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Antibacterial activity of *Annona Muricata* seed extracts against selected bacterial pathogens

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Abstract
The present study was aimed to determine the antibacterial activity of different extracts of *Annona muricata*. Dried seed powder was used for the extraction of different solvents such as chloroform, ethyl acetate, acetone, ethanol and distilled water. The solvent extracts were assessed for the antibacterial activity against *Bacillus subtilis*, *Enterococcus faecalis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Salmonella typhi* by using agar disc diffusion method. Among the selected solvents, ethanolic extracts of *Annona muricata* was more active against bacterial pathogens than aqueous extracts. *Staphylococcus aureus* and *Bacillus subtilis* was highly sensitive to all the solvents. Least activity was noticed against *Enterococcus faecalis*.

Keywords: antibacterial activity, *annona muricata*, bacterial pathogens

Introduction
Natural remedies from medicinal plants are found to be safe and effective (Chauhan & Mittu, 2015) [7]. *Annona muricata* is an edible fruit-bearing evergreen tree with large glossy dark green leaves. It is cultivated throughout India. The extracts from its leaf, stem, roots, and seeds have demonstrated the antibacterial activity against a plethora of microorganisms (Biba *et al*., 2014; Vijayameena *et al*., 2013) [8, 9]. *Annona muricata* is a lowland tropical fruit bearing tree in the Annonaceae family. It is commonly known as Soursop or Graviola. *Annona muricata* is a large spiny, green tropical fruit with sweet and white pulp. It is widely distributed in India and Central America. The edible fruits, leaves, seeds and roots are known to have medicinal properties. The fruit of *Annona muricata* Linn. is found to be edible in Yunnan province of China and their fruits is used commercially for the production of juice, candy and sherbets. The soursop flavor possesses a maximum of 114 volatile compounds that is found to be responsible for the whole aroma profile, 44 esters, 25 terpenes, 10 alcohols, 9 aldehydes and ketones, 7 aromatic compounds, 5 hydrocarbons, 3 acids, 3 lactones and 8 other miscellaneous compounds (Gajalakshmi *et al*., 2012) [1]. In laboratory studies, *Annona* selectively hunts down and kills 12 different types of cancer cells, including breast, prostrate, lung, colon and pancreatic cancer (Rojas *et al*.,2003) [2]. *Annona muricata* produces natural compounds in its leaf, stem, bark, fruit and seeds. Three separate research have confirmed that these chemicals have significant antitumorous properties and selective toxicity against various types of cancer cells (without harming healthy cells). Over twenty laboratory studies, kept have shown this tree 10,000 times more powerful than Adriamycin, a commonly used chemotherapy (Benjamin and Stone., 2003) [3]. The common use of the species, which is deficient in scientific research and requires more studies to explore the medicinal potential of the plant. In the present study, antibacterial activity of *Annona muricata* seed extract was carried out against selected bacterial pathogens.

Materials and Methods
The seeds of *Annona muricata* were collected from Kanyakumari District, Tamil Nadu, India. The collected seeds were open-air-dried, powdered and extracted using Soxhlet apparatus using chloroform, ethyl acetate, acetone, ethanol and aqueous.

Preparation of test microorganisms
The pathogenic microbial strains namely *Bacillus subtilis*, *Enterococcus faecalis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Salmonella typhi* were obtained from Scudder Laboratory, Nagercoil and maintained by subculturing on nutrient agar medium. The antibacterial activity was determined using disc diffusion method.

Results and Discussion
Ethanol extract of *Annona muricata* L. showed maximum antibacterial activity. Among the selected solvents all the solvents exhibited significant activity (Table 1). However, ethanol extract exhibited 19mm zone of inhibition against *Bacillus subtilis*, which is higher inhibitory activity than the standard control and the acetone extract highly inhibited *Staphylococcus aureus* (19mm).

Table 1: Antibacterial activity of *Annona muricata* seed extracts

Pathogens	Zone of inhibition (mm) in different solvents					
	Chloroform	**Ethyl acetate**	**Acetone**	**Ethanol**	**Aqueous**	**Control**
Bacillus subtilis	13mm	9mm	-	19mm	15mm	16mm
Enterococcus faecalis	-	-	9mm	9mm	10mm	13mm
Staphylococcus aureus	8mm	12mm	19mm	14mm	10mm	17mm
Klebsiella pneumoniae	-	7mm	9mm	16mm	16mm	27mm
Pseudomonas aeruginosa	8mm	7mm	7mm	11mm	7mm	10mm
Salmonella typhi	8mm	9mm	9mm	10mm	8mm	39mm

Also, *Enterococcus faecalis* was found to be least sensitive while *Bacillus subtilis* (19mm) exhibited higher zone of inhibition than the standard control. *Staphylococcus aureus* was found more sensitive while *Enterococcus faecalis* showed least sensitivity to all the solvents. Chloremphenicol was the standard control used for this study. *Pseudomonas aeruginosa* showed 11mm inhibitory activity on ethanol extract, which is higher than the standard control.

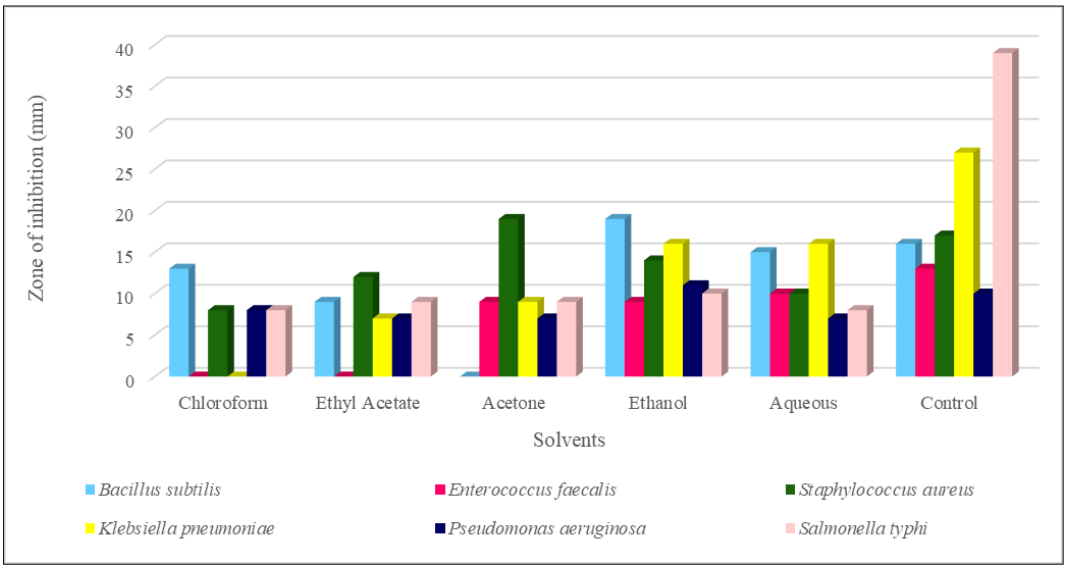

Fig 1: Seed extracts of *Annona muricat*a showing antibacterial activity

Annona muricata extract contains a wide spectrum of activity against a group of bacteria that are responsible for the most common bacterial diseases. Thus, the plant possesses an abundant of the antibacterial compounds (Pathak *et al*., 2010) [4]. The ethanolic extracts exhibited significant antibacterial activities on the tested pathogens. This result was relevant with the result of Uchegbhy *et al*. (2017) [5], Gajalakshmi *et al*. (2012) [1] and Pathak *et al*. (2010) [4]. The antibacterial activities may due to strong occurrence of different chemical compounds such as alkaloids, flavonoids, tannins, phenols, steroids and Saponins (Easwari *et al*.,2018) [6].

Conclusion

Currently, pharmaceutical industries are insisting on plant-based drug to cure some severe diseases. Because plant based novel drugs are without any side effects when compared with synthetic drugs available in the market. The result of the present study concludes that ethanol extract of *Annona muricata* seed extracts possess remarkable antibacterial activity. So further study is necessary to develop a new drug from the seeds of *Annona muricata*.

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