

***Kapikacchu* (*Mucuna pruriens* (L.) DC.) - A Comprehensive Review**

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Abstract

Mucuna pruriens (L.) DC. belongs to the family *Fabaceae* is commonly known as *Kapikacchu*, *Atmagupta*, *Kacchura*, *Markati* etc. in Sanskrit; Velvet bean, Cowitch, Cowhage in English and *Kawaanch*, *Kavach* in Hindi. Its synonyms, morphology, properties, actions and medicinal uses are described in *Ayurvediya Samhitas* as well as *Nighantus*. It is an established herbal drug used for the management of male infertility, nervous disorders, and also as an aphrodisiac. It possesses many pharmacological activities like antidiabetic, aphrodisiac, anti-oxidant, antimicrobial, hypoglycemic, anti parkinsonism and antivenom activity.

M. pruriens seed is a natural source of the amino acid L-3,4-dihydroxy phenyl alanine (L-DOPA), the direct precursor to the neuro transmitter dopamine which is used widely in the treatment of Parkinson's disease. Other major constituents isolated are four new alkaloids viz., mucuadine, mucuadinine, mucuadinine and prurienidine along with mucunin, mucuadine, small amount of nicotine, various amino acids, carbohydrate, acids, indole alkyl amines and serotonin.

According to Ancient *Ayurvedic* literature *Kapikacchu* is used as a potent aphrodisiac, geriatric tonic and vermifuge. It is also used for the treatment of menstruation disorders, constipation, oedema, fever, tuberculosis, etc. In addition, *Mucuna* is also grown as food crop, ornamental plant, living mulch and green manure crop. The reviews summarize the literature review, botanical description, medicinal uses, phyto constituents, cultivation and propagation and pharmacological activities of *M. pruriens*.

Keywords *Mucuna pruriens*, L-dopa, aphrodisiac, *Kapikacchu*, *Pharmacology*



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INTRODUCTION

Medicinal plant species have played an important role in Indian subcontinent since the time of *Rig Veda* dating back to 5600 BC where 67 medicinal plant species were recorded out of a total of 250,000 higher plants, more than eighty thousand plant species have medicinal value & India occupies a unique position amongst world's twelve biodiversity centres. It has been an old practice to utilize natural substances particularly plants, for the control of diseases which thereby has led to the discovery of more than half of all the modern pharmaceuticals being used today. Recent years have claimed a growing interest worldwide in the utilization of phyto-pharmaceutical medicines for the prevention of many diseases¹.

M. pruriens is a tropical legume & is commonly called by the name of velvet bean or cowitch or cowhage or Alkushi. Being one of the most well-known medicinal plant of India, it is the constituent of approximate 200 indigenous medicinal formulations. It is found abundantly in plains of India^{2,3}. The demand of *Mucuna* has increased many folds in Indian as well as international drug market after it was found to have L-3,4-dihydroxy phenyl alanine (L-DOPA). L-

DOPA is a potent anti-parkinsonian and the precursor of neurotransmitter dopamine.

Mucuna is self-pollinating; therefore its natural out-crossing is rare. Many cultivated *Mucuna* species are found in tropics which represent a fragmentation from the Asian cultigen, and numerous crosses and hybrids⁴ are available. Most common species of *Mucuna* include *M. utilis* Wallich (Bengal velvet bean), *M. pruriens* (L.) DC., *M. deeringiana* Merrill, *M. Hassjoo* (Yokohama velvet bean), *M. aterrima* Holland (Mauritius and Bourbon velvet bean), *M. capitata*, *M. nivea* and *M. diabolica*⁵. The taxonomy of these species is confused, yet some of its designations may be synonymous.

The main difference in the cultivated species is the character of pubescence on the pod, its seed colour and the number of days consumed to harvest the pod. Cowitch and Cowhage are some of the common English names of *Mucuna* types which have abundant long stinging hairs on its pods. On contact and touch, it results in intense itchy dermatitis which is due to mucunain⁶. The non-stinging species, commonly known as velvet bean have silky hairs present on its pods.

The plant *M. pruriens*, also known as velvet bean is an annual climbing legume belonging to eastern India and southern China where it is used to be cultivated widely as a green vegetable crop⁷. Being one of the most popular green crop currently found in tropics, velvet bean has great potential as both food and medicine worldwide. Velvet bean has been used traditionally as a food by many ethnic groups in many countries worldwide. It is reported to be cultivated in Asia, Africa, America & Pacific Islands, where in the pods are used as a food source for human consumption & its tender leaves are used as fodder for animals.

Kapikacchu (*Mucuna pruriens* (L.) DC.) is a very well-known drug used in *Ayurvediya* literatures. It has been used for the properties of *Vrishya*, *Balya*, *Brihankaraka* and *Vata shamana*⁸. It is described as *Vrishya Dravya* in *Samhita*⁹ as well as *Nighantus*¹⁰. *Kapikacchu* is a climber growing in rainy season wildy. Legumes are covered with stiff hairs (*Sukashimbi*) like those of monkey's tail (*Languli*). The plant is protected naturally by hairs (*Atmagupta*) as they produce intense itching (*Kandura*) and as such is difficult to handle. Seeds resemble testicles (*Adhyanda*) and are potent

aphrodisiac (*Ajada*, *Vrishbhi*, *Vrishyabeeja*)¹¹.

LITRETARY REVIEW ON *KAPIKACCHU*

(1) In *Vedic* literature there is no reference regarding "*Kapikacchu*".

(2) In *Samhita kala*, many references of the drug *Kapikacchu* are found in *Brihatrayee*, *Laghutrayee*.

In *Charaka Samhita*, *Kapikacchu* is mentioned in *Purishvirajaniya Mahakashaya*¹², *Balya Mahakashaya*¹³ and *Madhura Skandha*. Description of *Kapikacchu* is found in 27th chapter (*Annapanvidhiyadhyaya*) under the heading of *Shamidhanya varga*¹⁴. *Acharya Charaka* mentioned the drug *Kapikacchu* in *Chikitsa Sthana* in reference to *Vajikarana* in *Vajikarana Adhyaya*. He has also given many formulations in *Chikitsa Sthana* in the context of *Vajikarana* and *Vata Vyadhi Chikitsa* in which *kapikacchu* is mentioned.

According to *Acharya Sushruta*, *Kapikacchu* has been mentioned in *Vidarigandhadi Gana*¹⁵, *Vata Sanshamana Varga*¹⁶. He has also given many formulations related to *Vajikarana Chikitsa* and their respective indications.

Acharya Vagbhata mentioned *Kapikacchu* in *Vidaryadi Gana*¹⁷ and has given its formulation and uses in reference to *Vajikarana* and *Vatavyadhi Chikitsa*.

Kapikacchu is mentioned in *Vrinda Madhava* and *Bhava praksha* in references of *Vajikarana* and *Vatavyadhi Chikitsa*. Acharya Sharangadhara has given many formulations in which *kapikacchu* is mentioned for the purpose of *Vajikarana* and for the treatment of *Shukra Kshaya*.

(3) In *Nighantu Kala*, description of *Kapikacchu* has been given in almost every *Nighantu*. All *Nighantu* like *Dhanvantari Nighantu*, *Sodhala Nighantu*, *Kaiyadeva Nighantu*, *Bhavaprakasa Nighantu*, *Raj Nighantu*, *Saligrama Nighantu*, *Priya Nighantu* etc. have described the drug *Kapikacchu* with its synonyms, properties, actions, *Dosaghnata*, *Rogaghnata*, and *Rasa-panchaka*.

Some synonyms like *Atmagupta*, *Kapikacchu*, *Syamgupta*, *Kacchura*, *Kakanda*, *Markati*, *Languli*, *Kakandola*, *Kandula*, *Chanda*, *Durabhigrha*, *Kandura*, *Vyanda*, *Ajaharsini*, *Pravrsenya*, *Kapiromaphala*, *Duhsparsa*, *Sukasimbi*, *Adhyanda*, *Ajada*, *Vrishbhi*, *Vrishyabeeja* etc. are mentioned in *Samhita* and *Nighantu*.

The drug is having hairs on its pods and monkeys also have hairs on their body. Due to this similarity of *roma* (hairs), above synonyms have been given to *Kapikacchu*.

Mukhya Nama (Main Name) - *Atmagupta, Kapikacchu*

Upama (Representative) - *Kapikacchu, kapi, Vanari, Markati, Kapiloma,*

Svarupa (Morphology) - *Adhyanda, Roma-valli, Rrusyaprokta,*

Due to self-protecting nature - *Atmagupt, Svagupta, Svyangupta, Gupta*

According to Karma (action) - *Shoth, Vrisya, Dusparsha, Kandura, Harsini*

Regarding *Rasa- panchaka* of *Kapikacchu*, it is having *Guru, Snigdha Guna, Madhura Rasa, Sheeta Virya* and *Madhura Vipaka*.

Regarding *Dosaghnata*, according to Acharya Charaka, Acharya Sushruta and Acharya Vagbhata it alleviates *Vata dosha*.

According to *Dhanwantari Nighantu* it has *Vata-Pittahara* property. According to *Sodhala Nighantu* *Kapikacchu* is *Vatahara-Pittala-Kaphakara*. *Kaiyadeva Nighantu, Bhavaprakasha Nighantu* and *Priya Nighantu* accept its *Tridoshaghna* property. *Madhava Dravyaguna, Madanapala Nighantu, Shankara Nighantu, Priya Nighantu* also accept its *Vatahara* property.

Table 1 Karma according to Different Nighantu

S.No.	Karma	DN	So.N.	MD	MN	KN	BP	RN	Sa. N.	PN	Dg.V.
1.	<i>Balya</i>	-	+	+	-	+	+	-	+	+	+
2.	<i>Vrishya</i>	+	+	+	+	+	+	+	+	+	+
3.	<i>Brahana</i>	-	+	+	+	-	+	-	+	+	+
4.	<i>Rasayana</i>	-	-	-	-	-	-	-	+	-	-
5.	<i>Vajikarana</i>	-	-	-	+	-	+	-	-	-	+
6.	<i>Shukrakara</i>	-	+	-	-	-	-	-	-	-	-
7.	<i>Stanyakara</i>	-	+	-	-	-	-	-	-	-	-
8.	Yoni-sankirnakara	-	-	-	-	-	+	-	-	-	-
9.	<i>Atimutrala</i>	-	+	-	-	-	-	-	-	-	-
10.	<i>Swarya</i>	-	+	-	-	-	-	-	-	-	-

[DN- Dhanvantri Nighantu, So.N.- Shodhala Nighantu, MD- Madhav Dravyaguna, MN- Madanpala Nighantu, KN- Kaiyadeva Nighantu, BP- Bhavaprakasha, RN- Raja Nighantu, Sa.N.- Shaligram Nighantu, PN- Priya Nighantu, Dg.V.- Dravyaguna Vigyana]

BOTANICAL DESCRIPTION

Taxonomic Classification of *Kapikacchu*

Kingdom	:	Plantae
Division	:	Angiospermae
Class	:	Dicotyledoneae
Order	:	Fabales
Family	:	Fabaceae
Subfamily	:	Faboideae
Genus	:	Mucuna
Species	:	Pruriens
Binomial name	:	<i>Mucuna pruriens</i> (L.)DC.

Botanical Synonym: *Mucuna prurita*
Hook.

Habitat: It is an herbaceous twinning annual plant.

Roots: The outer surface is dark brown to black in colour and slightly rough due to the

oblong slightly protruding prominent lenticels and a few rootlets and consists of many long, softly woody, somewhat flexible roots and having a diameter of 7mm¹⁸.

Leaves: leaves are large, stipulate, alternate, pinnately and trifoliate. Stipules are deciduous about 1/5th inches in length. Stipels are 3 to 5 inches long and are minute and osculate, rachises leaflets are 3 to 4 inches long, by 2 to 3 inches wide, short, thick, sparingly deflexed hairy stalks which are ovate-rhomboid acute or sub-acute, mucronate, membranous, glabrous and densely covered with fine lustures and silvery grey pressed hairs beneath. The shapes of terminal leaflets are rhomboidal and oval, whereas the lateral ones are varying unequal sided with their lower halves much broader¹⁹.

Flowers: The heads of the flower are in form of axially arrayed panicles. They are 15 to 32 cm long and have 2 or 3 or many flowers. The leaves accompanying them are about 12.5 mm long; the stand axes of the flower range from 2.5 to 5 mm. The bell is 7.5 to 9 mm long and silky. The length of sepals is same as like of shuttles. Crown is of purple or white. The flag is 1.5 mm long and wings are 2.5 to 3.8 cm long²⁰.

Pods: The pods are, two to three or four inches in length and half an inch broad. These are turgid explosively dehiscent pod, having the shape like the letter 'S' blunt and slightly covered at both ends. The pod is compactly covered with many pointed hairs which are short, stiff, weak but not easily detached; initially they are of a pale yellowish brown in colour but later changes into steel grey. Seeds present in the pods are four to six or sometimes more with septa or partitions between the seeds²¹.

Seeds: Seed ovoid, slightly laterally compressed, with a persistent oblong, funicular hilum, black and dark brown with spots; usually 1.2-1.8cm long, 0.8-1.2cm wide, hard, smooth to touch, not easily breakable; odour not distinct; taste, sweetish-bitter²².

Distribution: Distribution is all over India upto 1000 m in Himalaya and in Andaman and Nicobar Islands. It is common in Bengal, Assam, Khasi hills and Deccan as well as in the east and west coast region.

Parts used: Root, leaf, seed, Pod's hair²³.

PHYTOCONSTITUENTS

M. pruriens seeds contain high concentrations of L-3,4-dihydroxy phenyl alanine (L-DOPA), an unusual non protein amino acid. It is a direct precursor to the neuro transmitter dopamine, an important chemical involved in movement and sexuality. The mature seeds of the plant contain about 3.1 to 6.1% L-DOPA, with very low amounts of dimethyl tryptamine (DMT), 5-hydroxy tryptamine (serotonin), 5-MeO-DMT, nicotine, bufotenine and beta-carboline. The leaves contain about 0.5% L-DOPA, 0.006% dimethyl tryptamine and 0.0025% 5-MeO-DMT²⁴.

Other major constituents isolated from seeds are four new alkaloids viz. mucuadine, mucuadinine, mucuadinine and prurienidine along with mucunin, mucuadine, small amount of nicotine, various amino acids, carbohydrate, indole alkyl amines.²⁵ The seeds also contain oils including palmitic, stearic, oleic and linoleic acids²⁶.

GC-MS analysis showed the presence of phytochemicals like n-hexadecanoic acid (48.21 %), Squalene (7.87%), Oleic acid (7.62%), Octadecanoic acid (6.21%) and ascorbic acid (3.80%) were present in the extract²⁷. The seed also contains two tetrahydroquinoline alkaloids which are 3-methoxy-1,1-dimethyl-7,8-dihydroxy-1,2,3,4-tetrahydroquinoline and 3-methoxy-1,1-dimethyl 6,7-dihydroxy-1,2,3,4-tetrahydroquinoline²⁸.

PHARMACOLOGICAL ACTIONS

Anti-Parkinson's activity:

In India, traditionally the seeds of *M. pruriens* have been used as a nervous system tonic, and as an aphrodisiac for male virility. Powdered seeds possess anti-parkinsonism properties, may be due to the presence of L-DOPA. It is well known that dopamine is a neurotransmitter. Amount of dopamine content in brain tissue is reduced when the conversion of tyrosine to L-DOPA is blocked. L-DOPA, the precursor of dopamine is able to cross the blood-brain barrier and undergo conversion to dopamine, restoring neurotransmission.

In a clinical study, Nagashayana *et al.* (2000) revealed the contribution of L-DOPA in the recovery of PD followed by Ayurveda

medication²⁹. Katzenschlager *et al.* (2004) revealed that 30 g *Mucuna* seed powder preparation has considerably fast action for treating PD patients than with conventional standard drugs, namely, Levodopa or Carbidopa and suggested that natural source of L-DOPA may have advantages over conventional drugs in long term management of PD³⁰.

Aphrodisiac activity:

Oral administration of 5 gm of *Mucuna* seed powder once in a day for men with decreased sperm count and motility, relieves psychological stress and seminal plasma liquid peroxide levels along with improved sperm count and motility. The study concludes that *M. pruriens* not only reactivates the anti-oxidant defense mechanism, but also helps in the management of stress and improves semen quality³¹.

Hypoglycemic activity:

The hypoglycemic effect of the aqueous extract of the seeds of *M. pruriens* was investigated in normal, glucose load conditions and streptozotocin (STZ)-induced diabetic rats. In normal and STZ diabetic rats, the aqueous extract of the seeds of *M. pruriens* (100 and 200 mg/kg body weight) significantly lowered the blood glucose

levels two hour after oral administration of seed extract. It also significantly reduced the blood glucose in STZ diabetic rats after twenty one days of daily oral administration of the extract. Therefore, it was clearly depicted that *Mucuna pruriens* could be a source of hypoglycemic compounds³².

Antimicrobial activity:

M. pruriens is also used for antimicrobial properties for extracting plant metabolites against plant pathogenic bacteria and fungi. The methanolic extract showed high antibacterial activity against *Xanthomonas campestris*, *Erwinia carotovora*, *Pseudomonas aeruginosa*, *Pseudomonas syringae*, *Pseudomonas marginalis* and high anti-fungal activity against *Fusarium oxysporum*, *Pencillium expansum*, *Curvularia lunata*, *Tiarosporella phaseolina*, *Ustilago pomaydis*, *Rhizoctonia solani*³³.

Antioxidant Activity:

Various parts of the *M. pruriens* contain total phenols which might have antioxidant activity. The similar findings were observed for this plant where free radical scavenging activity was evaluated. The alcoholic extract had significant antioxidant activity which was comparable with standard ascorbate and total phenol content³⁴.

Anti-Inflammatory activity:

The aerial parts of the plants have significant anti-inflammatory activity in both cotton pellet implantation and carrageenin induced paw edema method in rats. Weight of the cotton pellet and paw edema volume was reduced in test animals than control ($p < 0.001$). It was observed that the extracts of *M. Pruriens* were effective at 200 and 400 mg/kg doses in both the methods³⁵.

Anti-venom activity:

Research on *Mucuna* effects against *Naja* species³⁶ has shown that it has profound to be used in the prophylactic treatment of snakebites. Aqueous extracts of *M. pruriens* seeds were tested for their activity on various pharmacological effects such as lethality, fibrinolytic activity, phospholipase activity, haemorrhagic activity and edematous activity of cobra and krait venoms. About 0.16 and 0.19 mg of *M. pruriens* seed extracts were capable of completely neutralize the lethal activity of 2LD₅₀ of cobra and krait venom, respectively, thus suggesting that aqueous extracts of *M. pruriens* seeds possess compounds, which inhibit the activity of cobra and krait venoms³⁷.

ACTION AND USES

All parts of *Mucuna* possess valuable medicinal properties. It is used in many disorders like neurological, urinary tract and menstruation disorders, constipation, tuberculosis, ulcers, edema, fever, helminthiasis and Parkinson's disease³⁸. Traditionally, the powdered seeds of *M. pruriens* were found to increase the general mating behavior and thereby sexual activity in rats³⁹.

The roots are bitter, sweet, stimulant, purgative, thermogenic, aphrodisiac, anthelmintic, febrifuge and diuretic. They are used in nephropathy, dysmenorrhoea, amenorrhoea, elephantiasis, fever, dropsy, ulcers, constipation, helminthiasis and delirium. The leaves are aphrodisiac, anthelmintic and are useful in ulcers, cephalagia, inflammation, helminthiasis and general debility. Seeds are aphrodisiac, laxative, anthelmintic, astringent, alexipharmic and tonic. These have proved that useful in sterility, gonorrhoea and general debility. The pods are used as anthelmintic. The hairs of *Mucuna* pods are used as a vermifuge to expel ascarids⁴⁰.

Seeds are useful in parkinson's disease and help in making our nervous system work to the optimum levels. It helps in improving

the libido and significantly relieves psychological stress and seminal plasma lipid peroxide levels and also improves sperm count and sperm motility⁴¹.

Besides medicinal properties, in many parts of the world, *M. pruriens* is used as an important forage, fallow and green manure crop. The plant being a legume, it fixes nitrogen and fertilizes soil. It is a wide spread fodder plant in the tropics. The whole plant is fed to animals in the form of silage, dried hay or dried seeds. *M. pruriens* silage contains 11 to 23% crude protein, 35 to 40% crude fiber while dried beans contain 20 to 35% crude protein. It is also used as a biological control for problematic *Imperata cylindrica* grass in Benin and Vietnam⁴².

FORMULATIONS AND PREPARATION

*Musalipaka, Shatavaryadi churna, Manmatha rasa, Vanari gutika, Kapikachchhu churna, Kapikachchhu paka, Dhatuspaushtika churna, Somaraji taila, Mashabaladi pachana*⁴³.

PROPAGATION AND CULTIVATION

This crop can be grown on a wide variety of soils but it grows well on sandy to clayey loam, provided drainage is proper. The best

season for planting is July to August. A basal dose of 13-15 tone of farmyard manure along with 80 kg of P_2O_5 per hectare should be applied to the fields before ploughing. Top dressing of a mixture of 100 kg of Nitrogen and 75 kg of K_2O per hectare is given in 2 equal split doses when the crop is 30 days old and 60 days old. Seeds used are 56 kg per hectare. Sowing is done at a spacing of 60x60 cm provided support is given to the plants. However if no support is given to the plants, then the sowing should be done at a spacing of 60x45cm. The seeds sprout in about 7-10 days. The vines can be supported individually with the help of sticks, 150-180 cm high or tied to an overhead trellis by gunny twines. The crop requires 1-2 weeding in the initial stages. After 60 days of planting the ground is completely covered by plants. The plants start flowering after 45 days of plantation and continue till the end. Hence the pods mature periodically and picking of mature pods has to be done 3-4 times in a season i.e. up to February. The seed yield from a rain fed crop without staking or support is around 1500-1750 kg per hectare. Where stakes are provided for support, yield is about 3000-3750 kg per hectare⁴⁴.

CONCLUSION:

Kapikacchu (*Mucuna pruriens* (L.) DC.) is well known drug and it is used therapeutically since *Samhita* period. According to review its all parts have many phyto constituents in which L-DOPA is found in maximum quantity in seeds. It is a natural source of L-DOPA which is the precursor of the neurotransmitter dopamine. In fact, all parts of the *Mucuna* plant possess medicinal properties. In *Ayurveda*, it is commonly used as an aphrodisiac (*Vrishya Karma*) and to support proper function of the reproductive system. It increases sexual vigour and potency, strengthens and tones the reproductive organs.

Various pharmacological activities are shown by different parts of *Mucuna pruriens*. In view of the many medicinal uses, more clinical studies are also necessary to investigate other grandness of this plant. So we can say that it has been proved as a magical drug due to its multidirectional work.

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