



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(1): 2366-2368

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Received: 19-11-2018

Accepted: 23-12-2018

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Exploring neglected velvet bean (*Mucuna pruriens*) vegetable in Arunachal Pradesh

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Abstract

Arunachal Pradesh is a State where nature has bestowed rich botanical wealth and a large number of diverse types of wild vegetables growing in different parts. It is considered to be the home of many legume vegetables, which remain neglected. It has a wide array of Neglected legumes that are cheap sources of nutritious food for resource-poor communities, but there has been little documentation of their use, production and processing. Nowadays Legume vegetables are becoming more popular considering their nutritional and pharmaceutical importance. Out of Different legumes, neglected velvet bean are an essential source of vitamins, micronutrients and protein but there is lack of adequate knowledge and information on neglected velvet bean in Arunachal Pradesh. The cultivation of velvet bean is mostly few area of Arunachal Pradesh. It has very good scope for commercial cultivation. This will help the small farmers to improve their economic condition that ultimately leads to overall prosperity of this region. This review focuses Velvet bean uses, botany, production and future Prospects. This type of review could contribute to educate the different tribe of Arunachal Pradesh on the importance of velvet bean vegetables and these plants can also be incorporated in commercial crop plantations so as to improve the economy and minimize the scarcity of traditional food availability in tribal areas.

Keywords: Exploring, neglected velvet, *Mucuna pruriens*, Arunachal Pradesh

Introduction

Indigenous cultures worldwide consume Velvet Beans as an integral part of daily life. In Central America it is used to this day as a coffee substitute and in certain areas of Guatemala as a staple food in tribal diets. The beans are also immensely popular throughout India and Southeast Asia. In fact, nearly every tropical culture on the planet uses *Mucuna Pruriens* in some way, either medicinally, ornamentally or as food in daily life; however, when used as food, the Velvet Beans undergo a special process to remove much of their psychoactive compounds, as large doses can cause unwanted effects. Even without these compounds, the Velvet Beans of the *Mucuna Pruriens* plant are rich in amino acids, making them a useful vegetarian source of protein.

Among the various Neglected wild legumes the Velvet bean *Mucuna pruriens* is widespread in tropical and sub-tropical regions of the worlds. *M. Pruriens*, commonly referred to as velvet bean. This species, which originated in Asia, can be either an annual or perennial, and is now grown for throughout the tropics, particularly in the western hemisphere. It is indigenous to Asia and now grows in many tropical regions, including Asia, Africa, South America, and the West Indies. It was grown throughout the south-eastern United States as a livestock feed and green in many tropical countries, *Mucuna* beans are processed into flour or a coffee substitute, or eaten as a vegetable

Medicinal Uses

The velvet bean serves many other purposes besides being an effective fertilizer. It has been used all over the world as a source of food and medicine for both humans and animals. Velvet bean seeds contain a high dose of Levodopa (L-Dopa), which is a naturally occurring dietary supplement found in certain kinds of food. It is a precursor to neurotransmitters dopamine. The most beneficial use of this supplement is in the clinical treatment of Parkinson's disease. Parkinson's disease is a degenerative disorder of the central nervous system and is caused by the death of dopamine-containing cells. This causes movement-related problems such as shaking, rigidity, slowness of movement, and eventually difficulty walking. The *Mucuna* seeds

help increase the dopamine concentrations in patients with Parkinson's disease. In Asian medicine, velvet beans are used to treat a range of symptoms including high blood pressure, infertility, and nervous disorders. The pods and seeds are purported to kill intestinal worms and parasites. In the West, the plants tend to be grown more for their nitrogen fixing properties, working as a cover crop to restore nitrogen to the soil. They are also sometimes grown as animal feed, both for farm and wild animals. The plants are edible, and the beans have been known to be boiled and eaten and ground as a coffee substitute. It is cultivated as a green manure or as a cover crop and is used as a mixed crop with sugarcane and maize in rotation with sugarcane in Burma. Velvet beans have three main uses: food, feed (forage and seeds) and environmental services. The young leaves, pods and seeds are edible and used in several food specialties including "tempeh", a fermented paste made of boiled seeds, originally from Indonesia. In Central America velvet bean is also used as a coffee substitute. The plant can be a cover crop, and provides fodder and green manure. In the USA, velvet bean is also used as an ornamental species. In Southeast Asia, the immature pods and leaves of velvet bean are used as vegetables. The seed has high viscosity starch, which acts as thickening agent for food products, or as an adhesive in the paper and textile industries. Recently, interest in studying velvet bean's food and feed potential has picked up both at national and international levels since it has repeatedly impressed the farmers and researchers due to its high biomass production, weed suppression and consequent beneficial effects on many crops. It is a popular Indian medicinal plant, which has long been used in traditional Ayurvedic Indian medicine, for diseases including parkinsonism.

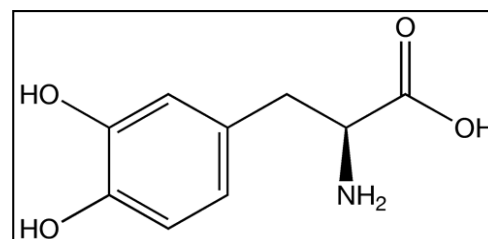
Phytochemistry

Seeds of velvet beans are known to produce the unusual nonprotein amino acid 3-(3, 4- dihydroxyphenyl)-L-alanine (L-DOPA) [1]. It also contains glutathione, gallic acid and betasitosterol. It has unidentified bases like mucunine, mucunadine, pruriene, prurieninine. Other bases isolated from the pods, seeds, leaves and roots include indole-3-alkylamines-N, Ndimethyltryptamine. Leaves also gave 6-methoxyharman. Serotonin is present only in pods [2]. The seeds also contains oils including palmitic, stearic, oleic and linoleic acids [3]. GC-MS analysis showed the presence of phytochemicals like n-hexadecanoic acid (48.21 %), Squalene (7.87%), Oleic acid (7.62%), ascorbic acid (3.80%) and Octadecanoic acid (6.21%) were present in the extract [4]. The seed also contains two tetrahydroquinoline alkaloids namely (-) 3-methoxy-1, 1-dimethyl-6, 7- dihydroxy-1, 2, 3, 4-tetrahydroquinoline and (-) 3- methoxy-1, 1-dimethyl-7,8-dihydroxy-1,2,3,4- tetrahydroquinoline [5]. It also contains serotonin (5-hydroxy tryptamine, 5-HT), 5-hydroxy tryptophane (5-HTP), nicotine, N, N-dimethyl tryptamine (DMT), bufotenine, and 5-methoxy-N, N-dimethyl tryptamine (5-MeODMT) 5-methoxy-N, N-dimethyl tryptamine-n-oxide (5-MeO-DMT-n-oxide). The mature seeds of the plant contain about 3.1-6.1% L-DOPA, with trace amounts of serotonin, nicotine, Bufotenine, 5-MeO-DMT-n-oxide, and betacarboline. The leaves contain about 0.5% LDOPA, 0.006% DMT, 0.0025% 5-MeO-DMT and 0.003% DMT n-oxide [6].

L-Dopa

Mucuna spp. have been reported to contain the toxic compounds L-dopa and hallucinogenic tryptamines, and anti-

nutritional factors such as phenols and tannins [7]. 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 [8]. Velvet bean is well known for its nematicidal effects; it also reportedly possesses notable allelopathic activity, which may function to suppress competing plants [9]. The presence of L-DOPA, a precursor of dopamine in the seeds of *M. pruriens* made the plant valuable in the treatment of PD. *M. pruriens* is used in Ayurvedic medicine to treat diseases of the central nervous system and geriatric disorders. L-DOPA is present at about 1% by fresh weight in leaves and roots of *M. pruriens*. There was no significant difference in the content of L-DOPA when *M. pruriens* was grown under shade or open conditions. The variation of L-DOPA contents in different parts of *Mucuna* species, namely, fully matured seeds 3.6 to 4.2%, pod-pericarp 0.14 to 0.22%, leaves 0.17 to 0.35%, stems 0.19 to 0.31% and roots 0.12 to 0.16% and the highest amount of LDOPA was found in half mature seeds. The content of L-DOPA in the seeds of different accessions ranged from 7.62 to 8.37%. The isolation of L-DOPA (1.5% on dry weight basis) from *Mucuna* seeds is carried using different extraction procedures. A high performance liquid chromatographic assay for the extraction and quantitative determination of L-DOPA in *M. pruriens* var *utilis* seeds is reported. Scientists reported that high performance liquid chromatography (HPLC) analysis revealed LDOPA concentrations ranged from 3.9 to 6.2% in *Mucuna* seeds.



(Structure of L-Dopa)

Botany

Velvet Beans are a summer legume. It grows rapidly, with climbing or trailing vines 6-8 m long. The plant is an annual, climbing shrub with long vines that can reach over 15 meters in length. When the plant is young, it is almost completely covered with fuzzy hairs, shed with age. The leaves are tripinnate, ovate, or rhomboid shaped. In young plants, both sides of the leaves are hairy. The leaves are large and trifoliate with lateral leaflets 7-15 cm long, 5-12 cm wide. Flowers are light purple or white, resulting in pods 4-13 cm in length. Wild forms have pods with hairs that, due to a protein called mucunain, are irritating to the skin and can cause severe itching; cultivated varieties (var. *utilis*) have non-stinging hairs. Mature, dry pods have a hard shell with each pod containing 4-6 seeds which, depending on the variety, vary in color (from black to white, brown, or mottled) and are 1-2 cm long. The velvet bean, *Mucuna pruriens* (L.) DC. var *utilis* (Wall. ex. Wight.) Bak. ex. Burck, is a large twining herb; leaves are pinnately tri-foliate, terminal leaflet often markedly smaller than laterals. Inflorescence axis and pedicels pubescent, flowers are large, the lower calyx tooth is long and corolla is papilionaceous. Pods are long; linear; hairs are present. Seeds are uniseriate whitish, fawn, pale orange or black, sometimes marbled in these colours or with oblique dark markings; aril orange.

Cultivation

The crop grows in all types of soils, but sandy loam soil with good drainage and pH between 5.50 to 7.50 is preferred. It thrives in sub-tropical to tropical climate with a minimum temperature of 15°C in winter and maximum of 38°C in summer months. The crop is seen growing in varied climate such as coastal humid climate to dry arid climate. Hence the crop is said to be highly acclimatizing and adaptive. The crop is raised by direct sowing of seeds in the field. The seed is treated with Capital or any other contact fungicide before planting to protect against soil borne diseases. The field is ploughed 2-3 times to a fine tilth and later divided into beds of convenient size. Direct sowing of seeds is done at a spacing of 60 cm within rows with support plants. In case the support plants are not grown the spacing should be 60 x 45 cm. Seeds are dibbled on the slope of the ridges. Seeds take 8-10 days to sprout. FYM 15t and 100, 80 and 75 kg N, P and K per hectare are the recommended doses of fertilizer out of which, entire quantity of FYM and Phosphorus are applied at the time of land preparation. Nitrogen and Potash are applied in two equal splits at 30 and 60 days after sowing. The seed is best planted between April and July, at a depth between 1/2" and 2 inches. It does not need any Nitrogen however it will respond well to Phosphorus and Potash according to a soil test. Soybean inoculant will also help this plant. Velvet Beans will need a good, soaking rain for it to germinate, and then it can begin grazing between 45 to 60 days. It will bloom around mid-September in Arunachal Pradesh, growing to around 18 to 20 feet in length. Temperatures below 30 degrees will terminate the plant. The crop matures in about 140 days after sowing. Mature pods are harvested to collect seeds from the pods. At the time of harvesting the pods turn to greyish-brown in colour indicating maturity for picking. Normally 3-7 seeds are found in a pod and 5-6 pods per inflorescence are generally available. Thus, about 25-30 bunches can be harvested per plant. Normally 100 seeds weigh 90-110 gm. The pods thus harvested from the field are dried in the sunlight for 4-7 days; the seeds are further dried in shade to reach approximately 7-8% moisture in the seeds. The seeds are normally stored in gunny bags made of jute and then covered with polythene to protect from absorption of atmospheric moisture.

Conclusion and future prospects

Velvet beans are important legume vegetable for nutritional point of view. Several cultivars has been developed and released for other legume crops. Whereas, Velvet bean legume had not been paid concerted efforts for research. This bean having good potential to contribute to the income of farmers. The crop is now popular among Arunachal Pradesh farmers due to its nutritional value and its shelf life. Therefore, in Arunachal Pradesh more attention and priority should be given on cultivation of velvet bean in larger area, Priorities should be given to future exploration and collection based on gaps in areas and diversity required and Inventory and database for information documentation and dissemination and to help better monitoring and management.

Acknowledgement

The authors are very thankful to tribal people of Namsai, local vegetable vendors, and informants for their kind assistance and providing useful information, Arunachal University of Studies Providing the helps in carrying out the field works.

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