

A REVIEW ON UPODIKA (*BASELLA RUBRA* LINN.) – AN AYURVEDIC NUTRACEUTICAL WITH ENORMOUS MEDICINAL VALUE

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ABSTRACT

Basella rubra Linn. is a plant of the family Basellaceae, generally known by names such as malabar spinach, indian spinach, ceylon spinach and vine spinach. It is widely accepted as nutritional vegetable and grown generally in the tropical regions of the world. In India it is widely grown as pot herb. Different studies have proved that the plant is rich in vitamin A, vitamin C, flavonoids, saponins, carotenoids, many amino acids, organic acids, calcium and iron,. It was used to treat large number of human ailments as mentioned in various Samhitas and Nighantus. Major biological activities exhibited by *Basella rubra* is

androgenic, antiulcer, antioxidant, cytotoxic, antibacterial activity, anti-inflammatory, central nervous system (CNS) depressant activity, nephroprotective, antidiabetic, antimicrobial, antiviral, hepatoprotective, sleep inducing and wound healing properties. Besides these activities, the plant possess a valuable ethnomedicinal importance .It nourishes, makes the body stout, purifies blood, rejuvenates and acts as aphrodisiac. Adding it to regular diet would help in preventing weakness of bones, anemia, cardiovascular diseases ,cancers of colon and constipation, Traditionally, it is used in treating mouth ulcers, wound, inflammation, urticaria, anemia, malnutrition, insomnia, cracked feet, piles, bleeding disorders, cancers etc.

KEYWORDS:- *Basella rubra*, Basellaceae, Biological activity, Ethnomedicinal importance.

INTRODUCTION

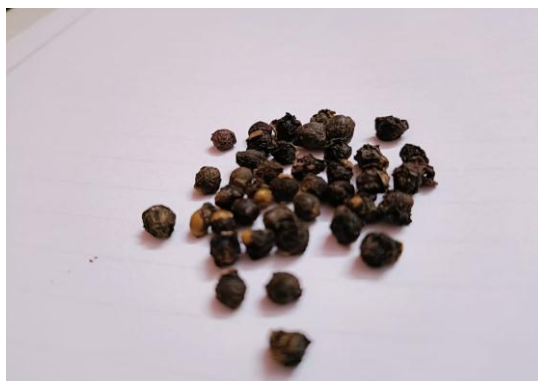
Traditional medicine can be defined as application of health practices, knowledge and beliefs via using plants, animals and mineral based medicines, therapies, manual techniques and

exercises, either singularly or in combination to treat, diagnose and prevent illnesses or maintain well being. Medicinal plant refers to any substance having properties that can be used for therapeutic purposes or as precursors for the synthesis of various drugs. Medicinal plants various biologically active compounds such as carbohydrates, proteins, enzymes, fats and oils, minerals, vitamins, alkaloids, terpenoids, carotenoids, sterols, phenols, glycosides, tannins, saponins, etc. Over the years, Traditional medicine is undoubtedly a reliable alternative approach to healthcare delivery in the metropolis because it is cheap, easily accessible, efficacious and offers a natural way to treat numerous human ailments. The majority of rural dwellers do not have access to modern health care, so they mostly depend on medicinal plant to prevent or eliminate diseases. Thus, there is need to incorporate medicinal plants and herbal remedies as potential sources of new drugs. Despite the availability of millions of chemically synthesized drug for a number of diseases; the natural products of plant origin has remained the most important and valuable source of new drugs. One such medicinal herb is *Basella rubra*.

Basella rubra L. (Basellaceae), commonly known as Indian or Malabar spinach belongs to family Basellaceae, is an herbaceous annual or biennial climbing herb found in tropical and sub-tropical areas. It is a succulent, branched, smooth, twining herbaceous vine, several meters in length. Stems are purplish or green. Leaves are fleshy, having ovate or heart-shape, length of 5 to 12 cms, stalked, tapering to a pointed tip and a cordate base. Fruit is fleshy, stalkless, ovoid or spherical, 5-6 mm long, and purple when mature and contain only one seed. The seeds are round or oval shaped and black in color. The flowers are pink.^[1] Due to easy adaptation to a variety of soils and climates Malabar spinach is considered one of the best tropical spinach throughout the tropical world.^[2] It is one of the wild leafy vegetables, which is rare in its natural habitat^[3] but nowadays it is an important leafy vegetable grown for its nutritive value^[4] throughout the temperate regions as an annual and the tropics as a perennial.^[5] Almost in every part of India, *Basella* is grown as a pot herb.^[6]

***Basella rubra* plant**



***Basella rubra* seeds****MATERIALS AND METHODS**

This paper includes the evidence-based overview of pharmacological and phytochemical properties and ethnobotanical uses of the *Basella rubra*, which may be helpful to establish a standard natural drug for further research. The present article provides Review on *Basella rubra* Linn. Collecting information on the various pharmacological studies conducted till date.

TAXONOMICAL CLASSIFICATION

Details	Upodika
Kingdom	Plantae
Division	Tracheophyta
Subdivision	Spermatophytina
Class	Magnoliopsida
Superorder	Caryophyllanae
Order	Caryophyllales
Family	Basellaceae
Genus	<i>Basella</i> Linn.
Species	<i>Basella rubra</i> Linn.

VERNACULAR NAMES

English Name - Indian spinach, Malabar spinach, Ceylon spinach, Vine spinach; Sanskrit Name – Pothaki, Upodika, Maalava; Hindi name - Poya, pol, Lalbachlu; Bengali Name - Poome, Puishaka; Marathi Name - Maayala, Velbendi, Mayalu; Gujarati Name - Pothi, poi-mopal; Kannada Name - Basale soppu; Tulu Name-Basale; Telugu: bachhali; Malayalam Name- Vasalaccira, Cheera, Vallicheera; Tamil Name -Basalakira, Vasalakkirai, Kodip pasalai, Kodip pasali; Konkani Name - Valchi bhaji; Manipuri Name - Urok Shumbal; Oriya- Poi saga; Chinese - Lo kwai, Luo kai Chan cai; Spanish-espnaca de Malabar; Mexican-espinaca.china; Japanese-tsurumurasaki; French-baselle; German-indischer spinat;

Portuguese: Bertalha,; Filipino: Alugbati,; Sinhalese: VelNiviti (Sudu),; Danish: indisk spinat,; Dutch: ceylonspinazie; Indonesian: gondola; Italian: spinacio della cina; Javanese: jingga; Kikuyu: murerema; Nepalese: poi saggi; Swedish: indisk spenat,; Thai: phak plang,; Turkish: pazu; Vietnamese: mong toi.

SYNONYMS

Pothaki, upodika, Maalava, Matsyakaali, Phalambika, Vrinthaka, Turangi, Kantaki, Madaghni Chichila, Vrinta madalika.

GEOGRAPHICAL DISTRIBUTION

Basella rubra Linn. Belonging to the family Basellaceae, is widely distributed in the tropics and often cultivated in warm temperate areas of both the eastern and western hemisphere. Watt stated that it is cultivated in almost whole of India, especially in lower Bengal and Assam where it is an important part of diet. In Bengal almost every village has a hedgrew of it, the succulent leaves and stems are used as a pot herb by all classes.^[7]

According to Burkhill, *Basella rubra* Linn. is grown throughout Malaya and used as pot herb. Its leaves are used to poultice sore in both India and Malaya. The laxative property of the plant is used for treating constipation in children in Indonesia. It is considered as food plant in the Philippine, and boiled and eaten like spinach. It is cultivated extensively by Chinese gardener and is on sale in Manila market throughout the year. The white variety had been introduced into Fiji shortly before 1956. It has been also reported from Ethiopia, Mozambique, Sierra and Camroons.^[7]

BASELLA RUBRA IN AYURVEDIC TEXTS

CLASSICAL CATEGORIZATION

Basella rubra (Upodika) is mentioned in different ayurvedic texts in following vargas:-

1. Charak Samhita- Shaka varga
2. Shushrut Samhita- Shaka varga
3. Ashtang Samgraha- Shaka varga
4. Ashtang Hridaya- Shaka varga
5. Bhavaprakasha Nighantu - Shaka varga
6. Kaiyadeva Nighantu - Aushadhi varga
7. Raja Nighantu-Moolakadi varga
8. Shodala Nighantu - Guduchyadi varga

Ayurvedic Pharmacodynamics^[8]

Rasa -Madhura

Guṇa – Snigdha, Sara, Balyaa

Virya - Shita

Vipaka- Madhura

Effect on dosha- Vataghna, Pittaghna, Kaphakara action

Organoleptic character^[9-10]

Sparsh (Touch)-Snigdha (smooth)

Rupa (Apperance) – Dark green

Rasa (Taste) Madhura

Gandha (Smell)-No particular smell

Medicinal qualities^[11]

Akanthya- not good for throat

Picchila- Slimy and sticky in nature

Nidrada - Improves sleep

Shukrada - Increases semen

Raktapittajit -Relieves bleeding disorders

Balada - Increases strength

Ruchikrit- Improves taste

Pathya- Conducive to body and mind

Triptikaarini - Causes satisfaction

Brumhana- Nourishing in nature

PHYTOCHEMISTRY AND CHEMICAL CONSTITUENTS

Basella rubra Linn. is a rich source of nutrients and minerals. Sheela et al., (2004) have analyzed macronutrients composition of *Basella rubra* on dry weight basis and mentioned that the plant contains carbohydrate = 0.4g., energy = 31kcal., fat = 1.9g, fiber = 0.3g., moisture = 93% and protein = 3.3 g, while the micronutrient composition and oxalic acid content were ascorbic acid = 15mg., calcium = 187mg., iron = 5.45mg., and oxalic acid = 60 to 84mg. per 100g of edible portion.^[12]

S. No.	Plant Part	Chemical constituents	References
1	Leaves	flavonoids (133.1±26.2 mg QC /100 g FM), β- cyanin and 7, 4'- di- ortho methyl kempferol., in β carotene and vitamin A ¹⁷ , βsitosterol and stigmasterol glucoside	[13,14]
2	Flower	phenolic compounds (269.0±3.1mg GAE/100 g FM) such as Rutin, Quercetin, Scopoletin, Coumarin, β-xanthin and β- cyanin pigments and Caffeic-, Homo-protocatechuic-, Chlorogenic-, trans- and cis-p-coumaric-, phydroxy-benzoic-, phloretic-, trans- and cissinapic-, cinnamic-acids	[1]
3	Fruit	β-cyanin(betanidin monoglucoside), gomphrenin I, gomphrenin II, and gomphrenin III, 4-coumaroyl and feruloyl , isogomphrenin I and II ³¹	[15]
4	Seeds	oils (36.9%), fatty acids (50.3%), linoleic acid (49.1%) and protein (23.1%) ¹⁸	[16]
5	Calluses	anthocyanin	[17]

Lola A. (2009) has studied the fat content of raw *Basella rubra* which was about 0.30%.^[18] Oladele and Aborisade (2009) have evaluated the influence of different drying methods and storage on the quality of *Basella rubra*. They observed significant reduction in Ca, Mg, Na, Fe, Mn and Zn during drying and storage.^[19] Basella fruit dye Mell (1937) isolated the purple dye from the *Basella* plant.^[20] Cao et al., (1991) extracted a red pigment from the fruit of *Basella rubra*.^[21] Mundo et al., (1995-96) reported that the stain obtained from *Basella rubra* fruit pulp can be used as a substitute for crystal violet or safranin in the Gram staining and as a biological stain for plant nuclei and organelles.^[22]

BIOLOGICAL AND PHARMACOLOGICAL ACTIVITIES

Antibacterial activity

Basella rubra leaves on performing cup plate diffusion method shown that aqueous, ethanol and petroleum ether extracts of the leaves exhibited antibacterial activity against *E. coli*, *Vibrio cholera*, *Staphylococcus aureus* and *Staphylococcus typhi*.^[23]

Antiulcer activity

The gastric ulcers in the rats were induced by giving the treatment of ethanol and pylorous and then the treated animals were fed with aqueous extracts of *Basella rubra* leaves. It was found that, the treatment of *Basella rubra* aqueous leaf extract in the ratio of 10mg/kg and 20mg/kg had significant and dose dependent antiulcer activity.^[24]

The aqueous extract of *Basella rubra* Linn. possesses significant and dose dependent anti-ulcer and cytoprotective effects. The aqueous extract of *Basella rubra* Linn. has demonstrated antiulcer activity and leaves masticated kept in mouth helped relief aphthae.^[25]

Activity on Kidney and Liver

Basella rubra aqueous leaf extract in Wistar albino rats is studied and evaluated on the basis of various parameters of kidney and liver. The Wistar albino rats of either sex were grouped into four groups. The first group was treated as control and fed with PBS (phosphate buffer saline) while second, third and fourth groups animals were orally administered with 300 mg/kg, 200 mg/kg and 100 mg/kg of aqueous leaf extracts respectively. All the rats were administered with a particular dose once a day for about two weeks. After that the animals were scarified using cervical dislocation, kidney and liver from animals were excised and used for further studies. It was observed that all the parts of the liver and kidney were well preserved which indicated that plant extracts had no adverse effects on the histology of kidney and liver in Wistar albino rats.^[26]

Haematological activity

The effects of aqueous and ethanol extracts of *Basella rubra* leaf extracts for the determination of haematological parameters of normal Swiss mice and amylase activity in Wistar rats were analysed. It was observed that the haematological parameters like WBC, RBC, Hb and PCV were significantly increased in the animals after got treated with the 100 mg/kg body weight (bw) of ethanolic extract. The biochemical parameters of serum for estimation of total bilirubin content were determined and it was reported that the animals treated with 200 (mg/kg body weight) aqueous extract and ethanolic extract of *Basella rubra* leaf had considerable increase in the bilirubin content. The amylase activity in experimental animals with three different extracts i. e. aqueous, ethanol and hexane in the ratio of 200 mg/kg body weight was also determined. After the proper treatment the animals were scarified and ana urine samples were analysed for determination of amylase activity which was found more in the animals treated with hexane extract. Thus the study supported the fact that the *Basella rubra* leaves, traditionally are used in the treatment of anaemia and also has hepatoprotective potential.^[27]

Hepatoprotective activity

The hepatoprotective activity of aqueous ethanol extracts of *Basella rubra* aerial parts was studied against carbon tetrachloride and paracetamol induced hepatotoxicity in rats. The

Wistar rats that were administered with carbon tetrachloride and paracetamol showed increase in activities of AST, ALT, and ALP with increase in serum bilirubin level which indicates development of hepatic injury. The increased activities and bilirubin level were significantly decreased and brought to the normal conditions when the intoxicated rats were fed with ethanol extract of *Basella rubra*. Depending on this study it was reported that the *Basella rubra* ethanol extract has a protective effect on improvement of the functional integrity of liver cells.^[28]

Antidiabetic activity in relationship with the antioxidant property

The hypoglycemic effect of aqueous leaf extract of *Basella rubra* with that of streptozotocin (STZ) in two months old male albino rats was studied. After a month of proper treatment all the experimented rats were scarified and the antidiabetic properties was analysed. The results reported that the rats treated with *Basella rubra* pulp significantly brought back the blood glucose level.^[29]

The antioxidant properties of plant leaf extract was studied and reported that the levels of liver enzymatic antioxidants such as catalase, superoxide dismutase, glutathione peroxidases and non enzymatic antioxidants like vitamin C, vitamin E and reduced glutathione significantly increased in the animals treated with the *Basella rubra* pulp. Thus the findings suggested that the plant has hypoglycemic and antioxidant properties.^[30]

The aerial plant parts of *Basella rubra* were lyophilized and homogenized into powder. Then various in vitro assays, such as DPPH, ABTS, reducing power, hydroxyl radical scavenging activity, superoxide radical scavenging activity and nitric oxide radical scavenging activity, metal ion chelating ability and peroxidation inhibition activity were performed to evaluate an antioxidant and free radical scavenging activities for aqueous, methanol and acetone extracts. It was observed that all the extracts shown reducing power and effectively inhibited hydroxyl radicals, nitric oxide radical and superoxide radical. Research explained that almost all the extracts exhibited a considerable amount of total phenolic content and vitamin C ranging from 31.1- 34.5 mg TAE/g and 39.5 – 42.8 mg AAE/g respectively. It was also concluded that aqueous extract showed total tannins about 10.3±4.7 mg TAE/g, while the flavonoids in maximum quantity were obtained in acetone extract about 16.9±1.6 mg RE/g.^[31]

Antifungal activity

Two novel antifungal peptides, designated α - and β -basrubrins, respectively, isolated from seeds of the *Basella rubra* Linn. α - and β -basrubrins exhibited a molecular weight of 4.3 and 5 kDa, respectively. The translation in a rabbit reticulocyte system with an IC₅₀ value of 400 and 100nM, respectively was inhibited by them. α - and β -basrubrin also inhibited HIV-1 reverse transcriptase by $(79.4 \pm 7.8)\%$ and $(54.6 \pm 3.6)\%$, respectively, at a concentration of 40 μ M, and $(10.56 \pm 0.92)\%$ and $(2.12 \pm 0.81)\%$, respectively, at a concentration of 40 μ M. Both α - and β -basrubrins exerted potent antifungal activity toward *Botrytis cinerea*, *Mycosphaerella arachidicola*, and *Fusarium oxysporum*. Neither α -basrubrin nor β -basrubrins exhibited DNase, RNase, Lectin protease activity, indicating that their antifungal action is not due to these activities. The heat shock protein-like peptide and serine–threonine kinase-like protein exhibited a molecular mass of 3 and 30 kDa, respectively. They inhibited neither translation in a rabbit reticulocyte system at concentrations up to 50 μ M nor HIV-1 reverse transcriptase activity at concentrations up to 400 μ M.^[32]

Anticancer activity

Fruit extracts of *Basella rubra* Linn. were investigated for their antioxidant and anticancer activities against human cervical carcinoma (SiHa) cells. The fruits were contained with total betalain contents of 0.34 g/100 g fresh weight and 1.9 g/100 g dry weight. Betanin, isobetanin and gomphrenin I were identified as the major pigments along with Phenolic compounds. Both water and aqueous methanol extracts of fruits exhibited significant free radical scavenging potential and ferric reducing antioxidant power. Fruit extracts at 50 mg/mL showed strong (81%) cytotoxic activity against human cervical carcinoma cells. Thus, fruit extracts have potential application for cancer treatments and as nutraceutical or dietary supplements.^[33] The plant and leaves are ground with sour buttermilk and salt for preparing a poultice and which is indicated for arbuda.^[34]

Antioxidant activity

The investigation of antioxidant activity of two species of leafy vegetable *Basella* was done. The leaves of *Basella* are low in calories (95–110/100 g) and fats, but rich in vitamins, minerals, and antioxidants. The EC₅₀ values in BAW extract (3.4 mg/mL) were high for DPPH radical scavenging activity. BAW extract (1.04) at 50mg/mL reported high ferric reducing antioxidant power and least in BAM extract. Various extracts from leaves with different constituents were shown dose dependent antioxidant and high scavenging abilities

which play a key role in combating the reactive oxygen species.^[35] Methanolic extracts of all leafy vegetables tested shown antioxidant activity. The tested leafy vegetable reported better oxidative activity at 200µg/ml concentration at all temperature. To conclude leafy vegetables infers a protective radical scavenging activity which exhibit dose dependant stability irrespective of temperature and it shows substrate specificity.^[36] When fruit flesh was extracted with 80% methanol (containing 0.2% formic acid) and subjected to solid-phase extraction, semi preparative HPLC isolation, mass spectrophotometric analysis, and structural elucidation. The major red pigment known as gomphrenin I, whose quantity increased with the increase of fruit maturity. The gomphrenin I extract yield from ripe fruits was 36.1 mg/100 g of fresh weight. In addition to gomphrenin I, betanidin-dihexose and isobetanidin-dihexose were also detected. The antioxidant activities of gomphrenin I determined by Trolox equivalent antioxidant capacity (TEAC), α,α -diphenyl- β -picrylhydrazyl (DPPH) radical scavenging activity, reducing power, and antioxidative capacity assays were equivalent to 534 µM Trolox, 103 µM butylated hydroxytoluene (BHT), 129 µM ascorbic acid, and 68 µM BHT at 180, 23, 45, and 181 µM, respectively. Gomphrenin I act as a principal pigment of *Basella alba* fruits and a potent antioxidant and inflammatory inhibitor. These findings suggest that *Basella alba* fruit is a rich source of betalains and has value-added potential for use in the development of food colorants and nutraceuticals.^[37] EtAc extract showed moderate radical scavenging activity in the DPPH assay. The crushed leaves and the flowers juice of both species have been used against skin inflammations and the most active extracts of the plants are likely to be the aqueous extracts. For instance, the aqueous extract of *Basella rubra* has demonstrated antiulcer activity and leaves masticated kept in mouth helped relief aphthae. Therefore, in order to obtain a higher level of pharmacological activities of *Basella alba* and *Basella rubra*, an aqueous extraction could be of interest for further investigation.^[38]

Antiviral activity

Verma et al., (1995) reviewed antiviral activity of many plant tissues.^[39] This property is due to the presence of ribosome inactivating proteins (with single chain (type I) or two chains (type II)) present in the extracts of plant tissue.^[40] Bolognesi (1997) isolated type I RIPs from the seeds of *Basella rubra* and tested them for inhibiting infection of *Nicotiana benthamiana* by AMVC.^[41] Liu et al., (2006) studied that the early inoculation of *Basella rubra* extract on tobacco plant showed inhibitory effects against tobacco mosaic virus.^[42] Dong et al., (2012) reported structures of acidic polysaccharides from *Basella rubra* and their effects on herpes simplex virus type.^[43]

In vivo-two pectin-type polysaccharides BRP-2 and BRP-4 obtained from *Basella rubra* linn were found to exert potential anti-HSV-2 effects in vitro mainly by interfering with the absorption of virus to host cells. The most abundant pectin-type polysaccharide BRP-4 exhibited a high therapeutic efficacy in the mouse model, when intravaginally infected with HSV-2, as observed from the severity of herpetic lesions, the survival rate of mice and virus shedding. On the other hand, orally administered BRP-4 resulted in moderate therapeutic efficacy against IFV based on virus yields in the mice. Moreover, BRP-4 stimulated the production of neutralizing antibody and the secretion of mucosal IgA in IFV-infected mice in spite of less antigens (viruses), implicating an attribution to the protective effect of oral administration of BRP-4 on IFV.

Cai-Xia studied on four neutral polysaccharides (BRN-1, BRN-2, BRN-3 and BRN-4) isolated from the hot water extract of the aerial part of *Basella rubra* Linn. They were found to consist of a large amount of d-galactose (81.0–92.4%) and small amounts of l-arabinose (5.4–7.8%), d-glucose (2.2–11.0%) and mannose (~2.9%). Linkage analysis showed that all these neutral polysaccharides might be arabinogalactan type I polysaccharides with different molecular weight and chain length. Among them, only BRN-3 showed antiviral activity against herpes simplex virus type 2 (HSV-2) with 50% inhibitory concentration of 55 µg/mL without showing the cytotoxicity up to 2300 µg/mL. Furthermore, the main antiviral target of BRN-3 was shown to be the inhibition of virus adsorption to host cell.^[44]

Antimicrobial activity

In vitro antimicrobial activity of methanolic extract of *Basella alba*, *Basella rubra* leaves and *Muntingia calabura* was studied. The extracts showed significant antimicrobial activity against gram positive and gram negative bacteria and fungi. *Basella rubra* showed mild inhibitory activity against *Staphylococcus aureus*, *Basella alba* showed good inhibitory activity against *Aspergillus niger*.^[45]

Immunomodulatory activity

BRP-4, polysaccharide isolated from *Basella rubra*, reported to activate macrophage function and stimulate splenocyte proliferation. The strong immunomodulatory activity of BRP-4 confirmed its good potential as an immunotherapeutic adjuvant.^[46]

Urticaria

The extracted juice is applied directly on the infected skin. The crushed leaves are mixed with cheese and it is then applied on the burnt places.^[47]

ETHNOBOTANICAL USES OF *basella rubra* L.^[72]

Sr. No.	Plant part used	Applications/ uses	References
1.	Whole plant	Used in ethnoveterinary for treatment of retained afterbirth, anaplasmosis, gonorrhea and balanitis. The aerial parts such as the leaves, stems and young shoots with buds are consumed as a vegetable and health food.	[48,49]
		Decoction is used as safe aperients for pregnant women to alleviate labour.	[50]
		Maceration is used to cure prolapsed hernia (invagination of the rectum).	[51,52]
		Dishes made are regularly eaten at the end of pregnancy to reinforce the contractions and to facilitate delivery.	[2]
		Cures mouth ulcers.	[53]
		Daily consumption of pureed leafy vegetable has a positive effect on Vitamin A stores in populations at risk of vitamin A deficiency.	[54]
		Reported analgesic, androgenic, anticonvulsant, antifungal, anti- inflammatory activity and used in the treatment of anemia.	[55,56, 57,5,58]
		Demulcent, diuretic and laxative activities and can be used as a cooling medicine in digestive disorders.	[6]
		The plant sap is rubbed on any part of the body affected by acne to reduce the irritation and in treating aphthae.	[59]
		Mucilage used in Thai traditional medicine as topical application for irritant, bruise, ringworm, laboring, carminative and dwarf tonic. Also used as medicine and cosmetic purposes for skin diseases.	[60]
		Used to cure cancer, indigestion, insomnia, stomachache, insecticide, tonic, tumor, burn, stop bleeding. The whole plant is prescribed to increase weight in under-weight children and adults.	[61]
		Used in traditional medicine to treat sexual asthenia and infertility in man.	[62]
		Used in enhancing fertility in women, treating burn wounds etc.	[63]
		<i>Basella rubra</i> is a traditional Indian folklore medicine used in treating bleeding piles, pimples, boils, tumour, whooping cough, urticaria, to cure irritations and itching, to heal ringworm, eczema, septic wounds, ulcers, anemia, as an effective tooth powder that cures many diseases of gum and teeth, cure all evil effects of	[64,14]

		alcoholism, biliousness, leprosy etc.	
2.	Leaves	Leaf juice is prescribed in case of constipation particularly in children and pregnant women and in urinary diseases.	[65,53,66, 67,4]
		The mucilaginous liquid of the leaves and tender stalks is a significant remedy for habitual headaches. A decoction of the leaves works as laxative for pregnant women and children.	[48,59]
		Ground leaves with fruits of <i>Solanum sysymbriifolium</i> and fruits of <i>Phoenix reclinata</i> which is used to promote pregnancy, sexual impulse and fertility in domestic animals.	[51,68]
		Leaf juice is used to treat catarrh and is applied externally to treat boils.	[69]
		Leaves are given as enema followed by manual removal of the hard faeces in ehnoveternary medicine. Also used as oral drench or as feeds to increase milk production in cows. <i>Basella alba</i> is boiled and administered to the cow with a retained placenta, it develops severe diarrhea that also causes the placenta to come out.	[70]
		In ayurveda system of medicine it is recommended that application of leaves to head about half an hour before bathing brings sound refreshing sleep.	[71,58]
		Delicious bread prepared by mixing boiled leaves with flour of <i>Sorghum</i> . The extract of the boiled leaves is mixed with the spices and soup is prepared.	[53]
		Used as vegetable.	[72]
		The leaves are usually consumed in stew and soups.	[73]
		Leaf juice is used in treatment of balanitis and catarrhal affections ;applied externally in urticaria, burns; in intestinal complaints, used as a poultice .	[6,67]
		Used for the treatment of malaria	[74]
		Has laxative property.	[75]
		Used for preparation of a curry with pulse or other greens.	[76]
		Used to cure constipation and gonorrhea.	[77]
		Used for the treatment of hypertension	[78]
		Decoction is used internally for removal of after birth stomach pains, increase milk production.	[79]
		Used to cure burns, sore throat, liver diseases, scabies, as a blood producer and to increase weight,	[80]
		Boiled leaves along with <i>Sorghum</i> flour is an effective antiulcer agent.	[81]
		<i>Basella rubra</i> leaves are ground with sour buttermilk with salt for preparation of a poultice and indicated for arbuda.	[82,83]
		The leaves or aerial parts are used in treating constipation and also as a diuretic, toxicide and anti-	[84]

		inflammatory.	
		Used in catarrhal affection and to enhance suppuration. In general leaves contain several active components including flavonoids exhibits antioxidative, antiproliferative and anti inflammatory properties in biological systems. Leaves are used as anthelmintic, demulcent, antiinflammatory, anti malarial and analgesic.	[28]
3.	Stem	Mucilaginous cooked shoots are used in intestinal disorders.	[61]
		Used externally to cure fungal disease like Eczema, ringworm and general skin infections.	[85]
4.	Leaves and stem	Cooked leaves and stems have diuretic and febrifuge activity.	[50,49,86]
		Used in culinary practice.	[87,88]
		Applied for anticancer treatment such as melanoma, leukemia and oral cancer.	[83,60]
		Excellent substitute hot weather spinach and eaten raw in salads.	[89,90,91, 92]
		Used for antipruritis and burn.	[93]
		Used for acne and freckle treatment.	[94]
		Colours obtained from the leaves and stems are used for dying fabrics and in paintings.	[95]
		A paste of leaves and stem of is applied to cure acne, abscess, and skin diseases.	[61]
		Both stem and leaves of are used in Syphilis, intestinal disorders, tumour, acne, leucorrhoea.	[80,61]
5.	Flower	Useful for removal of kidney stone, gonorrhea and headache.	[96]
		Used as an antidote for poisons.	[50]
6.	Fruit	A purple dye from the ripened fruits has been extracted and used to colour or dye the 100% cotton and polyester fibers.	[97,73]
		Deep colouring matter obtained from the ripened fruits is used for colouring the food, to colour pastries or sweets.	[53,89]
		Fresh ripened fruits mixed with alum to obtain maroon colour used to colour the silk and cotton.	[98]
		Red dye from the fruit used for official seals and as rouge.	[60]
7.	Seed	Boiled seeds are added to dahl.	[89]
		Immature seeds are used to cure intestinal disorders, earache, carminative, itch, scabies, colic, sore throat, liver diseases and as a blood producer.	[60,80]
8.	Root	Paste of root has rubefacient activity. Cooked roots are also used as an astringent.	[50,69,23]
		Cooked roots have been reported to be used in the treatment of diarrhea.	[49,86]
		Decoction relieves bilious vomiting.	[2]

		A paste of root is used as a rubefacient and also applied to swellings.	[69]
		Used as an anti inflammatory agent after menstrual periods.	[99]
		Decoction is given in intestinal disorders.	[77]
		Decoction is used internally for removal of after birth stomach pains, increase milk production.	[79]
		Paste of <i>Basella rubra</i> root along with rice washed water is used to cure irregular periods.	[100]

CONCLUSION

The sincere aim of this review is to enlighten the focus on scopes and the importance of *Basella rubra* in the medicinal field. *Basella rubra* L. is also ethnomedicinally very important and used to cure various diseases. All these biological activities exhibited by the plant are with great potential and significance hence, detailed accounts of these should have to be performed at the molecular level.

From the above review it can be concluded that the plant *Basella rubra* Linn. which is having a wide range of medicinal value due to their variety of chemical constituents can be further investigated on toxicological and other parameters to obtain a valuable, cost effective and accessible marketed product.

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