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Review Article on Butterfly Pea and its Ethanophrmacological and Ethanomedicinal Use

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Abstract: *Herbal medicine has grown over the past decades and gain popularity in developing and developed countries to cure chronic diseases or disorders. C. PLURICAULIS, an evergreen herb called C. MICROPHYLLUS Sieb. and C. PROSTRATUS FORSK. it is utilized as a conventional folk remedy for a range of illnesses. In this article, we used PubMed, SCIFINDER, and Google Scholar to conduct electronic searches to find information about C. PLURICAULIS. The plant profile, phytochemistry, neuropharmacological, and toxicological information of C. PLURICAULIS are clarified by this thorough review. Many different in-vitro and in-vivo neuropharmacological effects, including as a boost to memory, anxiolytic, and tranquilizing properties, have been demonstrated by the crude herb and its metabolites, anti-depressants, anti-stress, neurodegenerative, anti- inflammatory, anti-oxidant, analgesic, sedative, anti-convulsant and Alzheimer's disease-reversing effects. Secondary metabolites form C. PLURICAULIS interact with various proteins, NEUROSYNAPSES, SIGNALING pathways and serotonergic synapse which plays a crucial role in neurotransmission, Alzheimer's disease, long term depression, addictions to alcohol, cognitive disorders, psychological conditions and increasing serotonin concentration in synapses.*

Keywords: Canscora Decussate, Clitoria Ternatea, Convolvulus Pluricaulis, Evolvulus Alsenoides, Shankhapushpi

I. INTRODUCTION

The butterfly pea is the larger wildflower with one to three showy purple flowers that are up to two inches long. The butterfly pea is the member of pea family, but surprisingly its is not frequented by butterflies. Rather, the expanded banner look a butterfly. The butterfly pea is used in production of medicine and making a dye for food, drink, brewing herbal tea, and creating natural skin care and hair product. The butterfly pea is show different pharmacological activity are show like anti- oxidant, anti-inflammatory, antimicrobial, and anti-cancer anti-diabetic, hepatoprotective anti-diuretic, cardiovascular gastrointestinal properties are show.

CLITORIA TERNATEA commonly called as the butterfly pea of family Fabaceae and sub-family PAPILIONACEA is a perennial leguminous twiner, which originated from the Asian tropical area and later was widely distributed in south and central America, East and West indies, India and China, where it has become naturalized [1]. The plant is also called as Aparajit in Hindi, Aparajita in Bengali, and KOKKATTAN in Tamil of Indian traditional medicine [2]. The thrives in regions with full sunlight and partial shade, and its seed germination typically takes around 1-2 weeks, with flowering occurring approximately 4 weeks after germination [15]. Being a leguminous plant its roots from a symbiotic association with soil bacteria known as rhizobium which fixes atmospheric nitrogen into a plant –unstable form (a process called nitrogen-fixation), therefore this plant is used to improve soil quality through the decomposition of nitrogen-rich plant Material [5]. The root part of C. TERNATEA has been used as laxative, purgative, diuretic, inflammation, indigestion, constipation, fever, arthritis, vision problems, anthelmintic [7]. Preliminary phytochemical screening of CLITORIA TERNATEA revealed that the preparation contained Tannis, phlebotomine, carbohydrates,

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anthocyanins, saponins, triterpenoids, phenols, alkaloids, flavonoids, FLAVONOL glycoside, proteins, anthraquinone, cardiac glycosides, volatile oils and steroids [8]. The Butterfly Pea flowers contain anthocyanins, which are natural antioxidants that slow down the aging process. Prevents skin aging and help the skin. The blue hue of CLITORIA TERNATEA flowers are used as an abundance of natural COLORING in the preparation of various dishes [10]. The most prominent characteristic of CLITORIA TERNATEA is its petals, which appeal blue colour. The increase in the awareness of food and safety opened new area of research, with the use of naturally OCCURING colourants from various plant based sources being recommended as a beneficial alternative to toxic synthetic dyes.

The butterfly pea plant or CLITORIA TERNATEA has a history rooted in Aasia and Africa, where it was first used for its medicinal properties, as a natural dye, and as a food source. The spread other parts of the world through trade and is now found in tropical and subtropical regions globally. The plant was introduced to INDIA around the 17th century and later Europe, eventually becoming cultivated across continents. The butterfly pea is originated from south America and Aasia.

MORPHOLOGY:

The taxonomical classification of CLITORIA TERNATEA species
KINGDOM: plantae
DIVISION: MAGNOLIPHYTA
CLASS: MAGNOLISIDA
SUBCLASS: ROSIDE
ORDER: FABACEAE
SUBFAMILY: PAPILIONOIDEAE
GENUS: CLITORIA
SPECIES: TERNATEA (LINNAEUS)

BOTANICAL CLASSIFICATION:

SHANKHPUSHPI, scientifically known as convolvulus PLURICAULIS, is an evergreen plant that is associated with the family Convolvulaceae. It is commonly found in India and other parts of Asia. The plant as slender stems and small white or pink flowers with a trumpet-like shape. Its leaves are oval-shaped and have a smooth texture. SHANKHAPUSHPI can grow UPTO 60 cm in height and thrives in warm and humid climates.

TRADITIONAL USES:

Butterfly-pea flower tea is a herbal tea (caffeine free), a drink produced with a decoction of leaves of the C. TERNATEA plant and dried lemongrass. BUTTERFLY pea flower tea still has many of the therapeutic properties of the CLITRORIA TERNATEA as well as extracting the deep blue colour of the petals that had made the plant the popular dye for centuries. One of the important factor of the tea is the fact that it changes colour based on the values of pH of the material that was added to it, for example adding OFLEMON juice to the tea will change it to purple [5].

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Root was used in the cause of therapy of ascetics, enlargement of ABDOMIBAL VISERA, sore throat and skin disease. They were not advised and were also used as purgative DUEO their tendency to create gripping and soreness. Root is ADMINISTRED with honey as general tonic to the children for enhancing mental abilities, developing muscles and moisturizing the skin. A further use for roots was in epilepsy. Numerous individuals utilize seeds and leave as a brain tonic for boosting memory and intelligence. For the anti- dote of snake bite juices and flowers are used [10]. The herb is non-toxic and its use does not bring into being any side effects. In contrast, there is stimulating effect in strengthening of health and weight gain. According to Ayurveda concept, RASYANA therapy affects the body, mind and brings about psychic and physical improvements. This therapy prevents the effects ageing, develops intelligence within the body resistance against diseases. It is among the most significant MADHYA RASAYANA drugs in Ayurvedic system of medicine. When taken as an astringent, the herb balances the Kapha-Vata-Pitta doshas and reduces anxiety by controlling the body's production of cortisol and adrenaline, two stress chemicals.

Butterfly pea yields 25-30 tons of dry materials annually per acre in a good-conditions, Due to its high calcium concentration the C. TERNATEA plant is used to make herbal drinks that are an excellent supplier of calcium [3].

Leaf:

The leaves have 21.5% Fiber and 21.5-29% protein content, respectively. From leaves of plant CLITORIN and kaempferol have been SEPERATED. The leaves also contains 3-monoglucosides, 3-rutinoside, 3-neohesperidoside, 3-o-rhamnosyl-glucoside, 3-o-rhamnosylgalactoside of KEAMFEROL, kaemferol-3-rhamnosylo- RHAMNOSYL glucoside. It also contain APARAJITIN and β-sitosterol. The flowers (blue in colour) contain delphinidin-3,5 DIGLUCOSIDE, delphinidin-3β-glucoside, and its 3methyl derivative, malvidin,3β-glucosides, KAEMFEROL and CAYNIDIN chloride. A lactone-APARAJITIN from leaves [3].

ROOTS:

The roots of the plant contains TAXAXEROL and TAXAXERONE.

The bark of roots contains the SERESIN. The root nodule contains LECINE, valine, and alanine, α-AMMINOBUTYRIC acid, glutamic acid, ARGININE, ornithine, HISTADINE, γ AMMINOBUTYRIC acid [3].

Seed:

Along with fixed oil, tannic acid and glucose, the seed also has a cotyledon and bitter-tasting granular starch as its active ingredient. Two distinct compounds have been extracted from seeds: ANTHOXANTHIN and sitosterol. Apart from that, linoleic, STEREARIC, palmitic and linolenic acids are produced from seed oil. Almost similar composition was discovered in the oils of blue and white-FLOWERS HEXACOSANOL, CINNAMICACIDE and NEOCLEOPROTIN which shares some ammino acid sequences with insulin are also found in seeds. The seeds are very high in protein content (15-25%). The seeds contains p-hydroxycinnamic acid, flavonol-3 glycoside, adenosine, 3,5,7,4-tetrahydroxyflavone-3-rhamnoglucoside, polypeptide, hand EXACOSANNOL. Oligosaccharides are also found in seeds. A edible colourant, delphinidin 3,3,5-triglucoside also reported in seeds lecine amounts to roughly 2.8% of the

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total protein that may be extracted from seed meal or 30mg of lectin/30g of C. TERNATE seeds in contrast 9mg fetuin/30g of seeds. Tryptophan and tyrosine were also reported in seeds [3].

FLOWER:

Two acyl moieties were determined as E-4-0-β-D-glucopyranosyl-p-coumaric acid and 6-0-malonyl-D glucopyranose. Other six TERNATINS A1, A2, B1, B2, D1 and D2 in C. TERNATEA flower are separated by reverse phase High Performance Liquid Chromatography (HPLC). The white flower yield only KEFEROL. Petals of C. TERNATEA L. contain some FLAVONOL glycosides isolated are kaempferol 3-O-(200-O-a-rhamnosyl-600-o-malonyl)-b glucoside; quercetin RHAMNOSYLRUTINOSIDE: 3-O-(200-O-arhanmnosyl-600-O-malonyl)-b-glucoside; quercetin 3-2G-rhamnosylrutinoside. myricetin 3-2G Flower also contain kaempferol3-2G RHAMNOSYLRUTINOSIDE: kaempferol 3-rutinoside; quercetin 3-glucoside; myricetin 3-glucoside. Cyanine chloride and kaempferol are identified from the flowers. SEPERATION of Six acylated anthocyanins A, B, C, D, E and F by the petals of blue flowers has been done with the partial characterization of kaempferol and its 3-glucosides, robinin, quercetin and 3-glucoside. Blue flowers of C. TERNATEA plant also contain LOBELININS, which has the 3,5,3,5-tetraglucoside substituted pattern. DEACYTERNATIN is also discovered in the blue flower petals [3].

PHARMACOLOGICAL ACTIVITS

Anthelmintic activity:

Anthelmintic ACTIVITY was found in ethanolic and water-based extract of C. TERNATEA leaves at the dos of 100mg/ml. This was performed at three different concentrations(100,50,25mg/ml) of ethanol-based extracts, utilizing Eisenia Foetida, in turn. The primary goal of the study was to compare the anthelmintic activity of C. TERNATEA leaf extracts in-vitro using both water-based and ethanol-based extracts. For this reason, the research required timing the worms' paralysis (P) and death (D). While determination of both extracts, the time of paralysis (P) and death (D) time of aqueous extract was reported as 18±1.57 and 53.33 ± 0.33 and in case of ethanolic extracts 12.33±0.80 and 32.33±0.71 respectively. At last, the anthelmintic activity of ethanol-based extract of C. TERNATEA was found more efficacious than water-based extract of C. TERNATEA [3].

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Anti Diabetic activity:

Anti diabetic activity of ethanolic extracts was evaluated in rats. Rats fed with ethanol-based extracts of flowers for three weeks significantly LOWERD serum sugar level in experimentally induced diabetics due to inhibition of the GALACTOSIDES and glucosides activities but no inhibition of fructosidase activity was observed. The HYPOGLYCEMIC properties of methanol, water, and petroleum ether and chloroform extract CLITORIA TERNATEA leaves were evaluated in streptozotocin-induced diabetics rats FORACUTE and subacute EFFECTS. The extracts of CLITORIA TERNATEA (200-400 mg/kg) significantly reduced the HYPERGLYCEMIC effect in streptozotocin-induced diabetic rats,400mg/kg possessed significant HYPOGLYCEMIC effects, 200mg/kg also decreased glucose level but not as 400mg/kg. The methanol extract's acute action resulted in nearly similar effects for200-400mg/kg; however, after the 30-minute mark, 200mg/kg caused a little drop in blood glucose levels.

Subcuts activity showed that on the long -term use of extract the dose 200mg/kg is much better to control the blood glucose level than the 400mg/kg dose. For all the biochemical tests, the leaf extract – treated rat essentially shown the same profile as those treated with the flower extracts. The anti-diabetic and anti -HYPERLIPIDEMIC potential was evaluated in streptozotocin-developed diabetic rats and co related either its in-vitro and in-vivo antioxidant activity. The extracts and parts was initially screened for acute and SUBCHRONIC anti diabetic activity in the dose range of 100-200mg/kg. The study revealed that the C. TERNATEA leaves and flowers extract possess anti-hyperglycaemic and anti -hyperlipidaemic effects and consequently may reduce liver and renal damage associated with alloxan-induced diabetic mellitus in rats. Anti-HYPERLIPIDEMIC effect of C. TERNATEA L. and V. mungo L. (Fabaceae) on preliminary developed HYPERLIPIDEMIA in rats by poloxamer 407- induced acute HYPERLIPIDEMIA and DEID – induced HYPERLIPIDEMIA models was studied and results showed that the mixture of water and alcohol lysates of the roots and the seeds of C. TERNATEA and the hydroalcoholic extracts of the seeds of V. mungo results in a significant ($P<0.05$) reduction of triglycerides, very low density lipoprotein CHOLESTROL, and low density lipoprotein cholesterol level. The atherogenic index (AI) and the high density (HDL) / low density lipoprotein (LDL) ratio were normalized after treatment in diet-induced HYPERLIPIDEMIC rats [5].

Anti-inflammatory activity, Anti-pyretic activity and analgesic activity:

Leaf and flower extract of C. TERNATEA has been identified as having an inflammatory activity. Petroleum based ether lysates and ethanol reported in the pain-relieving activity that ethanol treated lysates showed up to 1.5-2 hrs. of long- lasting effect. Flavonoids were important for anti-inflammatory, analgesic and anti-pyretic activity in C. TERNATEA.

The methanolic extract of C. TERNATEA root T 200, 300 and 400mg/kg body weight doses. The yeast provoked increased the temperature dose-dependent and decrease the body temperature to normal. The narcotics drugs treat the inflammatory and pain condition, which are mostly costly and have adverse effects. Natural drugs, especially from C. TERNATEA, can be an option for providing cheaper and feasible drugs [13]. Another study reported that carrageenan induced rat paw oedema and acetic acid-induced vascular permeability in rats were considerable reduced after oral administration of methanolic root extract of C. TERNATEA. The extract's anti-pyretic efficacy found to be comparable to paracetamol. Recently, C. TERNATEA leaf extract have been linked to analgesic properties [14].

Antidepressant activity:

The methanol- based extract of C. TERNATEA at the doses of 100 and 400 mg/kg, p. o has shown antidepressants effect in tail-suspension test in mice. The extract of CT significantly decreased the duration of motionlessness at doses 100 and 400 mg/kg. The reduction in the duration of motionlessness was greater in 400mg/kg of C. TERNATEA in contrast to fluoxetine, 10mg/kg, i. p. ITS another study anti-depressants effects of ethanol-based extract of C. TERNATEA roots was also resulted at the doses of 150 300mg/kg. The results from previous study indicated that two compounds, (Z)-9,17-octadecadienal and n-HEXADACANOIC acid isolated from root of CT can serve as potential lead molecules for developing Noval selective MAO-A inhibitors which can give herbal remedy for the treatment of psychiatric disorders including the depression and ANXESITY [7].

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Neuro-pharmacological activity:

C. TERNATEA has been reported to have neuroprotective effects, which may be linked to have its anti-oxidant and anti-inflammatory activities. It has shown promise in preventing the neurodegenerative disorders and increasing cognitive function [15]. C. TERNATEA is reported to be a good brain tonic drug mainly used in the treatment of mental wellness. Studies reported IP administration of alcohol extract of steam, flower, leave and fruit of C. TERNATEA to rats and mice, has been reported to produce sedative action and reduced alertness. The root parts of C. TERNATEA at 300-500mg/kg in rats in diminishing electroshock-induced amnesia, increase acetylcholine content and acetyl-CHOLINESTARESE activity in the different regions of the brains, viz, cerebral cortex, midbrain, medulla oblongata and cerebellum [12].

Anti-convulsant activity:

An imbalance between excitatory and inhibitory neurotransmitter caused seizures. The drugs which boost the GABA levels in brain, may possess anti-convulsant activity in the experimental models of seizures. The maximal electroshock (MES) is the validated model for screening of anti-epileptic drugs in the generalized tonic-LOINC seizures. The methanol-based extract of the arial parts of CT shown anticonvulsant activity at dose of 100mg/kg, p. o in both PHETYLENETERTAZOLE (PTZ) and MES developed seizures in mice delaying the onset of convulsions and reducing the duration of tonic hind limb extraction, respectively. These results suggest the potential of CT as an antiepileptic drug, however extract of arial part of CT was not effective against PTZ and MES induced seizures in rats [7].

Anti-oxidant activity:

Antioxidants acts as radical scavengers, inhibit lipid peroxidation and the other free radical-medicated processes, and therefore they protect the human body from several diseases attributed to the reactions of radical. Various phenol-based antioxidants such as TANINE coumarins, XANTHENES and more recently procyanidins have been introduced to scrounge radical in a dose-dependant manner and therefore are viewed as pathologies. Phenolic compounds are the large and diverse group of phytochemicals, which include many different families of aromatic secondary metabolites in plants. They are known to exert various physiological effects in humans, such as inhibiting platelet aggression, reducing the risk of coronary heart disease and cancer and preventing oxidative damage of lipid and low-density lipoprotein. Phenolic compounds have strong in-vitro & in-vivo anti-oxidant activities associated with their ability to scrounge free radical, breaks radical chain reactions and chelate metal [2].

Nootropic activity:

From the resulted studies, it was looked into the ethanol extract of C. PLURICULAS and its ethyl acetate and water-based parts has nootropic activity. 2 doses of 100-200 mg/kg/p. o of ethyl acetate and water-based parts are given to rats in distinct groups. Both the doses of C. PLURICULAS found to be effective for memory and learning in rats. This activity assessed active & passive avoidance paradigms using Cook and Weidle' s pole climbing apparatus and elevated plus-maze as models. One more study was done to find out nootropic property of SHANKHPUSHPI. 3 plants i.e. C. PLURICULAS, C. TERNATEA, EVOLVULUSASINOIDS were evaluated for the nootropic activity using Power Solt' s swim despair, RPM and ACTOPHOTOMETR models. The results showed that all 3 plants possess anxiolytic, CNS-depressants & nootropic activity but C. PLURICULAS plant shown a true source for memory enhancement [19].
Several studies have reported improvement in cognitive performance when C. TERNATEA extracts were administrated to experimental animals. In one study, rats orally dosed with ethanol extracts derived from C. TERNATEA roots or aerial tissues were showed to deplete electric shock-induced amnesia better than controls. In a separate study, 48 hrs. and 30 days after receiving an oral dosage of water -based C. TERNATEA root extract, neonatal rats demonstrated increased spatial learning skill and memory retention [9].

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Anti-microbial activity:

By employing the leaf- disc method and feeding deterrent using SPOLISOMA Oblique Walker as the test insect, the C. PLURICULIS plant was bio-assayed. A new compound, 29-oxodotriacontanol was isolated from chloroform fraction of the plant which found to be significant antifeedant constituent where as another compound, TETRATRACONTANOIC acid was discovered 1st time in this plant [19]. The antimicrobial screening was evaluated against Extended Spectrum Beta Lactamase (ESBL) producing Salmonella enteritidis, Salmonella typhimurium, KLESIELLA pneumonia, Enteropathogenic E. coli, Uro-pathogenic E. coli, and Pseudomonas AUREGINOSA isolated from patients with urinary tract infection and acute gastroenteritis. Disc diffusion method was used to test the above -mentioned extracts for their activity. Water, methanolic & chloroform extract of C. TERNATEA flower was showed activity against UROPATHOGENIC Escherichia coli, Enteropathogenic Escherichia coli, Enterotoxigenic Escherichia coli, Salmonella typhimurium, KLESIELLA pneumonia and Pseudomonas AUREGINOSA. Methanol extract of C. TERNATEA exhibits comparatively high as compared with aqueous and chloroform extracts. The zone of inhibition produced by water, chloroform & methanolic extracts at a conc. of 4mg/disc was found 12mm, 16 to 26mm and 14 to 18mm respectively while hexane & petroleum ether extracts did not show any activity [3].

ETHANOPHARMACOLOGICAL USES OF BUTTERFLY PEA:

The ETHANOLOGICAL use of butterfly pea including treating neurological disorders, inflammatory conditions, and skin problem.

The butterfly pea is widely use in traditional medicines like ayurveda for the memory enhancement and as an adaptogen. Various part of the plant, particularly the roots and flowers, are used to make remedies for a wide range of ailments, from eye issues and fever to diabetes and as an antidote for snake bites.

1] NEUROLOGICAL AND HEALTH:

* memory enhancement
* stress and anxiety
* cognitive function

2] inflammation and pain:

* inflammatory condition
* skin conditions
*pain relief

3]respiratory and digestive health:

*respiratory ailment
*digestive disorder
*constipations

4] other medicinal use:

*eye ailments
*fever and EDEMA
*Urinary disorder
*antidote
*antidiabetic

ETHANOMEDICINAL USE OF BUTTERFLY PEA:

The different traditional medicinal system utilize butterfly pea for various aliments.

1] AYURVEDA:

The Aparajita, it is used for the memory enhanced, stress reduction, and anxiolytic, as well as for liver, intestinal, indigestion, and skin issues.

2]TRADITIONAL CHINESE MEDICINE:

Employed for its detoxifying and cooling effects to treat skin diseases, sore throats, and inflammation.

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3] THAI, INDONESIAN, AND MALAYSIAN FOLK medicine:
The blue flower extract is consumed as a tea for relaxation, vision Improvement, and blood sugar regulation.
4] AFRICAN TRADITIONAL MEDICINE:
Used for treating infections, gastrointestinal problems, and reproductive health concerns.

FUTURE WORK:

The butterfly pea plants all part like steam LEVES and roots, flower are used in the production of medicine and this plant are show different type of pharmacological activity. So the future work prospect in butterfly pea. The phytochemistry and bioactive compounds like flavonoids, peptides, and alkaloids, this compound are isolation and characterization. comprehensive profiling of anthocyanins using the advanced techniques like lc-MS/ MS or NMR. And different type of work in butterfly pea.

II. CONCLUSION

CLITORIA ternate has a long tradition and is found in several countries. It is not just an ornamental flower but also a good medicinal plant which has numerous benefits. It has been experimented several years back by various scientists and have found a number of pharmacological uses as well. With the advancement of technology and Ayurvedic traditional medicine and the improvement of scientific research, different classes of plant species and their leading compounds have been studied. Extractions obtained through different methods of the roots, seeds, flowers, and leaves of CT have been experimented in Ayurvedic studies. Earlier different parts of CLITORIA ternate have been used for the treatment of Asthma, skin diseases, constipation, fever, Inflammation, Indigestion, snakebite and scorpion sting, etc. Later on, this plant is used for many pharmacological activities such as, memory enhancer (by increasing of acetylcholine content), act as a good stress, anxiety, and depression reliever, to gain calmness in mind and helps to have a good sleep. Moreover, it helps to lower the body temperature and also acts as a good pain reliever, the seeds are used to treat when joints in different parts of the body got swollen. It can best to treat when difficulties in urination occur and improve the flow of urination, treat boils, blisters, and ulcers, and act as a neutralizer for poisons that enter the body. One of the most important benefits of this plant is its anti-diabetic activity. Furthermore, it shows properties like antiseizure, tranquilizing, sedative, antimicrobial, insecticidal, and inhibition of blood platelet aggregation, etc. Extractions of this plant are also useful to treat many diseases still where the proper medications have not been discovered such as cancers, neuro problems, kidney-related disorders, HYPERGLYCEMIC, urinary disorder, other, disorders in the respiratory system, etc. This plant has a good source of evidence to be used as a memory enhancer.

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