

Phytochemical and antimicrobial study of *Andrographis paniculata* Nees

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Abstract

Andrographis paniculata Nees, a member of the family Acanthaceae is a plant commonly used by the local people, for the treatment of common cold, liver diseases, snake bite and some skin infection. The aerial part of the plant was screened for their phytochemical properties and antimicrobial activity. Antimicrobial activity of leaf extract of *Andrographis paniculata*, was studied using different solvent like chloroform, methanol, petroleum ether and water against bacterial strains like *Bacillus subtilis*, *Escherichia coli* by disc diffusion method. Methanolic extract showed maximum inhibitory action against *Escherichia coli* and *Bacillus subtilis* respectively. Results of the phytochemical screening showed that steroids, phenols, terpenoids, alkaloids, saponins, flavonoids were the active compounds present in the plant. The plant is traditionally used for the treatment of antibacterial, antioxidant, antidiabetic, antipyretic, hepatoprotective and several infectious diseases ranging from malaria to dysentery. The medicinal value of this plant is due to the presence of active ingredients viz andrographolide and neoandrographolide which are derivatives of diterpenoids. It is a potent scavenger of a variety of reactive oxygen species including superoxide anion, nitric oxide, hydrogen peroxide. The anti-oxidant activity was determined by DPPH (2, 2-diphenyl-1-picrylhydrazyl) method. Total antioxidant capacity were determined spectrophotometrically.

Keywords: Phytochemical, *Andrographis paniculata*, Antibacterial

1. Introduction

Herbal Medicine and Its Importance

Nature has been a source of medicinal agents for thousands of years and since the beginning of mankind. The application of medicinal plants especially in traditional medicine is currently well acknowledged and established as a viable profession. Medicinal plants are an important source for the therapeutic remedies of various ailments (Kokate, *et al.* 2003) [1]. Scientific experiments on the antimicrobial properties of plant components were first documented in late 19th century (Jorns, *et al.* 1997) [2]. There is a growing interest in correlating the Phytochemical constituents of a medicinal plant with its pharmacological activity (Kokate, *et al.* 2003) [1].

Andrographis Paniculata

Kalmegh (*Andrographis paniculata*) commonly known as "king of bitter" belonging to family Acanthaceae, is an important annual medicinal herb widely distributed in Madhya Pradesh, India. It is hardy and erect herb which grows mainly as undershrub in tropical, moist deciduous forest. It is one of the most widely used plant in Ayurvedic formulations (Okeke, *et al.* 2001) [3]. It is used to overcome *sannipata* type of fever, difficulty in breathing, hemopathy burning sensation, cough, skin diseases, fever, ulcer and worms. It is also useful in acidity and liver complaints (Aiyer and Kolammal, 1962) [4].

Morphology

Andrographis paniculata grows erect to a height of 30–110 cm in moist, shady places. The slender stem is dark green, squared in cross-section with longitudinal furrows and wings along the angles. The lance shaped leaves have hairless blades measuring up to 8 centimeters long by 2.5 wide. The small flowers are borne in spreading racemes. The fruit is a

capsule around 2 centimeters long and a few millimeters wide. It contains many yellow brown seeds. It is also known as *Bhui-neem*, meaning "neem of the ground", since the plant, though being a small annual herb, has a similar strong bitter taste as that of the large Neem tree.

Phytoconstituents

Medicinal plants contain physiologically active principles that over the years have been exploited in traditional medicine for the treatment of various ailments (Akbarsha, *et al.* 1990) [5]. *Andrographis paniculata* contains diterpenes, lactones and flavonoids. Flavonoids mainly exist in the root, but have also been isolated from the leaves. Aerial parts contain alkanes, ketones, and aldehydes and the bitter principles in the leaves were due to presence of the lactone andrographolide named kalmegin. Four lactones Chuaxinlian A (deoxyandrographolide), B (andrographolide), C (neoandrographolide) and D (14-deoxy-11, 12-didehydroandrographolide) were isolated from the aerial parts. The leaf and stem extracts were assayed for the presence of glycosides, flavonoids, gums, steroids, terpenoids, tannins, saponins and phenolic compounds. The ethanol, acetone, methanol, petroleum ether and chloroform extracts of Kalmegh were screened for the presence of secondary metabolites (Goodman and Gilman, 2000) [6].

2. Material and Methods

The agar disc diffusion method was employed for the determination for anti-bacterial activities of the extract of *A.paniculata*. All bacterial cultures were first grown on nutrient agar plates at 37 °C for 24 hours. Few colonies of similar morphology of the respective bacteria were transferred to nutrient broth and incubated until adequate growth. The inoculations of the respective bacteria were streaked on to the nutrient agar plates. Sterile filter paper

discs (5mm) (Watt’s man no.1) were punched and impregnated with petroleum ether, methanol, chloroform and aqueous extracts of *A.paniculata*. These were then placed on the nutrient agar plates inoculated with *S.aureus* and *B.*

subtilis. The plates were then allowed to stay for incubation at 37 °C for 24 hours. The assessment of antibacterial activity was based on the measurement of diameter of inhibition zone (mm) formed around the disc.

3. Observations

Phytochemical analysis of drug extract

Phytochemical Tests	Kalmegh (<i>Andrographis paniculata</i>)			
	Chloroform	Methanol	Petroleum Ether	Aqueous
Alkaloids (Mayers Reagent)	-	+	+	+
Carbohydrates & Glycosides (Fehling Solution)	-	-	-	+
Phenolic compounds & Tannins (Ferric Chloride Test)	-	+	-	+
Flavonoids	-	+	+	+
Steroid	+	+	+	+
Terpenoids	-	+	+	-
Saponins	-	+	-	+

Table Phytochemical Analysis Test Chart of *Andrographis paniculata*

(+) --- Positive
(-) ---- Negative

Anti-Bacterial Activity of Drug Extract From Soxhlet Extraction Method

Table 1: (A) Chloroform Extract

S. No.	Micro-organism	Zone of Inhibition (in mm)
1.	<i>E. coli</i>	08 mm
2.	<i>S aureus</i>	14 mm

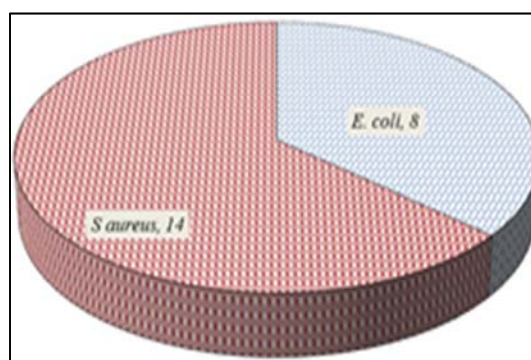


Fig 1: Chloroform Extract

Table 2: Anti-Bacterial Activity of Chloroform Extract of *Andrographis paniculata*. (B) Petroleum Ether Extract

S. No.	Micro-organism	Zone of Inhibition (in mm)
1.	<i>E. coli</i>	No ZOI
2.	<i>S aureus</i>	No ZOI

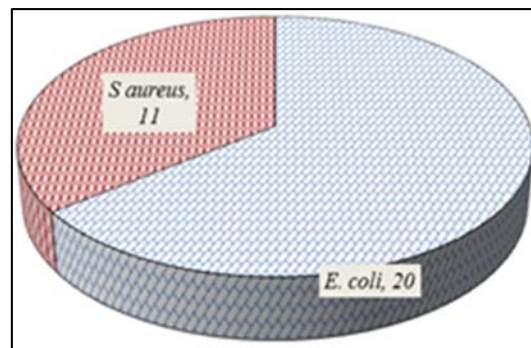


Fig 2: Methanol Extract

Table 3: Anti-Bacterial Activity of Petroleum Ether Extract of *Andrographis paniculata*. (B) Methanol Extract

S. No.	Micro-organism	Zone of Inhibition (in mm)
1.	<i>E. coli</i>	20mm
2.	<i>S. aureus</i>	11mm

Table 4: Anti-Bacterial Activity of Methanol Extract of *Andrographis paniculata*. (C) Aqueous Extract

S. No.	Micro-organism	Zone of Inhibition (in mm)
1.	<i>E. coli</i>	12mm
2.	<i>S aureus</i>	15mm

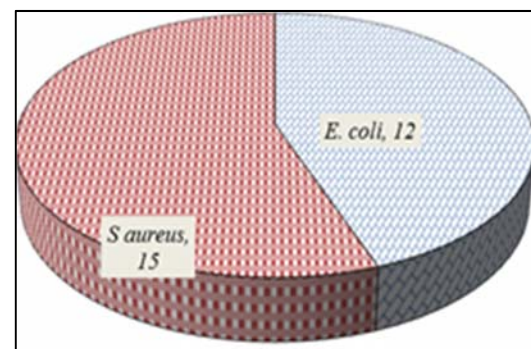


Fig 3: Aueous Extract

ZOI - (Zone of Inhibition)

Anti-Bacterial Activity of Some Standard Antibiotics

Table 5: Anti-Bacterial Activity of Aqueous Extract of *Andrographis paniculata*.

S. No.	Micro-organism	Zone of Inhibition (in mm)	
		P ₁₀	OFX ₅
1.	<i>E. coli</i>	18 mm	19mm
2.	<i>S. aureus</i>	17 mm	20mm

P₁₀ - Penicillin G
OFX₅ - Ofloxacin

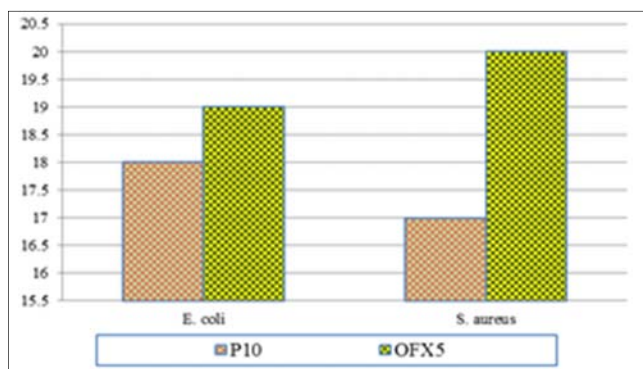


Fig 4: Anti-Bacterial Activity of Aqueous Extract of *Andrographis paniculata*

4. Discussion & Conclusion

The determination from the present study showed that the four extracts (chloroform, petroleum ether, methanol, and aqueous) of Kalmegh revealed anti-bacterial properties against the two bacteria *S. aureus* and *E. coli*. When the four extracts were compared with each other and with the standard antibiotic Penicillin G and Ofloxacin, the methanolic extract observed to have highest potential compared to that of chloroform, petroleum ether and aqueous extracts. The anti-bacterial activity of the methanolic extract of Kalmegh is attributed due to the combined effect of andrographolide and arabinogalactan proteins (Lenzen, *et al.* 1998)^[7].

5. Acknowledgements

The authors is very much grateful to the authorities of Pt. S.N.S. Govt. P.G. College, Shahdol for providing the facilities.

6. References

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