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Mini Review

Review on medicinal importance of *Vigna* genus

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Abstract

Globally, there are more than 500,000 plant species (green scum, duckweed, lichens, liverworts, fungi, ferns, conifers, mosses and flowering plants etc.) that maintain earth's environmental equilibrium, ecosystem stability and also possess vast endemic, aesthetic and cultural importance, provide medicine, food, fuel, shelter and clothing. Plants are used as therapeutic agents to improve health by a large part of population. Several clinical facts suggest that plant derived foods hold various potential health benefits and well known as neutraceuticals. These are the products that are used as food or as a part of food (foodstuffs), able to cure and prevent diseases in addition to their basic nutritional value. More than 200,000 chemical compounds are synthesized by plants and no doubt, also possess medicinal importance. Worldwide, about 70% plant based preparations are used as traditional medicines and also facilitate the base for 50 percent of prescription and/or over the counter drugs used in the Western-type practice of medicine. For underdeveloped and developing countries, it is a need to provide safe, efficient and cheap medications. In various part of India medicinal plants are widely distributed and always have increasing demand due to their medicinal properties. The present review is focused on the genus *Vigna* which is widely cultivated and used as neutraceuticals. They grow in varied climatic zones, in high temperatures, low rainfall and poor soils with low input in form of fertiliser and irrigation that make them valuable crop plants. As *Vigna* is an important genus that fulfils the food demand, useful in cosmetics and medicines, there is scope to enhance its productivity via resource conservation, optimum use of rainwater, bridging the yield gaps and innovations in technology transfer and up scaling. One of the important steps to find out a way to increase the production is the detection and analysis of naturally occurring DNA sequence variation by using DNA markers or molecular markers as these markers are indispensable tool that construct maps of genetic linkage and mark the agronomically important traits.

Keywords: Neutraceuticals; Pharmacognosy; Phytochemicals; Environmental stress

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Introduction

The name of the *Vigna* genus is derived from an Italian botanist of the 17th century Dominico Vigna. It comprises around 150 species (1). It is closely related to *Phaseolus*. Most commonly cultivated crops of the *Vigna* genus are blackgram *(Vigna mungo),* cowpea *(Vigna unguiculata),* greengram *(Vigna radiata),* bambara groundnut *(Vigna subterranea),* azuki bean *(Vigna angularis),* snail

Table 1. Different *Vigna* species and their medicinal importance

S. No.	*Vigna* species	Medicinal value	References
1.	*V. marina*	Fractured bone, food poisoning, weakness after child birth, headache, stomach-ache, asthma, poultice, mouth infections and abscesses.	(7,59)
2.	*V. radiata*	Light diet, fever, dysentery, cooling and astringent, vertigo, beri-beri, polyneuritis granuloma, poultice (treatment of scabies, psoriasis and other skin ailments), heat stroke, antidiahrroeal, antioxidant, antimicrobial, anti-inflammatory, antitumor, antidiabetic, antihypertensive, gastritis, uraemia, hypercholesterolemia, coronary heart disease, lipid metabolism accommodation, hepatitis, toxicosis, cholera, corneal opacity and macula.	(7, 17-20, 26, 60-67)
3.	*V. unguiculata*	Neuritis, insomnia, weakness of memory, indigestion, dyspepsia, sensation of pins and needles in limbs, periodic palpitation, congestive cardiac failure, stomatitis, corneal ulcers, coleic diseases, kwasiorkar, marasmus, hyperacidity, nausea and vomiting, malnutrition and micronutrient deficiencies.	(7, 34, 68)
4.	*V. vexillata*	Parkinson's disease.	(7)
5.	*V. mungo*	Liver disorders, rheumatism, infection of nervous system, aching bones, dropsy, cephalgia, anti-hypertensive and antidiabetic, hypolidimic action.	(7, 66, 69-72)
6.	*V. philosa*	Roots are used as aphrodisiac and germicidal, cough, fever, diarrhoea, hemoroids, opthalomapathy, burning sensation, dyspepsia.	(7)

Table 2. Phytochemicals reported from *Vigna* sp.

S. No.	*Vigna* species	Phytochemicals Reported	References
1.	*V. mungo*	Glycosides, tannins, alkaloids, flavonoids, saponins, terpenoids, quinone, sterols, ethylbenzene, pentane, 1,1-diethoxy-, hexanoic acid, propane, 1,1,3-triethoxy-, octanoic acid, decanoic acid, dodecanoic acid, 3-hydroxy-, (1,1'-bicyclopropyl)-2-octanoic acid, 2'-hexyl-, methyl ester, desulphosinigrin, 3-O-methyl-d-glucose, phthalic acid, butyl isohexyl ester, ethanol, 2-(9-octadecenyloxy)-,(Z)-, n-hexadecanoic acid, hexadecanoic acid, 9,12-octadecadienoyl chloride, (Z,Z)-, oleic Acid, octadecanoic acid, ethyl ester, genistein, 2'-hydroxy-genistein, 2'-hydroxydaidzein, kievitone, cyclokievitone	(73-76)
2.	*V. angularis*	Vitexin, isovitexin	(77)
3.	*V. radiata*	Steroids, triterpenoids, glycosides, flavonoids, alkaloids, polyphenols, tannins, saponins, daidzin, daizein, ononin, formononetin, isoformononetin, 6,7,4'-trihydroxyisoflavone, 6,7,4'-trihydroxyisoflavone, genistin, sissotrin, genistein, prunetin, biochanin A, 6''–O-acetylgenistin, 5,7,4'-trimethoxyisoflavone, 2'-hydroxygenistein, apigenin, vitexin, isovitexin, rutin, quercetin-3-glucoside, quercetin, kaempferol, myricetin, rhamnetin, kaempferitrin, kaempferol-3-rutinoside, 3,5,7,3',4'-pentahydroxyflavonol, 3,7,8,3',4' -pentahydroxyflavonol, naringenin-7-glucoside, naringin, neohesperidin, hesperetin, 5,7-dihydroxyflavanone, eriodictyol-7-glucoside, eriodictyol, naringenin, rhododendrin, scopoletin, pomiferin, delphinidin, 2',4,4'-trihydroxychalcone, phloretin, coumestrol, osajin, p-hydroxybenzoic, protocatechuic, syringic, gallic acid, vanillic acid, gentisic acid, shikimic acid, p-coumaric, cinnamic acid, caffeic acid, ferulic, chlorogenic acid.	(67, 78, 79)
4.	*V. subterranea*	Delphinidin 3-O-â-glucoside, petunidin 3-O-â-glucoside, and malvidin 3-O-â-glucoside, alkaloids, saponin, flavonoids, carbohydrate, fats, oil, resins, terpenoids, steroids, glycosides, proteins.	(50, 80, 81)
5.	*V. aconitifolia*	Amino acids, carbohydrates, glycosides, flavonoids, tannins, phenolic compounds, saponins, ascorbic acid.	(82)
6.	*V. unguiculata*	Alkaloids, saponin, flavonoids, tannins, glycosides, sterols, carbohydrates, polyphenols, reducing sugar, fats, oil, proteins.	(80, 81, 83-85)
7.	*V. umbellata*	*p*-coumaric acid, ferulic acid, sinapic acid, catechin, epicatechin, vitexin isovitexin quercetin.	(86)
8.	*V. vexillata*	Sterol, isoflavone.	(87)

bean *(Vigna caracalla),* pencil yam *(Vigna lanceolata), Vigna marina, Vigna parkeri,* wondering cowpea *(Vigna speciosa),* jungle mat bean *(Vigna trilobata),* red bean *(Vigna umbellatA)*, moth bean *(Vigna aconitifolia)* and zombie pea *(Vigna vexillata)* etc. Cowpea, mungbean, blackgram and azuki bean are called as orphan grain legumes since there is little study has been done on these crops and limited genetic and genomic resources are available (2-3). Some wild species of *Vigna* are well known for various uses such as soil enrichment material, human food, medicinal plants, soil erosion-preventing materials and animal feed (4). Legumes such as bambara groundnuts (*V. subterranea*), black gram (*V. mungo*), peas (*Pisum sativum*), green gram (*V. radiata*) and beans (*Phaseolus vulgaris*) etc. occupy around 20-57% of cultivable land in different countries due to their properties (5). It is well known that there are various environmental stresses i.e. biotic and abiotic that adversely affect the crop yield (6). The seeds of nearly all species of

Vigna have antioxidant properties and are used to treat different diseases like rheumatism, liver diseases, diabetes, coughs, cancer, fevers, microbial infections, kidney disorders, paralysis, hormonal disorders and for weight reduction (7-8). Therefore further research is required to find out pharmacognostic importance of individual components of these species.

Medicinal importance of a few *Vigna* species

1. *V. mungo* (Blackgram)

Blackgram/urdbean (*V. mungo* (L.) Hepper), a self-pollinating diploid ($2n = 2x = 22$) short duration legume crop (90-120 days) originated in India which is the largest consumer and producer (9-10). In India, it is widely grown in the rainy season and gives around 20% to the overall world pulse production (11-12). It is important in cropping systems as it adds to soil fertility due to nitrogen fixing capacity of symbiotic bacteria in nodules. It constitutes an integral part of human diet due to high nutritive value as mature dry seeds that possess proteins, vitamins, amino acids and lipids (13-14). Immature seeds or green pods are used as food for animals in the form of hay and straw. Seeds are highly nutritive (calorific value-350cal/100g) containing about 24-26% protein, 60% carbohydrates, 1.3% fats, phosphorus (345mg/100g), potassium, iron (8.7mg/100g), calcium (185mg/100g), amino acids (arginine, phenylalanine, leucine, lysine, valine and isoleucine etc.), niacin (2mg/100g) and vitamins B1 (0.42mg/100g), A, and B2 (0.37mg/100g) (9). Since ancient time it has been in use as medicinal as well as cosmetic material (15-16). It is used to treat nervous disorder, sexual dysfunction, diabetes, hair disorders, rheumatic afflictions and digestive system disorders etc.

2. *V. radiata* (Green gram)

This is a widely grown legume of *Vigna* species in India. It is used as food and medicine due to higher ratio of vitamins, calcium, irons and phosphorus in compare to other legumes. Contents of green gram such as amino acids, proteins, polyphenols and oligosaccharides possess antioxidant, antitumor, anti-inflammatory and antimicrobial activities (17-20); flavonoids and phytosterols possess certain degree of anti-bacterial and anti-viral effects; coumarins, alkaloid, phytosterols and saponins enhance the immune system and increase the amount of phagocytic cell; protein and phospholipid enhance appetite and excite nerves; polysaccharides avoid the chances of coronary heart disease and angina cordis (7); trypsin inhibitors, hem agglutinin, tannins, and phytic acid enhance the digestion and remove the toxins (21); α-tocopherol (antioxidant) reduces the risk of certain types of cancer and cardiovascular diseases (22-23); γ-tocopherol reduces LDL oxidation, platelet aggregation, and delaying intra-arterial thrombus formation (24-25). Studies reported that methanolic extract contains anti inflammatory activity that may inhibits the prostaglandin synthesis (26). Bark and fruits are more important in comparison to other parts of plant.

3. *V. unguiculata* (Cowpea)

Since Neolithic times Cowpea is used as food source (27). It is widely grown legume crop in developing countries of Africa, Northern and North-eastern regions of Brazil, Latin America, and Asia due to their highly nutritive value at low cost (28-31). Whole plant parts are consumed as a food or forage legume (32-33) like tender shoot tips and leaves are used as vegetable in seedling stage; immature pods and seeds are eaten in the fruiting stage; mature dry seeds are used to prepare cowpea cake, or deep fried into bean balls, or the seeds could be boiled, mixed with sauce or stew and consumed directly. Cowpea is used by low income population who suffer from iron and zinc deficiencies (malnutrition and micronutrient deficiencies) in Brazil (34). Medicinal value of cowpea is also observed (35) who reported cowpea is an important legume crop to manage, prevent and cure the degenerative diseases linked with free radical damage (35).

4. *V. subterranea* (Bambara groundnut)

This legume plant from *Vigna* genus is under researched and in Africa, the second most important indigenous food legume (36). It is believed that bambara groundnut is a drought tolerant crop as it is able to grow in poor soils and harsh climatic conditions (37-38). Development of pods are underground and seeds are used as foodstuff. Average production of bambara groundnut is about 300 – 800 kg / ha (39). It may reach the level of 3000 kg/ha and 100 kg / ha depending on various growth conditions (39-40).

Phytochemical constituents and pharmaco-logical properties reported in *Vigna*

Formulation of a new drug has been done by using black gram flour contains mucilage which has the ability to sustain the release of freely soluble drug (41). It is reported that blackgram contains hypoglycaemic action. Its extract used in rheumatism and roots contain narcotic property (42). Green gram is highly nutritive and possesses rich amount of iron and phosphorus (43). Absence of canavanine (non protein amino acid) in seeds and proanthocyanidin (polyphenol) in leaves were reported in biochemical study of eleven species of *Vigna* (44). Bioactive compounds like β-sitosterol, stigmasterol, soyasapogenol C, 1,4-butanediamine, 3-(carboxy methyl amino) propanoic acid, 1H-Imidazole, spermidine, spermine, amino acids and peptides are isolated from *V. radiata* seeds (45). Induction of phenyl propanoid pathway (PPP) has been reported through the pentose phosphate and

shikimic acid pathways, by natural elicitors (fish protein hydrolysates (FPH), lactoferrin (LF) and oregano extract (OE)) in sprouts of *V. mungo* (46). Isolation of phosphorylase and Q- enzyme (starch metabolizing enzymes) have been done from aqueous extracts of *V. radiata* seeds (47). Antioxidative properties and total phenolic contents were studied via the extraction with 70% acetone in two varieties of cowpea (48). The pulses are also reported to possess cholesterol lowering effect and serum phospholipid lowering effect (49). Several anthocyanins including delphinidin-3-glucoside is reported from *Vigna* (50). Phosphoenolpyruvate phosphatase (PEP) has also been characterised from germinating green gram (51). In germinating blackgram interconversion of (-)-quinic acid and 3-dehydro quinic acid is reported (52). BGL-I-1 (94 kDa) and BGL-I-2 (89 kDa) are obtained by partial purification of BGL-I (galactose-specific lectins) in blackgram (53). Antioxidant mechanism has been studied in green gram seeds and antioxidant activity reported using DPPH method and ferric reducing activity in cowpea (54). Phytoestrogens are reported in the extract of seven legumes by using an estrogen-dependent MCF-7 breast cancer cell proliferation assay (55). All plant parts (seeds, leaves, stems and roots) possess trypsin inhibitor (56). Comparative phytochemical studies on legumes have been done by using the technique GC-MS and LC-MS (57). Evaluation of any immunostimulatory activities in an animal model via the extract of green gram seeds has been done (58).

Conclusion

Nowadays several traditional medicines are in international market but the genus *Vigna* with around 150 species, have received little attention. Therefore it is require to find out the medicinal importance of individual parts of these plants, to manage, prevent and cure diseases. In this review it is concluded that many species of *Vigna* possess antioxidant activity and able to manage and cure different diseases linked with free radical generation. To fulfil the demand of efficient, safe and cheap medications, there is a need to understand the taxanomical characters of various medicinal plants, climatic conditions, various folklore usages, phytochemical, pharmacological, antimicrobial values and it is possible by the collaborative work of botanist, phytochemist and pharmacist.

Competing interest

The author declares no conflict of interest.

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