Antibacterial activity of *Mucuna pruriens* (L.) Dc. var. *pruriens* – an Ethnomedicinal Plant

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ABSTRACT

In this study, an attempt was made to evaluate the phytochemical screening and antibacterial activity of root and seed of *Mucuna pruriens* var. *pruriens* used as ethnomedicine in various region of India. The preliminary phytochemical study of the methanol extracts of root and seed of *Mucuna pruriens* var. *pruriens* revealed the presence of alkaloids, anthraquinones, flavonoids, phenols, tannins, terpenoids and xanthoprotein. The extracts were tested against *Staphylococcus aureus, Klebsiella pneumoniae, Bacillus subtilis, Pseudomonas aeruginosa, Salmonella typhi and Escherichia coli* using disc diffusion method. The hexane, petroleum ether, benzene, methanol and aqueous extracts of *Mucuna pruriens* var. *pruriens* root and seed possess various degrees of significant inhibitory effect against the tested organisms.

Key words: Itching bean; *Staphylococcus aureus,* Chloramphenicol.

INTRODUCTION

Infectious diseases are an important health hazard all over the world, both in developing and developed countries. Several synthetic antibiotics are employed in the treatment of infectious and communicable diseases. A number of researchers now-a-days are working seriously to find out substitutes for antibiotics as they cause side effects on the functioning of different parts of the body organs and systems. Antibiotics are also known to disturb the natural intestinal microflora (Hidayathulla *et al*. 2011), thus, depriving the benefits of these microbes to human body. Medicinal plants exhibit antibacterial activity (Viji and Murugesan, 2010), since they contain innumerable biologically active chemical constituents. Over the last forty years, intensive efforts have been made to discover clinically useful antibacterial/antifungal drugs (Sofowora 1984, Kudi *et al.* 1999, Perumalsamy *et al.* 1999, Perumalsamy and Ignacimuthu 2000, Sashikumar *et al.* 2003). The increasing interest on traditional ethnomedicine may lead to discovery of novel therapeutic agents. Keeping this in mind, the present study is carried out to evaluate the antibacterial activity of root and seed of itching bean, *Mucuna pruriens* var. *pruriens* used in traditional medicine in various region of India.

The non-protein amino acid, L-DOPA, is extracted from the seeds of *Mucuna pruriens* var. *pruriens* to provide commercial drugs for the treatment of Parkinson's disease (Haq 1983). The seed powder is known to exhibit faster hypothermic (Rajendran *et al.* 1996) and anti-Parkinsonian activity than the synthetic L-DOPA (Rajendran *et al.* 1996; Hassain and Mayan 1997). The seed powder in known to stimulate more sexual activity in male albino rats than L-DOPA and is also reported to arouse sexual desire in patients suffering from Parkinson's disease (Anantha Kumar *et al.* 1994).

Vigorex-SF capsule, an ayurvedic herbo-mineral formulation consisting of the seed powder is found to have adaptogenic effect to improve libido, disturbed due to psychological fear and emotional imbalance and other allied ailments (Shaw and Bera 1993). Alcoholic extracts of leaves and fruit trichomes of this wild legume are found to increase the pain threshold and decrease body temperature. The extract also exhibits anti-inflammatory activity, as it is known to inhibit carrageenin-induced edema (Iauk *et al.* 1993). Seeds of this wild legume are widely used for treating male sexual dysfunction in Unani Medicine (Amin *et al.* 1996).

The blocking effect of King Cobra venom at neuro-muscular junction is removed by the aqueous extract of the seeds of this plant species (Aguiyi *et al.* 1997). Rhinax, a herbal formulation comprising this wild pulse possesses anti-hepatotoxic activity (Dhuley and Naik 1997). The tribe, Garos of Maghalaya, India consume the seeds for increasing potency and the hairs of the pod are used as vermifuge (Vasudeva Rao and Shanpru 1991). In Nigeria, powdered hairs on pods are administered with honey for expelling intestinal worms (Gill and Nyawuame 1994).

MATERIALS AND METHODS

COLLECTION OF PLANT MATERIALS

The root and seed materials of *Mucuna pruriens* (L.) DC. var. *pruriens* were collected from Saduragiri hills, Western Ghats, Tamil Nadu. They were shade dried at room temperature for 10-15 days.

EXTRACTION OF PLANT MATERIAL

Various organic solvents were used for the extraction of bioactive compounds. The root and seed

powders (10g) of *Mucuna pruriens* var. *pruriens* were first extracted with petroleum ether for defatting in a Soxhlet apparatus. The defatted powdered sample of *Mucuna pruriens* var. *pruriens* were dried and successfully extracted with hexane, petroleum ether, benzene, methanol and then water in a Soxhlet apparatus. The extracts obtained were completely evaporated by using vacuum rotary evaporator. The concentrated extracts were subjected to qualitative test for the identification of various phytochemical constituents as per standard procedures (Brindha *et al.* 1981, Anonymous 1996, Lala 1993). The concentrated extracts were used for antibacterial activity.

MICROORGANISMS

Bacterial strains of *Staphylococcus aureus* (MTCC 96), *Klebsiella pneumoniae* (MTCC 109), *Bacillus subtilis* (MTCC 441), *Escherichia coli* (MTCC 424), *Pseudomonas aeruginosa* (MTCC 443) and *Salmonella typhi* (MTCC 531) were procured from microbial type culture collection, Chandigarh. The bacteria were incubated on a nutrient agar-slant (stationary cultures) for 48h at 37^{o}C followed by inoculation in Muller Hinton Agar (MHA) medium.

ANTIBACTERIAL ASSAY

Antibacterial activity was demonstrated using a modified method originally described by (Bauer *et al*. 1996) which is widely used for the antibacterial susceptibility testing (Barry and Thornsberry 1985). A loopful bacteria was taken from the stock culture and dissolved in 0.1ml of saline. All the tests were done by placing the disc (6mm diameter) impregnated with (20µl) various crude solvent extracts on the Muller Hinton Agar surface previously inoculated with 10ml of MHA liquid medium with Gram positive and Gram negative bacteria. Respective solvents without plant extracts served as negative control. Standard antibiotics of chloramphenicol and tetracycline were used as reference or positive control. Plates were incubated at 37^{o}C for 24 hours. After the incubation period, the diameter of the inhibition zone around the plant extracts saturated discs were measured and also compared with the diameter of inhibition zone of commercial standard antibiotic discs.

RESULTS AND DISCUSSION

The preliminary phytochemical study of the methanol extracts of root and seed of *Mucuna pruriens* var. *pruriens* revealed the presence of alkaloids, anthraquinones, flavonoids, phenols, tannins, terpenoids and xanthoprotein (Table 1).

Table 1: Preliminary phytochemical screening of root and seed extracts of *Mucuna pruriens* var. *pruriens*.

Presence/absence of bioactive compounds	Name of the extracts									
	Hexane		Petroleum ether		Benzene		Methanol		Water	
	Root	Seed	Root	Seed	Root	Seed	Root	Seed	Root	Seed
Alkaloids	+	+	+	+	+	+	+	+	-	-
Anthraquinones	-	-	-	-	+	-	+	+	-	-
Catachin	-	-	-	-	+	+	-	+	-	-
Coumarin	-	-	+	-	+	+	-	-	-	-
Flavonoids	+	-	-	-	-	-	+	+	-	-
Phenols	+	+	+	-	+	+	+	+	-	+
Quinones	+	-	-	-	+	-	-	-	+	-
Saponins	-	-	-	-	-	-	+	-	+	-
Steroids	+	+	+	+	-	-	-	+	-	-
Sugar	+	-	-	-	+	+	+	-	+	+
Tannins	+	-	-	-	-	-	+	+	-	-
Terpenoids	+	+	-	-	-	-	+	+	-	-
Xanthoprotein	+	+	+	+	-	-	+	+	-	-

Table 2: Antibacterial activity of *Mucuna pruriens* var. *pruriens*

Name of the extracts	Plant part & (Antibiotic)	Zone of inhibitor (mm)					
		S.aureus	*K. preumoniae*	*B.subtilis*	*P. aeruginosa*	*S.typhi*	*E.coli*
Hexane	R	1	-	1	-	3	1
	S	3	1	2	-	1	2
	T	8	9	8	9	9	9
	C	9	9	9	9	9	8
Petroleum ether	R	2	1	3	-	-	4
	S	1	-	-	2	3	1
	T	9	9	8	8	9	8
	C	9	8	9	8	9	8
Benzene	R	3	1	4	2	3	3
	S	2	2	1	4	4	5
	T	9	9	9	9	8	9
	C	9	8	9	9	9	9
Methanol	R	6	2	2	5	2	4
	S	5	5	4	1	3	2
	T	8	9	9	9	9	8
	C	9	9	9	9	8	9
Water	R	1	2	1	-	-	1
	S	-	-	1	1	2	-
	T	9	8	9	9	9	8
	C	9	9	8	9	9	9

R- Root S- Seed T- Tetracycline C- Chloramphenicol

The antibacterial activity of the root and seed extracts of *Mucuna pruriens* var. *pruriens* are furnished in Table 2. All the extracts have exhibited different degrees of antibacterial activity. Benzene and methanol extracts of root and seed of *Mucuna pruriens* var. *pruriens* shows activity against all the six tested pathogens. Hexane extract of root shows antibacterial activity against *S. aureus, B. subtilis, S. typhi,* and *E. coli* whereas, root extract does not inhibit *P. aeruginosa.* Petroleum ether extract of root shows activity against all the tested microorganisms except *P. aeruginosa* and *S. typhi,* whereas, seed extracts fails to inhibit the growth of *K. pneumonia* and *B. subtilis.* Aqueous extract of root does not inhibit the growth of *P. aeruginosa* and *S. typhi,* whereas, the seed extract fails to inhibit the growth of *S.aureus, K. pneumoniae* and *E. coli.* The methanol extract of root of *Mucuna pruriens* var. *pruriens* shows the highest inhibition zone, observed against *S.aureus.* Earlier Salau and Odeleye (2007) have reported that, methanol extract of leaf of *M. pruriens* shows strong antibacterial activity against *S. aureus, B. subtilis, E.coli* and *P. aeruginosa.* Antibacterial activity was comparable with that of the standard antibacterial agent tetracycline and chloramphenicol against the organisms tested.

It is concluded that, in the present study, the plant contains potential antibacterial components that may be useful for evolution of pharmaceutical for the therapy of ailments. The hexane, petroleum ether, benzene, methanol and aqueous extracts of *Mucuna pruriens* var. *pruriens* root and seed possess significant inhibitory effect against the tested organisms. The results of the investigation support the traditional claim of this plant. Thus further work can be carried out on the isolation procedure for finding out the exact phytocompound responsible for the biological activity.

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