, pods pendulous, greenish, 22.5-50.0 cm. or more in length, triangular, ribbed; seeds trigonous with wings on angles.



MORINGA OLEIFERA—FLOWERING BRANCH

Image : FIG. - M. OLEIFERA-FLOWERING BRANCH

The tree is indigenous to North-West India and is plentiful on recent alluvial land in or near sandy beds or rivers and streams. It is often cultivated in hedges and homeyards. It grows in all types of soils except stiff clays and thrives best under the tropical insular climate of S. India. The tree can be propagated by seeds or form cuttings; cuttings are preferred. Plants raised from seeds produce fruits of inferior quality. Further, cuttings of fairly large size, planted in moist soil, strike root readily and grow to sizeable trees within a few months. Under N. Indian conditions, the tree sheds its leaves in December-January and new leaves appear in February-March. They are followed by flowers and long whip-like tender fruits, which ripen during summer. Sometimes, particularly in S. India, flowers and fruits appear twice a year. A good tree yields as many as 1,000 fruits

Reference : (Troup, I, 250; Benthall, 138; Muthuswamy, S. Indian Hort., 1954, 2, 18; Bull. Indian Cocon. Comm., 1954-55, 8, 101).

The tree is not affected by any serious disease in India. A foot-rot, caused by Diplodia sp., has been observed in Madras. Two caterpillars and a stem borer are known to affect the tree. Of these, the hairy caterpillar, Eupterote mollifera Wlk., causes defoliation; it is controlled by spraying the tree with fish oil-rosin soap or BHC, or by burning with lighted torch

Reference :(Mem. Dep. Agric. Madras, No. 36, 1954, 1067; Ramakrishna Ayyar, 266; Muthuswamy, loc. cit.)

The tree is valued mainly for the tender pods which are esteemed as vegetable. They are cut into slices and used in culinary preparations; they are also pickled. Flowers and tender leaves are eaten as pot herb. Seeds are consumed after frying; they are reported to taste like peanuts. The roots of the tree used as condiment or garnish in the same way as those of true horse radish (Cochlearia armoracia). Twigs and leaves are lopped for fodder

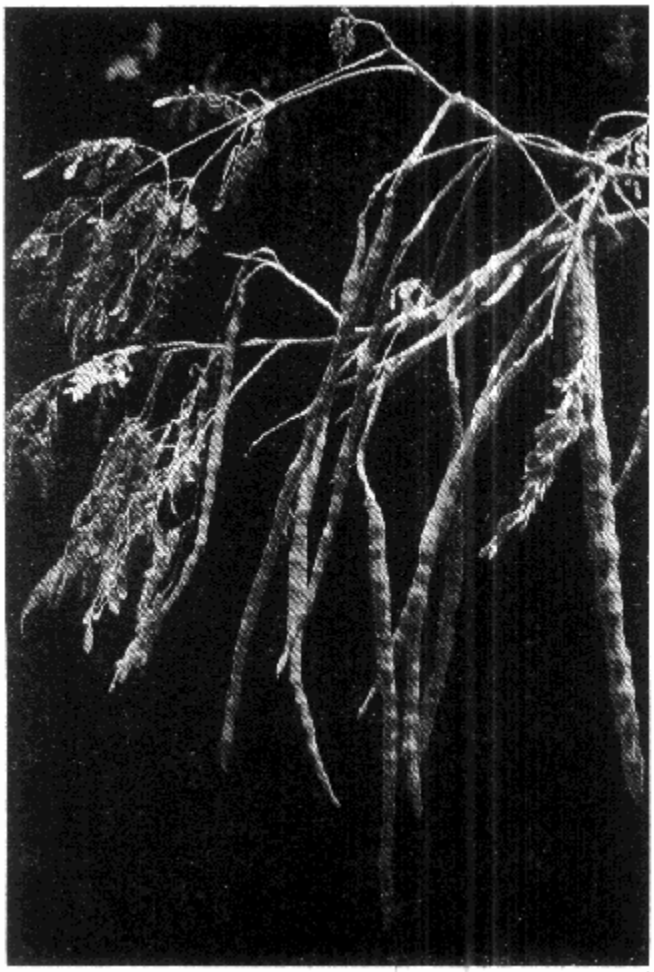
Reference : (Burkil, II, 1496; Parker, 121; Jt Publ. imp. agric. Bur., No. 10, 1947, 111).

All parts of the tree are considered medicinal and used in the treatment of ascites, rheumatism, venomous bites and as cardiac and circulatory stimulants. The roots of the young tree and also root bark are rubefacient and vesicant. The leaves are rich in vitamins A and C and are considered useful in scurvy and catarrhal affections they are also used as emetic. A paste of the leaves is used as an external application for wounds. Flowers are used as tonic, diuretic and cholagogue. The seeds are considered antipyretic, acrid and bitter. The seed oil is applied in rheumatism and gout

Reference :(Burkill, II, 96; Dalziel, 23; Chopra et al., 161-63; Chopra, 1958, 365-67; Kirt. & Basu, I, 678- 80).

Analysis of pods gave the following values: moisture, 86.9; protrein, 2.5 fat (ether extr.), 0.1; carbohydrates, 3.7; fibre, 4.8; and mineral matter, 2.0%: calcium, 30; phosphorus, 110; and iron, 5.3 mg./100 g.; copper (3.1 µg./g.), iodine (18 µg./kg.) and oxalic acid (0.0.1%) are present. The pods contain: carotene (as vitamin A), 184 i.u.; nicotinic acid, 0.2 mg.; and ascorbic acid, 120 mg./100 g. Pressed juice of the pods contains ascorbic acid oxidase

Reference : (Hlth Bull., No. 23, 1951, 38; Bagchi & Chowdhury, Ann. Biochem., 1949, 9, 107; Iodine Content of Foods, 126; Basu & Ghosh, Indian J. med. Res., 1943, 31, 29; Srinivasan, Curr. Sci., 1935-36, 4, 407).



MORINGA OLEIFERA—FRUITING BRANCH

Image : FIG. - M. OLEIFERA-FRUITING BRANCH

The pods contain a globulin (N, 15.6; sulphur, 1.58%) and a prolamin (N, 14.02; sulphur, 1.43%). The essential amino acids present in the total proteins are (g./16 g. N): arginine, 3.6; histidine, 1.1; lysine, 1.5; tryptophan, 0.8; phenylalanine, 4.3; methionine, 1.4; threonine, 3.9; leucine, 6.5; isoleucine, 4.4; and valine, 5.4. Non-protein nitrogen forms 56.9% of the total nitrogen. The distribution of amino acids in the non-protein fraction is as follows: histidine, 4.6; arginine, 48.0; threonine, 19.5; valine, 27.5; methioninie, 2.6; phenylalanine, 5.6; isoleucine, 15.0 leucine, 18.2; and tyrosine, 3.7 mg./100 g.; lysine and tryptophan, traces; and cystine, nil. The pods are remarkably rich in free leucine

Reference : (Rau & Ranganathan, J. Indian Inst. Sci., 1937, 20A, 49; Kuppuswamy et al., 116; Kulkarni & Sohonie, Indian J. med. Res., 1956, 44, 511).

The leaves are rich in carotene and ascorbic acid. Analysis gave the following values: moisture, 75.0; protein, 6.7; fat (ether extr.), 1.7; carbohydrates, 13.4; fibre, 0.9; and mineral matter, 2.3%: calcium, 44.00; phosphorus, 70; and iron, 7.0 mg./100 g.; copper (1.1 µg./g.) and iodine (51 µ./kg.) are present. Leaves contain: carotene (as vitamin A), 11,300 i.u.; vitamin B1 210 µg.; nicotinic acid, 0.8 mg.; ascorbic acid, 220 mg.; and tocopherol, 7.4 mg./100 g. Estrogenic substances and a pectinesterase are reported to be present. Attempts have been made to prepare ascorbic acid concentrates by extracting leaves with water, concentration and dehydration. For this purpose, leaves are collected during the period of maximum vegetable growth; the vitamin is fairly stable in aqueous extracts, the loss observed even after 3 days of storage being 25%. Ascorbic acid oxidase is elanorated in the leaves after the tree flowers and the vitamin is rapidly destroyed in aqueous extracts of leaves gathered after the flowering stage
Referenec : (Hlth Bull., No. 23, 1951, 32; Chem. Abstr., 1947, 41, 5643; Iodine Content of Foods, 126; Bagchi & Chowdhury, loc. cit.; Pithawala & Sreenivasan, Proc. nat. Inst. Sci. India, 1951, 17, 265; J. Indian Inst. Sci., 1958, 40A, 83; Panse & Sreenivasan, Curr. Sci., 1945, 14, 303).

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Referene : (Kuppuswamy et al., 112, 116; Swaminathan, Indian J. med. Res., 1037-38, 25, 847; Rau & Ranganathan, Curr. Sci., 1937-38, 6, 609; Sur, Bull. cent. Fd technol. Rec. Inst., Mysore, 1954-55, 4, 159).

The flowers contain traces of alkaloids; they also contain a wax (m.p. 69-72°; acid val, 10.5; sap. val., 29.8; and unsapon. matter, 75.5%), quercetin and kaempferol; the ash is rich in potassium and calcium
Reference (Rangaswami & Sankarasubramanian, Curr. Sci., 1946, 15, 316; Pankajamani & Seshadri, Proc. Indian Acad. Sci., 1952, 36A, 157).

Seed oil --The seeds (av. wt. of seed, 0.3 g.; shell, 26-30%; kernel, 70-74%) are oleaginous. Analysis of the kernel gave the following values: moisture, 4.0; crude protein, 38.4; fatty oil, 34.7; N-free extr., 16.4; fibre, 3.5; and mineral matter, 3.2%. A pale yellow non-drying oil with a mild pleasant flavour can be extracted from the kernel; it deposits stearin on chilling. The characteristics of the oil are as follows: sp. gr.30°, 0.8984; n 30°, 1.4652; acid val., 3.5; sap. vl., 182.2; iod. val., 64.2; R.M. val., 0.44; acet. val., 11.5; Hehner val., 91.6; and unsapon. matter, 3.05% . The component fatty acids of the oil are: palmitic, 9.3; stearic, 7.4; behenic, 8.6; and oleic, 65.7%; the presence of myristic and lignoceric acids has been reported by some authors; glyceride composition : trisaturated, 1.40; disaturated monounsaturated, 23.47; monosaturated di-unsaturated, 25.62; and tri-unsaturated, 49.51%. The proportion of acids found in oil samples from Haiti and Trinidad are reported to be somewhat different

Reference :(Eckey, 450-51; Adriaens, 81; Rao et al., J. Indian chem. Soc., 1953, 30, 477; 477; Ayyar & Parekh, Proc. Indian Sci. Conger., 1932, 214).

The oils from the seeds of M. oleifera and of M. peregrina Fiori syn. M. aptera Gaerlin. are known in the trade as Ben or Behen oil, used locally for edible purposes, illumination and in cosmetics. Ben oil was erroneously reported to be resistant to rancidity and considered particularly suitable for enfleurage and as a lubricant for fine machinery. The oil turns rancid like any other vegetable oil. It resembles olive oil and may be of some value as a constituent of non-yellowing, non-drying, plasticising alkyds
Referene : [Eckey, 450; Brown, 1941, II, 60; Krishna et al., Indian For. Rec., N.S., Chem., 1936, 1(1), 26; Chatfield, 81].

Antibiotics --Pressed juice of the leaves of the plant show strong antibacterial activity against Micrococcus pyogenes var. aureus, Escherichia coli and Bacillus subtilis. The leaf juice is bacteriostatic in dilution of 1:1,000,000
Reference : [Scharpenseel et al., Araneta J. Agric., 1956, 3(2), 46].

The roots contain an active antibiotic principle, pterygospermin (C22H18O2N2S2, m.p. 15°), which is obtained as low-melting unstable substance with a characteristic odour, soluble in organic solvents but sparingly soluble in water. It readily decomposes to benzyl isothiocyanate; it is more stable in phosphate buffer than in water. Pterygospermin (in concentrations of 0.5-3 µg./cc.) inhibits the growth of many Garm-positive and Gram-negative bacteria including Micrococcus pyogenes var. aureus, Bacillus subtilis, Escherichia coli, Aerobacter aurogenes, Salmonella typhosa, S. enteritides, S. paratyphosus Shigella dysenteriae, Mycobacterium phlei and M. tuberculosis var. hominis. In higher concentrations (7-10 µg./cc.), it is active aganist fungi. It is stable in the presence of blood and gastric juice but breaks down in the presence of pancreatic juice. Its effect is counteracted by thiamine and glutamic acid but reinforced by pyridoxine. It is toxic to experimental animals, but in low concentrations protects mice against staphylococcal infections. In view of its activity against moulds and fungi and negligible effect on seed germination, pterygospermin may find application in the preservation of fruits and vegetable and in sed treatment
Reference : (Rao et al., Nature, Lond., 1946, 158, 745; Rao & Natarajan, Proc. Indian Acad. Sci., 1949, 29B, 148; Kurup & Rao, J. Indian Inst. Sci., 1952, 34A, 148; Kurup, Indian J. Pharm., 1952, 34A, 219; Rao & Kurup, Indian J. Pharm., 1953; 15, 315; Kurup & Rao, Indian J med. Res., 1954, 42, 85, 101; Gopalakrishna et al., ibid., 1954, 42, 97).

The vitamin-rich, mineral packed nutritious drumstick is chiefly valued for the tender pods. It is a good source of a-linolenic acid in human diets in India. The tree is a minor source of honey
Reference:[Peter & Devdas, Indian Hort, 1989, 33 & 34(4 & 1), 8; Chem Abstr, 1993, 119, 480001; Morton, Econ Bot, 1991, 45, 318].

The pods yield a mucilage. Spectrophotometric studies of the mucilage designated as Drumstick Polysaccharide (DSP), revealed the presence of galactose, dextrose, xylose, and sodium, potassium, magnesium, and calcium salts of glucosonic acid. Contrary to

mucilages, the presence of glucose was an exception in this case. The mucilage can serve as an alternative for conventional bulk laxative because of its comparable swelling factor with that of agar-agar
Reference : (Rao & Mishra, Indian J Pharm Sci, 1992, 54, 28).

All parts of the drumstick tree are credited with a number of biological activities. The leaves are hypotensive. Hypotensive principles niazinin A, niazinin B, niazimicin, and niaziminin A and B were obtained from ethanolic extracts of the fresh leaves. These compounds are mustard-oil glycosides and are very rare in nature. They are rare examples of naturally occurring thiocarbamates
Reference : (Caceres, J Ethnopharmacol, 1992, 36, 233; Chem Abstr, 1993, 119, 529).

The tribals of Andhra Pradesh use the fruits of Moringa as an antidiabetic medicine. The fried fruit is taken for 20 days. It contains protocatechuic acid, caffeic acid, and p-hydroxy benzoic acid
Reference : [Nagaraju & Rao, Ancient Sci Life, 1989, 9(1), 31].

Seeds of drumstick contain an antimicrobial constituent which on roasting produces a mutagenic compound. Both the compounds arise from the same precursor. Seed extract showed significant antibacterial activity against skin infections (pyodermia), in experimental animals. The seeds are used as antibacterial, anticholeric and anti-viral; they contain the active principles pterigospermin, spirachin and banzyl isothiocyanate. In Guatemala, drumstick is used for the treatment of dermal infections, gastrointestinal afflictions, and rheumatism. An infusion of the kernels acts as a febrifuge. A paste of the crushed seeds is spread on warts. The seeds are also used in many parts of India as diuretic for the treatment of oedema, and as a febrifuge. Biological activity studies have confirmed the anti-inflammatory, antispasmodic, and diuretic activities of the seeds. In Venezuela, a decoction of the raw leaves and seeds is taken as purgative and anthelmintic. Seeds crushed and boiled with salt are taken with honey as a vermifuge in Nepal. All parts of the plant are also reported to be used as cardiac and circulatory stimulants
Reference : [Villasenor, Philipp J Sci, 1990, 119(1), 33; Caceres & Lopez, Fitoterapia, 1991, 62, 449; Vohora, Indian Drugs, 1989, 26, 526; Caceres, J Ethnopharmacol, 1992, 36, 233; Morton, Econ Bot, 1991, 45, 318; Bhattarai, Int J Pharmacogn, 1992, 30, 145].

The seeds have been successfully employed as a vegetable coagulantor flocculant in clearing turbidity in surface water in rural areas in the tropics. The dewinged and peeled seeds are crushed and wrapped in cloth and swirled in turbid water for 20-30 min. or more depending on the turbidity. The residual effect of the powder was found to be non-toxic. Warm water required lesser time for clarification. In a rural water treatment pilot plants, the dosage of the biological disinfectant or coagulant was found to be between 50 mg and 100 mg/l depending on the turbidity of the water. This gives a mean germ elimination of 99%
Reference : (Morton, Econ Bot, 1991, 45, 318; Kaser, Nat Res Dev, 1991, 33, 32).

The roots of drumstick tree are reported to show antifertility activity. Oral administration of the fresh root aqueous extracts produced anti-implantation effect in rats.

The root and its bark exhibited anti-implantation activity. The tribals of Rayalseema (Andhra Pradesh) use the stembark with pepper, cumin and onion in the form of a paste, for permanent birth control. Besides, the crushed root is soaked in alcohol and used as a liniment for rheumatism

Reference :[Caceres, J Ethnopharmacol, 1992, 36, 233; Shukla et al, J Res Ayurv Siddha, 1989, 10(1&2), 93; Vedavathy et al, Int J Pharmacogn, 1991, 29, 113].