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A review on *Griffonia simplicifollia* - an ideal herbal anti-depressant

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Abstract

Medicinal plants are the nature's gift to human being to have disease-free healthy life. It plays a vital role to preserve our health. India is one of the most medico-culturally diverse countries in the world where the medicinal plant sector is part of a time-honored tradition that is respected even today. Medicinal plants are believed to be much safer and proved elixir in the treatment of various ailments. In our country, more than 2000 medicinal plants have been recognized. *Griffonia simplicifollia* Fabaceae Family) is an important medicinal plant for antidepressant. Its medicinal usage has been reported in the traditional systems of medicine. *Griffonia Simplicifollia* has been used extensively for treatment of some diseases like as depression, anxiety, insomnia, fibromyalagia, and chronic headache. The present article including the detailed exploration of phyto-pharmacological properties of *G. Simplicifollia* is an attempt to provide a direction for further research.

Keywords: Medicinal plant, Anti-depression, anxiety, Serotonin, *Griffonia Simplicifollia*

Introduction

World Health Organization (WHO) estimated the 80% of the population in the developing countries almost exclusively on traditional system of medicines for their primary health care needs[1], however most of the population of India also using herbal (natural) medicine, even in modern system of medicines so many naturally isolated compounds using or chemically modified compounds with natural origin. Due to the Increasing toxicity and allergic manifestation of the synthetic drugs and increasing cost of Production due to involvement of complex technology for Formulation Research & Development. Medicinal plants are the local heritage with global importance. Medicinal herbs constitute an important source for all traditional system of medicine and synthetic system of medicines. There is now an ever increasing interest and demand for herbs and herbal products in the world over. The world market for herbal medicine including herbal products and raw materials has been estimated to have an annual growth rate between 5 and 15%. India has a great wealth of traditional knowledge and wisdom [2] Global trend leading to increased demands of medicinal plants for Pharmaceuticals, phytochemicals, nutraceuticals, cosmetics and other products is an opportunity sector. [3]

Griffonia simplicifolia plant is found principally in the West African countries of Ghana, Ivory Coast and Togo. The plant is adapted to wide a range of agro climatic conditions. It is common in the coastal plains as well as secondary forest. It thrives well on termite hills and on mountain slopes.[4] Griffonia seed raises serotonin levels in the brain. Serotonin is important in regulating brain chemistry and is especially important in problems such as depression, insomnia, and eating disorders. Theoretically, supplementing with Griffonia seed can raise serotonin levels and provide relief from depression and insomnia.

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Griffonia seed should also regulate appetite through the increase in serotonin, leading to weight reduction in obese persons, while helping normalize the weight of people suffering from anorexia nervosa. Griffonia seed has also been used in treating fibromyalgia and chronic headaches in order to reduce pain. [5]

Classification: [5, 6,]

Binomial name	: *Griffonia simplicifollia* (DC.) Bail
Synonyms	: *Bandeiraea simplicifolia* (DC.) Benth.
Kingdom	: Plantae
Division	: Magnoliophyta
Class	: Magnoliopsida
Order	: Fabales
Family	: Fabaceae
Subfamily	: Caesalpinioideae
Genus	: *Griffonia*
Species	: *G. simplicifolia*
Common Name	: Griffonia
Local name (Akan)	: Kajya, Atooto, Poopoo

Morphological Characteristics

Origin

Griffonia simplicifolia is distributed from Liberia to Gabon. Griffonia *simplicifolia* plant is found principally in the West African countries of Ghana, Ivory Coast and Togo. The plant is adapted to wide a range of agro climatic conditions. It is common in the coastal plains as well as secondary forest. It thrives well on termite hills and on mountain slopes. [7]

Fig1: Griffonia Plant

Ecology and Botany

In the coastal plains it grows as a shrub to a height of about 2 metres whilst in the forest zones it takes the form of climber around tall trees. There is no commercial cultivation of the plant but it is common to find Griffonia covering several hectares of land in the wild. Griffonia is widely distributed in the country. The highest concentration is found along the coast from Komenda to Kasoa. Other areas of concentration include Dodzi, Akatsi, Agbezume and Nkonya areas of the Volta region, Bomaa, Nsoatre and Ahafo areas of the Brong Ahafo region: Nyinahini, Kokofu, Ejisu areas of the Ashanti region: Akwamu, Somanya, Kwahu areas of the Eastern region and Sefwi, Enchi and Asankragua areas of the Western region. Though no cultivation of the plant exists, it can be seen stretching over several hectors of land in the Gomoa and Mfantsiman districts of the central region. Griffonia normally flowers between August and October and matures in December-February.

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Description [9]

Shrub or large liana with glabrous, brown-black branches. Leaves alternate, simple, glabrous; stipules triangular, 1 mm long, soon falling; petiole up to 1.5 cm long; blade ovate, 6–12 cm × 3–6 cm, base rounded to cordate, apex rounded to short-acuminate, 3(–5)-veined from the base, reticulate veins prominent on both sides. Inflorescence an axillary, pyramidal raceme 5–20 cm long; bracts and bracteoles triangular, very small, persistent. Flowers bisexual, almost regular, 5-merous; pedicel 3–4 mm long; receptacle urn-shaped, 1–1.5 cm long, pale green; calyx tube 12–15 mm long, orange, lobes triangular, up to 2 mm long; petals almost equal, elliptical, 10–12 mm long, fleshy, greenish, sparsely short-hairy on the margin; stamens 10, filaments filiform, up to 2 cm long; ovary superior, c. 4 mm long, stiped, style 1–2 mm long, persistent, stigma small. Fruit an oblique-cylindrical pod c. 8 cm × 4 cm, stipe 1–1.5 cm long, inflated, leathery, 1–4-seeded. Seeds orbicular, c. 18 mm × 5 mm × 6 mm, glabrous. Seedling with epigeal germination.

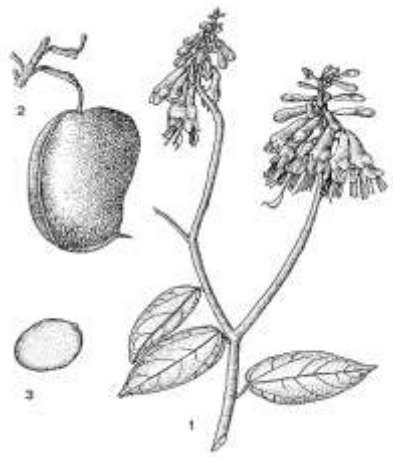

Fig 2: 1 Flowering branch; 2 Fruit; 3 Seed, *Redrawn and adapted by Iskak Syamsudin*

Propagation and planting

Propagation by seed gave poor results and different seed treatments did not improve germination, although fungicide treatment of the seed appeared beneficial for establishment. Use of stem cuttings has not been successful. In productivity trials wildlings were successfully used as planting material; this is impractical at a larger scale.

Harvesting

For local medicinal use *Griffonia simplicifolia* is harvested in small quantities. Although harvesting seeds from the wild is usually fairly sustainable, there are worrying reports of lianas being cut down on a large scale to be able to collect the seeds. Harvesting for fodder is best done at intervals of 12 weeks, as total herbage yields are then considerably higher than when harvested at 6 week intervals.

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Fig:3 Seeding

Handling after harvest

The seeds of *Griffonia simplicifolia* are extracted in factories in the United States, Germany and probably elsewhere. The extract is either a grey-white powder or pale brown crystals containing 95–98% 5-HTP and is sold wholesale at about US$ 800 per kg (prices in 2000). It is finally sold mixed with vitamins and packed in capsules or mixed with green tea or yerba mate.

Genetic resources

Even though *Griffonia simplicifolia* is reportedly common, the high commercial value of the seeds forms a serious threat. Destructive harvesting combined with high grazing pressure could contribute to reduction of populations.

Breeding

The insecticidal lectins of *Griffonia* are of interest for plant breeders who want to build in insect resistance in other crops.

Prospects

Griffonia simplicifolia will remain in high demand as a natural alternative for the antidepressant Prozac. Measures for sustainable harvesting need to be enforced or developed. Research to domesticate this species is urgently needed, solving the problems with germination being a first step.

Other botanical information

Griffonia occurs in tropical Africa. It belongs to the tribe *Cercideae* and comprises 4 species. *Griffonia physocarpa* Baill., *Griffonia tessmannii* (De Wild.) Compère and *Griffonia speciosa* (Benth.) Taub. occur from Nigeria east to DR Congo and south to Angola. They are less common than *Griffonia simplicifolia*. The main use of *Griffonia*

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physocarpa is as a dye plant. In DR Congo *Griffonia tessmannii*, *Griffonia physocarpa* and *Griffonia speciosa* have similar medicinal uses. A decoction of the aerial parts is drunk to treat gonorrhoea and stomach problems. Feverish children are bathed in the same decoction to bring down the temperature. Young leaves are chopped and eaten as an aphrodisiac and pulped they serve to massage body parts with oedema. The seeds of *Griffonia physocarpa* and *Griffonia speciosa* contain high concentrations of 5-HTP.

Production and international trade

The seed of *Griffonia simplicifolia* is an industrial source of 5-hydroxytryptophan (5-HTP), a serotonin precursor. Trade statistics are not available. In the early 1990s the annual export from Ghana to Germany amounted to 80 t. In view of the increased demand for 5-HTP in the Western world, the trade must have expanded since then. In 1999 the wholesale price of seed was US$ 8–9 per kg.

Chemical constituents

The seeds of the plant are used as a herbal supplement for their 5-Hydroxytryptophan content. 5-Hydroxytryptophan also known as 5-HTP is an important building block for the human body to form serotonin. Serotonin plays an important role in the body especially as a neurotransmitter to transport signals between neurons in the nervous system. Griffonia simplicifolia is a natural source of 5HTP (5-Hydroxytryptophan), an enhancing amino acid that is a highly absorbable type of tryptophan and a direct precursor to serotonin. It has been used, as an adjunct to medical care, for depression and fibromyalgia.

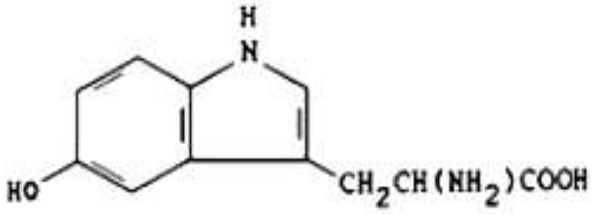

Fig 4: 5-Hydroxytraptophan

In addition, it is commonly used for mild insomnia, migraine headaches and as a weight loss therapy. It has been demonstrated to reduce the pain and anxiety associated with fibromyalgia. In some migraine populations, 5-HTP was found to be as effective in treatment and prevention as beta-blockers or methysergide. These results have not been consistent in all trials. 5-HTP seems to work for mild depression. It is effective in uncomplicated insomnia. At higher doses, 5-HPT has been shown to reduce appetite and promote weight loss.

Properties

The leaves of *Griffonia simplicifolia* contain a volatile oil and coumarins. The ripe seeds contain 6–14% 5-HTP. In the leaves 5-HTP is accompanied by 5-hydroxytryptamine (= serotonin), each at a concentration of 0.1–0.2%. In humans, 5-HTP increases the synthesis of serotonin in the central nervous system and has been shown to be effective in treating a wide variety of conditions, including depression, fibromyalgia, obesity, chronic headaches and insomnia. 5-HTP is poisonous to insects, i.e. bruchids (*Callosobruchus maculatus*). The cyanoglucoside lithospermoside (= griffonin) has been isolated from the roots; it is the active ingredient against sickle-cell anaemia. In the seeds a number of lectins are found. One of them is of the acetylglucosamine-group which is commonly found in *Poaceae* and *Solanaceae* but is rare in *Leguminosae*. Some lectins have insecticidal properties. Isolectin B4 isolated from *Griffonia simplicifolia* is used as a marker of small primary sensory neurons in neurological research.

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As a fodder *Griffonia simplicifolia* is appreciated for its vigour, high palatability, high crude protein content (about 16%), high P content (about 0.12%) and high Ca content (about 2.2%).

Adulterations and substitutes

Lithospermoside (= griffonin) has been isolated from several plants, e.g. from the African *Lophira alata* Banks ex C.F.Gaertn. and *Tylosema fassoglense* (Schweinf.) Torre & Hillc.

Uses

In Côte d'Ivoire and Nigeria the pulped bark is applied to syphilitic sores. A leaf decoction is used as an emetic, cough medicine and aphrodisiac. A decoction of stems and leaves is taken as a purgative to treat constipation and is used externally as an antiseptic wash to treat suppurating wounds. Leaf sap is used as eye drops to cure inflamed eyes and is drunk or applied as an enema to cure kidney problems. Stems and stem bark are made into a paste that is applied to decaying teeth, and a paste made from the leaves is applied to burns. Ground twig bark, mixed with lemon juice and *Capsicum* pepper, is applied to scarifications to treat intercostals pain. Chewing the stems is claimed to produce an aphrodisiac effect. The leaves are put in chicken pens to kill lice. In Nigeria an extract from the a powdered root has been used to treat sickle cell anaemia. The wood is hard and tough and in Ghana stems are used to make walking sticks. The leaves are used in the production of palm wine, and give the wine a bitter taste. Sap that exudes from cut stems can be drunk to quench thirst. In Ghana the roots are chewed and dried to produce a white powder that is used by women to powder their face. A black dye is obtained from the leaves. The pods are made into toy whistles and spoons. The leaves are highly valued as animal feed and are said to stimulate reproduction. Free-ranging cattle browse heavily on the shrubs. The stems are used to make baskets and chicken cages, and also beaten into fibres serving as chewing sponges, a popular means of tooth cleaning in Ghana. The stems and roots are used as chew-sticks.

Uses of Plant by Locals

Traditional African uses for the plant include use of the stem and roots as chewing sticks, leaves for wound healing, and leaf juice as an enema and for the treatment of bladder and kidney ailments. A decoction of the stems and leaves is also used to stop vomiting and to treat congestion of the pelvis. Griffonia seed is also reputed to be an aphrodisiac, as well as an antibiotic and a remedy for diarrhea, and stomachache, dysentery and as a purgative.

Mechanisms of action [9, 10, 11]

5-HTP acts primarily by increasing levels of serotonin within the central nervous system. Other neurotransmitters and CNS chemicals, such as melatonin, dopamine, norepinephrine, and beta endorphin have also been shown to increase following oral administration of 5-HTP.

Clinical Uses

Depression [12]

Studies in patients with either unipolar or bipolar depression have demonstrated significant clinical response in 2 to 4 weeks at doses of 50-300 mg three times a day.

Chronic Headache [13]

5-HTP has been used successfully in the prevention of chronic headaches of various types, including migraine, tension headache, and juvenile headaches.

Insomnia [14]

5-HTP has been shown to be beneficial in treating insomnia, especially in improving sleep quality by increasing REM sleep.

Fibromyalgia [15]

Fibromyalgia patient have been found to have loss serotonin levels, in three clinical trials have demonstrated significant improvement in symptoms, including pain, morning stiffness, anxiety and fatigue.

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Pharmacological Activities

L-5-Hydroxytryptophan (5HTP) is decarboxylated "in vivo" to yield serotonin, a neuro-hormonal transmitter released by neurons in the brain, spinal cord and symphatetic ganglia.. Its seed contains active drug 5-hydroxytryptophan (5-HTP). 5-HTP is an aromatic amino acid naturally produced by the body from the essential amino acid L-tryptophan. Produced commercially by extraction from the seeds of the African plant Griffonia simplicifolia[16].

Therapeutic Applications

L-5-Hydroxytryptophan is reported to be of greatest benefit in psychiatric and neurological disorders where there is a deficiency of neurol serotonin. L-5-Hydroxytryptophan is also indicated for its uses in alleviating the symptoms of a number of common syndromes such as anxiety and depression. L-5-Hydroxytryptophan is also cited as a natural relaxant, to help alleviate insomnia by inducing normal sleep, for the treatment of migraine and headaches and to aid in the control of cravings such as in eating disorders. L-5-Hydroxytryptophan is also thought to assist and strengthen the immune system and may help to reduce the risk of artery and heart spasms. L-5-Hydroxytryptophan has also been cited in the management of Parkinson's disease (PD) and epilepsy.

Summary and conclusion

Recent research suggests that Griffonia seed raises serotonin levels in the brain. Serotonin is important in regulating brain chemistry and is especially important in problems such as depression, insomnia, and eating disorders. Theoretically, supplementing with Griffonia seed can raise serotonin levels and provide relief from depression and insomnia. Many Antidepressant drugs are assumed to bring about a mood- elevating effect by increasing the availability of serotonin in certain brain synapses. Unfortunately, these drugs can produce many unpleasant and dangerous side effects. Since Griffonia simplicifollia (5-HTP naturally) can not be patented as a pharmaceutical substances, drug companies have profit incentive to market this natural substances. 5-HTP appears to have equal efficacy to antidepressant medication, but without the drug risks and side effects. Griffonia seed has also been used in treating fibromyalgia and chronic headaches in order to reduce pain.

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