

## Folk Medicine, Pharmacological and Biological Activities

*Aerva lanata* is used in traditional medicine as diuretic, anthelmintic, expectorant, refrigerant, sudorific, stimulant, vermifuge, in lithiasis, cough and in treatment of headache and kidney troubles. It is also used in arsenic poisoning (Chopra *et al.*, 1956; Wassel and Ammar, 1987; Chandra and Sastry, 1990; Chowdhury *et al.*, 2002; Manokaran *et al.*, 2008; Varghese *et al.*, 2010), antidote snake bite (Pandikumar *et al.*, 2011), stopping haemorrhage during pregnancy, burn healing, as an anti-inflammatory, in the treatment of kidney and gall bladder stones, for uterus cleaning after delivery and to prevent lactation. The plant extract is used to treat nasal bleeding, cough, scorpion stings, fractures and spermatorrhoea. The flowers are used in dysentery, diarrhea and bronchitis. In addition, the different parts of the plant (flowers, seeds, leaves and roots) are used as antirheumatic, demulcent and to cure diarrhea, jaundice, cholera, antidiabetic and antitumour (Soundararajan *et al.*, 2006; Varghese *et al.*, 2010; Rajesh *et al.*, 2011). The root is used in cough, sore throat, diabetes, wounds, piles, cardiac diseases and pain (Shiddamallayya *et al.*, 2010).

The aqueous extract of *Aerva lanata* growing in Egypt has been reported to possess diuretic, natriuretic and kaliuretic effects (Mahmoud *et al.*, 1992; Aboutabl *et al.*, 1997), and antidiarrheal activity (Joanofarc and Vamsadhara, 2003). The plant has been reported as a curative agent for urolithiasis (Salvam *et al.*, 2001; Soundarajan *et al.*, 2006). It increases the urine volume, thereby reducing the solubility product with respect to calcium oxalate and other crystallizing salts such as uric acid which may induce epitaxial deposition of calcium oxalate (Selvam *et al.*, 2001). There are several other reports which proved the following activities: diuretic (Kumar *et al.*, 2005; Sharma *et al.*, 2010), antifertility (Savadi and Alagawadi, 2009), anthelmintic (Rajesh *et al.*, 2010), antioxidative (Muthukumaran *et al.*, 2011) and antimicrobial (Mini *et al.*, 2010; Muthukumaran *et al.*, 2011).

The water-insoluble fraction of the alcoholic extract of *Aerva lanata* produced positive inotropic effect (Tripathi *et al.*, 1985). The plant has been reported to possess anti-inflammatory (Udupihille and Jiffry, 1986) and nephroprotective actions in rats (Shirwaikar *et al.*, 2004). The polysaccharide (pectic substance) of *Aerva lanata* exhibited more remarkable hypoglycemic activity than those of *Aerva javanica* (Aboutabl *et al.*, 1997). The aqueous extract of the aerial parts of *Aerva lanata* exhibited smooth muscle relaxant effect in a dose depending manner as well as a significant antispasmodic activity (Wassel *et al.*, 1997). The alcoholic extract of shoots of the plant has shown significant antidiabetic activity in rats (Vetrichelvan and Jegadessan, 2000). Deshmukh *et al.* (2008) studied the antihyperglycemic activity of the alcoholic extract of *Aerva lanata* leaves in alloxan induced diabetic mice. In this study alcoholic extract (AL) (100, 200 and 400 mg/kg) and glyburide (10 mg/kg) were administered orally in alloxan (70 mg/kg i.v.) induced diabetic in mice. In AL (400 mg/kg), the onset was 4 hours, the peak effect was 6 hours but the effect waned at 24 hours. In the

subacute study, repeated administration (once a day for 28 days) of the glyburide and AL caused a significant reduction in the serum glucose level as compared to the vehicle treated group. AL (400 mg/kg) treatment prevented a decrease in the body weight of the diabetic mice. The results of both the acute and the subacute study hypothesized that the onset of the action and prolonged duration of the action of the alcoholic extract may result from improved pancreatic cytoarchitecture. These results confirmed the use of *Aerva lanata* in folklore practice as an antidiabetic (Deshmukh *et al.*, 2008). Other studies about the antidiabetic activity of the plant have been reported (Vetrichelvan and Jegadeesan, 2002; Krishnan *et al.*, 2009; Krishnan, 2010a,b). The plant can be used for removing calculus from gallbladder (Korovaev, 1997). The extracts of *Aerva lanata* exhibited growth of monosodium urate monohydrate crystals and can be useful for gout treatment (Parekh *et al.*, 2009). The plant possesses antioxidant activity (Surveswaran *et al.*, 2007; Sajeeth *et al.*, 2011). The ethanolic extract of *Aerva lanata* possesses significant nephroprotective effect against mercuric chloride-induced renal injury in rats (Soumyo *et al.*, 2011).

The extracts of *Aerva lanata* exhibited antibacterial activity against Gram-positive bacteria (*Bacillus cereus*, *Bacillus subtilis* and *Staphylococcus aureus*) and Gram-negative bacteria (*Escherichia coli*, *Klasiella* sp., *Shigella boydii*, *Shigella dysenteriae*, *Shigella flexneriae*, *Shigella shiga*, and *Shigella sonnei*). The extracts also showed antifungal activity against *Aspergillus fumigates*, *Aspergillus niger*, *Candida albicans*, *Hensinela californica* and *Rhizopus oligosporum* (Chowdhury *et al.*, 2002). The antibacterial activity of the plant was also reported by Emmanuel *et al.* (2010). On the other hand, *Aerva lanata* extract has been found to influence the growth of *Corynebacterium xerosis* (Baronets *et al.*, 2001).

Chowdhury *et al.* (2002) reported that petroleum ether, ethyl acetate and methanol extracts of *Aerva lanata* showed significant cytotoxic properties. The study of the cytotoxic potential of different extracts showed that 50 µg/ml of PEF produced 100% cell death in DLA cell lines, 80% cell death in EA cell lines and 75% cell death in B16F10 cell lines (Nevin and Vijayammal, 2003). The antitumour activity of the plant has been reported by others (e.g. Nevin and Vijayammal, 2005b; Siveen and Kuttan, 2011, 2012a,b).

A medicated liquor, contains plants including *Aerva lanata*, can regulate functions of immune system, endocrine system, nervous system and digestive system; improving memory and working ability; and can be used for treating cardiovascular diseases (such as hypertension, atherosclerosis, and coronary heart disease) and blood diseases (such as iron deficiency anemia, trombocytopenic purpura, headache, ulcer, and allergic disease) (Shengeliya and Mardaleishvii, 2000). The petroleum ether extract of the plant possesses protective effect against liver damage induced by CCl<sub>4</sub> in rats (Nevin and Vijayammal, 2005a). The hydroalcoholic extract of the plant also possesses hepatoprotective activity against paracetamol induced hepatotoxicity in rats (Manokaran *et al.*, 2008). The leaves extract of *Aerva lanata* showed larvicidal effect against *Anopheles* mosquito (Kensa, 2011).