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Antimicrobial Activity and Phytochemical Analysis of *Capparis grandis* Linn

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ABSTRACT

Capparis grandis Linn. is a species of the family *Capparidaceae*. It is commonly known as 'Pachunda'. The main objective of the present study was to investigate the antimicrobial activity and phytochemical analysis of an aqueous extract of *Capparis grandis* Linn. Medicinal plants have an alternative rich source of phytochemicals and antibacterial agents. The phytochemical result showed the presence of carbohydrate, steroid, alkaloid, flavonoid, tannin, and glycosides. The antibacterial activity was studied by the agar well diffusion method using an aqueous extract of *Capparis grandis* Linn. leaves. This extract was tested against five bacterial strains *Pseudomonas, Bacillus pasteurii, Escherichia coli, Bacillus subtilis, Streptococcus mutant*, and three fungal strains *Candida albicans, Aspergillus niger*, and *Dreschlera turcica*. This result shows that the leaves of this plant have a potentially broad-spectrum antibacterial activity and phytochemical constituents and these help in the production and development of phytomedicines for antibacterial or antimicrobial properties.

Keywords: *Capparis grandis*, phytochemicals, antimicrobial activity, Pachunda, medicinal plant, Antibacterial, Antifungal, secondary metabolites.

I. INTRODUCTION

The medicinal plant has been an important source of medicines for thousands of years. These all-medicinal plants are useful for healing as well as for curing various human diseases [1]. Medicinal plants are a rich source of bioactive phytochemicals and bio-nutrient as well as antibacterial or antimicrobial activity. Phytochemicals are biologically active naturally accruing chemical compounds in plants [2]. According to the world health organization, nearly 65-80% of the world's population depends on

traditional medicine for curing various human diseases [3]. Phytochemicals are primary and secondary compounds. A primary compound such as carbohydrates and lipids contribute directly to the growth or development of plants including photosynthesis, respiration, etc. A secondary compound like alkaloids, steroids, tannins, and flavonoids are not in the role of plant growth [6, 19]. They are only for the protection from herbivores. In general, the chemical present in a plant protects plant cells from environmental hazards like pollution, stress, drought, UV exposure, and pathogenic attack [5][7].

The *Capparidaceae* contain the *Capparis* genus, including the species of Capparis grandis Linn. Which is called in Hindi "pachunda". The main objective of the present study was to investigate the antimicrobial activity and phytochemical analysis of an aqueous extract of *Capparis grandis* Linn. This plant is used in the traditional medicine system for curing various diseases caused by a microorganism [16].

Capparis grandis Linn. is an evergreen plant. It is native to Indo-Malaysia including Eastern and the Western Ghats or Rajasthan southwards to Karnataka. [10, 22] It is a small tree with branchlets. Leaves of *Capparis grandis* Linn. are ovate, wooly on both sides, and 4-6×3-4cm. leaf-stalk up to 1cm, densely wooly, flowers are born in corymbs at branch ends, lower with leaves, upper with small bracts flower is up to 2cm across, white in color and sweetly fragrant. Petals are up to 1.3 cm long. Flower-cluster stalk is up to 3cm long, wooly flower, stalk 2.5cm, berries are green in color, 2.5cm across spherical in shape and after ripening their color is red. Flowering: all year. [4][8-9] *Capparis grandis* Linn. is a small tree used in traditional medicine, Ayurveda, Siddha, and Unani. It has a long history of traditional uses for various diseases. Root leaves and flowers of *Capparis grandis* Linn. are widely used to cure several diseases. The infusion of leaves is used internally for swelling and eruption. Some tribal healers administered *Capparis grandis* Linn. on asthma, wound, and burns.[13-14] Fresh leaves of Capparis grandis Linn. are cooked and eaten as vegetable soup to treat skin eruption.[16] it was also be Given as a blood tonic.[4] Fresh leaves are crushed and pulp is applied on insect bites.[17]

II. METHODS AND MATERIAL

Collection and identification of plant material:

Fresh plants were collected from Nighoj, Tal- Rahata, District- Ahmednagar, Maharashtra, India. The plant *Capparis grandis* Linn. was identified and authenticated Postgraduate Department and Research Centre of Botany, Mula Education Society's Arts, Commerce and Science College, Sonai. Tal. Newasa Dist. Ahmednagar (M.S.). The leaves, root, root bark, fruit coat, and seed were separated from the plant, washed and dried into a hot air oven then milled into fine powder.

Phytochemical analysis of aqueous extract:

In qualitative analysis, aqueous extract of *Capparis grandis* Linn. showed secondary metabolites such as steroid, alkaloid, flavonoid, tannin, and glycosides and absence of protein, amino acids, and fats & oils [11-12, 16, 18].

Antibacterial activity of aqueous extract of leaves:

The antibacterial activity of the leaves of *Capparis grandis* Linn. was carried out by aqueous extract. The antibacterial activity was studied against bacterial cultures like *Bacillus subtilis*, *Escherichia coli*, *Bacillus pasteurii*, *Pseudomonas*, *Streptococcus mutant*. These bacteria were previously isolated, identified, and stored in the Department of Microbiology of Sanjivani Arts Commerce and Science College Kopargaon, Maharashtra, India. This bacterial culture was maintained on nutrient agar slant at first incubating at 37^0 c for 20-24 hours and then stored at 4^0 c as stock for antibacterial activity [20]. The fresh culture was obtained by transferring a loop full of culture into the nutrient broth and then incubate at 37^0 c overnight.

To test antibacterial activity, a good diffusion method was used [15].

Antifungal activity of methanol extract of leaves:

The antifungal activity was tested by the disc diffusion method. The potato dextrose agar plates were inoculated with each fungal culture (10 days old) by point inoculation. The filter paper discs (5 mm in diameter) impregnated with 100 µg MLG concentrations of the extracts were placed on test organism-seeded plates. Methanol was used to dissolve the extract and was completely evaporated before application on test organism-seeded plates. Blank disc impregnated with solvent methanol followed by drying off was used as negative control and Nystatin (10 µg disc) was used as a positive control. The activity was determined after 72 hr of incubation at 28°C. The diameters of the inhibition zones were measured in mm [21].

Culture media preparation:

In this study media used for antibacterial activity is nutrient agar (NA). This was prepared and sterilized at 121^0 c at 15 psi for 15 minutes in an autoclave. After autoclave, the media was poured into pre-sterilized Petri-plates and allowed to solidify at room temperature [21].

Well, diffusion method:

After plate solidified the freshly prepared bacterial broth culture suspension was spread over the nutrient agar media using L shape sterile glass spreader separately under the aseptic condition. Then well was made in each plate with the help of the tip of a micropipette of 70 mm diameter. In this well fill the leaves extract. This method depends upon the diffusion of leaves extract from the hole through the solidified agar layer of petri-dish to such an extent that the growth of added microorganisms is prevented entirely in a circular area or zone around the hole containing leaf extract [1, 3, 21].

Incubation:

Petri-plates were incubated for 24 hours at 37^0 c in the incubator. After incubation, the diameter of the clear zone of incubation produced around the well was measured in mm by measuring scale [21].

III. RESULTS AND DISCUSSION

Table 1: preliminary phytochemical screening of aqueous extract of *Capparis grandis* Linn.

Sr. No	Chemical constituents	Test	Leaf	Root	Root bark	Fruit coat	stem	seed
1.	carbohydrate	Molisch's test	+	+	+	++	+	++
		Benedict's test	-	+	+	+	+	+
2.	alkaloid	Hager's test	+	+	+	+	+	+
		Wagner's test	+	+	+	+	+	+
3.	glycosides	Keller-killiani test	-	-	+	+	+	+
		Saponin foam	+	+	+	+	+	+
4.	flavonoid	Sulfuric acid test	-	+	+	+	+	+
5.	tannins	Dil.HNO_3	+	+	+	+	+	+
6.	Protein	Xanthprotein test	-	-	-	-	-	+
		Millon's test	-	-	-	-	-	+
7.	Amino acids	Ninhydrin test	+	+	-	-	-	-
8.	Fats and oils	Solubility test	-	-	-	-	-	-
9.	steroid	Salkowski test	+	+	++	++	+	+

(+ presence, - absence, ++ large amount present).

Table 2: Antibacterial activity zone of inhibition.

Sr. No.	Test organism	Zone of inhibition in mm.
1.	*Bacillus subtilis*	26 mm
2.	*Escherichia coli*	23mm
3.	*Bacillus pasteurii*	22mm
4.	*Psuedomonas*	22mm
5.	*Streptococcus mutant*	21mm

Table 3. Antifungal activity zone of inhibition.

Sr. No.	Test organism	Zone of inhibition in mm.
1.	*C. albicans*	21 mm.
2.	*A. niger*	19 mm.
3.	*D. turcica*	20 mm.

IV. CONCLUSION

From the above study, we concluded that the aqueous extract showed the presence of phytochemicals as well as antibacterial activity. In the antibacterial activity zone of inhibition against *Bacillus subtilis* (26mm), *Escherichia coli* (23mm), *Bacillus pasteurii* (22mm) *Pseudomonas* (22mm), *Streptococcus mutant* (21mm) [Table no.2], and the antifungal zone of inhibition against *Candida albicans* (21mm), *Aspergillus niger* (19 mm), and *Dreschlera turcica* (20mm) [Table No.3]. Preliminary phytochemical investigation showed the presence of carbohydrate, steroid, alkaloid, flavonoid, tannin, glycosides and absence in fat and oils, protein and amino acids [Table 1]. The fruit coat and seed extract showed the maximum amount of carbohydrate, root bark, and the fruit coat showed the maximum number of steroids. Protein is present in only seed extract and amino acid is present in only leaf and root extract.

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