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Phytochemical and pharmacological properties of *Entada phaseoloides* (L.): A review

G Sharanya, A Srivani and G Krishna Mohan

Abstract
Entada phaseoloides (L.) is a well-known creeper that is frequently used therapeutically in the orient and is gaining popularity as a significant medicinal plant. Numerous investigations on this medicinal plant have produced a wealth of information regarding its shape, chemical constituents, and biological activity in relation to extracts and extracted secondary metabolites. Their bioactive components have been shown to have a variety of pharmacological effects through biological research and conventional therapeutic practice. Since ancient times, the plant has been utilized as an anti-inflammatory, analgesic, antipyretic, antiarthritis, antidiabetic, antioxidant, cytotoxic, antibacterial, and molluscidal agent in ayurvedic medicine. The current review provides a summary of the state of our understanding of morphology, significant bioactive ingredients, their chemistry, claimed therapeutic characteristics, pharmacological activities, and folkloric (traditional) applications. Additional research is needed to fully understand *E. phaseoloides* and assess the many biological activities of either its extracts or the isolated chemicals with potential mechanisms of action.

Keywords: Entada phaseoloides, morphology, chemical constituents, pharmacological properties, traditional applications

Introduction
For centuries, people have traditionally relied on plants, animals, minerals for their essential needs such as food, protection from enemies and hunting, and treatment of infectious diseases and health conditions. Many conventional medicinal systems are still sources of interesting drugs and therapy. As per the latest estimates, a significant portion of the population in many developing countries depends heavily on traditional practice-based resources to satisfy basic medical needs. Despite the availability of modern medicine in several countries, herbal medicines have maintained cultural and historical significance. Simultaneously numerous people in the modern world are turning towards effective alternative therapies such as herbal medicines [1]. Nature has consistently served as a leading example of the remarkable phenomenon of symbiosis [2, 3].

One of the most important and widely used medicinal plants for oriental cures, *E. phaseoloides*, and a creeper is growing in popularity. *Entada* genus with 30 tree species, shrubs, and tropical vines and about 21 species known from Africa, 6 from Asia, 2 from the American tropics, and one with a pantropical distribution. This thorough analysis highlights our current understanding of the key bioactivities and therapeutic effectiveness of *E. phaseoloides* one of the most widely used plants today [4, 11]. It seems that future studies on saponin-type chemicals would be particularly interested in the *Entada* species, which is frequently utilized as a health supplement in traditional medicine, especially in terms of biological activity and toxicity of plant extracts [6].

Plant introduction
E. phaseoloides is a huge woody climber belonging to the family: Fabaceae, order: Fabales, and sub-family: Mimosoideae. The scientific name of the plant is *Entada phaseoloides (L.) Merril* [7]. The synonyms of *Entada phaseoloides* are *Entada scandens (L.)* [8], and Lens phaseoloides *(L.)* [9]. Its common names are matchbox bean, gogo, vine, St. Thomas bean, etc. [10] The species is extensively spread throughout India, particularly in Tirupati (Andhra Pradesh), the eastern Himalayas, and East Bengal [4]. The plant has a long history of usage in Indian folk medicine as an emetic, anti-irritant, stimulator of hair growth, painkiller, and treatment for cerebral haemorrhage among other ailments [12-20].

Due to its strong pharmacological effects, the stem of *E. phaseoloides* is frequently employed in traditional medicine [21-23].

Taxonomical hierarchy

Rank	Scientific classification
Kingdom	Plantae
Sub- kingdom	Viridiplantae
Clade	Angiosperms
Super division	Embryophyta
Division	Tracheophyta
Class	Magnoliopsida
Super order	Rosanae
Order	Fabales
Family	Fabaceae
Subfamily	Caesalpinioideae
Genus	*Entada*
Species:	*Entada phaseoloides (L.) Merr*

Vernacular names: [12]
Assamese: Bor gilla, Ghila, Gila lewa, Gilar lot.
Bengali: Gilagach, Gilla, Pangra.
Hindi: Barabi.
Kannada: Doddakampi, Hallebilu, Hallekayiballi.
Malayalam: Paringakavalli, Perimkakuvalli, vattavalli.
Marathi: Garambi
Oriya: Giridi.
Sanskrit: Prthvika
Tamil: Anaittellu, Camuttirappuliyan, Irikki, Kirancakamiram, Ottolakkoti, Yanaittellu.
Telugu: Gila tiga, Gilatige, Peddamadupu, Tandramanu, Tikativva.

History
The tailed green-banded blue butterfly's larvae eat *E.phaseoloides* as their primary source of food. This species has been used as a fish poison and may have therapeutic qualities. In Java, the Philippines, and Malaysia, the species has been used medicinally. The seeds have been used for centuries as a tonic, emetic, and anthelmintic [24].

Description
Stem: *E. phaseoloides* is an evergreen, woody, climbing plant with a flattened and spiral stalk. It may be 18cm in diameter and 100 m long. The long spike of yellowish-white blooms grows in the axils of the leaves. They have long leaf stalks on leaves. The stems can be flattened or compressed laterally with up to 18cm in diameter. They (stems) can also be twisted like a corkscrew. The transverse section of the vessels is huge and clearly visible to the naked eye. In stem cross sections, the pith is eccentrically positioned significantly closer to the margin than the other.

Leaves: Bipinnate leaves have 2-4 leaflets one on each secondary axis and 8-16 leaflets overall. The primary rhachis extends beyond the leaf as a branching tendril. Leaflet stalks are around 0.1-0.7 cm long and transversely wrinkled, while leaflet blades are about (4-11) 2.5-5.5 cm in size. Stipules are straight and falcate, about 2-4 mm in length. While numerous tiny glands can be observed with a naked lens, just a very few large clear glands are visible in the leaflet blades.

Fruits: The fruits are endocarp-enclosed, flattened, and around (88-100) × (9-12) cm in size. They are constricted at intervals and split into about 12 segments, each measuring about 7 × (9-10) cm. The segments fall from the pod, leaving only the sutures of the pod still connected to the vine. Exocarp is shed by rolling into tissue rolls. Endocarp is more or less leathery or like parchment but not hard.
Flowers: Flowers are roughly cup-shaped and have an apical diameter of 1.5 mm. the inner surface of the corolla is cream-colored or transparent and ranges in color from pink to crimson. The size of the petals is 3× (1-1.5) mm. stamina filaments, which are around 6-7 mm long at anthesis are curled in the bud.

Seeds: The seeds have a lateral compression and measure 5-6 cm in diameter and 1.5-2 cm in thickness. Testa is tough. Cotyledons are rigid, measuring (4.5-5.5) × (4.5-5) cm in diameter and fusing along the edge. The radicle is around 4mm long [12].

Habitat
They are found in a variety of environments, including freshwater swamps, inland mangroves, montane forests, and other locations up to 1,700 meters in elevation [25].

(A)

(B)

(C) (D)

(E) (F)

Fig 1: (A) Entada seeds (B) stem bark and stem transverse section (C) Entada leaves and fruit (D) Entada flower (E) Entada vines (F) Entada fruit

Distribution

It is indigenous to Bangladesh, the Bismarck Archipelago, Borneo, Caroline Islands, China South-Central, China Southeast, Cook Islands, East Himalaya, Fiji, Hainan, Hawaii, Japan, Jawa, Lesser Sunda Islands, Maluku, Marianas, Marshall Islands, Nansei-shoto, Northern Territory, Philippines, Phoenix Islands, Queensland, Samoa, Santa Cruz Islands, Solomon Islands, South China Sea, Sulawesi, Sumater [26].

The plant grows in the monsoon forests of the Western and Eastern Ghats, in Sikkim, in Assam, Bihar, and Orissa, and across the sub-Himalayan tract from Nepal eastwards up to 4,000 ft. It is also common in the Andaman Islands [25].

Uses

- Dry vine material decoction is said to be effective against rheumatism, back, leg pain, sprains, and contusions [27-30].
- Seeds when taken orally with water can cure jaundice and oedema due to malnutrition.
- For abdominal pain and colic, the crushed kernels of the seeds can be mixed with oil and applied as a poultice to the affected area.
- The paste of seeds is used as a counterirritant and applied to swollen hands, feet, joints, and glandular swellings in the axilla, loins, and hands [27-30].
- It is also employed as a stimulant for hair growth. As an emetic, seeds are utilized. It functions as a febrifuge.
- In South Africa, young children chew on seeds while they are going through the teething process.
- It is utilized as a treatment for cerebral haemorrhage as well.
- The afflicted area is cleaned with the decoction of Entada phaseoloides bark to relieve skin itchiness [22].
- A macerated stem in cold water is used as both a cleaning agent and an emetic [12].

Edible uses

- Young leaves are consumed in the Dutch Indies either fresh or cooked [34].
- The seeds are consumed in Bali and Sumatra after undergoing certain processing.
- The seeds and ash are continuously boiled by Nepalese tribes until the boiling water stops changing color after which the finished product is held overnight in a river's swift current [36].
- In South Africa, seeds and pods are used as a replacement for coffee [31].
- From the seed, edible oil can be produced.
- Fresh leaves are consumed as a vegetable.
- The sap that emerges from the pruned branches is consumed as a drink [34, 35].

Folkloric uses

- Bark juice is used for conjunctivitis in the Philippines. The area with the itch is cleaned with a decoction of the bark; the stem can be used as an emetic and make a washing soap by macerating it in cold water. To treat colic, stomachaches, and other conditions, seed kernels are crushed and used topically [15].
- In Dinalupihan, Bataan, Ayta people used pounded stems as soap to treat dandruff and heal wounds [27].
- A decoction made from dried vine components is used to treat contusions, sprains, and rheumatic leg discomfort [15].
- For jaundice and oedema brought on by malnutrition, take 3 to 9 grams of powdered seeds orally with water.
- For abdominal aches and colic, crush the seed kernels, combine them with oil, and apply them as a poultice to the affected area [12].
- Counterirritant: to treat glandular swells in the axilla, loins, joints, and swollen hands and feet, make a paste from the seeds.
- Used as a stimulant for hair growth [31].
- For Emesis, seeds are used. It is utilized as a febrifuge as well.
- Seed paste was administered to hand and foot swelling brought on by overall weakness, pain in the loins and joints, and inflammatory glandular swelling in the axilla.
- Seeds are used to wash hair.
- In Samar, water mixed with pounded bark is used as a bath soap or shampoo for dandruff. The bark is also used for head lice [37].
- In South Africa, seeds are utilized as teething toys for young children. It is utilized as a treatment for cerebral haemorrhage as well [37].
- In India's Tripura for the treatment of jaundice, a paste of root bark is ingested with water in small doses [39].

Other uses

- Hair the Philippines and other Asian nations use this extensively for washing hair. Moreover, it is a component of hair tonics. The bark is soaked in water until it becomes pliable, the fibres are distributed, and the juice is then produced by rubbing the fibres together until they lather, the lather is then used to wash the scalp. The gogo-prepared liquid is extremely abrasive and unpleasant to the eyes. Seeds are also used to wash hair [40].
- Poison it is a fish poison.
- Large pods and seeds are utilized by kids as playthings and for crafts. Further, it is used to create necklaces.
- Wood-bark is used as cordage. In Europe, it is used to make matchboxes and as tinder.
- Fatty oil made from the seeds is used as an illumination source in the Sunda Islands [40].
- Snuff it is said that seeds are used for snuff in Europe [41].
- Shampoo a component of the herbal shampoo Lauat (Lawat/Litsea glutinosa, Gugo/ Entada phaseoloides, virgin coconut oil [40].
- Seeds are used to make traditional rosaries in Manipur, India]37].

Phytochemistry

E. phaseoloides produce saponins that are reported to be abundant in bark, less in wood and more in seeds than in leaves [12]. A crystalline saponin isolated from the seed nucleus of *E.phaseoloides* has the tentative empirical formula $C_{45}H_{82}O_{27}$. Acid hydrolysis produces crystalline sapogenin, evidently $C_{30}H_{48}O_5$ identical to entagenic acid, along with arabinose and xylose [42].

Entadamide A [43] and Entadamide B, **(47)** two novel sulfur-containing amides isolated from the seeds of the *E. phaseoloides* were synthesized by the addition of methanethiol to propiolic acid, followed by condensation with ethanolamine with the use of dicyclohexylcarbodiimide. These compounds inhibited 5-lipoxygenase activity of RBL-1 cells at 10^{-4} g/ml. this finding suggests that entadamide A and B may be examples of a new type of anti-inflammatory drug. **(31)** Entadamide B was spectroscopically characterized as N-(2-hydroxyethyl)-3,3-bis (methylthio) propanamide and was synthesized in two steps from propiolic acid.**(48)** A third new sulfur-containing amide, entadamide C, was isolated together with entadamide A from leaves of *E.phaseoloides*. The sulfoxide form of entadamide A, entadamide C, is marked as (R)-(+)-trans-N-(2-hydroxyethyl)-3-methylsulphinylpropenamide. The chemical synthesis of (±)-entadamide C from propioloc acid was achieved in three steps [49].

Three new compounds, 2-hydroxy-5-butoxyphenylacetic acid, 2-β-D-glucopyranosyloxy-5-butoxyphenylacetic acid, entadamide A-β-D-glucopyranoside, a new natural product 2,5-dihydroxyphenylacetic acid methyl ester isolated and characterized from seeds of *E.phaseoloides* collected in Indonesia [50].

The structure of phaseoloidin isolated from seeds of *E.phaseoloides* was determined to be homogentistic acid 2-O-β-D-glucopyranoside by chemical and spectral means [51].

The 1-BuOH-soluble fraction of an H_2O extract of kernel nuts of *E.phaseoloides* (L.) Merrill yielded one novel and one recognized sulphur-containing glucoside from a MeOH extract, as well as four new triterpene saponins having N-acetylglucosamine in their sugar chains [52].

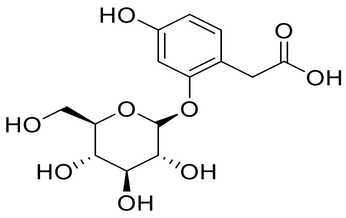
Two novel chalcone glycosides- 4′-O-(6″-O-galloyl-β-D-glucopyranosyl)-2′, 4 dihydroxychalcone and 4′-O-(6″-O-galloyl-β-D-glucopyranosyl) 2′-hydroxy-4-methoxychalcone along with a known chalcone 4′-O-β-d-glucopyranosyl-2′-hydroxy-4-methoxychalcone have been identified, were both extracted from the stems of *E.phaseoloides*. On the basis of in-depth spectroscopic analysis, including HSQC (heteronuclear single quantum correlation spectroscopy), HMBC (heteronuclear multiple bond correlation spectroscopy), ^{1}H, ^{1}H COSY (^{1}H, ^{1}H correlation spectroscopy), and chemical evidence, the structures of the new compounds were clarified. It was the first time chalcone-type compounds from the *Entada* genus had been reported. **(53)**

Most of the unigenes related to triterpenoid saponin backbone biosynthesis were specifically upregulated in the stem. A total of 26 cytochrome P450 and uridine diphosphate glycosyltransferase candidate genes realted to triterpenoid saponin biosynthesis were identified [54].

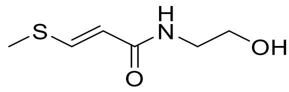
There have been reports of isolated chemicals from the seeds and stems of *E.phaseoloides*, including quercetin, luteolin, apigenin and dihydrokaempferol [44].

By using HPLC, 7 phenolic compounds were discovered including gallic acid, protocatechuic acid, 4-hydroxybenzoic acid, quercitin, luteolin, kaempferol and apigenin [45, 46].

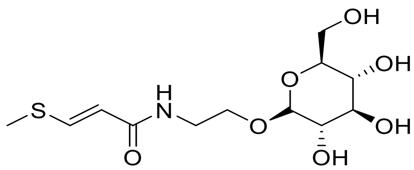
Structures of isolated constituents



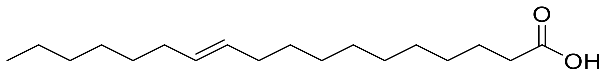
PHASEOLODIN



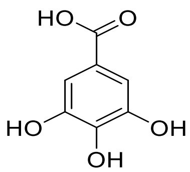
ENTADAMIDE A



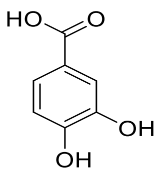
ENTADAMIDE A BETA D
GLUCO PYRANOSIDE



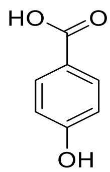
OLEIC ACID



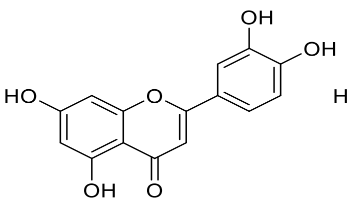
GALLIC ACID (**1**)



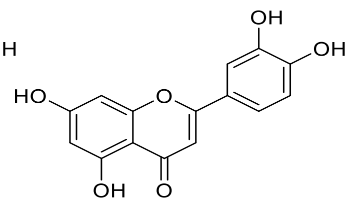
PROTOCATECHUIC ACID (**2**)



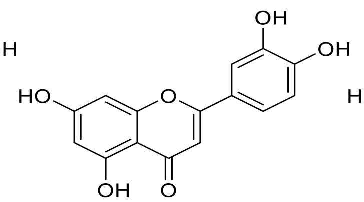
4-HYDROXY BENZOIC ACID (**3**)



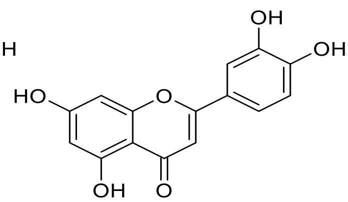
LUTEOLIN (**4**)



QUERCETIN (**5**)



KAEMPFEROL (**6**)



APIGENIN (**7**)

Pharmacological activities

Anti-arthritic activity

Rheumatoid arthritis and osteoarthritis are the two most prevalent types of arthritis. Inflammation and functional limitation are the primary symptoms of all forms of arthritic pain. Arthritis is a fairly prevalent clinical disorder affecting both sexes and all ages, the effects of two formulations of *E.phaseoloides* seeds following topical treatment in “monoidoacetate-induced osteoarthritis” in rats were investigated. Anti-inflammatory medications, such as NSAIDs, corticosteroids, disease-modifying anti-rheumatic medicines, etc., are used to treat symptoms, but they frequently have side effects that are just as challenging to deal with as the disease itself. New methods of treating these people are thus required. In a rat MIA (monoiodoacetate-induced osteoarthritis) model, the effects of two preparations of EP (*Entada phaseoloides*) seeds applied topically were investigated. Both paste and ointment formulations of EP were administered to 32 animals weighing 150-200g, divided into four groups: (I) vehicle, (II) EP paste, (III) EP ointment, and (IV) Diclofenac ointment was rested in wistar rats. Osteoarthritis was induced by intra-articular injection of 50 µl of MIA solution. Drug treatments were administered topically for 14 days per group. Animals were observed for joint inflammatory and locomotion. General histopathology was examined and evaluated. Left knee swelling and redness were observed in all rats within 24 hours and subsided gradually. Lame to gait and joint knee capsule thickening were observed only in control rats. Histopathologically, osteoarthritic changes were significantly less in the drug-treated group compared to the control group. As a result, both formulations of EP were found to be effective in preventing joint damage [54].

Anti-ulcer activities

The anti-ulcer efficacy of the *E.phaseoloides* ethanol extract against aspirin plus pylorus ligation, HCl-ethanol, and water immersion stress-induced stomach ulcers in rats, mice, and humans were evaluated. All of the models showed anti-ulcer efficacy that was statistically significant ($p > 0.001$). Gastric secretion volume, free acidity, total acidity, and ulcer index were used to measure anti-ulcer activity. Steroids, saponins, and alkaloids tested positively in the *E.phaseoloides* preliminary phytochemical screening. According to the findings, *E.phaseoloides* have antiulcer activity [55].

Anti-inflammatory and analgesic activities

The saponin from *E.phaseoloides* seed kernels was particularly discovered to have substantial efficacy against Walker 256 carcinosarcoma in rats, according to several prior experimental models. [56] *E.phaseoloides* saponins were isolated from this plant and were found to have a significant anti-inflammatory effect. The anti-inflammatory activity of saponin was explained in the study of methanolic extract of *E.phaseoloides* seeds in animal models of inflammatory where the LD_{50} was found to be more than 5000 mg/kg in acute oral toxicity testing. The extract inhibited acetic acid induced writhring dose dependently (40, 80, and 120 mg/kg) but was found inactive in reducing the pain produced by thermal injury. The results indicated that the extract possesses weaker acute but strong sub-acute anti-inflammatory activity and strong peripheral analgesic activity [57].

In another study of the anti-inflammatory effects of topical application of various formulations of EP *(Entada phaseoloides)* seed pulp, local inflammatory reactions occurred within 24 hours in all rats. In the control group, the swelling did not subside even after 21 days. Both EP formulations showed significant (P< 0.001) anti-inflammatory activity compared to controls. *E.phaseoloides* ointment was more effective than Diclofenac sodium by day 21. Both formulations of *E. phaseoloides* were found to have anti-inflammatory effects, but the paste was much more effective than Diclofenac sodium [58].

Anti-diabetic and hypolipidemic activities:

The TSEP (Total saponin from *Entada phaseoloides*) was reported to dramatically reduce the fasting blood glucose and serum insulin levels in T2DM (Type 2 diabetes mellitus) rats. Further investigations revealed a possible anti-inflammatory effect by representing chronic inflammation responses. Its effects were comparable to metformin. Investigations revealed a possible anti-inflammation effect by examining serum levels of IL-6 (interleukin-6), TNF-α (tumor necrosis factor-alpha) and CRP (C- reactive protein) [59].

In another experimental model, the anti-diabetic effects of AcOEt (Ethyl acetate), Pet ether (Petroleum-ether) and Chloroform fractions were investigated from the methanolic extract of seeds of *E.phaseoloides* in AIDM (alloxan induced diabetic mice). The effect of these fractions (200 mg/kg body weight i.p) was observed on FBG (fasting blood glucose) level and active fraction was further investigated for its dose dependent activity (250 mg/kg and 350 mg/kg body weight) on fasting blood glucose level and also on TC (total cholesterol), TG (triglyceride), SGOT (serum glutamate oxaloacetate transaminases) and SGPT (serum glutamate pyruvate transaminases) level in AIDMS which showed significant effects. The most significant reduction of FBG level of around 72.02% was observed for Et-Ac fraction in AIDM [60].

Anti-complement and anti-microbial activities

Seventeen Flavanoids isolated from extracts of *E.phaseoloides* strains have anti-complement activity (both classical and alternative pathways) and gram-positive MSSA (methicillin-susceptible staphylococcus aureus), MRSA (methicillin-resistant staphylococcus aureus), based on antibacterial activity against enterococcus and bacillus subtilis Gram negative bacteria (E.Coli, pseudomonas aeuroginosa), and the yeast-like pathogen candida albicans. In anti-complement studies, isolated quercitin, luteolin, apigenin, galangin, 5,2’,5’-trihydroxy-3,7,4’-trimethoxyflavone-2’-O-β-D-glucoside dose-dependent activity was demonstrated among (+)-3,3’,5’,5,7-pentahydroflavanone, (+)-dihydroxy-kaempferol, (-)-epicatechin, (+)-catechin, naraingenin, 5,7,3’,5’-tetrahydroxyflavone, and antibacterial results show that quercitin, 5,7,4’-trihydroxy-3’-methoxyflavanol, and galangin are associated with MRS, MSSA and enterococci, whereas luteolin and rhamnocitrin inhibited only MRSA and MSSA [61].

Anti-oxidant and cytotoxic activities

In the DPPH (1,1-diphenyl-2-picrylhydrazyl) assay, the crude extract of bark and its chloroform and aqueous soluble fractions demonstrated strong anti-oxidant properties with IC50 of 3.24, 1.55 and 3.6 µg/ml, respectively whereas all the fractions of seed extract revealed mild antioxidant activity. The hemolysis of the RBC in rat blood was, however, decreased by crude extracts of seed and bark that were soluble in petroleum ether by 78.89% and 57.43% respectively as opposed to the 84.44% effect of acetyl salicylic acid (0.10 mg/ml). With MIC (minimum inhibitory concentration) and MBC (minimum bacterial concentration) values of 7.81 mg/ml and 125 mg/ml respectively, in antimicrobial screening, the carbon tetrachloride soluble fraction of bark demonstrated significant antimicrobial activity against staphylococcus aureus (zone of inhibition= 17.0 mm) [62].

Anti-toxicity activities

The effects of raw and processed products of *E.phaseoloides* on gastrointestinal motility in mice were investigated by small-intestinal charcoal propulsion and gastric emptying methyl-orange colorimetric methods to observe acute toxicity. The oral LD_{50} in mice for raw *E.phaseoloides* and two processed products of *E.phaseoloides* was 27.17 g/kg, 35.13 g/kg and 42.18 g/kg body weight, respectively. Raw and processed products of *E.phaseoloides* can significantly enhance normal mouse intestinal motility and counteract atropine-induced depressive state, but have no effect on neostigmine-induced hyperactivity. High, medium, low dose groups showed significant inhibition of gastric emptying in normal mice. Processed *E.phaseoloides* can affect intestinal propulsion in normal and depressive mice and inhibit gastric emptying in normal mice, but the safety was superior to raw *E.phaseoloides* [63].

Anti-photo toxicity effect

Effects of isolated and/or conventional AE (acetone extract of *E.phaseoloides* leaves) chemicals on human keratinocytes resistance to phototoxicity (HaCaT cells) were studied. The anti-inflammatory effects of protocatechic acid, epicatechin, and kaempferol from AE were demonstrated, together with enhanced COX-2 and iNOS gene expression. Additionally, epicatechin and protocatechuic acid may significantly improve cell migration during wound healing. The studies suggest kaempferol, epicatechin and procatechuic acid as possible anti-photoaging agents [64].

Neuroprotective activity

The radial arm maze model was used in the study to assess the protective effects of crude extract from seeds in boosting cognition in scopolamine-induced learning and memory deficits. Escape delay and reference memory error significantly lowered after MEEP treatment. In rat hippocampal region, MEEP praised scopolamine-induced hyperactivation of acetylcholinesterase activity as well as upregulation of the proteins NF-kB p65 BAX and caspase-3. The findings point to the possibility of *E.phaseoloides* seeds as a therapy for cognitive impairemet [65].

Wound healing

In a rat wound infection model, a study assessed the impact of total tannins on the wound healing process. By using the MTT assay and a scratch test, the effect on fibroblast migration and proliferation in NIH3T3 mice was assessed. The extract produced a 76.18% overall tannin content. According to the findings, TEPT accelerated the healing of infected wound in rats [66].

Anthelmintic activity

Entada phaseoloides and *Erigeron linifolius* plant extracts were tested for their ability to treat goat gastrointestinal helminthes. Results demonstrated that *Haemonchus contortus* and *Fasciola gigantica* parasites were successfully repelled by both plant extracts, either alone or in combination. The action was dose-dependent, with 3000 g/ml showing the best efficacy [67].

Conclusion

Drug discovery has used medicinal plants as a significant source of lead molecules. Worldwide, indigenous groups have employed *Entada* species to treat a wide range of illnesses. *Entada phaseoloides* offer a wide range of ethanobotanical applications based on different patterns of secondary metabolites, with saponins, diterpenes, triterpenes and phenolic compounds being the most common ones. Phenolic compounds, saponins, diterpenes, and triterpenes have been reported to contribute to the pharmacological properties of *Entada phaseoloides* such as anti-inflammatory, anti-diabetic, anti-tumor and analgesic activities (saponins); anti-complementary, anti-bacterial, antioxidant (phenols); anti-ulcer, anti-toxic, in addition to molluscicidal activity.

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