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aerva lanata: a comprehensive profile in the pharmaceutical and food industries

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Abstract

Aerva lanata (L.) Juss Ex. Schult is also known as Mount knotgrass and called Polphala or Gorakha Ganga belonging to the family of Amaranthaceae. There are medicinal properties present in each part of the plant including stem, leaves, flowers, etc. This article wishes to achieve ways in order to augment the application of this plant in varied sectors and stretch the therapeutic potential of Aerva lanata species pharmaceutically, in the cosmeceutical industry, agriculturally, and the food industry. Aerva lanata and all its manufactured-products are widely used as a substantial herbal medicine system. Although they are used traditionally by a huge number of people in local areas, its potential capability of therapeutic existence is still undiscovered. This organized review is an extensive compilation of all the detailed data on phytochemistry, wide ethnopharmacological uses, medicinal characteristics and commercially applicable formula of Aerva lanata in different sectors, with the potential of antimicrobial, antiparasitic, diuretic, and anti-urolithiasis, acute renal failure, anti-asthmatic, anti-infertility, anti-hyperglycemic and anti-diabetic, hypolipidemic, hepatoprotective, immunomodulatory, anti-tumor, anti-diarrheal, anti-urolithiatic, nephroprotective, anti-ulcer, anti-HIV, anti-microbial, antioxidant etc. It will also pave a path for forthcoming research for the development of herbaceous drugs and other products to be used in agricultural and the food industry, largely contributing to the development of both these tracts.

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Introduction

Nature is being sighted as a vast remedy in the form of medicinal plants as the treatment of various diseases. In primordial times herbs contained many phytoconstituents that gave contribution vastly in pharmacological activity which then leads to the production of the beneficial effects.Approximately 80% of the people all over the world depends on herbal medicines for some fraction of their predominant health care according to the latest report of World Health Organization (WHO). Herbal medicines have received popularity over the standard medicines for some fraction of effectiveness against the chronic conditions, side effects, lower cost and widespread availability [1]. *Aerva lanata* (L.) Juss Ex. Schult is also known as Mount knotgrass and called Polphala or Gorakha Ganga belonging to the family of Amaranthaceae. It is contemplated as a medicinal plant and also widely accepted to be a principal source of nutrition and

some chemical properties having potential of therapeutic effects [2]. The taxonomic classification of *Aerva lanata* is shown in Table 1. It is vernacular to tropical Africa, South Africa, Sri Lanka, Madagascar, Saudi Arabia, topical Asia, and In India widely distributed to the Tamil Nadu, Kerala, Andhra Pradesh, and West Ghats in India [3, 4]. This plant is a functional and essential source for both traditional and modern medicines. It is sort of a woody, prostrate or perennial, succulent herb of about 0.038 meters in height; it flowers mainly during September to January and bears the fruits during January to February. Different parts of plant are involved in various diseases and treatment.it is loaded with wide range of phyto-constituents such as cardiac glycosides, alkaloids, saponins, steroids, flavonoids, amino acids, proteins, tannins and terpenoids. Every part of the plant including stem, leaves, flowers, etc., is used as antimicrobial, antiparasitic, diuretic, and anti-urolithiasis, acute renal failure, anti-asthmatic, anti-infertility, anti-hyperglycemic and anti-diabetic, hypolipidemic, hepatoprotective, immunomodulatory, anti-tumor, anti-diarrheal, anti-urolithiatic, nephroprotective, anti-ulcer, anti-HIV, anti-microbial, antioxidant etc [5]. In the field of this plant used as astringent, emollient, vermifuge, in Vattamalai hills in the Namakkal districts of Tamil Nadu [6]. It helps in curing piles, malarial fever, piles, hemorrhage and is also used as an antidote for snake poison by Kanis and Nardas of Kanyakumari district and Tamil Nadu [7]. It is also used in kidney stone and skin ailments in the Aravali regions of Rajasthan [8]. The extract is prepared from the roots used in treatment of Jaundice in Himalayan regions of Uttarakhand [9]. The whole Plant is used in treatment of asthma and chest pain in Kani tribals in Tirunelveli hills [10]. In the Udhampur district of Jammu and Kashmir used as diuretic [11]. The leaves of this plant are being used for treatment of cough, fever, hypertension in Andaman and Nicobar Islands [12]. The whole plant employed as a diuretic and anthelmintic and the roots are used to cure headache, leucorrhea, ureteral stone, and fruit powder is used in treating pyorrhoea in Andhra –Pradesh [13].

Taxonomical classification Averva lanata

Botanical name	*Aerva lanta*
Family	Amaranthaceae
Kingdom	Plantae (Plants)
Sub Kingdom	Trachebionta (Vascular plants)
Division	Magnoliophyta(Angiosperms, flowering plants)
Class	Magnoliopsida (Dicotyledones)
Subclass	Caryophyllidae
Order	Carphylliade
Genus	Aerva
Species	*Aerva lanata* (L) Juss Ex.Schult

Methodology

The present information is quantitative and qualitatively accumulated from digital database searches like, Scopus, DOAJ, Sci-Hub, and Science direct, PubMed, and Google scholar were systematically identified. Keywords used were "*Aerva lanata* in pharmaceutical and in the food industry". Collection of data was started in October 2021. Numerous articles were studied for information, out of which, only few were referred for proper understanding (Fig 1).

Fig 1: Plant of Aerva Lanata *(A higher resolution / colour version of this figure is available in the electronic copy of the article)* [58].

Botanical description of plant

Morphology

It is Annual, erect and/or ascending, diffuse herbs, 15 to 50 cm tall vertically, consisting of woody and thickened at base. Stems are simple or branched glandulous, striate, hairy and leaves are broadly ovate, obovate, or elliptic, subacute at apex, at the base of appressed hairs on both surfaces, the petioles size is 0.3 to 1.6cm. The inflorescence are spikes. Flowers are mainly small, whitish, or greenish white, in axillary spikes on 2 to 4, 0.5 to 3 cm long culminating into an interrupted panicle at the end of the branches due to suppression of upper leaves. It contains 5 staminodes; 2 Stigmas; yellow filaments pale. Fruits of this plants are utricle minute, broadly ovoid, smooth, subacute, shining, one-seeded. Seeds are black,

smooth, shining, at one end, without-sided margin. Flowering time September to January [14].

Cultivation and collection

Aevra lanata is grown by seed propagation. Each plant is panted consecutively with an interval of 30 cm. The light of sun is essential for plant growth. These plants are planted in the month of September. The first year of planting will produce flowers. To prevent the attack of of foreign substances such as microorganisms, weeds, and insects, inorganic, organic, and synthetic fertilizers used for the cultivation. We can also use animals waste, vegetable waste (organic fertilizer) and cow dung. Peat improves the absorption properties of plant and has no nutritional value. During the flowering season of *Aerva lanata* (November - December) aerial components were obtained from the wild source and fruits are collected in the month (January - February) [15, 16].

Soil and Climate

Aevra lanata plants grows in well-drained soil type at pH ranges from alkaline to acidic and neutral and these plants are bi-sexual and self-pollinated and they are grown in tropical climate [17].

Synonyms

Achyranthes villosa Forssk, *Aerva arachnoidea* Gand, *Aerva incana* Suess, *Aerva mozambicensis* Gand, *Aerva sansibarica* Suess, *Illecebrum lanatum* (L.) L.

Vernacular Names

English: Mountain Knotgrass
Hindi: Gorakhuti or Kapuri jadi, Gorashaganha, Gorkhabundi, Chaya
Marathi: Kapuri-madhura,Kapurmadhura, Kumrapindi, Kapurphuti
Sanskrit: Paashaanabheda, Gorakshaganjaa, Aadaanpaaki, Shatkabhedi
Assam: Bameha
Bengal: Chaya
Deccan: Khul-Khul
Guajarat: Bur, Kapurimadhri
Jharkhand: Cauliara
Kannada: Bilesuli, Bilihindi soppu
Malayalam: Cherula, Cerula, Ceruvuta
Punjabi: Baikallau, Bui-Kaltan (Flowers as sold in the markets)
Rajasthan: Bhui
Sind: Bui
Spain: Sanguinaria de cuba
Tamil: Sirru-pulay-vayr, Cerupulai, Poolai
Telugu: Pindi-kura,Pindi-chettu,Pindi-uttu, Kondapindi-chettu

Medicinal uses

Anti-urolithiatic activity

The aqueous extract obtained from different parts of the *Aerva Lanata* were tested on male albino Wistar rats. For this Ethylene glycol (0.75%) was fed to a group of rats for inducing urolithiasis activity in the rats. continuous monitoring of oxalate, calcium and phosphate in the liver and kidney was undertaken. This suspension did not give any behavioural changes in the rats. The rats which were given this suspension had an antiurolithic activity. [18.] In this particular article targets at scrutinising the utility ability of the antiurolithic activity property of the various phytonutrients fragments abstracted from process of hydro alcoholic extraction from the aerial sections and the roots of *Aerva Lanata*. This trial was undertaken by the nucleation method. It was divulged that the phenolic and other phytonutrients like flavonoid obtained from different aerial parts of the plant were most actively present in the processes undertaken, when put against that obtained from the roots. [19]. the effect of a Polyherbal syrup considering of aqueous porridge of *Aerva Lanata* was analysed against a specific induced glycolic urolithiasis in the male Wistar albino rats. This urolithiasis was supervised by a 0.75% ethylene glycol assorted along with drinking water for 28 days. A simultaneous evaluation with this polyherbal syrup and the standard drug hydrochlorothiazide for 28 days in addition with ethylene glycol in the same percent for same amount of days showcased an exponential increase in the urinary volume, with decrease in pH and magnesium and uric acid, creatinine, urea. This evaluation assured the beginning of urolithiatic as microcrystal decomposition in regions of kidney. This was reduced while treatment with polyherbal syrup. [20]. a hyperlipidemic analysis carried out in urolithic rats of *Aerva Lanata* on the properties of ethylene glycol induced calcium oxalate. There was a steady increase in the total lipids, the total cholesterol and triglyceride levels, and phospholipds high density lipoprotiens, low-density lipoprotiens and very low density lipoprotiens levels also fluctuated in the rats. On intake of *Aerva lanata* aqueous suspension, all of these changes were brought down to normal, which implies that this suspension works as a hyperlipidemic agent [21].

Nephroprotective activity

When employed against mercuric chloride, the extract, which was ethanolic in nature, demonstrated nephroprotective effect. In the kidneys and damage to the liver of the groups that were removed and treated, there was an increase in glutathione, Vitamin C, and antioxidant enzymes such glutathione oxidase, dismutase, catalase, and methyltransferase. [22]. this analysis was also considered for studying the nephroprotective activity present in the cisplatin and gentamicin by inducing acute injuries in albino rats irrespective of their sex. in the entire process, the dosage of 75, 150, and 300 mg/kg expressed a dose-dependent decrease in the raised blood urea and serum creatinine levels. Also further helped in normalising the histopathological reactions. This assay suggests that the ethanol extract of *Aerva Lanata* owned nephroprotective activity with very negligible levels of toxicity and thus vouched an encouraging role in therapy of acute renal injury that can be caused due to nephrotoxins like cisplatin and gentamicin. [23].

Antidiabetic activity

In addition, the wet extract of all ethereal sections showed a significant reduction in fasting blood glucose, total serum cholesterol and triglyceride, creatinine levels, SGOT, SGPT, alkaline phosphatase, BUN, and a clear decrease in body weight with a rise in total bilirubin. [24]. With alloxan-induced diabetic mice, the antihyperglycaemic efficacy of an alcoholic extract of *A. lanata* leaves on serum glucose levels and the oral glucose tolerance test (OGTT). [25]. In streptozotocin (STZ)-induced diabetic rats, *Aerva lanata*, and an herb popular for its culinary and medicinal potential. When compared to diabetic controls, treatment with 70% ethanolic extract (ALE) at 500 mg/kg body weight per day for 21 days improved fasting blood glucose (120.33 1.99 mg dL(-1), insulin level (9.81 0.38 mU L(-1), HbA1c (7.3 0.36 percent), and glycogen content in the liver (35.33 1.38 mg g(-1) protein) and muscle (7.67 0.11 mg g(-1) protein). In an oral glucose tolerance test on Day 21, the extract showed a significant drop in blood glucose of 47.29 percent by the end of 2 hours. Flavonoids, tannins, and terpenes, as well as micronutrients, may contribute to its medicinal potential. [26, 27].

Anti-diuretic activity

The amount of urine voided and the electrolyte concentration in urine were both influenced by Ecbolium ligustrinum. According to the findings, the roots of *Aerva lanata* and Ecbolium ligustrinum are diuretic. Furosemide was used as the standard medication in an experiment on male wister strain albino rats. Oral dosages of 20 mg/kg and 200 mg/kg were used for the standard and test, respectively. The urine output, pH, salt, potassium, and chloride amounts in the urine are all measured to determine the diuretic action. Ecbolium ligustrinum has a diuretic index of 1.70, which is close to the usual furosemide value of 1.80. In comparison to the standard, the *Aerva lana*ta group has a lower diuretic index of 1.49 [28].Total urine volume, salt, potassium, and chloride content were all used to determine diuretic action. In comparison to the control, the results clearly show that the ethanolic extracts acts as a diuretic at a dosage of 800 mg/kg. [29]. Anti-diarrheal activity was tested using ethanolic and aqueous extracts of *Aerva lanata* and Aerva javanica. In a charcoal meal test, all of the extracts showed anti-diarrheal efficacy. As a mechanism of action, it is proposed that intestinal transit be reduced [30].

Anti-bacterial activity

Antimicrobial activity of *Aerva lanata* whole plant ethyl acetate and methanol extracts against *Bacillus subtilis, B. cereus, S. aureus, E.coli, Salmonella typhi, Shigella shiga, Shigella sonnei, Shigella flexneriae, Shigella boydii, Klebsiella, A. niger fumigatus*.The findings indicated that Ethyl acetate and Ethanol extracts of stems have high antibacterial activity when compared to conventional drugs.The entire plant *Aerva lanata* was extracted with hydroalcohol, then fractionated with n-butanol and ethylacetate. At various dilutions, the fractions were tested for antibacterial efficacy against *Escherichia coli*, *Clostridium* species, *Proteus* species, and *S.aureus*. Antibacterial activity against microbiological infections were tested on the extracts. The solvent extracts exhibited significant effectiveness against the tested microorganisms, according to the findings. The plant's MIC values ranged from 5 mg/ml to 40 mg/ml. The plant extract had a MIC of 5 mg/ml and was incredibly beneficial against *Escherichia coli* and *Mycobacterium aerogenes*. [31-39].

Antioxidant activity

Antioxidant compounds can be found in a variety of natural sources, including plants and microorganisms. Antioxidant properties have also been reported in many *Aerva* species. The aerial parts of *A. lanata* had significant antioxidant activity in both aqueous and metabolic extracts. Aqueous extract of *A. lanata* inhibited 2, 2-diphenyl-1-picrylhydrazyl (DPPH) extreme with an IC50 value of 110.74 g/mL, according to another study. The effect of Alternanthera sessilis (L.) R. Br. on serum ferritin and hemoglobin

levels in mice and rats was studied. After inducing anemia in the test animals, different doses of the test material were given orally for 14 days. The positive control was ferrous sulphate, and the negative control was H2O. The study revealed significant increase in blood ferritin and haemoglobin levels that was dose and linear, but no significant difference between mice and rats on these parameters. According to the findings, Lupo has hematinic action, especially in iron-deficient anaemia. [40, 5, 41, 42].

Anti-cytotoxicity activity

The parameters considered were tumour weight, the survival time and the tumour cell growth reticence. The Brine shrimp lethality bioassay was tested in vitro cytotoxicity and it consisted of moderated cytotoxicity activities. A semi herbal formulation made up of *Aerva lanata* was also evaluated for its antitumor properties in ascites and the solid tumours caused by the DLA cells in the Swiss Albino mice. To investigate the cytotoxic activity of *Aerva lanata* L. in vitro (flowering aerial part). The Sulphorhodamine B (SRB) assay was used to investigate lung, leukaemia, prostate, colon, and cervical cancer in 5 different human cell lines. This study used three doses of each *Aerva lanata* L. Dichloromethane fraction (ALCF) and *Aerva lanata* L. Ethanolic Extract Fraction (ALEAF) of 10, 30, and 100 g mL-1. When compared to the standard medicine mitomycin, ALCF exhibited a substantial percent inhibition activity for leukaemia, lung, and colon at a maximal dose of 100 g mL-1. [43, 44, 45].

Hepatoprotective activity

Petroleum ether, methanol, and acetone were used to extract the complete plant of *Aerva lanata*. In vitro, the petroleum ether extract's slightly TLC-purified fraction (PEF) was found to be cytotoxic to Dalton's lymphoid ascites (DLA), Ehrlich ascites (EA), and B16F10 cell lines. PEF was utilised to explore the pharmacological activity and its potential to diminish solid tumours caused by DLAcell lines in mice since it was discovered to become more toxic to DLAcell lines. PEF dramatically reduced the formation of solid tumours in mice, according to the findings. Natural compounds derived from plants, such as alkaloids, flavonoids, terpenoids, and polysaccharides, have gotten a lot of attention in recent years because of their wide range of pharmacological activities, including immunomodulatory, anti-inflammatory, cytotoxic, cancer chemopreventive, and so on. The immunomodulatory action of 10-Methoxycanthin-6-one, a -carboline alkaloid from the medicinal plant *Aerva lanata*, was tested in Balb/c mice. At the same time, treatment of 10-methoxycanthin-6-one to lipopolysaccharide (LPS)-stimulated macrophages could considerably lower high levels of proinflammatory and nitric oxide generation. The mRNA levels of inducible nitric oxide, cyclooxygenase 2, tumour necrosis factor alpha (TNF)-, interleukin (IL)-1, and IL-6 in LPS-stimulated macrophages were similarly significantly reduced after administration with 10-methoxycanthin-6-one. [46, 47].

NASIDs, analgesic, and nocioception Activity

The shade dried powder of *Aerva lanata* (Family: Amaranthaceae) was subjected to successive extraction using the solvents (Petroleum ether, Ethyl acetate and Ethanol) in the increasing order of polarity. Thus prepared extracts were subjected to the Preliminary phytochemical analysis. Then the extracts were investigated for analgesic activity and anti-inflammatory activity in the wistar rats using Diclofenac sodium and Indomethacin as standard drug respectively.The results revealed that all the extracts showed significant analgesic activity by tail immersion method and anti-inflammatory activity by carrageenan induced paw edema method in wistar rats. The ethanol extract at dose 800 mg/kg body weight was found to be more significant compare to other extracts. The hydroethanolic extracts from the aerial parts were also evaluated for their antinociceptive properties through the acetic acid-induced abdominal writhing and hot plate test on Swiss albino mice. The extract also showed an antinociceptive effect in a dose dependent manner. An increment in the latency period was also observed predictable with morphine. The anti-nociceptive activity of *A. lanata* was not antagonized by naloxone, which was chosen as the opioid receptor antagonist [48].

Anti-ulcer activity

Under Omeprazole as the standard drug,pyloric ligation, Ethanol, indomethacin and cysteamine generated ulcer models were utilised to analyse the antiulcer activity of the aqueous extract obtained by the stem in wistar albino rats. There was an exhibition of a dose dependent activity. There was a curtailment in the ulcer index, with reduction in free-acidity and total-acidity with a rise in the pH in the pylorus ligated model [49].

Antiretroviral activity

Extracts were made using a progressive maceration process in hexane, chloroform, ethyl alcohol, acetone, and methanol solvents, and the filtered mass was collected at low ambient temperature below pressure in a rotating

vaccum evaporator. Retro Sys HIV-1 RT activity kit was used to test the anti-HIV activity of all methanol extract of *Aerva lanat*a root (Innovagen, Sweden). PBMCs obtained from whole blood were used to conduct a cytotoxicity analysis on all extracts using the MTT test. All extracts demonstrated the most significant efficacy, with the aqueous extracts of *Aerva lanata* having the highest (91.0 percent) HIV-RT inhibition at 2 mg/ml concentration, followed by hexane, ethyl acetate, and acetone extractions (86.9, 85.2 and 77.5 respectively). At a concentration of 2 mg/ml, the control medication (AZT) showed a 91.7 percent success rate. IC50 (Inhibitory Concentration 50) [50]. Medicinal *Avera lanata*, tribal use of *Avera lanata* and phytoconstients present in *A. lanata*. Data, Fig. **(2)**, Table. **(2)** and **(3)** shows the different phytoconstituents present in varied and distinctive parts of the plant with uses and structure, respectively (Fig 2).

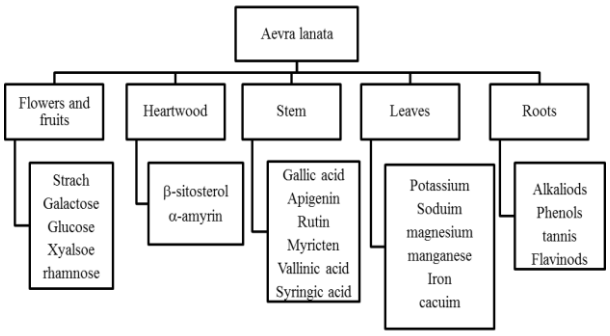
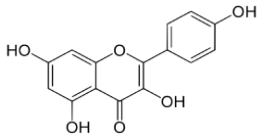
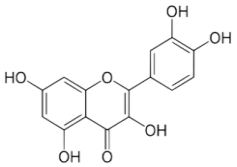
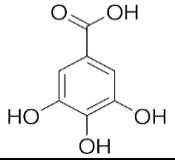
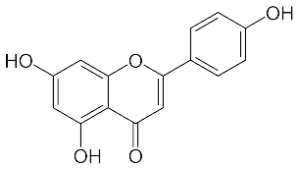
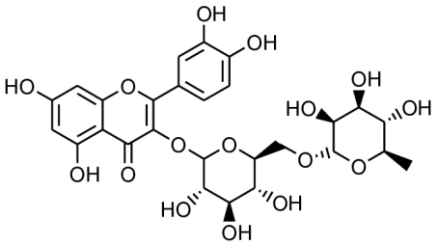
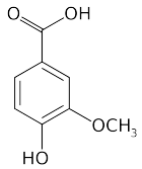
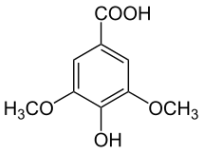
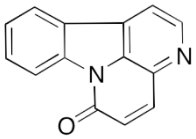
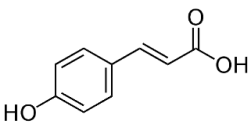


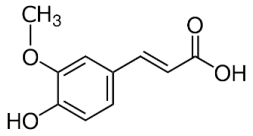
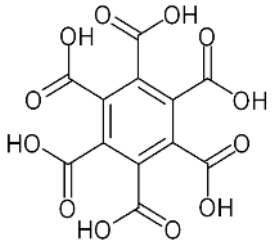
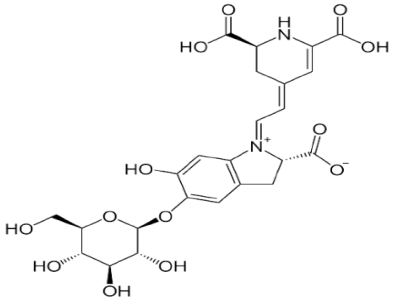
Fig 02: Photochemistry of Gorakhuti

Phytochemical constituents and pharmacological uses of different plant of Gorakhuti

Parts	Phytochemical's constituents	pharmacological Uses	References
Leaves	Crude Proteins, Carbohydrates, Mineral Composition (Orthophosphates, Potassium, Calcium, Manganese, Iron, Zinc, Magnesium), etc.	Nutrition, bolster your immune system, heal wounds.	[51]
Stems	Gallic acid, Apigenin, Myricetin, Rutin, Vanillic acid, Syringic acid, etc.	Antioxidant, Anti-inflammatory, Antineoplastic properties, Immunomodulatory, Anti-allergic, Analgesic, Osteoarthritis, Fever, Blood clotting, Spams, GIT distress, Dysmenorrhea, Diabetes, Cerebral Ischemia, Neuro, and liver damage.	[52]
Roots	Gallic acid, Quinones, Phenols, Triterpenoids, Phytosterols and Phlobatannins, etc.	Antidiabetic, Diuretic, Antifertility, Hepatoprotective activity, Anti-HIV	[1]
Flowers	Calcium, Phosphate, Flavonoid, Total phenols, Tannin, Carotenoids and Lycopene, etc.	Anti urolithiatic, Diuretic, Antimicrobial, Analgesic and Anti-inflammatory	[29,53]
Seeds	Docosane, Dotriacontane, Dctadecenoic acid, etc.	Anti-urolithiatic activity	[29]

Structure of some Phytoconstituents

Kaepferol	
Quecetin	
Gallic acid	
Apigenin	
Rutin	
Vallinic acid	
Syringic acid	
Canthin-6- alkaliods	
p-coumaric acid	

Ferulic acid	
Melilotic acid	
Betatin	

Commercial application in the food industries and another area

In India, the young shoots are utilised in curries, and the leaves are also eaten as a famine food. In Sri Lanka, it is commonly consumed as a vegetable [54]. This plant is utilised for nutrition for both humans and wildlife creatures. The entire plant is tasty, by and large the leaves. Its leaves are used in soups, as a spinach substitute, or as a vegetable. Stock, game, and fowl can all graze on the property. Snakebites are treated with this plant in traditional medicine. [55]. Even though the plant has many therapeutic virtues, it is widely used in the Southern part of India during the Tamilian festival "Pongal" because its bloom is used for decorating. This festival is also known as Ponga-Poo in Tamil, which is procured from the names Pongal – a Tamil harvest festival – and Poo, which means flower in Tamil. "Kannu Pillai Poo" and "Siru Poola" are two other Tamil names for this plan. This very plant is also employed as a protection at odds with evil spirits, a hunting talisman, and a talisman for widows' well-being [56]. The extract of crushed *Aerva lanata* root is used in treatment for jaundice in Indian traditional medicine [57].

Conclusion

In this article focusing on the pharmacology uses of *Aerva lanata. A. lanata* has been used as a healing agent for a large number of diseases. Furthermore, numerous scrutiny works have proven its uses lie beyond the ethnobotanical ones in experimental animals. Pharmaceutical analysis suggested that aerva species has healing properties of antimicrobial, anti-urolithiasis, anti-ulcer, anti-asthmatic, acute injuries in the kidney, anti-diarrheal effects, antioxidant, antihyperglycemic, hypolipidemic and antiulcer. *Aerva lanata* has a propitious capacity in the treatment of countless diseases and metabolic disorders due to its higher antioxidant consequence and other such integral components thereby catering better wellness and health maintenance. Various such constituents are to be studied properly for ensuring that it would be adequate for exhibiting pharmacological activity. Analytical methods are to be used promptly to find various concentrations of substances present in the alcoholic extract of the *Aerva lanata* plant.Alkaloids and flavonoids which were isolated from this plant can also be credited for its diagnostic activities. Furthermore it is a necessity to establish distinctive bioactive molecules, which might be responsible for these actions. The discovery of a phytotherapy will be highly beneficial in various treatments against infectious diseases. The results of the ongoing research strongly indicates the significance of conventional medicines and this plant extract can be used in development of a very useful source for novel antibacterial substance antioxidant components. Furthermore, isolation of active

metabolites and structural enactment from this plant is required to identify the potent molecule from a pharmaceutical point of view in future studies. Therefore the horticulture, accumulation, and further pharmacological exploration of *Aerva lanata* are undoubtedly crucial.

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