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A COMPREHENSIVE REVIEW OF *MORINGA OLEIFERA* LAM. WITH SPECIAL REFERENCE TO NIGHANTUS

Sumita Ghosh[1]* and Avik Pal[2]

[1]MD Scholar, Institute of Post Graduate Ayurvedic Education and Research, Shyamadas Vaidya Shastra Peeth Hospital, Kolkata, West Bengal, India.

[2]Assistant Professor, Department of Dravaguna Vigyan, Kunwar Shekhar Vijendra Ayurved Medical College and Research Centre, Gangoh, Uttar Pradesh, India.

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***Corresponding Author**
Dr. Sumita Ghosh
MD Scholar, Institute of Post Graduate Ayurvedic Education and Research, Shyamadas Vaidya Shastra Peeth Hospital, Kolkata, West Bengal, India.

ABSTRACT

Medicinal plants play a pivotal role in the health care of ancient and modern cultures. A number of folk medicines are available in India since ancient times. Sigru is one of them. Nowadays Sigru is called as Miracle tree for its highly nutritional and medicinal properties. ***Sigru (Moringa oleifera Lam.)*** is a small or medium-sized tree having corky, soft, thick, deeply fissured bark. Its root, bark, leaf and seed are used for medicinal purposes. It has several established medicinal uses such as- antimicrobial activity, anti-oxidant activity, anthelminthic activity, anti-inflammatory activity, hepatoprotective activities and so on. It is used for the treatment of various diseases like dyspepsia, anorexia, diarrhoea, inflammations, fever, cough, asthma, bronchitis etc. It contains various flavonoids, protein components, minerals which give it immense medicinal value. In various Samhitas such as Charak samhita, Sushruta samhita, Astanga hriday, Astanga samgraha and nighantus like Dhanvantari Nighantu, Raj Nighantu, Madanpal Nighantu, Shaligram Nighantu, Kaiyadeva Nighantu, Bhavprakash Nighantu, various synonyms, properties, therapeutic uses of sigru and various formulation of sigru are mentioned.

KEYWORDS: Samhitas, Nighantus, Hepatoprotective, Antimicrobial, Antioxidant.

INTRODUCTION

Medicinal plants have been in use for treatment of various diseases since time immemorial. According to World Health Organization, about 80% of world population rely chiefly on

plant based traditional medicine for their primary healthcare need.[1] The miracle tree Sigru is commonly known as Drumstick plant because of the appearance of its fruits. Every part of Sigru like roots, bark, leaves flowers, fruits, and seeds contain nutritional and medicinal value. It is distributed widely in the sub Himalayan tract, from Chenab eastwards to Sarda and cultivated all over the plains of India.[2] Due to its easy availability, Sigru is included in daily food regimen. The different parts of this plant has analgesic, diuretic, antihypertensive, antispasmodic, antitumor, anticancer, antiulcer, cholesterol lowering effect, hepato protective, and hypoglycemic effect and also effective in skin and mucosal diseases.[3]

Taxonomic Classification

- **Kingdom:** Plantae
- **Subkingdom:** Viridiplantae
- **Infrakingdom:** Streptophyta
- **Superdivision:** Embryophyta
- **Division:** Tracheophyta
- **Subdivision:** Spermatophytina
- **Class:** Magnoliopsida
- **Superorder:** Rosanae
- **Order:** Brassicales
- **Family:** Moringaceae
- **Genus:** Moringa
- **Species:** *Moringa oleifera* Lam. – horseradish tree[4]

Classical Names

Sigru, Sobhanjana, Akshiv, Krishnagandha, Ghanachada, Tikshnamula, Bahumula, Murangi, Mulakparni, Mochaka, Vidradhighna, Haritashaka.

Vernacular Name

- **Sanskrit:** Sobhanjana, Bahola, Sakhapatra
- **Bengali:** Sajina, Sajne
- **English:** Horse Radish Tree, Drum-stick Tree, Ben oil tree, Miracle tree, and “Mother’s Best Friend"
- **Gujrati:** Saragava
- **Hindi:** Sahijana

- **Kannada:** Nugge, Nuggemara, Nuggekoyimara
- **Malayalam:** Muringya, Murinna
- **Marathi:** Shewga
- **Punjabi:** Sohajana
- **Tamil:** Murungai
- **Telugu:** Munaga chettu, Mulaya chetta
- **Urdu:** Sahajan, Sohanjana[5]

Namrupa Vijnana

१. शिग्रुः (भा०)-शिनोति तीक्ष्णतां विदधाति, शिञ् निशाने ।

२. अक्षीवः (भा०)-न क्षीवो मदयुक्तः, मदनाशक ।

३. कृष्णगन्धः (कै.)-कृष्णं मरिच, तद्वत्तीक्ष्णो गन्धोऽस्य; 'तीक्षणगन्धः' (अ०) इत्यस्यापि स एवार्थः।

४. घनच्छदः (कै०)-घनाः संहताश्छदा अस्य । 'बहलपल्लवः'(अ०ह०) इत्यपि पठ्यतेऽस्मिन्नेवार्थे ।

५. तीक्ष्णमूलः (रा०)-तीक्ष्णं मूलमस्य ।

६. बहुमूलः (रा०)-बहूनि मूलान्यस्य ।

७. मुरङ्गी (कै०)-लौकिकी संज्ञा ।

८. मूलकपर्णी (ध०)-मूलकस्येव तीक्ष्णानि पर्णान्यस्य ।

९. मोचकः (भा०)-मोचयति रोगेभ्य इति; मुञ्चति निर्यासं वा ।

१०. विद्रधिघ्नः (कै.)-विद्रधिं हन्तीति ।

११. शोभाञ्जनः (भा०)-शोभामनक्ति, शोभमान इत्यर्थः ।

१२. हरितशाकः (ध०) हरितशाके प्रयोज्यः ।

Sigru (Moringa oleifera Lam.) is a beautiful tree (sobhañjāna) having dense and luxuriant foliage (ghanacchada, bahalapallava) with pungent smell (mulakaparni) known as murangi (murangi). It has many roots (bahumūla) with pungent smell and taste (tiksnamūla, ĩigru, krsnagandhā). Leaves and also fruits are used as green vegetable (haritaśāka). Sigru posesses

anti-biotic property and is useful in infective disorders like abscess (vidradhighna). It is also useful in many other disorders (mocaka).[6]

Literature Review

A) Samhitakala

In **Charaka Samhita** totally 42 references were found in 27 different Adhyayas of 5 different Sthanas. In Sutra Sthana 8, Nidana Sthana 1, Vimana Sthana 3, Chikitsa Sthana 26, and in Siddhi Sthana 4 references were mentioned.

In **Sushruta Samhita** total 28 references are scattered in 23 Adhyayas of 5 Sthanas. In Sutra Sthana 8, Chikitsa Sthana 6, Kalpa Sthana 3, Sarir Sthan 1, Uttaratantra 10 references are quoted.

In **Asthanga Hridaya** total 38 numbers of references are divided into 28 different Adhyayas of 4 different Sthanas. Maximum 12 references are found in Chikitsasthana, followed by 10 in Uttaratantra, 4 in Sutrasthana and Sarirsthana states 2 references.[7]

Table no. 1: Categorization of Sigru in Samhitas.

Drug	Charak Samhita	Sushruta Samhita
Sigru	❖ Swedapoga ❖ Krimighna ❖ Shirovirechanapaga ❖ Katukaskandha ❖ Haritaka varga	❖ Varunadi varga ❖ Shirovirechan varga

B) Nighantu kala

Table no. 2: Categorization of Sigru in Nighantus.

Sr.No.	Text	Varga / Gana
1.	Bhavaprakash nighantu	❖ Guduchyadi varga
2.	Madanpal nighantu	❖ Saka varga
3.	Kaidev nighantu	❖ Ausadhi varga
4.	Saligram nighantu	❖ Guduchyadi varga
5.	Raj nighantu	❖ Mulakadi varga
6.	Priya nighantu	❖ Haritakyadi varga
7.	Dhavantari nighantu	❖ Karavadi varga
8.	Nighantu adarsha	❖ Sigruadi varga

Table No. 3: Showing synonyms as per different Nighantus.

Sr.No.	Synonyms	DN	RN	MPN	BPN	KN	SN	PN	NA
1.	Sobhanjan	+	-	-	+	+	+	+	+
2.	Krishnagandha	-	-	+	-	+	-	-	+
3.	Murangi	-	-	-	-	+	-	-	-
4.	Shalnaksham	-	-	-	-	+	-	-	-
5.	Ghanachhad	-	-	-	-	+	-	-	-
6.	Tikshnagandha	+	-	-	+	+	+	-	-
7.	Mochak	-	-	-	+	+	-	-	-
8.	Bahalchhad	-	-	-	-	+	-	-	-
9.	Abadamsha	-	-	-	-	+	-	-	-
10.	Mulaparni	-	-	-	-	+	-	-	-
11.	Mukhabhag	-	-	-	-	+	-	-	-
12.	Harichhad	-	-	-	-	+	-	-	-
13.	Subhanjan	-	-	-	-	+	+	-	-
14.	Vidradhighna	-	-	-	-	+	-	-	-
15.	Akshiva	-	-	-	+	+	+	-	+
16.	Mulakchhad	-	-	-	-	+	-	-	-
17.	Sakapatra	-	+	-	-	-	-	-	-
18.	Updamsa	-	+	-	-	-	-	-	-
19.	Komal-patraka	-	+	-	-	-	-	-	-
20.	Damsamula	-	+	-	-	-	-	-	-
21.	Haritsaka	+	+	-	-	-	-	-	-
22.	Supatraka	-	+	-	-	-	-	-	-
23.	Kshamadamsa	-	+	-	-	-	-	-	-
24.	Bahumula	-	+	-	-	-	-	-	-
25.	Tikshnamula	-	+	-	-	-	-	-	-
26.	Soubhanjana	-	-	+	-	-	-	-	-
27.	Bahulacchada	-	-	+	-	-	-	-	-
28.	Sigru	-	-	-	+	-	+	+	+
29.	Sigruk	+	-	-	-	-	-	-	-
30.	Laghupatrak	+	-	-	-	-	-	-	-
31.	Abadamshaksham	+	-	-	-	-	-	-	-
32.	Damsa	+	-	-	-	-	-	-	-
33.	Mulakparni	+	-	-	-	-	-	-	-
34.	Mukhabhanga	+	-	-	-	-	-	-	-

"+'' denotes same name was mentioned in various Nighantu. "-" denotes this name was not mentioned.

(DN- Dhanvantari Nighantu, MPN- Madanpal Nighantu, RN- Raj Nighantu, KN- Kaiyadev Nighantu, BPN-Bhav Prakash Nighantu, SN- Saligram Nighantu, NA- Nighantu Adarsh, PN- Priyo Nighantu).

Summarising the Synonyms mentioned by the various Nighantukaras it can be concluded that Dhanvantari nighantu, Raj nighantu, mentioned 9 synonyms, Madanpal nighantu 3,

Bhavprakash 5, Kaidev nighantu 16, Shaligram nighantu 5, Priya nighantu 2, Nighantu adarsha 4 synonyms. Most number of Synonyms was mentioned by **"Kaidev nighantu".**

Table No. 4: Showing Rasa, Guna, Virya and Vipaka of Sigru according to Various Nighantus.

RASAPANCHAK		TEXT							
		DN	RN	MPN	BPN	KN	SN	PN	NA
RASA	MADHUR	-	-	+	-	+	+	-	-
	AMLA	-	-	-	-	-	-	-	-
	LAVAN	-	-	-	-	-	-	-	-
	KATU	+	+	-	+	+	+	+	+
	TIKTA	+	+	-	-	+	-	+	+
	KASAYA	-	-	+	-	-	-	-	-
GUNA	USHNA	+	+	+	+	-	+	-	+
	LAGHU	-	-	+	-	+	+	-	-
	RUKSHA	-	-	-	-	+	-	-	-
	TIKSHNA	-	+	+	+	+	+	-	+
VIPAK	KATU	-	+	-	-	+	+	-	+
VIRYA	USHNA	+	+	+	+	+	+	+	+

"+'' denotes same Rasa, Guna, Virya & Vipak was mentioned in various Nighantu. "-" denotes this Rasa, Guna, Virya & Vipak was not mentioned.

(DN- Dhanvantari Nighantu, MPN- Madanpal Nighantu, RN- Raj Nighantu, KN- Kaiyadev Nighantu, BPN-Bhav Prakash Nighantu, SN- Saligram Nighantu, PN- Priyo Nighantu, NA- Nighantu Adarsha.)

Summarising the Rasapanchak mentioned by the various Nighantukaras it can be concluded that Sigru has Madhur, Katu, Tikta, Kasaya rasa, Laghu, Ruksha, Tikshna, Ushna gunas, Ushna virya and Katu Vipaka.

Table No. 5: Showing types of Sigru according to Various Samhitas & Nighantus.

Samhitas & Nighantus	Types		
	1	2	3
Sushruta Samhita	Sigru	Madhusigru	
Astanga Hridaya	Sigru	Madhusigru	
Dhanvantari Nighantu	Shweta	Rakta	
Raj Nighantu	Shweta	Rakta	Nila
Madanpal Nighantu	Shweta	Rakta	
Kaidev Nighantu	Shweta	Rakta	
Bhavprakash Nighantu	Shyama	Shweta	Rakta
Shaligram Nighantu	Shweta	Rakta	
Nighantu Adarsha	Madhusigru	Katusigru	

According to Bhavprakash Sigru with red flowers and smelling like honey is called Madhusigru. Shweta variety Sigru has pungent taste, so it is called Katusigru. Since the colour of the seeds are white and resembles maricha (*Piper nigram*), so called Shweta maricha.

Botanical Description

A small or medium-sized tree, growing upto 10m. **Bark-** corky, soft, thick, deaply fissured. Wood is soft. **Leaves-** tripinnate compound, available in the form of leaflets and some broken pieces of rachis, slender, thickened, and articulated at the base; **leaflet**- 1.2-2 cm long and 0.5-1 cm wide, entire, elliptic, ovate or obovate, rounded or narrowed at base and obtuse at apex; smooth and greenish-grey to pale green; odour and taste not distinct. **Flowers-** bisexual, irregular, fragrant, white, in large panicles. **Fruits-** pod, triangular ribbed, pendulous, greenish, 22.5-50.00 cm or more in length. **Seeds-** trigonous, winged (flowers in February- March and fruits in March- April).[8,9]

FIG.1- Bark of Sigru

FIG. 2- Leaves of Sigru

FIG.3- Flowers of Sigru

FIG.4- Fruit of Sigru

FIG.5- Seeds of Sigru

FIG.1:

https://commons.wikimedia.org/wiki/File:Sonjna_(Moringa_oleifera)_trunk_at_Narendrapur_W_IMG_4175.jpg

FIG.2: https://www.echocommunity.org/vi/resources/d98f8a44-1849-4753-abc2-ce22c843518c

FIG.3: http://www.ilovemoringa.com/How-To-Eat-Moringa-Buds-Blossoms-Flowers.html

FIG.4: https://commons.wikimedia.org/wiki/File:Fruits_of_Moringa_oleifera.jpg

FIG.5: https://www.indiamart.com/proddetail/moringa-oleifera-seeds-3344935548.html

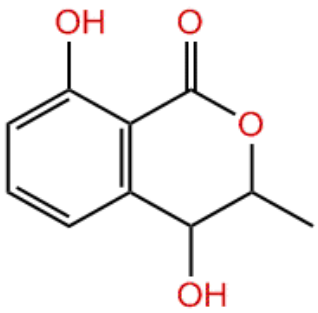
Distribution

The plant is found throughout north-west India and it is frequently cultivated all over the plains of India.[8]

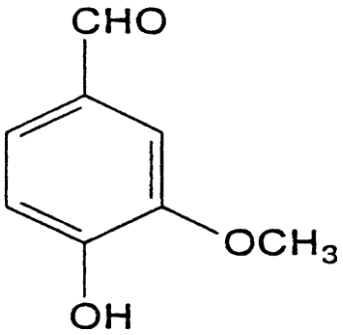
Part Used: Root bark, stem bark, leaf, fruit, seed.[8]

Chemical Constituents

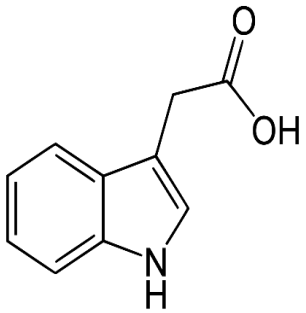
The plant contains 4. hydroxymellein, vanillin, moringine, moringinine, bayrenol, indole acetic acid, indole acetonitrile, benzylisothiocyanate, pterygospermin, cartotene, known flavanoids, polysaccharide, protein components, various essential amino acids, minerals and vitamins, fatty acids and spirochin. Pterygospermin was found to be an antibiotic principle.[8]



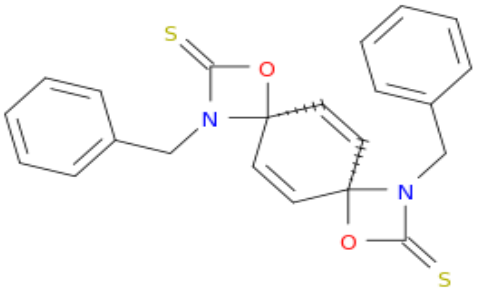
4. hydroxymellein



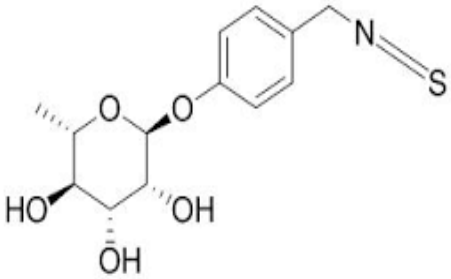
Vanillin



Indole acetic acid



Pterygospermin



Moringine

Action and uses

1. Root of Sigru should be taken with ghee & oil as anupana for the treatment of common cold.

2. Decoction of Sigru stem bark is given with Vidanga & honey for the treatment of intestinal worms.
3. In eye diseases, eyes are cleansed with the juice Sigru leaves.
4. For the treatment of Dadru kustha, Sigru root bark paste is applied locally.
5. Seed oil is used for local application in Osteoarthritis, Rheumatoid arthritis, Gout.
6. In diseases of gum and teeth decoction of Sigru is used for gargling.
7. Juice of Sigru is used for the treatment of facial paralysis, hemiplegia.
8. Decoction of root bark of Sigru is very effective in inflammation, abscess, calcul, epilepsy when administered with rock salt and asfoetida.
9. The roots and seeds are prescribed for the treatment of snake bite and scorpion sting.
10. The gum of the tree mixed with sesamum oil, is recommended to be poured into the ears for the relief of otalgia.[8,10]

Ayurvedic Properties

Rasa: Katu, Tikta

Guna: Laghu, Ruksha, Tikshna

Vipak: Katu

Virya: Ushna

Karma: Dosakarma: Kapha-vata shamak

Sharirakarma: Dipan, Pachan, Vidahi, Grahi, Sulaprasaman, Krimighna, Artav jannan, Vishaghna, Swedajanan, Kusthaghna, Jwaraghna.

Vyadhikarma: Aruchi, Agimandya, Udarsula, Gulma, Krimiroga, Medoroga, Sandhivata, Amavata, Kasa, Mutrakrichha, Charma roga, Shita jwar, Pakshaghat, Ardita.[11]

Dosage: Bark juice- 10-20 ml; Leaf juice- 10-20 ml; Seed powder- 1-3 gm.[8]

Important Formulations

Shobhanjanadi lepa, Manikya rasa, Kalkuta rasa, Shyamadi churna.[8]

Pharmacological Activities

Some important pharmacological activities with references

Antioxidant activity

Aqueous and alcoholic extracts (methanolic & ethanolic) of leaves and roots of Moringa oleifera exhibit strong in-vitro anti-oxidant and radical scavenging activity. Its leaves are rich source of antioxidant compounds; they could protect the animals against diseases induced by

oxidative stress. Administration of Moringa oleifera leaves extract seems to prevent oxidative damage caused by high-fat diet.

Antiepileptic activity

Methanolic extract of Moringa oleifera leaves exhibit potent anti-convulsant activity against pentylenetetrazole and maximal electroshock induced convulsions at the dose levels of 200 mg/kg and 400 mg/kg administered intraperitonially. Diazepam and phenytoin were used as reference standard. Methanolic extract significantly delayed the onset of seizures in Ptz induced convulsions and significantly reduced duration of hind limb extension in MES test at both the dose levels. This may be because of the presence of alkaloids, flavonoids and tannins present in the extract.

Anti-diabetic activity

Aqueous extract of Moringa oleifera leaves shows anti-diabetic activity and controls diabetes and thus exhibit glycaemic control.

The investigation of in-vitro antioxidant and in-vivo antidiabetic effects of methanol extracts of Moringa oleifera pods in streptozotocin (STZ)-induced diabetic albino rats was performed. Diabetic rats were treated with 150 or 300 mg/kg of extract for 21 days and the antidiabetic effects were evaluated by measuring changes in biochemical parameters in serum and pancreatic tissue. The progression of diabetes was significantly reduced after treatment with the extract. In treated rats, both doses of extract induced a significant reduction in serum glucose and nitric oxide, with concomitant increases in serum insulin and protein levels.

The antidiabetic activity of two doses of Moringa seed powder 50 and 100 mg/kg on STZ induced diabetes male rats was investigated. The diabetic positive control group showed increased IL-6, increased lipid peroxide, and decreased antioxidant enzyme in the serum and kidney tissue homogenate compared with that of the negative control group.

Cardiovascular activity

Ethanolic extract of Moringa oleifera leaves showed prominent anti-hypertensive or hypotensive activity. The in-vivo activity was done in animal's heart and it was found that thiocarbamate and isothiocyanate glycosides were responsible for this powerful hypotensive activity.

Anti-fertility activity

Aqueous extract of Moringa oleifera roots was found to be effective as anti-fertility in presence or absence of estradiol dipropionate and progesterone. The in-vivo antifertility activity and histopathology study was done using aqueous extract to investigate the effect on histoarchitecture of the uterus during pre and post–implantation stages.

Antiurolithiatic activity

The in-vitro anti-urolithiatic activity was performed in aqueous and alcoholic extract of bark of Moringa oleifera. It showed reduction in weight of stone produced using ethylene glycol induced urothiasis. It also possesses both preventive and curative property.

Anti-asthmatic activity

A study was carried out to investigate the usefulness of Moringa oleifera seed kernel in patients of bronchial asthma. The patients of either sex with mild-to-moderate asthma were treated with finely powdered dried seed kernels in dose of 3 g for 3 weeks. The clinical efficacy was assessed using a spirometer prior to and at the end of the treatment. The majority of patients showed increase in hemoglobin (Hb) values and reduction in Erythrocyte sedimentation rate (ESR). Improvement was also observed in symptom score and severity of asthmatic attacks. After 3 weeks treatment in asthmatic subjects the drug produced significant improvement in forced vital capacity, forced expiratory volume in one second, and peak expiratory flow rate values by 32.97 ± 6.03%, 30.05 ± 8.12%, and 32.09 ± 11.75% respectively.

Alcoholic extracts of Moringa oleifera seed kernels were found spasmolytic in acetylcholine, histamine, $Bacl_2$ and 5HT, induced bronchospasm.

Hepatoprotective activity

In-vivo hepatoprotective activity of ethanolic extract of leaves and alcoholic extract of seed of Moringa oleifera was estimated against isoniazid, rifampicin, and pyrizinamide induced liver damage. Haematological along with hepatorenal functions of methanolic extract of Moringa oleifera roots, doses of the crude extract (CE) on liver and kidney functions were also reported.

Anti–cancer activity

Ethanolic extracts of leaves and seeds of Moringa oleifera shows potent anti–tumor activity. Thiocarbamate and isothiocyanate related compounds were isolated and which act as inhibitor of tumor promoter. The in-vivo antitumor potential was due the presence of three known thiocarbamate and isothiocynate related compounds which act as inhibitors of tumor promoter teleocidin B-4-induced Epstein–barr virus, interestingly.

Anti-inflammatory activity

Methanolic and aqueous extract of root and bark, methanolic extract of leaves and flowers and ethanolic extract of seeds of Moringa oleifera possess anti-inflammatory activity. In-vitro anti-inflammatory activity from the hot water infusions of flowers, leaves, roots, seeds and stalks or bark of Moringa oleifera using carrageenan-induced and the extract was pharmacologically evaluated.

Anti-microbial activity

Leaves, roots, bark and seeds of Moringa oleifera show anti-microbial activity against bacteria and fungi. The plant shows in vitro activity against bacteria, yeast, dermatophytes and helminths by disc- diffusion method. The fresh leaves and aqueous extract from the seeds inhibit the growth of Pseudomonas aeruginosa and staphylococcus aureus.

Anthelmintic activity

In-vitro study assessed the efficacy of macerated and infused aqueous extract as well ethanolic extract of Moringa oleifera against fresh eggs, embryonated eggs, L_1 and L_2 larvae of Haemonchus contortus. Five different concentrations of extracts were prepared (0.625, 1.25, 2.5, 3.75 and 5 mg/mL). Fresh eggs were exposed to these different concentrations for 48 hours, while embryonated eggs and larvae were exposed for 6 and 24 hours respectively. Distilled water and 1.5% DMSO were used as negative control. Results revealed that ethanolic leaf extract of Moringa oleifera was most efficient on eggs by inhibiting 60.3% ± 8.2% and 92.8% ± 6.2% eggs embryonation at 3.75 and 5 mg/mL respectively.

Different concentrations of ethanolic extracts of Moringa oleifera and Vitex negundo were assessed for antihelmentic activity against Pheritima posthuma. Piperazine citrate (10 mg/mL) was used as a reference standard and distilled water served as a control group. The results were expressed in were expressed in terms of time for paralysis and time for death of

worms. Moringa oleifera shows more activity as compared to Vitex negundo in dose dependent manner.

CNS activity

Moringa oleifera leaves extract restores mono amine levels of brain, which may be useful in Alzheimer's disease. In-vitro anticonvulsant activity from the aqueous extract of Moringa oleifera roots and ethanolic extract of leaves was studied on penicillin induced convulsion, locomotor behaviour, brain serotonin (5-HT), dopamine and norepinephrine level and evaluated.[12]

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