

## PHYTO-PHARMACOGNOSTIC AND PHARMACO-THERAPEUTIC REVIEW OF KAPIKACCHU(*MUCUNA PRURIENS*)

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### ABSTRACT

Kapikacchu commonly known as Magic Velvet Bean is a part of traditional medicine right from the Vedic era. It is botanically identified as *Mucuna pruriens* Linn. It is a herbaceous twinner and belongs to papilionaceae family. The useful parts are seeds, pod hair, leaves, flower and root. The seeds are bestowed with Vrishya (aphrodisiac), balya, rasayana and vata hara properties. The seeds are rich in L-dopa and is extensively used for parkinsons. This article has highlighted the references of kapikacchu from Vedas, Samhita, Nighantu , Modern texts and Researches. This review sums up the synonyms, types, properties, uses, cultivation, propagation, pharmaco-therapeutics of kapikacchu.

**KEYWORDS:** Kapikacchu, Balya, vata hara, L-dopa.

### INTRODUCTION

Ayurveda is one of the oldest holistic healing systems. The root meaning of Ayurveda is “Knowledge of life” means the science which does not limit itself only to the medicine but also focuses on the facts by which body can heal on its own. Rasayana and Balya are among the concept of rejuvenation which makes Ayurveda unique in its understanding. Kapikacchu is one such drug which does not only work on illness but also promotes the general strength of the body.

#### Historical review-

##### Vaidika kala<sup>1</sup>

It is mentioned in Rigaveda as a Balavardhaka aushadhi (strength promoting medicine).

##### Samhita kala<sup>2-3</sup>

Bruhattraï has also mentioned Balya property of it. Vagbhata , In the context of

Ojah kshaya has advised internal use of kapikacchu in the form of ghrita.

##### Nighantu kala<sup>5-16</sup>:

Almost all the Nighantukaras have mentioned about kapikacchu with its various synonymes. Dhanwantari Nighantu and Acharya Bhavmishra have mentioned balya and brumhana property of it. According to Shodhala Nighantu excessive seed consumption can lead to giddiness.

##### Varieties

1. Jangali and Bagi<sup>6</sup>.
2. Laghukacchu (*Mucuna prurita* (Hook) and Kapikacchu (*Mucuna pruriens* Bek.)<sup>9</sup>

##### Botanical Sources

*Mucuna* is a genus of around more than 100 accepted species of climbing vines and shrubs of the Family Fabaceae.

Few sources – *Mucuna pruriens*, *Mucuna macrophylla* wall, *Mucuna macrophylla*,

*Mucuna nigricans*, *Mucuna acuminata*,  
*Mucuna cochinchinensis*, *Mucuna pallida*,  
*Mucuna hoitoni*  
*Mucuna birdwoodiana*.

**Rasapanchakaka**<sup>5-16</sup>

Kapikacchu has TiktaMadhura rasa, guru  
 snigdha guna, sheeta veerya and madhura  
 vipaka.

**Table No.1:** Synonyms of Kapikacchu<sup>2,3, 5-16</sup>

Based on Morphology

Synonyms	C.S	Su.S	Sau. Ni	AN	DN	MPN	RN	KN	BPN	Sha.N	NA
Atmagupta	-	-	+	+	+	+	+	+	+	+	+
Kapikacchu	+	+	+	-	-	+	+	+	+	+	+
Markati	-	-	-	+	+	+	+	+	+	-	+
Shooka shimbi	-	-	-	-	-	-	+	+	+	+	+
Chanda	-	-	-	-	+	+	+	-	-	-	-
Swayamgupta	+	+	-	-	+	+	+	+	-	+	-
Adhyanda	-	-	-	-	-	-	-	+	-	-	-
Dukhagraha	-	-	-	-	-	+	-	-	-	-	-
Gupta	-	-	-	-	-	-	+	+	-	-	-
Kandukari	-	-	-	+	-	-	-	+	-	-	-
Kapiprabha	-	-	-	-	-	-	-	-	-	+	-
Kapikachura	-	-	-	+	+	-	-	-	-	-	-
Kapiromaphala	-	-	-	-	-	-	+	+	-	-	-
Kundalee	-	-	-	-	-	-	+	-	-	-	-
Maharshabhi	-	-	-	-	+	-	+	-	-	-	-
Praharshini	-	-	-	-	-	+	-	-	-	-	-
Rashabhi	+	+	-	-	-	-	-	+	-	-	+
Rishyaprokta	+	-	-	-	-	-	-	+	-	-	-
Romavalli	-	-	-	-	-	-	+	-	-	-	-
Shimbi	-	-	-	-	-	-	+	-	-	-	-
Shooka pindi	-	-	-	-	-	-	-	-	-	+	-
Vanarashookari	-	-	-	-	-	-	+	-	-	-	-

**Gana / Varga**

Table No.2: Classification according to various authors

Classical text	Gana/varga
Charaka Samhita <sup>2</sup>	Balya Mahakashaya Madhuraskanda Pureeshavirajaniya gana
Sushruta Samhita <sup>3</sup>	Vidarigandhadi gana Vatasamshamana gana
Ashtanga hrudaya <sup>4</sup>	Pittanashaka gana

	Shimbidhanya varga
Ashtanga Samgraha	Shimbidhanya varga
Ashtanga nighantu <sup>5</sup>	Vidaryadi Varga
Dhanwantari nighantu <sup>6</sup>	Guduchyadi Varga
Shodhala nighantu <sup>9</sup>	Guduchyadi Varga
Madanapala nighantu <sup>11</sup>	Abhayadi Varga
Raja nighantu <sup>8</sup>	Guduchyadi Varga
Kaiyadeva nighantu <sup>10</sup>	Aushadhi Varga
Bhavaprakasha nighantu <sup>7</sup>	Guduchyadi Varga
Shaligrama nighantu <sup>12</sup>	Guduchyadi Varga
Nighantu Adarsh <sup>13</sup>	Palashadi Varga
Priya nighantu <sup>15</sup>	Pippalyadi Varga

### Taxonomical Classification<sup>17</sup>

Table no.3: Taxonomical classification:

<b>Kingdom</b>	<b>Plantae</b>
Division	Embryophyta, siphonogram
Subdivision	Angiospermae
Class	Dicotyledonae
Sub Class	Polypetalae
Series	Rosales
Order	Rosineae
Family	Leguminaceae
Sub Family	Pappilionacea
Genus	Mucuna
Species	Pruriens
Scientific Name	Mucuna pruriens Linn.
Synonyms	Mucuna prurita (L.) Hook

### Botanical Description

*Mucuna pruriens* Bek.- morphology<sup>7, 18-22</sup>

Habit: *Mucuna* are large twinning shrubs, Annual, herbaceous, semi-woody twiner (more often a perennial) producing from its perennating root system. Leaves:- Alternate, pinnately trifoliate, fairly large on hairy petioles 6-12 inches long stipulate, subulate, rachises 3"-5" long. Leaflets:- 3"-4" long, 2"-3" wide or short thick, sparingly deflexed

hairy stalks, rhomboid, acute or subacute. Flowers: shortly stalked in clusters of 2 or 3 together in a pendulous peduncled long stalked slender drooping pubescent axillary raceme ½ - 1 foot or more long. Calyx: Cup shaped, silky externally, deeply cleft in a somewhat 2 hipped manner, the 2 upper segments being perfectly united to form a single triangular one and the lower 3 lanciolate. Corolla: Papilionaceous, standard broadly oval, acute, about ¾ inch long, with a short claw, pale purplish, wings nearly 1 ½ long, narrow oblong, blunt, slightly falcate, dull dark purple tinged with pale yellowish – green keel – petals narrow. Stamens: 10,9 combined by their filaments, the upper one distinct, fore part of the filaments somewhat dilated. Anthers: small, soon falling, oblong Ovary: surrounded at the base by a small crenulate disk, shortly stalked, hairy, tapering into the long slender style. Fruit /legume: Explosively dehiscent pod nearly sessile, ( 2 – 3 – 4) inch long & about ½ inch broad slightly falcately curved at both ends. Shaped like the letter ‘S’ blunt at either end & slightly longitudinally ridged. Somewhat compressed, densely covered with numerous pointed thick felt of stiff, short, sharp, pale

reddish hairs. Hairs : Stiff velvety brownish red, each of which is about 1/10 of an inch in length are also termed cow - itch. As a general rule they are filled with air but sometimes they contain a granular matter of which tannic acid is one of the constituents.

-Flowering: after rains & in autumn season. (Aug – Dec)

-Fruiting: in winter to spring season. (Dec – Feb)

Seeds: Ovoid or transversely oblong slightly laterally compressed with polished Dark brownish or black in colour, Reniform in shape, 15-20 mm long 7-15 mm broad & have prominent funicular hilum about 1/2 the length of the seed and cellular pit growth around the hilum seed coat hard, thick and glossy occasionally mottled testa, 4 – 5 separated by cellular partitions Embryo fills up the seed and is made up of two large cotyledons. The dry weight of the seeds is 55 to 85 g/100 seeds. With  $2n = 20, 22$  or 24 chromosomes.

### **Distribution**

It is commonly called pea family. It includes 375 genera. The family is represented in India by 70 genera and 754 species. The members of this family are Xerophyte and Halophytes.

In the World- India, South Africa, Pakistan, Bhurma, Srilanka

In India- Bengal, Northern Bihar, Calcutta, Karnataka, Eastern Himalayas, South western ghats, east and west coast regions, the plains to 2000 ft hanthni kund.

In Karnataka- Bangalore, Coorg, Hassan, Kolar, Mysore, North Kanara, South Kanara tropics.

### **Pharmacognosy<sup>20</sup>:-**

#### **Microscopic feature of Seed:**

TS of seed shows testa with single layered palisade – like cells, single layer of columnar cells, irregularly shaped stone cells. Hypodermis comprises of ‘I’ shaped bearded cells, followed by parenchyma cells containing oil globules and round to oval starch grains.

#### **Powdered Microscopy:**

Grayish white, bitter taste and unpleasant odour; fragments of epidermis. ‘I’ shaped bearer cells and parenchymatous cells with oil globules and starch grains are the characteristic features.

#### **Identity, Purity And Strength<sup>17,20</sup>**

Moisture content: <35%, Total Ash: <1.77%, Acid insoluble ash: <0.33%, Ethanol soluble extractive: >6%, Water soluble extractive: >21%, Benzene extractive: >3.5%, Pet-ether extractive: >2.8%, Moisture content: <35%

#### **Cultivation & Propagation<sup>21</sup>:**

This crop can be grown on a wide range of soils but it does well on sandy loan. The best season for planting is July-August. A basal dose of 13-15 tons of farmyard manure along with 80kg of P2O5 per hectare should be applied to the fields before ploughing. Top dressing of a mixture of 100 kg of Nitrogen and 75 kg of K2O per hectare is given in two equal split doses when the crop is 30 days old and 60 days old. Seeds used are 56 Kg/hectare. Sowing is done at a spacing of 60 cm \* 60 cm, provided support is given to the plants. The seeds sprout in about 7-10 days. The vines can be supported individually with the help of sticks. The plants start flowering after 45 days of plantation and continue till the end, picking of mature pods has to be done 3-4 times in a season i.e upto February. The seeds yield

from a rainfed 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 hectare.

**Harvest & Post-Harvest Handling<sup>21</sup>** –

Pods picked at semi dry stage give optimum seed yield and L-DOPA content (4.68%) seed yield from a rainfed crop without staking is around 1500 to 1750 kg/ha. Pods are dried in sun and seeds are collected by betting in sack.

**Chemical Constituents<sup>36-39</sup>** -

*Mucuna Pruriens* contains:

- L-DOPA is seen as the main constituent which is precursor to dopamine. The three catecholamines are also present in *Mucuna*.
- Serotonin and its precursor, 5HTP
- Beta-Carboline
- Nicotinic Acid
- 5-Meo-dimethyltryptamine (bufotenin) and NN-dimethyltryptamine in the seed.
- A dietary fatty acid with low bioavailability Behenic Acid.
- A glycoprotein inhibitor of protein digestive enzymes.
- Various saponins, anthraquinones, flavanoids, cardiac glycosides and tannins.

-Tetrahydroisoquinoline alkaloids which may have interactions with u-opioid receptors based on their structures.

-Mucunain is a compound causes itching when mucuna comes in contact with skin.

-CoQ10 and Nicotine adenine Dinucleotide (NADH) is found in the cotyledon of the plant.

-Has basic dietary minerals in traces, such as, Iron, Magnesium and Selenium.

-3.1-6.1% Levodopa is found in mature seeds; up to 12.5% has also been recorded.

The leaves contain around 0.5%. There are studies that has taken random marketed supplements from market and analyzed them, the value ranges between 3.8-4.3%.

Hallucinogenic compounds (Tryptamine) are found in the leaves at low dosage but are not found in seeds; 0.0025% 5-MeO-Dimethyltryptamine, 0.006% Dimethyltryptamine, and 0.003% Dimethyltryptamine Oxide. 5-MeO-Dimethyltryptamine (Bufotenin) has been noted as high as 4.14ug/g in the root, but was absent in the pod.

**Seed oil:** Mature seeds contain sterol, Palmitic acid, Arachide acid, Stearic acid, Linoleic acids and Myristic acid.

**Table no:5** Synonyms based on properties <sup>5-16</sup>

Vrishya	-	-	-	-	-	-	-	-	+	-	-
Vrashyabeeja	-	-	-	+	-	-	-	-	-	-	-
Vamani	-	-	-	-	-	-	-	+	-	-	-
Teekshna	-	-	-	-	-	-	+	-	-	-	-
Harshini	-	-	-	-	-	-	+	+	-	+	-
Kandura	-	-	-	-	-	-	-	+	+	+	+
Kandula	-	-	-	-	+	+	+	-	-	-	-
Pravrashenya	-	-	-	-	-	-	+	-	-	-	-

## Karma & Rogagnata<sup>2-4,5-16</sup>

Seed-Tridoshahara, Balya, Brumhana, Vajikarana, Stanyakara, Shukra janana, Kshaya, Kshata Kasa, Shosha, Avabahuka, Ardita. Root- Mootrala, Yonosankochaka, Yonodoshahara, Pakwa and Rakta atisara, Shlipada and Vishagna. Pod hair- Krimighna. Patra- Vranahara.

### Research Profile

#### Interactions with Hormones<sup>24</sup>

1. Dopamine- Mucuna Pruriens supplementation has been shown to increase circulating dopamine levels in otherwise healthy male controls, possibly through the main ingredient of levodopa.

2. Prolactin- Mucuna Pruriens has also been shown to suppress Prolactin levels *in vivo*, supposedly vicariously through Dopamine's ability to suppress prolactin secretion.

3. Testosterone- Testosterone has been increased in healthy infertile men without any impairments in seminal parameters following 5g of Mucuna Pruriens extract over 3 months. Testosterone was also increased in the seminal experimental groups (those with low sperm motility or count), and to a more significant degree. Testosterone levels in the control (no sperm problems, still infertile) group went from  $4.49 \pm 0.53$  to  $5.72 \pm 0.36$ ng/mL. The hypothesized mechanism of action was through levodopa content, in which the increase in serum dopamine antagonizes (works against) prolactin's suppressive effect on libido and testosterone.

In rats with type II diabetes, increases in testosterone have been seen with an oral dose of 200mg/kg bodyweight *Mucuna Pruriens* or in blend with two other aphrodisiac herbs.

#### Interactions with Glucose Metabolism

1. Results of interventions- Mucuna Pruriens has been investigated in rats for its anti-diabetic effects. It appears to reduce spikes in blood glucose in response to a meal up to 8 hours after ingestion in a relatively dose-dependent manner, with descending efficacy. Chronic usage of Mucuna for blood sugar reduction appears to be more potent than acute usage, although both are effective.

2. Diabetic management- Mucuna Pruriens shows efficacy in reducing the onset of diabetic cataracts in experimental rats, its influences on nerve damage in diabetic rats does not appear to be significant. Although Mucuna Pruriens may suppress a rise in urinary albumin levels associated with diabetes, it fails to prevent the hypertrophy of the kidneys associated with diabetes.

#### Interactions with Neurology

1. Parkinsons and Dopamine- In treating symptoms of Parkinson's Disease, *Mucuna Pruriens* is being investigated. At this moment in time, only one double blind study has been conducted on humans. Mucuna was equally effective as standard Levodopa/Carbidopa (200mg/50mg) treatment.

Beyond the double blind study mentioned, three open label studies in humans have been conducted which was found to improve symptoms of Parkinsons.

2. Memory and Cognition- *Mucuna Pruriens* has been involved in a blend of herbs (n=11) that increased memory retention in rats, but was too confounded to place any causation on Mucuna.

3. Neuroprotection- One *in vitro* study suggests that Mucuna Pruriens extract

increased the activity of complex I in brain mitochondria. *Mucuna Pruriens* was also found to restore levels of serotonin and catecholamines in the substantia nigra (area of the brain associated with Parkinson's), whereas isolated levodopa was not able to do this.

4. Libido and Fertility- *Mucuna Pruriens* supplementation in infertile men is associated with increased sperm count and motility after taking 5g of dried powder for 3 months. This same dose also increases various parameters of male semen indicative of increased fertility. In regards to testosterone, one study noted it could be increased over 3 months after ingestion of 5g *Mucuna Pruriens* seed powder daily; however, this study was conducted in infertile men and the increases seen did not exceed control.

5. Psycho- spiritual effect<sup>25</sup> - Most interesting property of the Velvet Bean is its content of exotic compounds such as dimethyltryptamine (DMT), 5-MeO-DMT, nicotine, and bufotenine in trace amounts. For this reason, it is safe to classify *Mucuna* as a particularly spiritual and consciousness-enhancing plant. DMT, for example, is secreted by the pineal gland, which is the master regulator of consciousness in the body and is believed to control our perception of time as well as our circadian rhythms (sleep/wake cycles). In fact, many who take *Mucuna Pruriens* report more vivid dreams and deeper sleep with regular use but often times after just a single dose.

#### **Protease Inhibition**

1. Anti-venom- *Mucuna Pruriens* has been traditionally used as an anti-venom agent, specifically against the venom of *Echis*

*carinatus* (a snake). This protection from venom appears to be mediated through a protease inhibitor; normally seen as a negative due to preventing absorption of dietary protein, the specific glycoprotein in *Mucuna Pruriens* can degrade the toxin from this snake as said toxins are quaternary proteins. *Mucuna Pruriens* shows efficacy against EC toxin either when pre-loaded or as a single bolus in rats.

#### **Digestion**

As a protease inhibitor, the glycoprotein from *Mucuna* can inhibit the two main human gastric protein digestive enzymes of trypsin and chymotrypsin in a dose-dependent manner. It belongs to the Kunitz family of trypsin inhibitors.

The glycoprotein inhibitor appears to be most stable at pHs of 4-7 and have structural similarities to the protease inhibitor found in soy. The inhibitory amounts are maxed at 61.5% for trypsin and 47.9% for chymotrypsin, with slightly higher values for whole *Mucuna* protein extract rather than isolated glycoprotein.

All inhibitory potential is lost at 100°C, and efficacy starts to be lost at 50°C, Increasing the pH to 9-12 can destroy the protein at temperatures of 75°C. Protein digestibility also increases when exposed to irradiation in a dose-dependent manner. Irradiation may decrease Manganese and Sodium content slightly and reduced caloric content on a basis of dry weight slightly.

#### **Safety and Toxicity**

One large double blind study noted no significant adverse effects from 15-30g of *Mucuna Pruriens* powder over the course of 12-20 weeks aside from one patient suffering from vomiting, which was deemed

unrelated to the bioactivity of *Mucuna* but rather its digestibility and palatability.

In rats, doses of 32mg/kg or above are associated with 'some adverse side effects' (hyperventilation, reduced spontaneous motor activity, spontaneous erections) that appeared 1 hour after ingestion transiently, and doses up to 100mg/kg are free from more significant side effects for up to 12 weeks (study termination).

#### Case studies<sup>24</sup>

There were once reports of psychosis associated with *Mucuna Pruriens* ingestion (bean form), in which 203 cases of acute psychosis were recorded over a 6 week period during famine in Mozambique. This was thought to be due to women (of which constituted 85% of the affected) eating raw beans prior to sufficient preparation, and the results may have been a combination of

protein deficiency paired with Levodopa, Bufotenin and N,N-dimethyltryptamine (all of which are constituents of *Mucuna Pruriens*). It is highly unlikely these results can be extrapolated to first world supplementation.

#### Substitution & Adulteration of Kapikacchu

*Mucuna utilis* Wall. Ex Wight seeds are often sold in the market in the name of kapikacchu<sup>17</sup>.

**Parts Used** - Seeds, Pod hair, Root, Leaf<sup>17</sup>.

#### Posology<sup>8</sup> :

The general doses of administration of kapikacchu in its various forms are  
Beeja churna :2-6 gm, Phala roma : 500mg-1gm, Moola Swarasa : 50 ml, Patra Swarasa: 50 m

#### Yogas of Kapikacchu

**Table No. 9:** Showing yogas of Kapikacchu beeja w.s.r. to the present study<sup>2-4,26-29</sup>.

Sl no	Yoga	Karma of Yoga	Indication	Reference
1	Brumhani Gutika	Balya, Vrushya, Brumhana		Ch. Chi. 2/1/24-32
2	Tritiya Sarpiguda		Yakshma, Karshya	Ch. Chi. 11/62
3	Dwitiya Bramha Rasayana	Rasayana, Mahabalya		Ch. Chi. 1/1/59
4	Agastya Haritaki	Rasayana, Balya	Kshaya	A.H Chi 3/127
5	Amritaprasha Ghrita		Kshata-kshina, Daurbalya	A.H Chi. 3/94
6	Vasishtha Haritaki	Rasayana		A.H Chi. 3/133
7	Kashmaryadi ghrita		Kshata, Kshaya	A.S Chi. 4/11
8	Guduchyadi modaka	Rasayana	Kshaya	Y.R , Yakshma chi.
9	Chaturmukha rasa	Pushtikara	Yakshma	Y.R, Yakshma chi.
10	Kamagnisandipan modaka	Rasayana, Balya	Yakshma	Y.R, Vajikarana
11	Mahakalyanak ghrita	Brumhana		Sahasrayoga, Ghrita prakarana



12	Chaturtkadi rasayan	Rasayana	Kshaya	Sahasrayoga, Leha prakarana
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### DISCUSSION & CONCLUSION

Kapikacchu is a drug which should be researched for its extensive arena of application although it is already in practice worldwide, there is still scope for exploration. It has been given importance from the time of vedas itself. The various synonyms mentioned in Vedas, Samhita, Nighantu points towards pharmacological and pharmaco-therapeutical property of kapikacchu. Seeds are immensely used for infertility and general debility. Other parts of the plant are used in various conditions like wound healing, dropsy, fever, dysmenorrhoea etc. This suggests dynamicity of kapikacchu must be studied and supported by modern researches for the better understanding of specificity and spectrum of the drug.

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<p><b>Leaves of Mucuna pruriens</b></p>	<p><b>Inflorescence and Velvety Pods</b></p>
	
<p><b>Seeds of Mucuna pruriens</b></p>	<p><b>Powder of Seeds</b></p>