Vol 7 | Issue 1 | 2016 | 6-12.

e - ISSN 2249-7544
Print ISSN 2229-7464

INTERNATIONAL JOURNAL
OF
PHYTOPHARMACY RESEARCH
www.phytopharmacyresearch.com

KAPI KACHU: A POTENTIAL SOURCE OF BIO ACTIVE DRUG

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ABSTRACT

The genus *Mucuna*, belonging to the Fabaceae family, sub family Papilionaceae, includes approximately 150 species of annual and perennial legumes. Kapi Kachu (Velvet bean) *Mucuna pruriens* is widespread in tropical and sub-tropical regions of the world. It is considered as a viable source of dietary proteins due to its high protein concentration (23–35%) in addition its digestibility, which is comparable to that of other pulses such as soybean, rice bean and lima bean. It is therefore regarded a good source of food. *Mucuna* spp. has been reported to contain the toxic compounds L-dopa and hallucinogenic tryptamines and anti-nutritional factors such as phenols and tannins due to the high concentrations of L-dopa (4–7%), Velvet bean is a commercial source of this substance, used in the treatment of Parkinson's disease. The toxicity of unprocessed velvet bean may explain why the plant exhibits low susceptibility to insect pests. Velvet bean is well known for its nematicidic effects, it also reportedly possesses notable allelopathic activity, which may function to suppress competing plants. Thus the current review highlights the pharmacognosy, phytochemistry and pharmacology of *M.Prureins* for better understanding to choose as a potential source of bioactive drug.

Keywords: Kapi Kachu, *Mucuna Prureins*, Bioactive drug, Parkinson's disease.

INTRODUCTION

KAPI KACHU [1-3]

Plant Name: Kapi Kachu (*Mucuna prureins* (L).DC)
Synonyme: *Mucuna atrocarpa*, *Carpogon capitatus* Roxb.
Biological source: it consists of seeds *Mucuna prureins* (L).DC belonging to family Fabaceae.

Habit and Habitat [4]:

The plant *M. pruriens*, widely known as "Velvet bean," is a vigorous annual climbing legume originally from southern China and eastern India, where it was at one time widely cultivated as a green vegetable crop. It is one of the most popular green crops currently known in the tropics; Velvet beans have great potential as both food and feed as suggested by experiences worldwide. The velvet bean has been traditionally used as a food source by certain ethnic groups in a number of countries. It is cultivated in Asia, America, Africa and the Pacific Islands, where its pods are used as a vegetable for human consumption and its young leaves are used as animal fodder.

PHARMACOGNOSY

Macroscopical characters [5]:

The plant is an annual, climbing shrub with long vines that can reach over 15 m in length. When the plant is Young, it is almost completely covered with fuzzy hairs, but when older, it is almost completely free of hairs. The leaves are trip innate, ovate, reverse ovate, rhombus shaped or widely ovate. The sides of the leaves are often heavily grooved and the tips are pointy. In young *M.pruriens* plants, both sides of the leaves have hairs. The petiole of the leaflets is two to three millimeters long. Additional adjacent leaves are present and are about 5 mm long. The flower heads take the form of axially arrayed panicles. They are 15 to 32 cm long and have two to three, or many flowers. The accompanying leaves are about 12.5 mm long; the flower stand axes are from 2.5 to 5 mm. The bell is 7.5 to 9 mm long and silky. The Sepals are longer or of the same length as the shuttles. The crown is purplish or white. The flag is 1.5 mm long. The wings are 2.5 to 3.8 cm long. In the fruit ripening stage, a 4 to 13 cm long, 1 to 2 cm wide, unwinged leguminous fruit develops. There is a ridge along the length of the fruit. The husk is very hairy and carries up to seven seeds. The seeds are flattened uniform ellipsoid, 1 to 1.9 cm long, 0.8 to 1.3 cm wide and 4 to 6.5 cm thick. The hilum, the base of the funiculars (connection between placenta and plant seeds) is a surrounded by a significant arillus (fleshy seeds shell). *M.pruriens* bears white, lavender, or purple Flowers. Its seed pods are about 10 cm long and are covered in loose

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orange hairs that cause a severe itch if they come in contact with skin. The chemical compounds responsible for the itch are a protein, mucunain and serotonin. The seeds are shiny black or brown drift seeds. It is found in tropical Africa, India and the Caribbean. The dry weight of the seeds is 55 to 85 g/100 seeds. With 2n = 20, 22 or 24 chromosomes.

Microscopic characters [7]:

Epidermal features:

The epidermis consists of single layer of cells. The adaxial epidermal cells are larger, with thick walls as compared to the abaxial epidermal cells. Unicellular trichomes are found on both the surfaces. A well-developed cuticle is present on both the surface of the leaf. The leaves having stomata are anomocytic. The number of stomata per unit area is always higher on the lower surfaces than on the upper surfaces. Trichomes are present in a great number on adaxial or abaxial surfaces of the leaf. The trichome frequency is more on vein than in the inter costal region. Unicellular trichomes are composed of thick walled long, narrow cells.

Petiole: Sectional views of petiole shows more or less circular in shape. Epidermis consists of barrel shaped cells, cell walls thick with outside thick cuticle. Hypodermis is collenchymatous with 2-3 layered followed by parenchymatous cortex. Vascular bundles are of dictyostele type and occur scattered within cortex in circular manner. Phloem consists of sieve tubes, companion cells and phloem parenchyma also xylem consists of vessels, tracheids and xylem parenchyma. Oxalate crystals occur in the cortex.

Leaf: The leaf is dorsiventral and hypostatic. The cells of upper epidermis are larger. The cells of lower epidermis are smaller with thin cuticle. Stomata are present on both surfaces. Papillae are absent. Non-glandular, unicellular trichomes are common. The mesophyll is differentiated into palisade and spongy tissue. Palisade is one to two layered and spongy tissues are of four to six layered. An arc shaped vascular bundle is present in the cortex of midrib region. Xylem element facing upwards. Phloem consists of sieve tubes, companion cells and phloem parenchyma and xylem consists of vessels, tracheids and xylem parenchyma. The epidermis in midrib region is followed by two to three layered collenchymas on abaxial surface and one layer of collenchyma on adaxial surface. The collenchymatus hypodermis is followed by parenchymatous cortex in which vascular bundle is present.

Stem: The transverse section of the stem shows an irregular outline. Epidermis has small cells compactly arranged; following the epidermis is a band of collenchyma of 4-5 layers and a zone of parenchyma 3-4 layers of cells. The stem possesses a dictiostele which encloses wide central pith. Phloem consists of sieve tubes, companion cells and phloem parenchyma as well as xylem consists of vessels, tracheids and xylem parenchyma. Starch grains, calcium oxalate crystals of acicular type are found abundantly in the region of the stem.

Root: The transverse section of the root shows an irregular outline. Epidermis has small cells compactly arranged. The cork consists of 4 to 6 rows of nearly cubical to rectangular cells of which, the cells of the peripheral rows are thick walled, but not lignified while the innermost one or two rows are thin walled. Phellogen is single layered. The cortex is wide zone consists of tangentially elongated cells and small group of stone cell. Starch grains of simple type are present in the cortex. Secondary growth is more. Each phloem group is composed of narrow tangential strips of phloem fibers alternating with the thin-walled phloem-elements. Xylem developed in large amount with linear manner.

Phytochemistry [8]

In addition to the low levels of sulfur-containing amino acids in *M. pruriens* seeds, the presence of anti-physiological and toxic factors may contribute to a decrease in their overall nutritional quality. These factors include polyphenols, trypsin inhibitors, phytate, cyanogenic glycosides, oligosaccharides, saponins, lectins, and alkaloids. Polyphenols (or tannins) are able to bind to proteins, thus lowering their digestibility. Phenolic compounds inhibit the activity of digestive as well as hydrolytic enzymes such as amylase, trypsin, chymotrypsin, and lipase. Recently, phenolic have been suggested to exhibit health related functional properties such as anti-carcinogenic, anti-viral, anti-microbial, anti-inflammatory, hypotensive and anti-oxidant activities. Trypsin inhibitors belong to the group of proteinase inhibitors that include polypeptides or proteins that inhibit trypsin activity. Tannins exhibit weak interactions with trypsin, and thus also inhibit trypsin activity. Phytic acid [myoinositol-1, 2, 3, 4, 5, 6-hexa (Dihydrogen phosphate)] is a major component of all plant seeds, which can reduce the bioavailability of certain minerals such as zinc, calcium, magnesium, iron, and phosphorus, as well as trace minerals, via the formation of insoluble complexes at intestinal pH. Phytate-olein complexes may also result in the reduced solubility of proteins, which can affect the functional properties of proteins.

Cyanogenetic glycosides are plant toxins that upon hydrolysis liberate hydrogen cyanide. The toxic effects of the free cyanide are well documented and affect a wide spectrum of organisms since their mode of action is inhibition of the cytochromes of the electron transport system. Hydrogen cyanide (HCN) is known to cause both acute and chronic toxicity, but the HCN content of *M. pruriens* seeds is far below the lethal level. Have investigated the concentration of oligosaccharides in *M. pruriens* seeds, and verbacose is reportedly the principal oligosaccharide there in. Fatty acid profiles reveal that lipids are a good source of the nutritionally essential linoleic and oleic acids. Linoleic acid is evidently the predominant fatty acid, followed by palmitic, oleic, and linolenic acids. The nutritional value of linoleic acid is due to its metabolism at tissue levels that produce the hormone-

like prostaglandins. The activity of these prostaglandins includes lowering of blood pressure and constriction of smooth muscle. Phyto hemagglutinins (lectins) are substances possessing the ability to agglutinate human erythrocytes.

The major phenolic constituent of *M. pruriens* beans was found to be L-dopa (5%), along with minor amounts of methylated and non-methylated tetrahydroisoquinolines (0.25%). However, in addition to L-dopa, 5-indole compounds, two of which were identified as tryptamine and 5-hydroxytryptamine, were also reported in *M. pruriens* seed extracts. mucunine, mucunadine, prurienine, and prurieninine are four alkaloids that have been isolated from such extracts.

The important chemical constiuents of mucuna prurueins are:

- L-dihydroxyphenylalanine (L-dopa, approximately 40 mg/g seed);
- Alkaloids mucunine, mucunadine, mucuadinine, pruriendine and nicotine;
- B-sitosterol, glutathione, lecithin oils, venolic and gallic acids;
- Protein content of 27.9g per 100g.
- D-chiro inositol; tryptamine, alkylamines, steroids, flavonoids, coumarins, cardenolides.

Pharmacology [9]:

Traditionally, *M. pruriens* has been used as an effective aphrodisiac. It is still used to increase Libido in both men and women due to its dopamine inducing properties and in Ayurvedic medicine it is said to increase sperm count. Dopamine has a profound influence on sexual function. Use of *M. pruriens* is well documented in Siddha medicine for a host of uses. The plant and its extracts have been long used in tribal communities as a toxin antagonist for various snakebites. Research on its effects against Naja (Cobra), Echis (Saw scaled viper), Callo selasma (Malayan Pit viper) and Banaras (Krait) have shown that it has potential use in the prophylactic treatment of snakebites. *M.pruriens* seeds have also been found to have Antidepressant properties in cases of depressive neurosis when consumed and formulations of the seed powder have shown promise in the management and treatment of Parkinson disease. Dried leaves of *M.pruriens* are sometimes smoked. *M.pruriens* has also recently become popular among lucid dreaming enthusiasts: when combined with other supplements it stimulates the cholinergic system.

Research work carried out on kapi kachu

MICROBIOLOGICAL WORK

Guerranti R et al, evaluated proteins from *Mucuna pruriens* and enzymes from *Echis carinatus* venom: characterization and cross-reactions [10]. Ekanem AP et al, investigated between the crude extracts of *Mucuna pruriens* (Fabaceae) and *Carica papaya* (Caricaceae) against the protozoan fish parasite *Ichthyophthirius multifiliis* [11].

BIOCHEMICAL WORK

Pugalenthi M *et al*, studied Alternative food/feed perspectives of an underutilized legume *Mucuna pruriens* var.utilis [12]. Ahmad MK et al demonstrated the effect of *Mucuna pruriens* on semen profile and biochemical parameters in seminal plasma of infertile men [13]. Aguiyi JC et al, identified blood chemistry of rats pretreated with *Mucuna pruriens* seed aqueous extract MP101UJ after *Echis carinatus* venom challenge [14]. Pras N et al, found that improved biotechnological production of the anti-Parkinson drug L-dopa from *Mucuna pruriens* by plant cell selection [15]. Rajyalakshmi P et al screened the nutritive value of the foods cultivated and consumed by the tribal of south India [16].

Vijayakumari K et al evaluated the effects of different post-harvest treatments on anti-nutritional factors in seeds of the tribal pulse, *Mucuna pruriens* (L.) DC [17]. Nagashayana N et al evaluated the efficacy of Ayurveda treatment of a concoction in cow's milk of powdered *Mucuna pruriens*, *Hyoscyamus reticulatus*, *Withania somnifera* and *Sida cordifolia* roots [18]. Nagashayana N *et al* found the association of L-DOPA with recovery following Ayurveda medication in Parkinson's disease [19]. Ibewiro B *et al* performed the Symbiotic of herbaceous legumes in tropical cover cropping systems by using *Murcuna prureins* [20]. Vadivel V *et al* detected the nutritional and anti-nutritional characteristics of seven south Indian wild legumes includes *Mucuna prureins* [21]. Siddhuraju P, studied nutritional composition and antinutritional factors of three different germplasm seed materials of an under-utilized tropical legume, *Mucuna pruriens* var. utilis [22].

PHARMACOLOGICAL WORK

Tharakan B et al evaluated *Mucuna pruriens* cotyledon powder (MPCP) has shown anti-parkinson and neuroprotective effects in animal models of Parkinson's disease that is superior to synthetic levodopa and *Mucuna pruriens* prevents levodopa induced plasmid and genomic DNA damage [23]. Bhat R et al evaluated the nutritional quality of Velvet bean seeds (*Mucuna pruriens*) exposed to gamma irradiation [24]. Johanek LM et al investigated the *Mucuna prureins* was psychophysical and physiological evidence for parallel afferent pathways mediating the sensation of itch [25]. Davidson S et al evaluated the itch-producing agents' histamine and cowhage activate separate populations of primate spinothalamic tract neurons [26]. Misra L et al extracted the bioactive principles from *Mucuna pruriens* seeds [27]. Soares AR et al, found out the role of catechol structure in the adsorption and transformation reactions of L-DOPA in soils [28]. Donate D et al demonstrated the Anti-diabetic oligocyclitols in seeds of *Mucuna pruriens* [29]. Katzenschlager R et al assessed the *Mucuna pruriens* in Parkinson's disease: a double blind clinical and pharmacological study [30]. Manyam BV et al, to evaluated the neuroprotective effects of the antiparkinson drug with *Mucuna pruriens* [31]. Guerranti R et al demonstrated the protection of *Mucuna pruriens* seeds against *Echis carinatus* venom is exerted through a multiform glycoprotein whose oligosaccharide

chains are functional in this role [32]. Manyam BV et al, elucidated the Effect of antiparkinson drug HP-200 (*Mucuna pruriens*) on the central monoaminergic neurotransmitters [33].

Adjorlolo LK et al susggested the preference of sheep for three forms of *Mucuna* forage and the effect of supplementation with *Mucuna* forage on the performance of sheep [34]. Singhal B et al, assesed the *Mucuna prureins* used for the treatment of Parkinson's disease and its Epidemiology in India [35]. Grover JK et al demonstrated the amelioration of experimental diabetic neuropathy and gastropathy in rats by the various plants (*Eugenia jambolana, Mucuna pruriens* and *Tinospora cordifolia*) extracts [36]. Ibewiro Betal, reviewed that *M.pruriens* was one of the medicinal plants of India with anti-diabetic potential [37].Grover JK et al, suggested traditional Indian anti-diabetic plants attenuate progression of renal damage in streptozotocin induced diabetic mice[38]. Guerranti R, et al, evaluated the effects of *Mucuna pruriens* extract on activation of prothrombin by *Echis carinatus* venom [39]. Manyam BV et al, told that traditional and complementary therapies in Parkinson's disease which includes *M.pruriens* [40]. Houghton PJ et al demonstrated the effect on blood clotting of some west African plants used against snakebite includes *M.pruriens*[41]. Akhtar MS et al investigated the antidiabetic evaluation of *Mucuna pruriens* Linn seeds [42]. Manyam BV et al demonstrated the *Mucuna pruriens* (Atmagupta, Sanskrit), which contains levodopa, was used in the treatment of paralysis agitans in "Ayurveda": in ancient Indian medical treatise [43]. Rathi SS et al assessed the various Ayurvedic plant extracts in the prevention of experimental diabetic cataract by Indian and the effect of *Momordica charantia* and *Mucuna pruriens* in experimental diabetes and their effect on key metabolic enzymes involved in carbohydrate metabolism [44-45]. Tripathi YB et al, found that effect of the alcohol extract of the seeds of *Mucuna pruriens* on free radicals and oxidative stress in albino rats [46]. Siddhuraju P Conducted the effect of various domestic processing methods on antinutrients and in vitro protein and starch digestibility of two indigenous varieties of Indian tribal pulse includes *Mucuna pruriens* Var. utilis[47].

PHYTOCHEMICAL WORK

Revilleza MJ et al, measured the oligosaccharide profile of raw mature seeds of seven different Philippine indigenous food legumes one of the plant is *Mucuna pruriens*[48]. Monson RK et al, demonstrated the relationships among isoprene emission rate, photosynthesis and isoprene synthase activity as influenced by temperature from the plant of *Mucuna prureins*[49]. Del Carmen J et al evaluated the raw and heated velvet beans (*Mucuna pruriens*) as feed ingredients for broilers [50]. Vadivel V et al detected the significance of nutritional and anti-nutritional composition of velvet bean: an under-utilized food legume in south India [51]. Prakash D et al screened some nutritional properties of the seeds of three *Mucuna* species [52]. Isolation of potent allele-chemicals from Velvet bean (*Mucuna pruriens*) and Hairy vetch (*Vicia villosa*) [53]. Zasada IA et al found that reduced allelopathic inhibition of lettuce (*Lactuca sativa*) growth caused by velvet bean (*Mucuna pruriens*) under 3D-clinorotation [54]. Lawal OS et al investigated the effect of acetylation and succinylation on solubility profile, water absorption capacity, oil absorption capacity and emulsifying properties of *Mucuna* bean (*Mucuna pruriens*) protein concentrate [55]. Misra L et al isolated the alkaloidal constituents from *Mucuna pruriens* seeds [56].Tomita-Yokotani K et al, analyzed distribution of L-DOPA in the root of velvet bean plant (*Mucuna pruriens* L.) and gravity [57]. Di Patrizi L et al demonstrated the structural characterization of the N-glycans of gpMuc from *Mucuna pruriens* seeds it act against cobra and viper venoms [58]. Adebowale YA et al, investigated the influence of kosmotropic and chaotropic salts on the functional properties from the isolation of *Mucuna pruriens* [59]. Biol Sci Space was conducted experiment to identify the relationship between action of volatiles and gravity in velvet bean (*Mucuna pruriens*) [60].

Figure 1. *Mucuna pruriens* (L.) DC Pods and Seeds

Figure 2. *Mucuna pruriens* (L.) DC Leaves

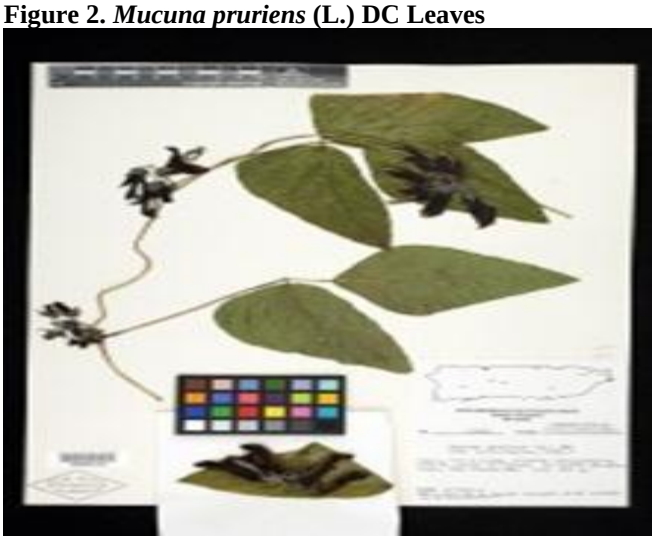


Figure 3. Starch granules seen under polarized light showing observed at 400x with acidified chloral hydrateglycerol solution.

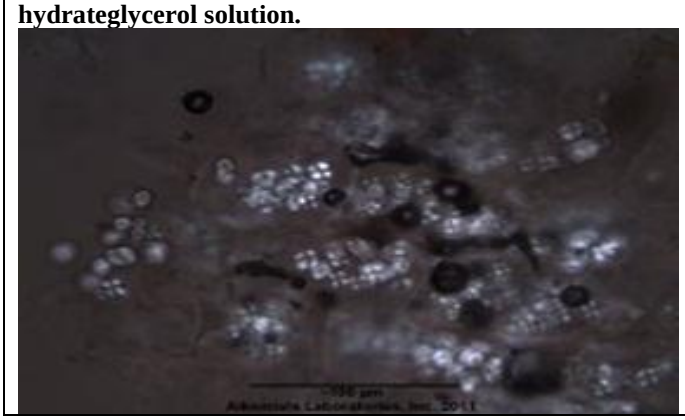
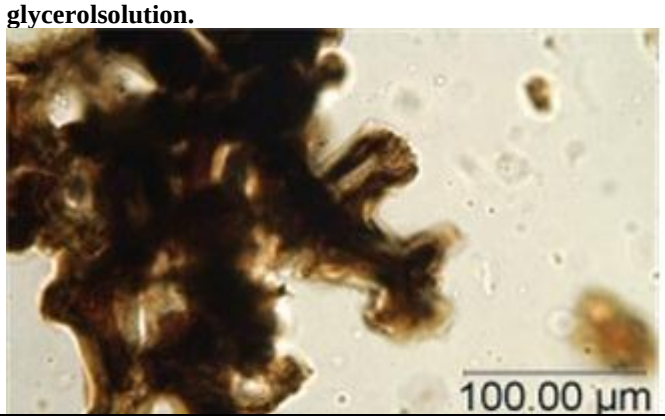


Figure 4. Small groups of pigmented osteosclerieds observed at 400x with Acidified Chloral hydrate glycerolsolution.



CONCLUSION

Mucuna pruriens is an exceptional plant. As it is rich in crude protein, essential fatty acids, starch content and certain essential amino acids. On the other hand, it also contains L-dopa (5%), along with minor amounts of methylated and non-methylated tetrahydro isoquinolines (0.25%).The important alkaloids are mucunine, mucunadine, prurienine, and prurieninine that have been isolated from such extracts. In fact, all parts of the *Mucuna* plant possess medicinal properties such as antidiabetic, aphrodisiac, antineoplastic, antiepileptic, and antimicrobial activities, antivenom activities, anticarcinogenic, antiviral, antinflammatory, hypotensive, and antioxidant activities. The main phenolic compound is L-dopa (5%) having a potent anti - Parkinsonism activity. The presence of bioactive compounds such as phenols, polyphenols and tannins, and preliminary studies on keratinocytes support its possible topical sage to treatredox-driven skin diseases. Collectively, the studies cited in this review suggest that this plant and its extracts may be of therapeutic value with regard to several pathologies. Although further work is needed to investigate in more detail the mechanism underlying the pharmacological ativities of *Mucuna prureins*.

ACKNOWLEDGEMENT

The authors wish to thank to the Dean, Mother Theresa PG&RI of Health Sciences, Puducherry for his valuable support and kindness of doing this research work.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest

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