## Folk Medicine, Pharmocological and Biological Activities

The root of *Carissa spinarum* is reported to have many medicinal uses. They are ground and put into wounds to kill worms. It is also used in combination with the roots of some other medicinal plants to treat rheumatism and hepatitis. It is a strong purgative and is used as one of the ingredients in some purgative preparations. A large dose of the roots may even be fatal owing to profuse purging. The roots also act as a repellent for snakes. It is also used as antidote to snake-bite (Pakrashi *et al*., 1968; Parmar and Kaushal, 1982; Kirtikar and Basu, 1984; Hegde and Joshi, 2010a; Hegde *et al*., 2012). The plant is also used as a restorative agent, stimulant and as antidote to snake-bite. The bark is reputed to be a veterinary drug for the treatment of chicken pox and skin diseases (Wangteeraprasert *et al.*, 2012). The flowers are used to treat eye diseases and the fruits for vomiting and dropsy (Gunasekaran and Balasubramanian, 2012). The plant is used in Indian and Chinese medicines to cure liver, epileptic, microbial and viral diseases (Fatima *et al.*, 2013a). The root of *Carissa edulis* Vahl is a remedy for chest complaints. The plant is also used in the treatment of "msanti" a plague-like disease. In East Africa the plant has been used as an abortifacient, tonic and cough remedy. In Ghana the root bark is regarded as being tonic and a restorative of virility (Watt and Breyer-Brandwijk, 1962). The root is tonic, abortifacient, and is used for treatment of lumbago, cough, chest complaints, gastric ulcer and veneral disease. The plant is reported as anthelmintic (Ayensu, 1978). The roots are used in Kenya to treat veneral diseases, epilepsy, malaria, heartburns, arthritis, sorcery and cancer (Pescaline *et al.*, 2011). In Uganda, the roots are used to treat fever, malaria, measles and helminth infection (Okullo *et al.*, 2014). Sprinkling powder on burning charcoal and inhaling smoke is used in Ethiopia to treat evil eye (Teklehaymanot and Giday, 2007). *Carissa edulis* is used traditionally for the treatment of headache, chest complaints, rheumatism, gonorrhoea, syphilis, rabies and as a diuretic. The diuretic effect of the extracts was proved supporting the traditional use of the plant (Nedi *et al.*, 2004). *Carissa edulis* has been reported to be used in managing disease conditions such as epilepsy, headache, toothache, cough, chest complaints, rheumatism, fever, sickle cell anaemia, gonorrhoea, syphilis, helminthoses and rabies (Ngulde *et al.*, 2013). It is also used for the treatment of edema. The root extracts exhibited anti-inflammatory, antioxidant (Woode *et al.*, 2007) and antimicrobial (Abdu *et al.*, 2008) activities. The root bark extracts have been found to possess diuretic (Nedi *et al.*, 2004) and anticonvulsant activities which support the ethnomedicinal claims of the use of plant as diuretic and in management of epilepsy (Ya'u *et al.*, 2008). A decoction of the root of *Carissa edulis* Vahl var. *tomentosa* Stapf. is used as a gentle purgative for children. In Tanganyika the ground-up root is used as part of the treatment of gonorrhoea (Watt and Breyer-Brandwijk, 1962). The stem bark is used in Kenya to treat malaria. The plant extract exhibited antiplasmodial activity (Ayuko *et al.*, 2009). The decoction of the root bark of *Carrisa edulis* is used traditionally for treatment of malaria and other ailments (Kebenei *et al.*, 2011). The plant is used in the management of chronic joint pains (Wambugu *et al.*, 2011).

*Carissa spinarum* extracts (roots) have been found to possess cardiotonic (Vohra and De, 1957, 1963), hypotensive (Chatterjee and Roy, 1965), anticonvulsant (Hegde *et al*., 2011), antiarthritic (Hegde *et al*., 2010c), antibacterial (Mathuram *et al*., 1998), wound healing (Sanwal and chaudhary, 2011) antioxidant (Hegde and Joshi, 2010c), antipyretic (Hegde and Joshi, 2010b), antiarithritic (Hegde *et al*., 2010c), hepatoprotective (Hegde and Joshi, 2010c), anthelmintic (Harwansh *et al.*, 2010), cytotoxic (Sehar *et al.*, 2011), CNS depressant (Hegde *et al*., 2012) and antitrypanosomal against *Trypanosoma brucei brucei* (Onotu *et al.*, 2013a,b) activities. The chloroform extract of *C. spinarum* stems possesses potent antioxidant activity (Rao *et al.*, 2005) and the acetonic extract of the leaves exhibit antihperglycemic and antihperlpidemic effects (Fatima *et al.*, 2013b). The antibacterial

activity of *Carissa spinarum* (Gebrehiwot *et al*., 2009; Sanwal and Chaudhary, 2011) and *Carissa edulis* (Ibrahim *et al*., 2010) has been reported. *C. spinarum* root extract has significant wound healing activity as evident from the rate of contraction and epithelization, which provides a scientific rationale for traditional use of the plant in the management of wounds (Sanwal and Chaudhary, 2011). Alcoholic extracts of the roots of *Carissa carandus* and *Carissa spinarum* lower the blood pressure in cats (Chatterjee and Roy, 1965). The aqueous extract of *Carissa edulis* exerted a significant decrease in the arterial blood pressure at a dose of 200 mg/kg, while the petroleum ether extract produced a highest decrease in heart rate at the same dose (Al-Youssef and Hassan, 2010). The ethanolic extracts of the leaves of *C. edulis*, growing in Egypt, showed insignificant antidiabetic effect (El-Fiky *et al.*, 1996). The ethanolic extracts of *C. edulis* root or root bark showed antibacterial, antifungal (Ngulde *et al.*, 2013) and antiviral (Tolo *et al.*, 2006, 2007) activities and erythropoietic activity with normocytosis and thus can be used in the management of anemic conditions (Koffuor *et al*., 2012). Also, the hexane extract of the plant exhibited antiviral activity against canine distemper virus (Bagla *et al.*, 2012) antibacterial (Mariita *et al*., 2010) and diuretic (Kumar *et al.*, 2010) activities.

The isolated compounds possess several biological activities The cardiac glycoside evomonoside was found to be the only antiherpetic principle, showing moderate activity against herpes simplex virus types I and II. The lignans (-)-carinol, (-)-carissanol and (-)-nortrachelogenin exhibited cytotoxicity against breast (MCF7) and lung (A549) cancer cells. Moderate anti-DPPH free radical activity was observed for all the isolated lignans (Wangteeraprasert *et al.*, 2012). Nortrachelogenin, from the roots also showed anti-plasmodium activity (Kebenei *et al.*, 2011). Naringin and ursolic acid, isolated from *C. spinarum* leaves, had similar antibacterial activities and they both completely inhibited the pathogenic Gram-neg. bacteria which cause diarrhea and dysentery (Mathuram *et al.*, 1998).

Lupeol, isolated from the root bark of *Carissa edulis* showed promising antiviral activity (Festus *et al*., 2009; Tolo *et al.*, 2010). The same species possesses diuretic effect (Kumar *et al*., 2010). An extract of *Carissa edulis* (containing lupeol, carissol, β-amyrin and oleuropein) showed strong activities in treatment of HIV/AIDS, diabetes, erectile dysfunction, hyperlipidemia and Hepes simplex (Maurice *et al*., 2011).