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Identification of antibacterial potential of Phenolic compounds from *Garcinia Mangostana* fruit pericarp extracts against pathogenic bacterium in freshwater fish *Cirrhinus mrigala*

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Abstract
G. mangostana fruits are the preserved part of this plant and are essential for the pleasant flavor. So, *G. mangostana* fruit was named as the 'queen of tropical fruits' fruit pericarp extract has been demonstrated the antimicrobial activity against pathogenic organisms. The present study was conducted to evaluate the antibacterial activity of *G. mangostana* fruit pericarp in various solvents against *P. fluorescens* in freshwater fish *C. mrigala*. *G. mangostana* fruit pericarp powder (20g) was extracted in 450 mL of each solvent (petroleum ether, Toluene-99.5%, ethyl acetate-99%, methanol -99%). Antibacterial activity was investigated. Vancomycin (VA30/disc) was used as positive control. Minimum inhibitory concentration was tested by using serial dilution method. GC-MS (Gas chromatography mass spectrometry) spectral analysis was used for mass spectral identification was an Aux Detector [Aux 1 MS Transfer line (C) 280] to identify phytochemical compounds of *G. mangostana* fruit pericarp extract. The antibacterial maximum inhibitory activity was produced by methanol extract (17.3 ± 1.53) against *P. fluorescens.* While minimal activity was found from petroleum ether extract (3.3±1.53). Minimum inhibitory concentration (MIC) was observed in *P. fluorescens* was 10 mg of extract, 10µl of bacterial sample in the dilution factor of 10^{-1} to 10^{-5}. In this study, *G. mangostana* possess antibacterial activity against *P. fluorescens*. Further analysis is needed for the isolation and identification of active principles present in the extracts which could apparently be worked for fish feed formulation use and also the disease prevention technique through feed in the freshwater aquaculture system.

Keywords: *Garcinia mangostana, Cirrhinus mrigala*, Antibacterial activity, Phytochemical compounds. *Pseudomonas fluorescens.*

1. Introduction
Medicinal Plants are used in various countries and are a source of numerous strong and capable drugs. The ancestral medicine is used in entire parts of the world and has rapidly developing commercial importance. (Dash *et al.*, 2005; Ushimaru *et al.*, 2007; Agra *et al.*, 2007) [18, 61, 1]. Herbaceous plants are vital sources for large number of biologically active compounds that have powerful therapeutic effects. Mangosteen *(Garcinia mangostana Linn.)* is known as "the queen of fruits" and is an evergreen tropical tree that belongs to the family *Guttiferae* and is broadly distributed throughout Myanmar, India, Malaysia, Thailand, Philippines, and Sri Lanka (Pedraza Chaverrí *et al.*, 2008) [44] People in this region have used the (hull, peel, rind) and pericarp or the ripe fruit of mangosteen as a folk medicine for the remedy of dysentery, diarrhea, abdominal pain, suppuration, chronic ulcer and wound infection. (Suksamrarn *et al.*, 2006; Hui Xiang *et al.*, 2010) [58, 25]. All over the world researchers are using extracts of herbs for their antibacterial, antiviral and antifungal activities (Bakht *et al.*, 2011a; 2011b; 2011c; Bhat and Al-daihan 2013; Ramesa and Al- Daihan 2013) [6, 5, 4, 48, 48]. *Garcinia mangostana* is one of the tropical fruit cultivated in the equatorial rainforest of Southeast Asia has been used as a remedy for a tremendous variety of therapeutic conditions for hundreds of years (Obolskiy *et al.*, 2009) [43]. Different parts of *Garcinia mangostana*, mostly bark, roots and fruit pericarp have been practiced for number of years in Southeast Asia as a remedy for a huge variety of therapeutic conditions. In India, China, Thailand, and other regions of Asia dried and grinded *Garcinia mangostana* fruit pericarp is practiced for anti parasitic therapy in diarrhoea and antimicrobial agents (Ji *et al.*, 2007; Nakatani *et al.*, 2002b; Moongkarndi *et al.*, 2004b; Saralamp *et al.*, 1996; Yu *et al.*, 2007) [28, 41, 40, 55, 58], as well as external treatments for suppurations, healing wounds and chronic ulcers (Farnsworth and Bunyapraphatsara 1992) [21].

The α- , γ-mangostins and xanthones are main bioactive compounds found in the fruit parts of the mangosteen (Jinsart *et al.*, 1992; Ching-Chiung Wang *et al.*, 2008) [30, 13]. Terpenoids, sugars and Xanthones been reported from the fruit parts and leaves of *(Garcinia mangostana)* mangosteen and some of them have exhibit a number of biological activities (Sakagami *et al.*, 2005) [14]. The biologically active phytochemical compounds that are found in medicinal herbs like *Garcinia mangostana* were responsible for its microbial killing activity (Ushimaru *et al.*, 2007) [61]. Xanthone byproducts of α- mangostin and *Garcinia mangostana* extract has been known to apply the ultimate dominant antimicrobial activity (Chomnawang *et al.*, 2005) [15], α, γ-mangostin, garcinone D, gartanin and BR-xanthone (Jefferson *et al.*, 1970) [27]. 8-deoxygartanin, flavonoids and tannins are called as epicatechin. Thease types of Xanthones segregated from the *Garcinia mangostana* fruit pericarp. *Garcinia mangostana* fruit pericarp has been practiced for the treatment of amoebic dysentery (Chopra *et al.*, 1956) [16], dysentery and Cholera (Sen *et al.*, 1980) [57], diarrhea and inflammation (Balasubramanian and Rajagopalan 1988) [7], wounds and skin infections (Pierce 2003) [45], analgesic activities (Wexler 2007) [64], anti-parasitic, antipyretic and anti cancer (Yukihiro *et al.*, 2008) [66], and antidiabetic

(GiriBabu Nelli *et al.*, 2013) [22]. Xanthones are Secondary metabolites which combined to the tricyclic aromatic rings of polyphenolic group. Xanthones are divided into five group namely simple oxygenated xanthones, xanthone glycosides, prenylated xanthones, xanthonolignoids and various xanthones (Pinto *et al.*, 2005) [46]. *Garcinia mangostana* fruits consist of xanthones which have replacement isoprene, methoxy and phenolic groups. α- mangostin was first segregated by Schmid., 1855 from *Garcinia mangostana* fruits and its phyto chemical compound nature proved by Dragendorff 1930. Xanthones have been segregated from mangosteen whole fruit, pericarp, bark, and leaves. Certain studies have shown that xanthones received from mangosteen fruit have significant biological activities (Suksamrarn *et al.*, 2006; Chin and Kinghorn 2008) [58, 12]. Xanthones have antibacterial, antifungal, antioxidant, antithrombotic, anti-inflammatory, antiplatelet aggregation, antitumor, and vasorelaxant activities, prevent oxidative damage of low-density histamine, lipoprotein, and serotonin receptor blocker activity, and inhibit HIV (Ji *et al.*, 2007).

Pseudomonas fluorescens is an effective component of freshwater ecosystem. *Pseudomonas fluorescens* has been related with ulcerative conditions and septicemia in vast variety of fishes. It has been considered as a fish decomposition organism as well as a primary, but poor pathogen (Jose Pedraza-Chaverri *et al.*, 2008) [44]. *Pseudomonas fluorescens* is ordinarily found in water, on the body of fishes and soil. It is an aquaculture microorganism that can infect many fish species, including common carp Indian major carps, and Japanese flounder (Mastan 2013) [39]. Therefore, the present study was conducted to evaluate the phytochemical compounds and antibacterial potential of Phenolic compounds from *Garcinia Mangostana* fruit pericarp extracts of various solvents against pathogenic bacterium in fresh water fish *Cirrhinus mrigala* by using GCMS Analysis and disc diffusion method.

2. Material and methods

2.1 Collection of plant material

Commercially available disease free fresh fruit of *Garcinia mangostana* were collected from Ooty, Tamil Nadu, India. The aril or the white pulp of the fruit of *G. mangostana L.* Was removed, Collected pericarp was washed cleanly in pure tap water, rinsed in double distilled water and shade dried for10 days in open air, crushed using pestle and mortar to make powder using laboratory mixer for few minutes at high speed and then sieved and stored in airtight closed containers before used for experiment.

2.2 Extraction of plant material

The powdered *Garcinia mangostana* fruit pericarp was extracted separately to exhaustion in a soxhlet apparatus using various organic solvents in the increasing polarity order. Twenty grams of powder was extracted in 450 ml of each solvent (Petroleum ether, Toluene-99.5%, Ethyl acetate-99%, Methanol-99%). The extract was collected carefully and then concentrated by using evaporating beakers at room temperature (27° C to 35° C) for 2–4 days till the final volume was reduced to one fourth of the original volume of the solvent and stored at 4° C in airtight containers until further use. *Garcinia mangostana* fruit pericarp extracts were tested for antibacterial activity against *Pseudomonas fluorescens* (gram negative rod shaped bacteria).

2.3 Microorganisms

Bacteria cultures of *Pseudomonas fluorescens* were obtained from Department of Microbial biotechnology, Bharathiar University. The cultures were maintained on agar plate at 4°C and activated at 25°C for 48hrs on agar plate before any sensitivity test.

2.4 Media preparation

7.5 grams of agar, 2.5 grams of peptone, 1.5 grams of beef extract, 2.5 grams of sodium chloride (NaCl) was dissolved in 500ml of distilled water and bring to boil. Agar medium was then autoclaved for 12-15 min at 120°C and left to cool at room temperature. Once the Agar medium was cooled, it was poured into Petri dishes. Each Petri dish was left on the flat surface for 10–15 min until absolutely set.

2.5 Antibacterial activity

Antibacterial activity was investigated by disc diffusion method for *Pseudomonas fluorescens* bacterial strains, overnight culture grown in broth medium was adjusted to an inoculums density of 100 µl. Further, 10 µl was spread onto 25 ml of sterile agar plates by using a sterile spread plate rod. The top of the agar medium was allowed to settle for about 5 to 8 min. Sterile filter paper discs (5-7 mm in diameter) impregnated with various test extracts 10mg were then placed on the surface of inoculated agar plates. Vancomycin (VA30/disc) was used as positive control. The plates were then incubated at 27°C for 48 h after which microbial growth was resolved by measuring the diameter of the inhibition zone (mm) using a measuring scale. Each extract was evaluated in triplicate, the mean values are presented. Vancomycin (VA30/disc) was used for comparing the biological estimation.

2.6 Minimum inhibitory concentration

The Minimum Inhibitory Concentration (MIC) was decided by using serial dilution technique (Ramesa Shafi Bhat, and Al-Daihan 2013) [48]. In this technique many number of test tubes was filled with 1 ml of germ free nutrient broth media and ranked quantity of sample solution were added. Then all test tubes were inoculated with the chosen organisms (inoculums consist of 106 cells / ml) followed by incubation at 27° C for 24 hours to concede the growth of the organism. In these test tubes which display least possible concentration in addition clear content were selected. This least concentration was treated as Minimum Inhibitory Concentration (MIC).

2.7 GC-MS Spectral Analysis

GC-MS (Gas chromatography mass spectrometry) spectral analysis was carried out to identify the presence of phytochemical compounds in the methanol extract of fruit pericarp of *Garcinia mangostana.* (Table. 3). The model of the GC-MS used for mass spectral identification was an Aux Detector [Aux 1 MS Transfer line (C) 280]. (Manimekalai *et al.*, 2016) [38].

2.8 Statistical analysis

The results were analyzed by using [Mean ± SD, (n = 3)] standard deviation (SD) statistical methods (Bhat and Al-

daihan 2013; Ramesa Shafi Bhat, and Al- Daihan 2013) [48, 23]

3. Results

3.1 Antibacterial activity

The antibacterial activity of four extract of *Garcinia mangostana* fruit pericarp was evaluated in vitro by agar disc diffusion method against *Pseudomonas fluorescens.* Encapsulate the bacterial growth inhibition of four extracts. The significant antibacterial activity of *Garcinia mangostana* fruit pericarp extracts was comparable to vancomycin (VA30/disc). In this study, the powdered plant materials were progressively extracted with four various organic solvents in increasing polarity order. Among the tested extracts, Methanol extract showed higher inhibition against the test bacteria related to petroleum ether, Toluene, and Ethyl acetate extracts of *G. mangostana* fruit pericarp. Antimicrobial activities of herbal extract depending upon the solvent used for the extraction (Khalil *et al.,* 2010) [32]. Against the tested bacterial strain, we observe organic extract (methanol extract) exhibit much better antibacterial activities in contrast to Petroleum ether, Toluene, Ethyl acetate extract, which may be because of high capacity of organic solvent to dissolve more active and organic antimicrobial compounds (Ramesa Shafi Bhat, and Al- Daihan 2013; Valgas *et al.*, 2007). (Vishnu priya *et al.,* 2010) revealed that the anti bacterial activity of Pericarp extract of Garcinia mangostana against *Staphylococcus albus, Staphylococcus aureus, Micrococcus lutus.* Microbial liability test using the disc diffusion procedure and the Minimal Inhibitory Concentration were carried out for *Staphylococcus albus, Staphylococcus aureus, Micrococcus lutus.*

3.2 Minimum inhibitory concentration

Minimum inhibitory concentration (MIC) was determined only against *Pseudomonas fluorescens.* To determine MIC various solvent extracts of *Garcinia mangostana* fruit pericarp were used against selected bacteria. The study showed a significant effect of antibacterial activity of *Garcinia mangostana* fruit pericarp methanol extract against pathogenic organism *Pseudomonas fluorescens* by agar disc diffusion method. Similar studies were conducted by Sundaram *et al.,* 1983. Who observed that the antibacterial and antifungal activity of α- mangostin and four of its derivatives. They found that *Pseuodomonas aeruginosa, Bacillus subtilis, Salmonella typhimurium* and *S. aureus* were highly susceptible to Xanthones. Whereas *Klepsiella sp., Proteus sp* and *Escherichia coli* was only moderately susceptible to them. About fungi, *Alternaria solani, Cunninghamella echinulata Rhizupus sp., Mucor sp.,* and *Epidermophyton floccosum* were also greatly liable to xanthone componds. Whereas *Microsporum canis, Trichophyton ment-agrophytes, Aspergillus flavus, Aspergillus niger, Curvularia lunata, Fusarium roseum* and *Penicillum sp.,* were only moderately susceptible to them. Several studies have demonstrated antifungal, antiviral and antibacterial properties of xanthones and extracts obtained from *G. Mangostana* (Cowan 1999; Sundaram *et al.,* 1983; Pongpaichit *et al.,* 1994) [17, 60, 47].

3.3 Phenolic compounds

The present study, revealed that the identification of essential phenolic compounds such as Methyl palmitate (Hexadecanoic acid, methyl ester (CAS)); MF- C17H34O2; MW-270), Methyl oleate (9-Octadecanoic acid(Z)-methyl ester (CAS); MF- C19H36O2 MW-296), c-Sitosterol (Stigmast-5-en-3-ol,(3a,24S); MF- C29H50O MW-414), Stearic acid, 3-(octadecyloxy) propyl ester (CAS) or (3-Octadecyloxy-1-0-octadecanoylpropanol);MF- C39H78O3; MW-594), Oleic acid (9-Octadecenoic acid (Z)-(CAS); MF-C18H34O2; MW-282), through GC-MS Analysis. Similar volatile compounds were also carried out by Imron Meechai *et al.,* 2016.

4. Discussion

The major bioactive compounds present in *Garcinia mangostana* are phenolic acids (Linuma *et al*., 1996; Chaivisuthangkura *et al.,* 2009; Zadernowski *et al.,* 2002; 2005; 2007; 2008) [6, 6, 9, 12, 13]. Ten phenolic acids were identified in *Garcinia mangostana* fruit and of these, proto catechuic acid was the main phenolic acid in the peel and rind, while p-hydroxybenzoic acid was the predominant phenolic acid in the aril as reported by several authors (Zadernowski *et al.,* 2005; Zadernowski *et al*., 2009; Lodovici *et al.,* 2001; Manimekalai *et al.,* 2016; Rice-Evans *et al.,* 1996; 1997) [68, 67, 37, 50, 51]. Mangosteen peel contains mangostin, such as xanthonoids, and other phytochemicals (Robbins 2003; American Cancer Society 2013; Chaovanalikit *et al.,* 2012; Greim and Reuter 2001; Gross and Crown 2009; Jiang *et al.,* 2004; Landbo *et al.,* 2006; 2007; Liao *et al.,* 2004; Nakatani *et al.,* 2002) [52, 2, 11, 23, 24, 29].

Chanarat *et al.,* 1997 revealed that polysaccharides collected from mangosteen-fruit pericarp can trigger activity of polymorphonuclear phagocytic cells opposite *Salmonella enteritidis.* Sampath and Vijayaraghavan 2007, found that antituberculosis possible of prenylated xanthones procured from mangosteen-fruit pericarp among them α, and β-mangostins and garcinone B displayed the most potent inhibitory effect against Mycobacterium tuberculosis, with an MIC of 6.25 lg/mL; whereas trapezifolixanthone and demethylcalabaxanthone had an MIC value of 12.5 lg/mL and mangostanin, cmangostin, mangostenone A, tovophyllin B, and garcinone D, had an MIC value of 25 lg/mL. The xanthones with low anti tuberculosis potential were mangostanol and mangostenol with MIC values of 100 lg/mL and 200 lg/mL, respectively. Chomnawang *et al.,* 2005 explained that the antibacterial activity of 19 medicinal plants from Thailand against *Propionibacterium acnes* and *Staphylococcus epidermidis* which have been accepted as pus-forming bacteria stimulating an inflammation in acne. Only 13 Thai medicinal plants were able to inhibit the growth of these two bacteria. Among these, *Garcinia mangostana* conferred the most potent inhibitory effect, with a MIC value of 0. 039 lg/mL both bacteria. Furthermore, the *Garcinia mangostana* minimal bactericidal concentration, that is the lowest concentration to kill bacteria, was 0.039 and 0.156 lg/mL against *S. epidermidis,* and *P. acnes* respectively. In addition, the same author found that *Garcinia mangostana* ethanolic extract could significantly reduce TNF-a production produced from peripheral blood mononuclear cells by triggering with *P. acnes* (Suksamrarn *et al.,* 2003) [58].

Phongpaichit *et al.,* 1994, evaluated the antibacterial activity of α and γ-mangostins and a mangostin mixture on 49 strains of MRSA segregated from patients in Songklanagarind Hospital. They also explained the antibacterial activity of a-mangostin on 50 strains of MRSA and 13 strains of *Enterococcus spp*., segregated from patients in Maharaj Nakorn Chiang Mai Hospital. Mangostin mixture had the

most dominant effect against MRSA, with an MIC value of 1. 48 lg/mL which was the same value as vancomycin, an antimicrobial agent used as a positive control, Penicillin G was also used as control and its MIC was >50 lg/mL. Furthermore, α, γ mangostins also had an effect against MRSA, with MIC values of 3.12 and 2. 26 lg/mL respectively. The MIC rate of a-mangostin against MRSA was 8 lg/mL. Mangostin subdued the growth of all *Enterococcus spp*. with an MIC rate of 1 lg/mL. Recently Chomnawang *et al.*, 2007, explained that a herbal mouthwash containing the pericarp extract of *Garcinia Mangostana* has some effect against volatile sulphur compounds, papillary bleeding and plaque in sixty subjects who were analysed as having moderate or mild chronic gingivitis, so the pericarp extract may be used as an adjunct in deal with oral malodour (Pinto *et al.*, 2005; Rassameemasmaung *et al.*, 2007; Azebaze *et al.*, 2006) [46, 49, 3], studied that antibacterial activity of xanthones segregated from *Garcinia Mangostana.*

Table 1: Antibacterial activity of different extracts of *Garcinia Mangostana* fruit pericarp against *Pseudomonas fluorescens* bacteria tested by disc diffusion method in various dilution.

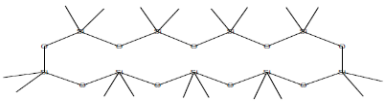
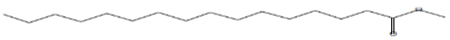
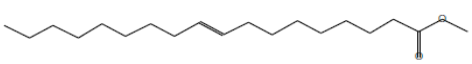
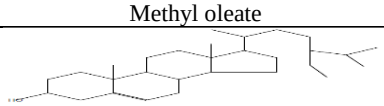
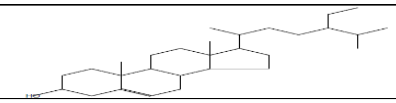
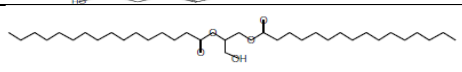
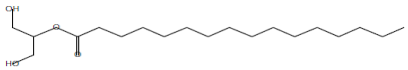
***G. Mangostana* fruit pericarp extract in (10mg)/ inhibition in (mm)**	***P. fluorescens* (10^{-1} dil)**	***P. fluorescens* (10^{-2}dil)**	***P. fluorescens* (10^{-3}dil)**	***P. fluorescens* (10^{-4}dil)**	***P. fluorescens* (10^{-5}dil)**
Petroleum ether	3.3 ± 0.03	6 ± 0.00	8.3 ± 0.01	9 ± 0.10	10.7 ± 0.10
Toluene	2 ± 0.10	2 ± 0.00	3 ± 0.20	3.7 ± 0.03	7 ± 0.10
Ethyl acetate	1.1 ± 0.02	3.4 ± 0.10	5 ± 0.10	6.7 ± 0.10	9 ± 0.10
Methanol	6.3 ± 0.03	9 ± 0.06	11.7 ± 0.01	14 ± 0.10	17.3 ± 0.17
Vancomycin (VA30/disc)	12.3 ± 0.02	15 ± 0.20	17.3 ± 0.10	17.7 ± 0.10	19.7 ± 0.02

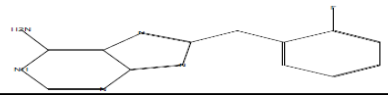
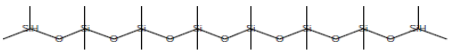
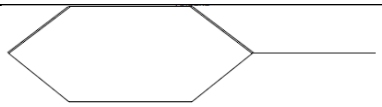
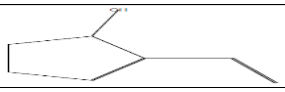
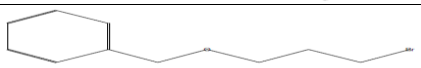
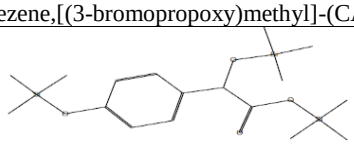
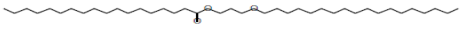
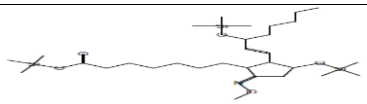
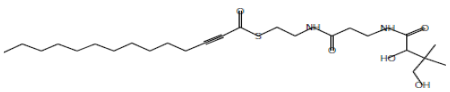
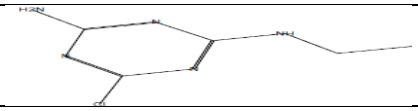
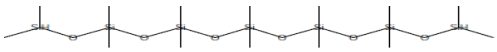
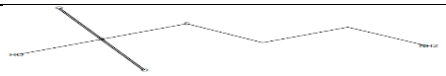
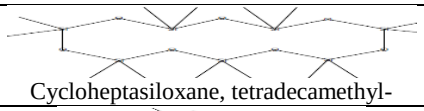
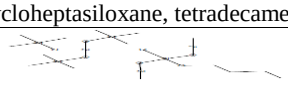
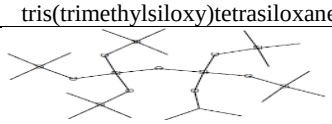
[Mean ± SD, (n = 3)] standard deviation (SD) statistical methods.

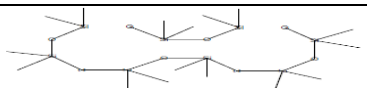
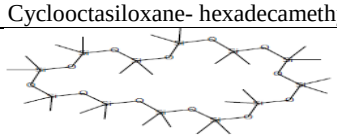
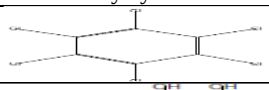
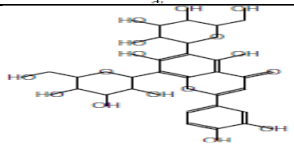
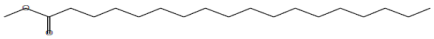
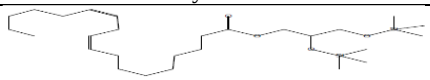
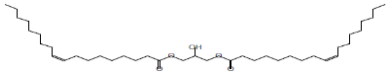
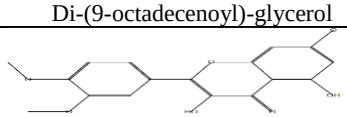
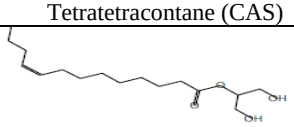
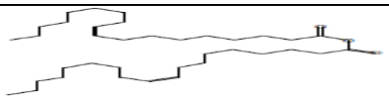
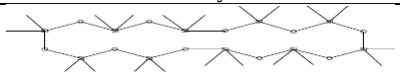
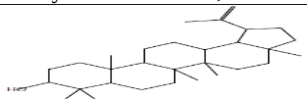
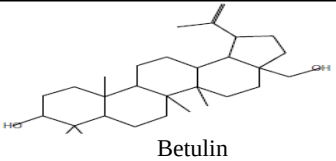
Table 2: Minimum inhibitory concentration (MIC) of different extracts of *Garcinia mangostana* fruit pericarp against *Pseudomonas fluorescens*.

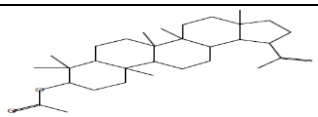
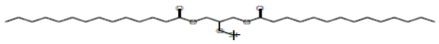
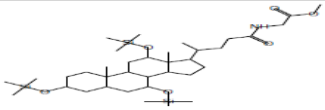
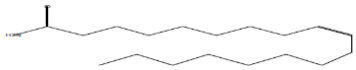
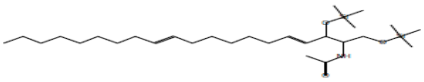
***G. Mangostana* fruit pericarp extract/(MIC)**	**0**	**0-5**	**5-10**	**10-15**	**15-20**
Petroleum ether	-	-	-	-	+
Toluene	-	-	-	-	+
Ethyl acetate	-	-	-	-	+
Methanol	-	-	-	+	+
Vancomycin (VA30/disc)	-	+	+	+	+

Table 3: Phytochemical compounds identified from methanol extract of *Garcinia Mangostana* fruit pericarp through GCMS analysis.

Compound Stucture	**Compound Name**	**Molecular Formula**	**Molecular Weight**
 Dodecane (CAS)	n- Dodecane	C12H26	170
 Tetradecane (CAS)	n- Tetradecane	C14H30	198
 Cyclononasiloxane octadecamethyl	Octadecamethyl- Cyclononasiloxane	C18H54O9Si9	666
	Heptasiloxane hexadecamethyl (CAS)	C16H48O6Si7	532
 Methyl palmitate	Hexadecanoic acid, methyl ester (CAS)	C17H34O2	270
 Methyl oleate	9-Octadecanoic acid(Z)-methyl ester (CAS)	C19H36O2	296
 c-Sitosterol	Stigmast-5-en-3-ol,(3a,24S)	C29H50O	414
	Stigmast-5-en-3-ol, (3a24S)-(CAS)	C29H50O	414
 1,2-Dipalmitin	Hexadecanoic acid, 1-(hydroxyl methyl)-1,2-ethanediyl ester (CAS)	C35H68O5	568
	Hexadecanoic acid, 2-hydroxy-1-(hydroxyl methyl) ethyl ester	C19H38O4	330

Palmitin,2-mono			
	1H-Purin-6-amine, [(2-fluorophenyl) methyl]-(CAS)	C12H10FN5	243
	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15 -hexadecamethyl	C16H50O7Si8	578
	2-Butanone, 3,3-dimethyl-1-(methylsulfonyl)-, o[(methylameno)carbonyl] oxime(CAS)	C9H18N2O4S	250
 Toluene	Benzene, methyl-(CAS)	C7H8	92
	2-Ethylcyclopent-2-enol	C7H10O	110
 Bezene,[(3-bromopropoxy)methyl]-(CAS)	3-Benzyloxy-1-bromo-propane	C10H13Bro	228
 4-Hydroxymandelic acid-Tritms	Benzene acetic acid, a,4-bis[(trimethylsilyl)oxy] trymethylsilyl ester (CAS)	C17H32O4Si3	384
 Stearic acid, 3-(octadecyloxy) propyl ester (CAS)	3-Octadecyloxy-1-0-octadecanoylpropanol	C39H78O3	594
	Trymethylsilyl 9-(methoxyimino)-11, 15-bis[(trimethylsilyl)oxy] prost-13-en-1oate	C30H61NO5Si3	599
	2-Myristynoyl pantetheine	C25H44N2O5S	484
	1,3,5-Triazine-2,4-diamine,6-chloro-N-ethyl-(CAS)	C5H8C1N5	173
	Heptasiloxane 1,1,3,3,5,5,7,7,9,9,11,11,13,13-tetradecamethyl	C14H44O6Si7	504
 Thiosulfuric acid,S-(2-aminoethyl) ester	Thiosulfuric acid(H2S2O3), S-(2-aminoethyl) ester	C2H7NO3S2	157
 Oleic acid	9-Octadecenoic acid (Z)-(CAS)	C18H34O2	282
	2,2-Dideutero octadecanal	C18H34D2O	268
 Cycloheptasiloxane, tetradecamethyl-	2,2,4,4,6,6,8,8,10,10,12,12,14,14-Tetradecamethylcyclo heptasiloxane	C14H42O7Si7	518
 3-Butoxy-1,1,1,7,7,7,hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane	1-Butoxy-3,3,3-Trimethyl-1-[(trimethylsilyl)oxy]disilox	C19H54O7Si7	590
 3-Isopropxy-1,1,1,7,7,7,hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane	1-Isopropoxy-3,3,3-trimethyl-1-[(trimethylsilyl)oxy disiloxanyl tris(trimethylsilyl orthosilicate	C18H52O7Si7	576

 Cyclooctasiloxane- hexadecamethyl	Hexadecamethyl Cyclooctasiloxane	C16H48O8Si8	592
 Tetracosamethylcyclododecasiloxane	Cyclododecasiloxane,Tetracosamethyl-(CAS)	C24H72O12Si	888
	Benzene, hexachloro- (CAS)	C6Cl6	282
 Lucenin 2	4H-1-Benzopyran-4-one,2-(3,4-dihydroxyphenyl)-6,8-di-a-D-glucopyranosyl-5,7-dihydroxy-(CAS)	C27H30O16	610
 MethylStearate	Octadecanoic acid, methyl ester (CAS)	C19H38O2	298
 1-Monolinoleoylglycerol trimethylsilyl ether	9,12-Octadecadienoic acid(Z,Z)-,2,3-bis[(trimethylsilyl)oxy propyl ester	C27H54O4Si2	498
 Di-(9-octadecenoyl)-glycerol	9-Octodecenoic acid(Z)-,2-hydroxy-1,3-propanediyl ester	C39H72O5	620
 Quercetin 7,3',4'-trimethoxy	4H-1-Benzopyran-4-one,2-(3,4-dimethoxyphenyl)-3,5-dihydroxy-7-methoxy-(CAS)	C18H16O7	344
 Trimethylsilyl derivative of 2-monoolein	9-Octadecenoic acid (z)-,2[(trimethylsilyl)oxy]-1[{(trimethylsilyl)oxy}methyl]ethyl ester (CAS)	C27H56O4Si2	500
Nonacosane (CAS)	n-Nonacosane	C29H60	408
Docosane (CAS)	n-Docosane	C22H46	310
Tetratetracontane (CAS)	n- Tetratetracontane	C44H90	618
 2-Monootein	9-Octadecenoic acid(Z)-, 2-hydroxy-1-(hydroxymethyl0ethyl ester (CAS)	C21H40O4	356
 Oleic anhydride	9 –Octadecenoic acid (Z)-anhydride	C36H66O3	546
 Cyclodecasiloxane, eicosamethyl	2,2,4,46,6,8,8,10,10,12,12,14,14,16,16,18,18,20,20-Icosamethylcyclodecasiloxane	C20H60O10Si	740
 Lupeol	Lup-20(29)-en-3-ol,(3a)	C30H50O	426
 Betulin	Lup-20(29)-ene-3,28-diol,(3a)-(CAS)	C30H50O2	442

 Lup-20(29)-en-3-ol, acetate, (3á)-	Lup-20(29)-en-3a-ol, acetate	C32H52O2	468
	Glycerine-1,3-dimyristate, 2-O-trimethylsilyl	C34H68O5Si	584
 Glycine	Methyl[24-oxo-3,7,12-tris(trimethylsilyl)cholan-24-yl)amino)acetate	C36H69NO6S	695
 Adogen 73	9-Octadecenamide,(Z)	C12H10FN5	281
	Bis-trimethylsilyl n-acetyl eicosasphinga-4,11-dienine	C28H57NO3Si2	511

Results

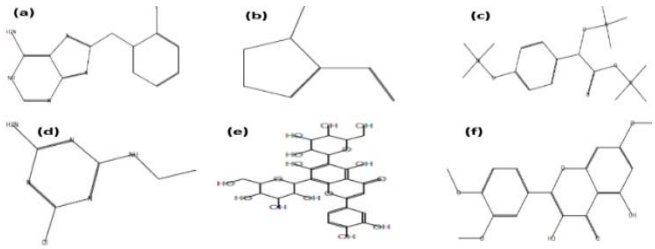


Fig 1: Phytochemical compounds

(a)1H-Purin-6-amine, [(2-fluorophenyl) methyl]-(CAS), (b) 2-Ethylcyclopent-2-enol, (c) Benzene acetic acid, a, 4-bis [(trimethylsilyl) oxy] trymethylsilyl ester (CAS), (d) 1, 3, 5 Triazine-2,4-diamine,6-chloro-N-ethyl-(CAS),(e)4H-1-Benzopyran-4-one,2-(3,4 dihydroxyphenyl)-6,8-di-a-D-glucopyranosyl-5,7-dihydroxy-(CAS),(f)4H-1-Benzopyran-4-one,2-(3,4-dimethoxyphenyl)-3,5-dihydroxy-7-methoxy-(CAS)(Quercetin7,3',4'-trimethoxy).

Fig 2: *Pseudomonas fluorescens* culture in Nutrient agar plate.

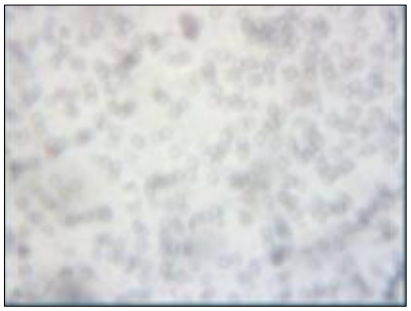


Fig 3: Microscopic view of Pseudomonas *fluorescens.*

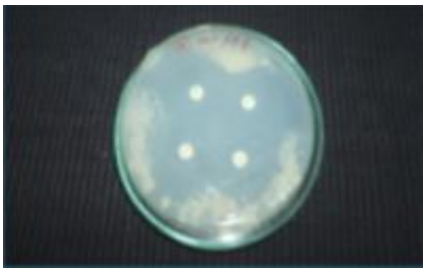


Fig 4: Control- Vancomycin (VA30/disc) (10^{-5}dil).

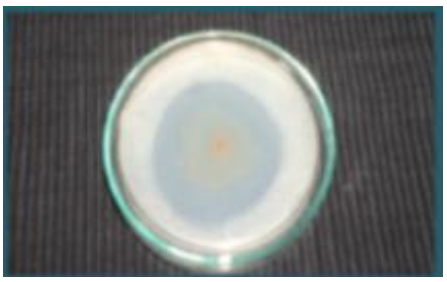


Fig 5: Antibacterial activity of Mangosteen methanol extract powder against *Pseudomonas fluorescens* culture. (10^{-5}dil).

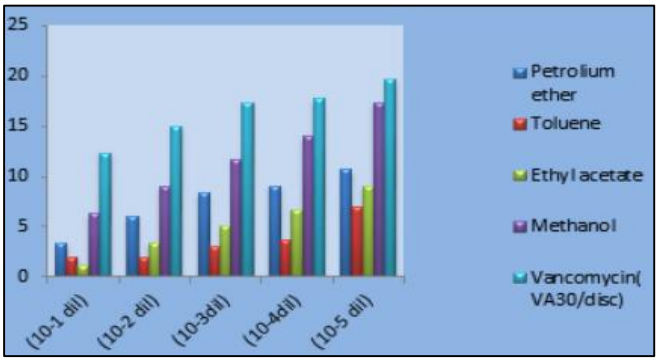


Fig 6: Antibacterial activity of different extracts of *Garcinia Mangostana* fruit pericarp against *Pseudomonas fluorescens.*

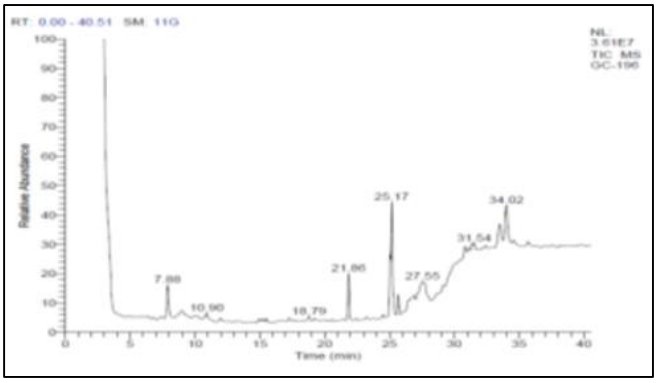


Fig 7: GCMS -Gas chromatography mass spectrometry Analysis of the 99 % methanol extract of *Garcinia Mangostana* fruit pericarp.

5. Conclusion

In this study, *Garcinia mangostana* fruit pericarp methanol extract posses significant antibacterial activity against *Pseudomonas fluorescens.* Further analysis is needed for the isolation and identification of active principles present in the extracts which could probably be exploited for fish feed formulation use and also the disease prevention technique through feed in the fresh water aquaculture system.

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6. Acknowledgements

We wish to convey our thanks to Dr. V. Brindha Priyadarshini, Assitant Professor, Clinical Biotechnology, Department of Microbial Biotechnology, Bharathiar University, Coimbatore- 641 046.Tamilnadu, India. For providing microorganisms to this study.

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