Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2015; 3(5): 35-39
Received: 27-09-2014
Accepted: 10-11-2014

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A Pharmacological review on Gorakha ganja (*Aerva lanata* (Linn) Juss. Ex. Schult)

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Abstract
Aerva lanata (Linn) Juss. ex. Schult is widely used in urinary disorders in southern part of India as a source of Pashana bheda. It is commonly known as Gorakha ganja a member of Amaranthaceae, usually found as weed on mountains and bare ground. It is an herb which trails on the ground with many branches and leaves are alternately arranged with fine hairs above and with wooly beneath. Flowers are greenish white in clusters. Since years many researches have been carried out to elicit the diuretic & anti-urolithic activity of this plant. Besides, it has been proven for many more pharmacological activities like anti-diarrhoeal, anti-hyperglycameic, anti-oxidant, anti-helmentic, and analgesic. In addition, various phyto chemical investigations reveal the presence of steroids, tannins, flavonoids, nutrients, terpenoids in different parts of the plant. This is an attempt to explore and high light the different phytochemical and pharmacological studies till date.

Keywords: *Aerva lanata* (Linn) Juss. ex. Schult, Diuretic, Anti-urolithic activity, Gorakha ganja.

1. Introduction
"*Aerva lanata* (Linn) Juss.ex Schult" of Amaranthaceae family is commonly identified and known as *Gorakshaganja* in Ayurveda system of medicine. It is considered as one among the few botanical sources of *Pashanabheda*. The plant is extensively used in urinary disorders like *Ashmari* (Urinary calculi), *Mootrakrichra* (Dysuria), *Mootravikara* etc by most of the Ayurveda and Siddha practitioners in southern India, in the name of *Pashanabheda*. As the plant bears almost all the properties similar to that of the original source of *Pashanabheda*. [1] Few synonyms mentioned for this plant are: *Aadanapaki, Shatakabheda*, [2] *Valliyaka, Tripatra, Krsnavalli*, *Prayanika* [3]. It is identified as *Shwethashelaa, Astmabayda, Bhadra* in Sanskrit, [4] Gorakhaganja, Gorakhabooti, Kapurijadi in Hindi, [2] Mountain knot grass in English, [5] Bilihindee soppu, Vibhoothikasa, Pashanabhedi in Kannada, Chirupoolaiin Tamil, Pindikoora/ Kondapindi in Telgu, Cherula in Malayalam, [4] Karur-madhurain Marathi, Buikallan in Punjabi, Paunsia in Odiya. And it is one of the plants included in *Dasapushpam*, the ten sacred flowers of Kerala [5].

2. Synonyms: *Acaranthes lanata* L, *Aerva elegans* Mog, *Illecebrum lanatum* L. [6]

3. Taxonomy [7]
Botanical name: *Aerva lanata* (Linn.) Juss. ex Schult
Kingdom: Plantae
Subkingdom: Viridaeplantae
Infra kingdom: Streptophyta
Phylum: Mangoliophyta [8]
Class: Magnoliopsida
Subclass: Caryophyllidae [9]
Super order: Caryophyllanae
Order: Caryophyllales
Family: Amaranthaceae
Division: Tracheophyta
Subdivision: Spermatophytina
Infra division: Angiospermae
Genes: Aerva
Species: Lanata.

The plant belongs to the family Amaranthaceae, a Latin word is means not to wither or everlasting [10]. The family has 72 genera, 700 species. Most of the plants of this family are herbs, erect/ with climbing branches. Leaves are opposite or alternate, ex-stipulate. Flowers are usually hermaphrodite, small usually in terminal simple or paniculate spikes, cymes or cluster; bracts hyaline never leafy, bracteoles 2. Fruits are membranous utricle, irregularly rupturing capsule, rarely berry. Seeds inverted or erect, orbicular or kidney shaped [11].

4. Habitat

Aerva lanata is distributed throughout the plains of tropical India as a common weed, which grows wild on the mountain slopes, fields and bare patches of ground up to an altitude, 900m in the hills and a native of Asia, Africa & Australia [11, 12].

5. Morphology

Aerva lanata is a prostrate dioecious herb having a tap root which is cylindrical, branched, 7-12 cm long, 2-8 mm thick, straight or slightly twisted with many slender, fibrous lateral roots, pale yellowish brown externally, whitish internally, camphoraceous odorous, it has many branches, branched from the root base; pubescent/ woolly-tomentose, striate. Leaves are simple, alternate, entire margin, lamina is elliptic or obovate or sub orbicular, obtuse or acute apex, tapering base, hairy above and more/ less white cottony beneath, short petiole, ex-stipulate. Spikate inflorescence, forms subglobose clusters bearing numerous flowers. Flowers are very small, sessile, usually bisexual, greenish/ hoary white. Stamens & perianth are five lobed, ovoid/ subglobous ovary. Fruits are greenish, round, compressed membranous utricle capsule with a coriaceous upper part/ lid containing a single seed. Seed are Reniform, shining black coriaceous testa [2, 11, 12].

6. Flowering & fruiting season: November-January. [13]

7. Part used: Whole plant, Root. [2]

8. Pharmacognosy

8.1 Microscopic

Root: TS of the root is circular in outline, exhibiting peripheral cork, central narrow wood encircled by rings of xylem and phloem occupying the major portion of the section. Cork is composed of 4-6 rows of tangentially elongated, thick-walled, followed by 2-4 rows of cortical parenchyma cells. The central core of the root is occupied by a compact, circular patch of primary xylem surrounded by 2-3 concentric rings separated by narrow parenchymatous bands. Medullary rays are multiseriate and radially arranged.

Stem: TS of the stem is circular with faintly ridges and furrowed pubescent outline. The epidermis cells are not uniform, smaller at the elevated places with plenty trichomes when young, few on old, cortex narrow, phloem very narrow forms a continuous band in old stem. Medullary rays uni to biseriate, pith very wide encircled by perimedullary vascular bundles, rosette crystals of calcium oxalate.

Leaves: Underneath the upper epidermis of lamina lie a row of the indistinct palisade layer and a wide zone of spongy parenchyma. In surface view contains many anomocytic stomata, it bears multicellular, uniseriate, thick walled, warty interlocking cells, 1 to 2 rows of collenchymatous tissue lies underneath the epidermis of the midrib; rosette crystals of calcium oxalate throughout.

Powder: Fragments of parenchyma containing rosette crystals of calcium oxalate; scalariform vessels with adjacent tracheids and fibres; fragments of upper epidermis and lower epidermis contains anomocytic stomata and multicellular uniseriate warty trichomes and highly sinuous epidermal cells, stomata and trichome with warty interlocking cells respectively [12].

9. Ayurvedic properties

The plant is said to have *Kashaya* (Astringent), *Tikta* (Bitter) *Rasa* (Taste), *Laghu* (Light), *Tikshna* (Sharpness) *Guna* (Property), *Usna* (Hot) *Virya* (Potency), *Katu* (Pungent) *Vipaka* (taste at the end of digestion) [14] and the *karma* (Actions) attributed by the plant are *Kapharoganashaka* (elevating kaphaja disorders), *Mootrala* (Diuretic),[15] *Vedanahara* (Analgesic), *Ashmarighna* (Lithotriptic), *Krimighna* (Anthelmintic), *Kasahara* [2] and *Mehahara* (Diabetes). [16] It acts as *Ashmaribhedana* (urolithic property) due to *Prabhava* (Special action). [15] The *Phanta* (hot infusion) of flowers are useful in *Ashmari* (Renal stones), Kwatha (decoction) of its root is used in the condition of *mootrakrichra* (Dysuria) and in *Tamakashwasa* (Asthama) the leaves and the flowers are used in the form of *Dhumapana* (fumigation) [2].

10. Ethno medicinal importance

The whole plant is used in the cases of Herpes in Orrisa. In Gujarat (Hills of Kutch district) the root extract is used in headache. [17] Local people of Trivandrum (Kerala) identify this plant as "Baliopov", the whole plant is used as *garbhashayabalya* (Uterine tonic) and administered from 6th day of delivery for three days in the form of Halwa (sweet dish) with rice & jaggery. In Kolkata (West Bengal) the juice of whole plant is given internally in Measles. In Madhya Pradesh the root of this plant is roasted and mixed with mustard oil and applied externally over the affected area in skin diseases [18].

In east & west Godavari of Andhra Pradesh the root decoction is used in conditions like Albuminuria in children. [19] In a village called Nakulnar near Dantewara of Bastar district (Madhya Pradesh), people use the stem pieces of this plant to tie around the neck of the cattle's get rid of worms in wounds [20].

11. Growth & propagation: Propagation is done through seeds. [16]

Thidiazuron is an efficient growth regulator for promoting shoot proliferation and adventitious shoot regeneration from leaf explants of *A. lanata*. Helps for micro propagation of this plant [21, 22].

In-vitro shoot culture was attained from the seeds of *A. lanata* with α-Naphthalene acetic acid; Indole-3-butyric acid, Indole-3-acetic acid in different concentration could provide optimum callus and multiple shoot initiation from leaf explants [23].

Application of inorganic fertilizer and plants planted in 30 cm spaced rows gave high dry matter yields /ha. Adequate sunlight was essential for higher yields and reduced light affected dry matter yields. Shade and age affected the composition of plant parts and those harvested at 140 days after planting contained more stems and flowers, and less leaves [24].

12. Phytochemical constitutions

The whole plant of *A. lanata* contains β-Sitosterol, α-amyrin, betulin, hentriacontane, sitosteryl palmitate, D-glucoside,

glycosides, Kaempferol-3-galactoside and Kaempferol-3-rhamnogalactoside, starch, free: sugars (fructose, galactose, rhamnose and sucrose). [12, 25] Alkaloids, phenolic compounds, phytosterols, carbohydrates, proteins, amino acids, flavonoids and quinones were identified in different solvents extracts [26].

The different studies revealed the presence of 30 different types of Steroids, 21 different types of Saponins, 27 varieties of Terpenoids and 24 types of Tannins in the methanolic extract of root, stem, leaves and seeds of *A. lanata* using HPTLC. [27, 28, 29, 30] In another study a new labdane type diterpene was identified in Methanol extract of dried seeds of the *A. lanata* [31].

The study revealed the presence of nutritive values in the leaves of *A. lanata* which are consumed. The Carbohydrate, crude protein and ash were found to be moderately high. The anti-nutrient levels also revealed the presence of tannic acid, saponin, alkaloids, flavonoids and oxalate. Mineral composition (mg/100g) revealed that the leaves were high in P (187) and moderately high in K (47.9), Na (39.4), Ca (51.7), Mg (41.5), Zn (44.7), Fe (11.0) and low in Mn (1.04). The phytic acid and phytin – phosphorus were also in low amount. Heavy metals such as Cu, Pb, Cd and Cr were not detected in the leaves [32].

13. Pharmacological activities

13.1 Diuretic activity

A study revealed that the ethanolic extract of whole plant of *A. lanata* at two different doses (200 and 300 mg/kg) in the experimental rats showed significant increase in urine volume, urinary sodium, potassium and chloride levels when compared with the standard drug frusemide [33].

In other study the fresh & dried aqueous extract of *A. lanata* at the dose of 50 and 100 g in 200 ml water resp. have showed diuretic effect in hydrated rat assay technique when given orally and has rapid onset of action which remained for about three hours. In the same study the aqueous solutions of dry powder of *A. lanata* of low and high molecular mass compounds (6.28 g and 2.94 g) resp. have showed more diuretic activity in low molecular mass fraction than the other [34].

The alcoholic extract of shoots of *A. lanata* at the dose of 800 mg/kg showed Diuretic activity in experimental rats when compared with the standard drug acelazolamide (20 mg/kg) [35].

13.2 Anti-oxidant activity

The petroleum ether and methanol extracts of two different doses of whole plant of *A. lanata* (100 and 200 mg/kg) showed significant dose dependent inhibition of lipid peroxidation in hepatotoxicity (treated with CCl_4) induced experimental rats [36].

The Water, Ethanol and Aqueous ethanol extracts of whole plant of *A. lanata* showed concentration – dependent antioxidant activity in experimental rats when compared with different standards (Butylated hydroxytoluene and Ascorbic acid) [37].

13.3 Anti-diarrhoeal activity

The alcoholic extract of two different doses of whole plant of *A. lanata* (400 and 800 mg/kg) showed anti-diarrhoeal effect in castor oil, charcoal meal test and PGE2 induced rats by reducing gastrointestinal motility and inhibiting the synthesis of prostaglandin [38].

13.4 Anti-hyperglycaemic activity

Alcoholic extract of three doses of *A. lanata* leaves (100, 200 and 400 mg/kg) on serum glucose level and on the oral glucose tolerance test in alloxan induced diabetic mice, revealed anti-hyperglycaemic activity in 400 mg/kg dose of alcoholic extract of *A. lanata* leaves [39].

13.5 Anti-helmintic activity

The aqueous & alcoholic extract of leaf and stem of *A. lanata* of four different doses (2.5, 5, 10 and 20 mg/ml) showed good anti-helmintic activity against both the tapeworms (*Taenia solium*) and the earthworms (*Pheretima posthuma*) but alcoholic extract was more potent when compared with the standard drug albendazole [40].

13.6 Analgesic activity

The ethanolic extract of dried aerial part of *A. lanata* (50 and 100 mg/kg) showed significant antinociceptive activity on acetic acid-induced writhing and hot plate test in mice. The study showed significant dose dependent analgesic activity in both the test models when compared with aspirin and morphine. This activity may be through peripheral pain receptors and not by central opioid receptors [41].

13.7 Anti-inflammatory activity

Benzene & alcoholic extracts of shoots of *A. lanata* (800 mg/kg) showed Anti-inflammatory activity by inhibiting carrageenan-induced rat paw edema [35].

13.8 Anti-urolithiatic activity

Aqueous suspension of aerial parts of *A. lanata* (2 g/kg) against calcium oxalate (ethylene glycol) induced urolithic rats showed significant decrease in the enzymes related to stone synthesis and produced cytoprotective mechanism [42].

Aqueous extract of dried flower of *A. lanata* (3.2 mg/kg) against ethylene glycol induced renal calculi in experimental rats showed better anti urolithiatic activity than the standard cystone tablet [43].

13.9 Anti-HIV Activity

Anti-HIV activity of *A. lanata* root (hexane, chloroform, ethyl acetate, acetone and methanol) extracts exhibited HIV-RT inhibition by using Retro Sys HIV-1 RT activity kit (Innovagen, Sweden), among all the extracts chloroform extract showed highest HIV-RT inhibition at 2 mg/ml against the control drug azidothymidine [44].

13.10 Anti-metastatic activity

Ethanolic extract of *A. lanata* (10 mg/kg) in three different modalities (prophylactic, simultaneous and developed metastasis) showed significant reduction in tumour nodule formation in B16F-10 melanoma induced lung metastasis mice; there was increase in the survival rate of metastatic tumour bearing animals [45].

13.11 Anti-ulcer activity

Aqueous extract of *A. lanata* stem (250 and 500 mg/kg) showed significant anti-ulcer activity when compared with reference standard drug omeprazole in gastric mucosal lesions in rats caused by ethanol, pyloric ligation, indomethacin and cysteamine [46].

13.12 Anti-asthmatic activity

Ethanolic extract of aerial parts of *A. lanata* exhibits

significant dose dependent anti-asthmatic activity *In-vitro* in the isolated goat tracheal chain preparation model at the dose of 100 µg/ml and in-vivo model using clonidine-induced catalepsy, mast cell degranulation in mice at the two different doses (30 and 60 mg/kg) [47].

13.13 Anti-Neurotoxicity

Aqueous ethanolic extract of dried aerial parts of *A. lanata* (250 and 500 mg/kg) showed dose dependent protective effect in the neurotoxicity induced by anti-cancer agent cisplatin in experimental rats [48].

13.14 Anti-diabetic activity

Methanol and aqueous extracts of *A. lanata* (200 and 400 mg/kg) in streptozotocin induced diabetic rat revealed that the methanol extract (400 mg/ kg) showed more significant anti-diabetic activity when compared with the standard drug glibenclamide [49].

14. Toxicity study

Oral administration of *A. lanata* ethanolic extract in mice was observed continuously for two hours and then occasionally for further four hours and finally overnight, showed neither any toxic effect nor any lethal effect in the dose range of 100 to 4000 mg/kg [48].

Administration of fresh & dried aqueous extract of *A. lanata* (18 ml/kg) for a period of one month has no significant toxic effects over the structural & functional aspect of urinary tract of rats [34].

15. Adulterants: The adulterant of *Aerva lanata* (Linn) Juss.ex Schult is *Aerva javanica* Juss [50].

16. Conclusion

The *Aerva lanata* is widely used herb. The pharmacological studies conform and support the therapeutic utility of the plant in various disorders mainly in diseases of the urinary system. So far the studies were performed *in-vivo* and *In-vitro*. However, these results should be further evaluated for their isolated principles and their mode of mechanism. Further, there is an area for clinical trials of revalidating the studies elicited through various animal models.

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