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Nutritional value, Ethnomedicine, Phytochemistry and pharmacology of *Vigna radiata* (L.) R. Wilczek

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Abstract

Vigna radiata (L.) R. Wilczek commonly known as Mung bean is one of the most important pulse crops, grown from tropical to sub-tropical areas around the world. Mung bean is reported to help in preventing the loss of nails and hairs, and also reduces the risk of hypercholesterolemia, coronary heart disease and decreases the absorption of toxic substances. Flavonoids and phenols are reported from this plant. Antioxidant, antidiabetic and hypocholesterolemic activities are also shown by *Vigna radiata*.

Keywords: *Vigna radiata*, Ethnomedicine, Phytochemistry, pharmacology

Introduction

Vigna radiata (L.) R. Wilczek, commonly known as Mung bean is widely grown in south and south-east Asia. More than 80% of the Mung bean is produced in South Asia [1]. *Vigna radiata* is one of the most important pulse crops, grown from tropical to sub-tropical areas around the world [2].

The sprouts and seeds of Mung beans are used as fresh salad vegetable or common food in Bangladesh, India, South East Asia and also in western countries. Mung beans contain balanced nutrients, including dietary fiber, protein, oligosaccharides, and significant amounts of bioactive phytochemicals [3, 4]. Polyphenols in Mung bean are important sources of lipid metabolism accommodation, anti-inflammatory, antioxidant, antimicrobial, antiseptic, antihypertensive and antidiabetic effects [5].



Fig 1: *Vigna radiata* seeds

Table 1: Name of *Vigna radiata* in different languages [6, 8].

Languages	Names
Bengali	Mug, Mung
Burmese	Pe-Di-Sein, Pe-Di
Chinese	Lü Dou, Luhk Dáu, Qing Xiao Dou
Czech	Fazol zlatý, Mungo fazole, Vigna Zlatá,
Danish	Mung-Bønne
Dutch	Mungboon
Estonian	Munguba
English	Mung bean, Green gram, Chinese Mung Bean, Golden gram, Indian Mung bean, Golden-Seeded Mung bean, Burmese Mung bean, Jerusalem Pea, Celera bean, Mung Dahl, Moong bean
Finnish	Mungopapu
French	Haricot mungo, Mungo, Ambérique, Haricot doré
German	Mungbohne, Jerusalembohne
Hindi	Maash daal
Ibanag	Balataong
Ifugao	Balatong Balatong
Indonesia	Kacang Djong, Arta Ijo,
Italian	Fagiolo Aureo, Fagiolino Verde,
Japanese	Fundou, Bundou, Ryokutou, Yaenari,
Laotian	Thwàx Ngo, Thwàx Khiêw
Malyalam	Cerupayar
Malay	Kacang Hijau
Manipuri	Mung-Hawai
Marati	Mung, Udid
Nepali	Mas
Oriya	Muga
Persian	Maash
Polish	Fasolka mung, Fasola Złota, Ola Mung
Portuguese	Feijão-da-china, Feijão-mungo
Punjabi	Moongi
Russian	Mash, Mas, Fasol' Vidov, Fasol
Sinhalese	Bu Me, Mun
Spanish	Frijol mungo, Judía mungo, Poroto chino
Swahili	Mchoroko, Mchooko
Swedish	Mungböna
Tagalog	Munggo, Balatong
Tamil	Pasippayaru, Pasipayar
Telugu	Pachha Pesalu, Pacha-Pesalu
Thai	Thua Khieo, Thuaa Khiaao
Urdu	Maash daal
Vietnamese	Dâu Xanh

Table 2: Taxonomy [7, 9, 10].

Kingdom	Plantae
Subkingdom	Tracheobionta
Super Division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Papilionaceae
Subfamily	Faboideae
Tribe	Phaseolae
Sub tribe	Phaseolinae
Genus	<i>Vigna</i>
Species	<i>radiata</i>
Synonym(s)	<i>Azuki radiata</i> (L.) Ohwi, <i>Phaseolus abyssinicus</i> Savi, <i>Phaseolus aureus</i> Roxb., <i>Phaseolus radiatus</i> L., <i>Phaseolus sublobatus</i> Roxb., <i>Phaseolus trinervis</i> Wight & Arn.
Plant	Annual, erect to semi-erect, slightly pubescent herb up to 1.3 m tall.
Stem	Pubescent, hairs brown, stiff spreading.
Leaves	Leaf trifoliate, petiole 5-21 cm long, leaflet 5-16 cm long, 3-12 cm broad, elliptic, rhomboid or ovate, the lateral somewhat oblique, entire or 2-3-lobed, acuminate, glabrous or bristly pilose on both surfaces, petiolule 3-6 mm long; stipules 1-1.8 cm long, peltate.
Inflorescence	Inflorescence axillary, many flowered, peduncle 2.5-9.5 cm long, bracts 4-5 mm long, pedicel 2-3 mm long, bracteoles 4-7 mm long. Calyx tube 3-4 mm long, glabrous, teeth 1.5-4 mm long, ciliate, the upper pair almost united. Corolla greenish yellow. Vexillum 1.2 cm long. Flower Bisexual, papilionaceous.
Fruit	Fruit 4-9 cm long, linear-cylindrical, 5-6 mm broad somewhat constricted between the seeds, pubescent, hairs spreading,

	dark brown, 8-14-seeded.
Seeds	2.5–4 mm × 2.5–3 mm × 2.5–3 mm, globose to ellipsoid or cube-like, commonly green but sometimes yellow, olive, brown, purplish brown or black, marbled or mottled with black patches, glossy or dull; hilum white, conspicuously flat, c. 1.5 mm × 0.5 mm; seed coat often with ridges, making the seed rough to the touch.

Macroscopy of seeds [11].

Hilum is at or almost at the level of seed coat and very short aril is present. Funicle present. Macrosclerids cylindrical with conical lumen.

Nutritional value

Mung beans is a pulse or food legume crop. It is mainly used as dried seeds and occasionally as forage or green pods or as vegetable. Dried seeds are eaten whole or split, cooked, fermented or milled and ground into flour. Confections, curries, soups, porridge and alcoholic beverages can also be made from Mung bean [12]. Seeds contain about 20 – 24% protein in which albumin (25%) and globulin (60%) are the main storage proteins [13, 14]. Mung bean protein is also rich in essential amino acids and contain aromatic amino acids,

leucine, isoleucine and valine, However, it is slightly deficient in lysine, threonine, tryptophan and total sulfur amino acids [15]. Mung beans also contain carbohydrate content as 50 – 60%. Starch is the major carbohydrate and therefore, mung bean is typically used in making starchy noodles. Beside this, trypsin inhibitors, hemagglutinin, tannins and phytic acid are also present in Mung bean to have biological functions, promoting digestion and eliminating toxins. Minerals like calcium and potassium are also reported in Mung bean, which are essential for enhancing the strength of bones and teeth. Mung bean rich in lecithin which reduces the liver fat and regulates the normal functioning of the liver. Other properties like easy digestibility and low proportions of flatulence factors also add to its value among the pulse crops [16].

Table 3: Nutritional value of seeds [8].

Water	9.05g/100g	Amino acid (g/ 100g of protein)	
Energy	347 kcal/100g	Alanine	1.050
Carbohydrates	62.62g/100g	Arginine	1.672
Proteins	23.86g/100g	Aspartic acid	2.756
Ash	3.32g/100g	Cysteine	0.210
Total dietary fibers	16.3g/100g	Glutamic acid	4.264
Total sugars	6.60g/100g	Glycine	0.954
Fats	1.15g/100g	Histidine	0.695
Lipids (g/ 100g)		Isoleucine	1.008
Total saturated fatty acids	0.348	Leucine	1.847
Total monounsaturated fatty acids	0.161	Lysine	1.664
Total polyunsaturated fatty acids	0.384	Methionine	0.286
Micro-minerals (mg/ 100g)		Phenylalanine	1.443
Copper	0.941	Proline	1.095
Iron	6.74	Serine	1.176
Manganese	1.035	Threonine	0.782
Selenium	8.2	Tryptophan	0.260
Zinc	2.68	Tyrosine	0.714
Macro-minerals (mg/ 100g)		Valine	1.237
Calcium	132	Vitamins (mg/ 100g)	
Magnesium	189	Provitamin A (Beta Carotene)	68
Phosphorus	367	Vitamin A (Retinol)	114 IU/100g
Potassium	1246	Vitamin B ₁ (Thiamin)	0.621
Sodium	15	Vitamin B ₂ (Riboflavin)	0.233
-----	-----	Vitamin B ₃ (Niacin)	2.251
-----	-----	Vitamin B ₅ (Pantothenic acid)	1.910
-----	-----	Vitamin B ₆ (Pyridoxine)	0.382
-----	-----	Vitamin B ₉ (Folate)	625
-----	-----	Vitamin C (Ascorbic acid)	4.8
-----	-----	Vitamin E (alpha-tocopherol)	0.51
-----	-----	Vitamin K (Phylloquinone)	9.0

Ethnomedicine

Mung bean is reported to help in preventing the loss of nails and hairs, and also reduces the risk of hypercholesterolemia, coronary heart disease, decreases the absorption of toxic substances and prevent cancer [16]. People in China are using Mung bean as medicine for more than 2000 years for detoxification activities, gastrointestinal problems, refresh mentality, skin moisture, decreasing the stroke of heat and other related problems with summer heat [5].

Table 4: Different traditional medicinal preparations of *Vigna radiata* [17].

Medicaments	Indication
Soup	Fever, ascites, cough.
Cold infusion	Polydypsia, emesis.
Decoction	Bacterial skin infection.
Ghee preparation	Diseases of teeth.

Table 5: Phytochemistry [8, 18, 22].

Polyphenol class	Polyphenol sub-class	Compounds
Flavonoid	Anthocyanins	Delphinidin ; Delphinidin 3- <i>o</i> -glucoside
	Chalcones	2,4,4'-trihydroxychalcone
	Dihydrochalcones	Phloretin
	Dihydroflavonols	Dihydroquercetin
	Flavanones	Eriodictyol ; Hesperetin ; Neohesperidin ; Naringin ; Naringenin ; Naringenin 7- <i>o</i> -glucoside ; Neohesperidin ; 5,7-dihydroxyflavanone ; Eriodictyol 7- <i>o</i> -glucoside.
	Flavones	Apigenin; Apigenin 7- <i>o</i> -glucoside; Apigenin 6- <i>c</i> -glucoside; Hypolaetin; Luteolin; Vitexin; Isovitexin.
	Flavonols	Kaempferol ; Kaempferol 3- <i>o</i> -rutinoside ; Kaempferitrin ; Quercetin ; Quercetin 3- <i>o</i> -glucoside ; Quercetin 3- <i>o</i> -rutinoside ; Myricetin ; Rhamnetin ; Rutin
Phenolic acids	Isoflavonoid	Biochanin A ; daidzin ; Daidzein ; Dihydrobiochanin A ; Dulcinoside ; 5,7-dihydroxy-8,4'-dimethoxyisoflavone; Formononetin ; Isoformononetin ; Genistin ; Genistein ; Glycitein ; 6''- <i>o</i> -acetylgenistin ; 2'-hydroxygenistein ; Ononin ; Osajin ; Pomiferin ; 6,7,4'-trihydroxyisoflavone ; Prunetin ; Sissotrin
	Hydroxybenzoic acids	4-Hydroxybenzoic acid ; Caffeic acid ; Ellagic acid ; Ellagic acid glucoside ; Gallic acid ; Gentisic acid ; Protocatechuic acid ; Vanillic acid
Other polyphenols	Hydroxycinnamic acids	<i>p</i> -coumaric acid ; Chlorogenic acid ; Ferulic acid ; Feruloyl glucose ; Sitosterol ferulate ; Syringic acid
	Hydroxycoumarins	Scopolin ; Scopoletin
Other polyphenols	Hydroxyphenylpropene	Rhododendrin
	Coumestan	Coumestrol

Table 6: Pharmacology

Part	Extract	Pharmacological activity
Seed	Aqueous	Anti-fungal [23], anti-hyperglycemic [24].
	Ethanol	Anti-inflammatory [25, 26].
	Methanol	Anti-microbial [27].
	Ethyl acetate	Antioxidant and anti-proliferative [28].
Seed sprout and seed coat	Ethanol	Antidiabetic [29].
	Aqueous	Antiseptic [30].
Seed sprout	Methanol and ethyl acetate	Whitening cosmeceutical ingredient [31].
	Aqueous	Anti-hypertensive [32].
	Methanol	Estrogenic effect [33].
Seed coat	Aqueous	Antiseptic [34].
Leaf	Methanol	Anti-inflammatory [35].
Compounds		Pharmacological activity [30].
Proteins, polypeptides, polysaccharides		Antioxidant
Enzymes, peptides		Antimicrobial
Phytosterol		Lipid metabolism
Proteins, amino acids		Antihypertensive
Polyphenols		Antidiabetic , antioxidant, antimicrobial, anti-inflammatory, antitumor, antiseptic

Conclusion

Medicinal uses, phytochemistry and pharmacology of *Vigna radiata* presented in this review could be helpful for future studies and research. The plant has good future prospective for the discovery of new molecules and pharmacological activities.

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