Chapter 4

Desert bioactives: profiling phytochemicals and antibacterial potential in *Cereus repandus* (L.) Mill. (Cactaceae)

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ABSTRACT

Cereus repandus, a succulent tree, has long been recognized in traditional medicine for its potential health benefits. Present study aimed to profile the phytochemical composition and evaluate the antibacterial activity of its hydroethanolic fruit extract. Qualitative phytochemical analysis revealed the presence of primary metabolites, including proteins, carbohydrates, and amino acids, highlighting the nutritional value of the fruit. Secondary metabolites such as tannins, flavonoids, and reducing sugars were detected, indicating potential pharmacological properties. The antibacterial activity was assessed against *Escherichia coli*, which established a minimum inhibitory concentration (MIC) of 50 mg/mL. The extract exhibited a concentration dependent inhibition of bacterial growth, suggesting moderate antibacterial potential. The observed bioactivity is likely associated with the presence of secondary metabolites, particularly tannins and flavonoids. These findings support the therapeutic property of *C. repandus* and highlight its potential as a source of bioactive compounds for future pharmacological applications.

Keywords: Antibacterial, ethnomedicine, nutraceuticals

INTRODUCTION

Cacti are remarkable desert plants that have adapted to survive under extreme environmental conditions, storing water and nutrients within their succulent tissues (Hultine *et al.,*2023). Many cactus species are valued for their nutritional and medicinal properties. Edible parts such as fruits and cladodes (flattened stems) are rich in nutrients including carbohydrates, amino acids, vitamins, and minerals. They also contain a wide range of bioactive compounds such as flavonoids, tannins, alkaloids, and phenolics that contribute to its pharmacological properties (Conte *et al.,*2025). Traditionally, cacti have been consumed as food and used in folk medicine across arid regions of the America, Africa, and Asia for treating ailments like diabetes, obesity, and digestive disorders (Monteiro *et al.,*2023). Native to the coasts of Venezuela to Colombia in the Caribbean Sea (POWO, 2025), *Cereus repandus* (Figure 1), commonly called as the Peruvian apple cactus or Cadushi by the locals, thrives in typical dry tropical habitats.



Figure 1: Fruit of *Cereus repandus* attached to the plant

Its interchangeable taxonomic identity often gets confused with the name *C. peruvianus* L. In southern part of Brazil, its cladodes formulation is known to inhibit gastric lesions and its extract is also marketed as an herbal medicine

used for weight loss (Nunes *et al.,*2022). Its stems are reviewed (Morton, 1967) to be used as a staple food and dried stems to be used as torches, fuel and fences and when matured, thick trunks are also used for carpentary. In recent years, scientific researches have also highlighted cacti as functional foods with potential health values. Their ethnobotanical use has also been linked to today's nutraceutical and pharmaceutical applications. In that light, fruits of *C. repandus* (Figure 2) were screened for studying their phytochemical richness and antimicrobial activity against *Escherichia coli*, a gram negative bacteria associated with common gastrointestinal disorders (Petersen, 2022).

METHODOLOGY

The fruits of *Cereus repandus* were collected from nearby Athagarh areas of Cuttack district, Odisha, India. The plant species was identified by the authors (Figure 1).



Figure 2: Collected fruit sample of *C. repandus*

The Soxhlet extraction method was adopted using hydroethanolic extract for qualitative phytochemical analysis (Table 1). Detection of primary and

secondary metabolites was conducted and antibacterial activity was studied by determining the minimum inhibitory concentration (MIC) using *Escherichia coli* using standard methods. (Devi *et al.,*2023; Jena *et al.,*2025; Sharma *et al.,*2025).

RESULTS AND DISCUSSION

The hydroethanolic extract of *Cereus repandus* fruits was analyzed for the presence of primary and secondary metabolites (Table 1). The extract contained primary metabolites including proteins, carbohydrates, and amino acids (Figure 3), indicating the nutritional and metabolic potential of the fruit. Secondary metabolites such as tannins, flavonoids, and reducing sugars were also detected (Figure 4), confirming the presence of key phytochemicals that may contribute to the pharmacological efficacy of the fruit.

Table 1: Qualitative phytochemical analysis of *Cereus repandus* for detection of primary and secondary metabolites

Extract	Category of Metabolites	Detected Bioactive Compounds	Significance
Hydroethanolic	Primary Metabolites	Proteins, Carbohydrates and Amino acids	Indicates the nutritional and metabolic potential of the fruit.
	Secondary Metabolites	Tannins, Flavonoids and Reducing sugars	Confirms the presence of key phytochemicals contributing to pharmacological efficacy.

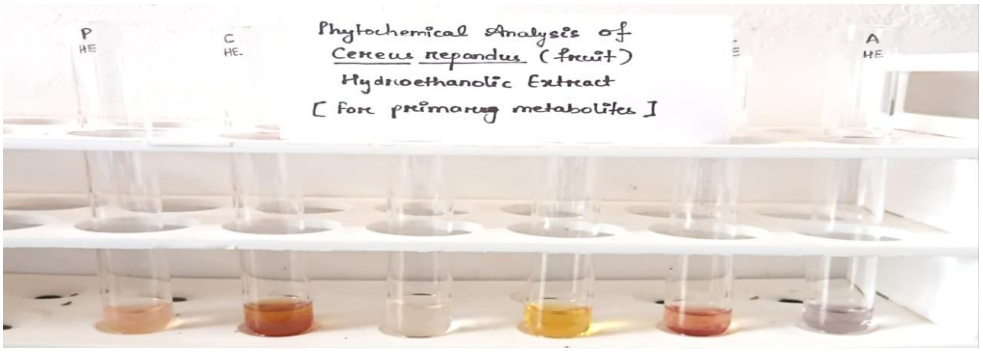


Figure 3: Detection of primary metabolites

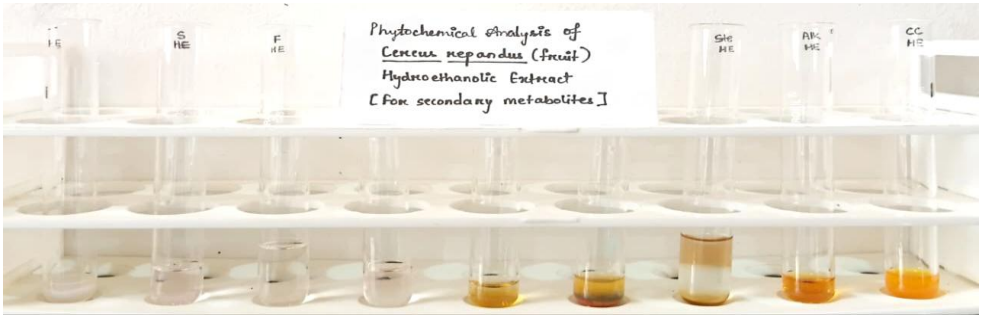


Figure 4: Detection of secondary metabolites

These findings suggest that *C. repandus* possesses both nutritional and bioactive properties, supporting its traditional and potential therapeutic applications. The antibacterial potential of the hydroethanolic extract was evaluated against *Escherichia coli* using the broth microdilution method (Table 2). The extract inhibited bacterial growth at concentrations of 50 mg/mL and above, establishing the minimum inhibitory concentration (MIC) at 50 mg/mL (Figure 5). At lower concentrations (25 and 12.5 mg/mL), visible bacterial growth was observed, indicating a concentration dependent effect. Control experiments validated the results, with nutrient broth showing no growth and microbial broth demonstrating normal bacterial proliferation, while antibiotic controls exhibited complete inhibition. These results suggest that the hydroethanolic extract of *C. repandus* fruits possesses moderate antibacterial activity, likely attributable to the detected secondary metabolites, such as tannins and flavonoids, known for their antimicrobial properties.

Table 2: Estimation of Minimum Inhibitory Concentration (MIC)

Hydroethanolic Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
Cereus repandus (fruits)	NG	NG	G	G	50
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-
Antibiotics	NG	NG	NG	NG	-

(NG: No growth of bacteria; G: Growth)



Figure 5: Determination of minimum inhibitory concentration (MIC)

CONCLUSION

The hydroethanolic extract of *Cereus repandus* fruits bespeaks dual significance: nutritional and bioactive. The presence of primary metabolites shows its metabolic and dietary value, while secondary metabolites, notably tannins and flavonoids, contribute to its moderate antibacterial activity against *E. coli*. This study validates the traditional use of *C. repandus* and highlights its potential as a natural source of bioactive compounds with pharmacological relevance. Further studies exploring other microbial strains and in vivo applications could expand its therapeutic potential and support its integration into modern medicinal frameworks.

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