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ORIGINAL ARTICLE **OPEN ACCESS**

Antimicrobial, Antioxidant and Anti-Inflammatory Activity of Petroleum Ether Crude Extracts of *Quisqualis Indica*

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ABSTRACT
Quisqualis indica is traditionally used as an antioxidant and anti-inflammatory agent. The objective of this study was to investigate experimentally the possible antimicrobial, antioxidant and anti-inflammatory properties of Quisqualis indica. The effect of petroleum ether flowers, leaf and bark extract of Quisqualis indica was evaluated in experimental models. The antimicrobial activity of petroleum. ether flowers, leaves and bark extracts of Quisqualis indica at higher concentration (400 µg/ml) showed maximum zone of inhibition against selected human pathogens such as Bacillus cereus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia, Bacillus subtilis, Staphylococcus epidermidis, Streptococcus pyogenes, Salmonella typhi. The petroleum ether flowers, leaves and bark extracts of the Quisqualis indica at a concentration 400 µg/3 ml exhibited potential inhibiting activity in DPPH and nitric oxide scavenging antioxidant in vitro test. There was a significant ($p<0.001$) inhibition in carrageenan induced paw edema with petroleum ether flowers, leaves and bark extracts of the Quisqualis indica (400 mg/kg). The present study indicates that the petroleum ether extract of Quisqualis indica exhibit significant antimicrobial, antioxidant and anti-inflammatory activities.
Keywords: *Quisqualis indica,* Antimicrobial, Antioxidant, Anti-inflammatory

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INTRODUCTION

Plants have provided positive energy for novel drug compound. Since ancient times, plants have been used for the discovery of antibiotics as remedies for a many diseases. Reactive Oxygen Species (ROS) are associated in the progression in number of diseases including liver disorders, atherosclerosis, cancer, inflammatory bowel disease and lung disease [1-2]. Many oxidants produce toxicity during its catalytic cycle by different mechanisms like protein oxidation, enzyme inactivation and damage to cell membrane Antioxidants are believed to protect against certain diseases by preventing the deleterious effects of free radical-mediated processes in cell membranes and by reducing the susceptibility of tissues to oxidative stress. Several studies have shown that medicinal plants consist of a rich source of antioxidants, antimicrobial and anti-inflammatory rich plant extracts [3-5]. Administration of antioxidant having antimicrobial property could reduce inflammations.

The plant *Quisqualis indica* (Family: Combretaceae) commonly known as 'Madhumalti' in India, is a well-known traditional rasayana drug used for variety of ailments. It is also known as Vilayati chambeli (Marathi), Madhumalti (Hindi), Rangoon creeper (English), Modhumalati (Bengali**),** Niyog-niyogan (Filipino), Quiscual (Spanish) and Radha Manoharam (Telgu). It is widely distributed all over the world especially on China, Philippines, Bangladesh, Myanmar and Malaysia and now also broadly grow in India as ornamental plant in most of the garden [6].

The *Quisqualis indica* (QI) have been very widely used traditionally as antihelmintic to expel parasitic worms or for alleviating diarrhea in 'anthelimintic [6]. The traditional use of this plant suggests Anti-inflammatory activity, Antidiabetic activity, Antipyretic activity, Immunomodulatory activity, Hypolipidemic activity, Anti-staphylococcal activity, Antioxidant activity, Anti-diarrhoeal activity, Antibacterial activity, Anthelmintic activity and Cytotoxic effects.

In view of this information, the present study have been undertaken to find out the Antimicrobial, antioxidant and antiinflammatory activity of petroleum ether crude extract of *Quisqualis indica* and to explore the responsible class of chemical constituents for the above said activity.

MATERIAL AND METHODS

Collection of plant material

Fresh flowers, leaves and bark of *Quisqualis indica* were collected from local area of Aravalli district, Gujarat, India in the months of July-October. This plant was identified and authenticated to Botanical Survey of India, Pune.

Animals

Adult male Wistar albino rats, weighing between 180 - 220 g and albino mice (25-30 g) were used and acclimatized to laboratory condition for one week. All animals were housed in well ventilated polypropylene cages at 12 h light/dark schedule with 25±2ºC and 55-65% relative humidity. The rats had fed with commercial pelleted rats chow and water *ad libitum* as a standard diet. Institutional Animal Ethics Committee approved the experimental protocol in accordance with CPCSEA.

Preparation of flowers, leaf and bark extract

The flowers, leaf and bark of *Quisqualis indica* were collected and dried in shade and ground. Coarsely powdered plant material were used for the study. Coarsely powdered plant material (1000 g) was subjected to successive extraction with petroleum ether (60 – 80^{0}C) in a soxhlet extractor at a temperature of 45-50^{0}C to 40 cycles per batch for 2 batches. The extraction was continued until the solvent in the thimble becomes clear indicating the completion of the extraction. After each extraction the solvent was distilled off and concentrated extract was transferred to previously weighed petri dish and evaporated to dryness at room temperature (45-50^{0}C) to obtain dried extracts. After completion of drying the petri dish was weighed again. The yield of extract was calculated by subtracting original weight of empty petri dish [7-8]. The yield for flower, leaf and bark extracts were 6.5g/100 g, 6.5g/100 g and 4.6 g/100 g respectively.

Preliminary phytochemical studies

Preliminary qualitative phytochemical screening for the identification of the phytoconstituents of the petroleum ether flowers, leaf and bark extract of *Quisqualis indica* (L.) has been carried out [9-10].

Acute oral toxicity of the extract

Adult Albino mice (25-30 g) were divided into different groups containing ten mice each. The mice were fasted for 6 h and access only water *ad libitum* before experimrntal study. Group I received only vehicle (distilled water). Group II to XIII animals received with different doses of petroleum ether flowers extract of *Quisqualis indica* (PEFQI), petroleum ether leaf extract of *Quisqualis indica* (PELQI) and petroleum ether bark extract of *Quisqualis indica* (PEBQI) i.e. 1000, 2000, 3000 and 4000 mg/kg respectively. All the doses and vehicle were administered orally. The animals were observed for 72 h for mortality [11-12].

Antimicrobial activity [13]

Antimicrobial activity was tested against bacterial pathogens against eight human pathogens like Bacteria: *Bacillus cereus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa,* Klebsiella pneumonia, Bacillus subtilis, *Staphylococcus epidermidis, Streptococcus pyogenes, Salmonella typhi* using agar well diffusion method. The test bacteria was grown in sterile Nutrient broth and Sabouraud / Potato dextrose broth tubes respectively overnight. The broth cultures of bacteria was then aseptically swabbed on sterile Nutrient agar and Sabouraud / Potato dextrose agar respectively using sterile cotton swabs. Wells of 6 / 10 mm diameter was created in the inoculated plates using sterile cork borer. Different concentrations of plant extracts were filled in labeled wells. The plates were incubated and the zone of inhibition was recorded.

Screening of Antioxidant activity of extracts [14]

Free Radical scavenging activity test (DPPH Method)

The DPPH (2, 2-Diphenyl-1-picrylhydrazyl) radical has a deep violet color due to its unpaired electron, and radical scavenging activity can be followed by absorbance at 525 nm Sample stock solutions (1mg ml^{-1}) will be diluted to final concentrations of 100, 50, 10 and 5 µg ml^{-1} in 70% ethanol or DMSO. The DPPH ethanol solution (0.2 mM, 0.5 ml) was added to 1 ml of sample solutions of different concentrations, shaken well by vortex, and allowed to react at room temperature. The absorbance values were measured after 10 min at 525 nm by UV/V is spectrophotometer.

$$\text{Percentage inhibition} = \frac{A_0 - A_t}{A_0} \times 100$$

where A_0 was the absorbance of the control (blank, without extract) and A_t was the absorbance in the presence of the samples of the extract. All the tests were performed in triplicate and the graph was plotted with the mean values.

Nitric oxide scavenging activity

The nitric oxide radical scavenging activity was measured using Griess' reagent. 5 mL each of extract solutions of different concentrations (100–1000 µg/3mL) in standard phosphate buffer solution (pH 7.4) will be incubated with 5mL of sodium nitroprusside solution (10 mM) in standard phosphate buffer (pH 7.4) at 25°C for 2.5 hours. In an identical manner 5 mL of ascorbic acid solution (200 µg/mL) in standard phosphate buffer solution (pH 7.4) was also incubated with 5 mL of sodium nitroprusside solution (10 mM) in standard phosphate buffer (pH 7.4). Control experiments without the test compounds but with equivalent amount of buffer was also conducted. After incubation, 0.5 mL of the incubation mixture was mixed with 0.5 mL of Griess' reagent (Sulphanilamide 1%, *O*-phosphoric acid 2% and naphthyl ethylene diamine dihydrochloride 0.1%) and the absorbance was measured at 546 nm. From the absorbance, the percent scavenging activity was calculated.

$$\text{Percentage inhibition} = \frac{A_0 - A_t}{A_0} \times 100$$

where A_0 was the absorbance of the control (blank, without extract) and A_t was the absorbance in the presence of the samples of the extract. All the tests were performed in triplicate and the graph was plotted with the mean values.

ANTI-INFLAMMATORY ACTIVITY

Carrageenan induced rat paw Oedema

The Wistar rats were starved overnight and divided into eleven groups of six animals each as follows Group I: Vehicle control rats received distilled water (10 ml/kg, p.o.), Group II: Diclofenac sodium (10 mg/kg, i.p.), Group III: PEFQI (100 mg/kg, p.o.), Group IV: PEFQI (200 mg/kg, p.o.), Group V: PEFQI (400 mg/kg, p.o.), Group VI: PELQI (100 mg/kg, p.o.), Group VII: PELQI (200 mg/kg, p.o.), Group VIII: PELQI (400 mg/kg, p.o.), Group IX: PEBQI (100 mg/kg, p.o.), Group X: PEBQI (200 mg/kg, p.o.), Group XI: PEBQI (400 mg/kg, p.o.). After selection of animals, 0.1 ml of 1 % carrageenan solution was injected into the left hind paw. The pretreatment time was 1 h before carrageenan injection. The paw volume was recorded immediately and at 1 h, 2 h, 3 h, 4 h and 6 h by using plethysmometer (UGO Basile 7140). Mean increase in the volume of oedema was measured and percentage inhibition was calculated [15-17].

Statistical Analysis

The observations were expressed in mean ± S.E.M. The difference in response to test drug was determined by two way ANOVA followed by Bonferroni test. ***P < 0.001 was considered as significant.

RESULTS

Phytochemical screening of the petroleum ether flowers, leaf and bark extracts of *Quisqualis indica* showed the presence of Tannins, Alkaloids, Saponins, Sterols, Flavonoids, Glycosides and Phlobatannins as shown in Table 1.

Table 1: Phytochemical screening of the petroleum ether flowers, leaf and bark extracts of *Quisqualis indica*

Sr. No.	TEST	PEFQI	PELQI	PEBQI
1	Alkaloids	+ve	+ve	-ve
2	Flavonoids	+ve	+ve	+ve
3	Saponins	+ve	+ve	-ve
4	Tannins	+ve	+ve	-ve
5	Sterols	+ve	+ve	+ve
6	Carbohydrates	-ve	+ve	-ve
7	Glycosides	+ve	+ve	+ve

Acute oral toxicity of the extract

The PEFQI, PELQI and PEBQI were found to be safe at all doses used and there was no mortality found up to the dose of 4000 mg/kg of PEFQI, PELQI and PEBQI when administered orally. Therefore, we have taken 400 mg/kg as the therapeutic dose and made variations by taking 100 mg/kg as lower dose and 400 mg/kg as higher dose.

Antimicrobial activity

The antimicrobial activity of petroleum. ether flowers, leaves and bark extracts of *Quisqualis indica* were investigated at different concentrations using agar well diffusion method against selected human pathogens such as *Bacillus cereus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia*, Bacillus subtilis, *Staphylococcus epidermidis, Streptococcus pyogenes, Salmonella typhi*.

Higher concentrations (400 µg/ml) of petroleum ether flowers, leaves and bark extracts of *Quisqualis indica* showed maximum zone of inhibition against Gram positive as well as Gram negative bacteria.

Most pronounced activity with inhibition zones more than B. subtilis (13.6 mm), *S. aureus* (14.9 mm), *E.*

Coli (13.6 mm), *P. aeruginosa* (16.8 mm), K. pneumonia (15.8 mm), *S. epidermidis* (13.7 mm), *S. pyogenes* (16.9 mm), *S. typhi* (15.9 mm) was shown by 400 µg/ml of *Quisqualis indica* petroleum ether extract. However, lower concentrations of *Quisqualis indica* petroleum ether extract did not express any acticvity or exhibited low activity (Table 2).

Table 2: Antimicrobial effect of petroleum ether flowers, leaf and bark extracts of *Quisqualis indica* against human pathogenic bacteria using Agar well diffusion method.

Treatment	Zone of Inhibition (mm)							
	B. cereus	***S. aureus***	***E. coli***	***P. Aeruginosa***	***K. pneumonia***	***S. epidermidis***	***S. pyogenes***	***S. typhi***
VEHICLE	4.5±0.25	3.9±0.16	3.7±0.16	3.2±0.35	4.7±0.23	3.4±0.37	4.1±0.16	5.4±0.35
STREPTOMYCIN (10 µg/ml)	21.9±0.29 ***	19.2±0.25 ***	17.9±0.32 ***	21.7±0.32 ***	26.7±0.25 ***	24.3±0.38 ***	21.9±0.32 ***	20.4±0.34 ***
PEFQI (100 µg/ml)	6.9±0.36	5.1±0.26	7.5±0.65	5.2±0.35	6.4±0.55	5.9±0.65	4.2±0.55	5.6±0.55
PEFQI (200 µg/ml)	9.2±0.36	8.5±0.26	9.3±0.61	8.7±0.82	7.4±0.21	7.4±0.66	6.4±0.55	7.8±0.88
PEFQI (400 µg/ml)	13.3±0.52 ***	14.9±0.62 ***	13.4±0.25 ***	16.5±0.94 ***	15.8±0.25 ***	13.4±0.24 ***	16.9±0.61 ***	15.9±0.16 ***
PELQI (100 µg/ml)	6.6±0.65	5.8±0.21	7.2±0.25	5.4±0.62	6.9±0.56	5.8±0.35	4.3±0.32	5.2±0.61
PELQI (200 µg/ml)	9.6±0.51	8.8±0.45	9.9±0.54	8.4±0.55	7.3±0.76	7.8±0.58	6.4±0.44	7.5±0.95
PELQI (400 µg/ml)	13.4±0.45 ***	14.3±0.49 ***	13.6±0.34 ***	16.8±0.12 ***	15.6±0.15 ***	13.6±0.55 ***	16.4±0.14 ***	15.9±0.48 ***
PEBQI (100 µg/ml)	6.9±0.54	5.4±0.93	7.6±0.65	5.3±0.56	6.3±0.56	5.7±0.56	4.4±0.54	5.5±0.42
PEBQI (200 µg/ml)	9.2±0.68	8.4±0.32	9.6±0.21	8.9±0.36	7.6±0.53	7.6±0.32	6.6±0.85	7.8±0.52
PEBQI (400 µg/ml)	13.6±0.26 ***	14.4±0.24 ***	13.6±0.25 ***	16.6±0.59 ***	15.6±0.65 ***	13.7±0.86 ***	16.8±0.84 ***	15.1±0.81 ***

Values are mean±S.E.M. of 3 replications. and statistical analysis was carried out by two way ANOVA followed by Bonferroni test. ***P < 0.001 compared to vehicle treated group.

Antioxidant activity

DPPH scavenging activity

The petroleum ether extract of the investigated plant showed effective free radical scavenging in the DPPH assay at higher concentrations. The different concentrations of petroleum ether flowers, leaves and bark extracts of *Quisqualis indica* showed antioxidant activities in a dose dependent manner. Petroleum ether flowers, leaf and bark extract of *Quisqualis indica* at a concentration 400 µg/3 ml exhibited 76 %, 79 % and 68 % DPPH scavenging activity respectively. Whereas, 200 and 400 µg/3 ml of Ascorbic acid exhibited 67 % and 96 % DPPH scavenging activity respectively. However, lower concentrations of extracts did not revealed significant activity. A higher DPPH radical scavenging activity is associated with a lower IC50 value (Table 3)

Table 3: Effect of petroleum ether flowers, leaf and bark extracts of *Quisqualis indica* on DPPH scavenging activity.

Treatment	Concentration	% Scavenging Activity
Ascorbic Acid	100 µg/3ml	49±1.12
	200 µg/3ml	67±1.10***
	400 µg/3ml	96±1.16***
PEFQI	100 µg/3ml	13±1.32
	200 µg/3ml	37±1.36
	400 µg/3ml	76±1.19***
PELQI	100 µg/3ml	16±1.63
	200 µg/3ml	41±1.46
	400 µg/3ml	79±1.54***
PEBQI	100 µg/3ml	16±1.46
	200 µg/3ml	29±1.41
	400 µg/3ml	68±1.63***

Values are Mean±S.E.M (n=3). and statistical analysis was carried out by two way ANOVA followed by Bonferroni test. ***P < 0.001 compared to vehicle treated animals.

Nitric oxide scavenging activity

The petroleum ether extract of the *Quisqualis indica* showed potential inhibiting activity against NO generation at higher concentrations. Petroleum ether flowers, leaf and bark extract of *Quisqualis indica* at a concentration 400 µg/3 ml exhibited 76 %, 79 % and 68 % nitric oxide scavenging activity respectively. Whereas, 200 and 400 µg/3 ml of Ascorbic acid exhibited 84 % and 92 % scavenging activity respectively. However, lower concentrations of extracts did not show significant activity (Table 4).

Table 4: Effect of petroleum ether flowers, leaf and bark extracts of *Quisqualis indica* on Nitric oxide scavenging activity.

Treatment	Concentration	% Scavenging Activity
Ascorbic Acid	100 µg/3ml	64±1.23
	200 µg/3ml	84±1.28***
	400 µg/3ml	92±1.21***
PEFQI	100 µg/3ml	23±1.27
	200 µg/3ml	39±1.26
	400 µg/3ml	76±1.92***
PELQI	100 µg/3ml	10±1.34
	200 µg/3ml	42±1.28
	400 µg/3ml	79±1.28***
PEBQI	100 µg/3ml	23±1.28
	200 µg/3ml	46±1.34
	400 µg/3ml	68±1.26***

Values are Mean± S.E.M (n=3). and statistical analysis was carried out by two way ANOVA followed by Bonferroni test. ***P < 0.001 compared to vehicle treated animals.

Antiinflammatory activity

Carrageenan induced rat paw Oedema

Sub-planter injection of carrageenan produced significant increase in paw volume in all animals. Pretreatment with diclofenac sodium (10 mg/kg) and 400 mg/kg of oral administration of petroleum ether flowers, leaf and bark extracts of *Quisqualis indica* significantly (p<0.001) decreased carrageenan induced paw edema at 1, 2, 3, 4 and 6 h as compared to vehicle group. However, lower doses (100 and 200 mg/kg, p.o.) did not show significant anti-inflammatory activity (Table 5).

Table 5: Effect of petroleum ether flowers, leaf and bark extracts of *Quisqualis indica* on change in paw volume in Carrageenan induced rat paw edema.

Treatment	Change in paw volume (ml)					
	0	1	2	3	4	6
VEHICLE	1.16±0.02	1.37±0.05	1.45±0.05	1.52±0.05	1.6±0.03	1.67±0.06
DICLOFENAC SODIUM (10 mg/ml)	1.15±0.05	1.24±0.04 ***	1.26±0.06 ***	1.27±0.08 ***	1.29±0.03 ***	1.28±0.05 ***
PEFQI (100 mg/ml)	1.16±0.02	1.39±0.02	1.41±0.02	1.48±0.05	1.51±0.05	1.56±0.09
PEFQI (200 mg/ml)	1.18±0.05	1.32±0.07	1.36±0.04	1.4±0.05	1.43±0.02	1.46±0.02
PEFQI (400 mg/ml)	1.16±0.04	1.28±0.03 ***	1.3±0.04 ***	1.33±0.04 ***	1.36±0.09 ***	1.36±0.05 ***
PELQI (100 mg/ml)	1.15±0.08	1.39±0.05	1.43±0.05	1.46±0.08	1.52±0.08	1.59±0.03
PELQI (200 mg/ml)	1.19±0.01	1.33±0.06	1.35±0.05	1.46±0.08	1.43±0.04	1.46±0.05
PELQI (400 mg/ml)	1.16±0.02	1.3±0.03 ***	1.3±0.05 ***	1.32±0.05 ***	1.34±0.05 ***	1.35±0.02 ***
PEBQI (100 mg/ml)	1.16±0.02	1.38±0.04	1.45±0.05	1.49±0.06	1.53±0.04	1.56±0.01
PEBQI (200 mg/ml)	1.16±0.03	1.31±0.07	1.35±0.05	1.39±0.06	1.43±0.05	1.43±0.06
PEBQI (400 mg/ml)	1.13±0.06	1.26±0.05 ***	1.3±0.06 ***	1.33±0.08 ***	1.35±0.06 ***	1.32±0.02 ***

Values are Mean± S.E.M. from 6 animals in each group and statistical analysis was carried out by two way ANOVA followed by Bonferroni test. ***P < 0.001 compared to vehicle treated animals.

DISCUSSION

The different parts of the plant such as flowers, leaf and bark of *Quisqualis indica* has been used for many years for its traditional uses. It contains vide source of secondary metabolites such as glycosides, alkaloids, phytosterols proteins, saponins and phytosterols. In view of the above the literature, the present study on the petroleum ether flower, leaf and bark extracts of *Quisqualis indica* were conducted to evaluate the antimicrobial, antioxidant and anti-inflammatory activities. For the development of newer drugs, phytomedicines is a natural blue print, used for the treatment of diseases. The antimicrobial activity was tested against bacterial pathogens against eight human pathogens like Bacteria: *Bacillus cereus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia, Bacillus subtilis*, *Staphylococcus epidermidis, Streptococcus pyogenes, Salmonella typhi* using agar well diffusion method. The petroleum ether flowers, leaves and bark extracts of *Quisqualis indica* showed maximum zone of inhibition against bacterial pathogens at higher concentrations. It indicates that *Quisqualis indica* could inhibit the growth of bacteria which cause infectious diseases.

DPPH is a nitrogen centred stable free radical. It becomes a stable diamagnetic molecule on accepting an electron or hydrogen atom. Extract has an ability to donate a hydrogen atom, the free radical of DPPH is lost and the purple color changes to yellow (diphenylpicrylhydrazine). The bleaching of DPPH radical is one of the most widely used method to screen the antioxidant activity of herbal extracts. This method is simple, rapid and measures the capacity of herbal extract to bleach the DPPH radical. The method is sensitive and requires small amount of samples [13]. In the present study, we monitored the decrease in DPPH absorption at 525 nm at different concentrations of petroleum ether flower, leaf and bark extracts. Higher concentrations of petroleum ether flower, leaf and bark extracts of *Quisqualis indica* showed high scavenging potential when compared to lower concentrations. It was evident that the active extracts showed hydrogen donating ability and therefore the extracts could serve as free radical scavengers, acting possibly as primary antioxidants [18]. In addition to reactive oxygen species, nitric oxide is also implicated in inflammation, cancer and other pathological conditions. The percentage inhibition of nitric oxide generation from sodium nitroprusside in buffered saline by petroleum ether flowers, leaf and bark extracts of the *Quisqualis indica* at different concentrations were compared with standard. Nitric oxide is a potent pleiotropic mediator of physiological processes. All the extracts with higher concentrations exhibited potential inhibiting activity against NO generation. The percentage scavenging activity increased with increasing concentration of the extracts.

Carrageenan induced oedema is a multimediated phenomenon that liberates diversity of mediators. It is believed to be biphasic the first phase (60 min) involves the release of serotonin and histamine while the second phase (over 60 min) is mediated by prostaglandins, the cyclooxygenase products, and the continuing between the two phase is provided by kinins [19-20]. Development of oedema induced by carrageenan is commonly correlated with early exudative stage of inflammation [21]. This study has shown that the petroleum ether flowers, leaf and bark extract of *Quisqualis indica* (400 mg/kg, p.o.) possess a significant ($p<0.001$) anti-oedematogenic effect on paw oedema induced by carrageenan compared to vehicle treated animals. Since carrageenan induced inflammation model is a significant test for anti-inflammatory agent acting by the mediators of acute inflammation [22].

The present investigation suggests a scientific support to the traditional antimicrobial, antioxidant and anti-inflammatory account in use of the plant *Quisqualis indica.* These data validated the traditional uses of this plant to assuage pain resulting from headache, dysmenorrhoea, and toothache as well as inflammatory diseases like gout, rheumatism, cystitis and nephritis.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

REFERENCES

1. Simonian, N. A. & Coyle, J. T. (1996). Oxidative stress in Neurodegenartive disease. Annu. Rev. of Pharmacol. Toxicol., 36: 83.
2. Halliwell, B., Gutteridge, J. M. C. & Cross, C. E. (1992). Free radicals, antioxidants and human disease: Where are we now? J. Lab. Clin. Med., 119:598.
3. De, S., Shukla, V. J., Ravishankar, B. & Bhavasar, G. C. (1996). A preliminary study on the hepatoprotective activity of methanol extract of *Paederia foetida* leaf. Fitoterapia., 67:106.
4. Dwivedi, Y., Rastogi, R., Chander, R., Sharma, S. K., Kapoor, N. K. & Garg, N. K. (1990). Hepatoprotective activity of picroliv against carbon tetrachloride-induced liver damage in rats. Indian J. Med. Res., 92:195.
5. Emmananuel, S., Amalaraj, T. & Ignaicimuthu, S. (2001). Hepatoprotective effect of coumestan isolated from the leaves of *Wedelia calandulaceae* Less in paracetamol induced liver damage. Indian J. Exp. Biol., 39:1305.
6. Sahu, J, Patel, P. K. Dubey, B. (2012). *Quisqualis indica*: A review of its Medicinal Properties. Int. J. Pharm. Pharm.

Sci., 1(5):313-321.
7. Chaudhari, R. L., Patil, P. S., Chaudhari, R. Y. & Bhangale, J. O. (2013). Antihyperglycaemic activity of ethanolic extract of *Cissus quadrangularis* (L.) leaves in alloxan induced diabetic rats. J. Appl. Pharm. Sci., 3(01):73-77.
8. Bhangale, J., Acharya, S. & Deshmukh, T. (2013). Antihyperglycaemic activity of ethanolic extract of *Grewia asiatica* (l.) Leaves in alloxan induced diabetic mice. World J. Pharm. Res., 2(5):1486-1500.
9. Harborne, J. B. Phytochemical methods, 3rd edn, Chapman and hall, London; 1998.
10. Bhangale, J. O., Acharya, N. S. & Acharya, S. R. (2015). Neuroprotective effect of pet ether extract *of Ficus religiosa* (L.) leaves in 3-nitropropionic acid induced Huntington disease. Int. J. Pharmtech Res., 8(10):1-10.
11. Bhangale, J. O., Acharya, N. S. & Acharya, S. R. (2016). Protective effect of *Ficus religiosa* (L.) against 3-nitropropionic acid induced Huntington disease. Orient Pharm. Exp. Med., 16(3):165-174.
12. Ravichandran, V., Suresh, B., Sathishkumar, M. N., Elango, K. & Srinivasan, R. (2007). Antifertility activity of hydroalcoholic extract of *Ailanthus excels* (Roxb): An ehanomedicines used by tribals of Nilfiris region in Tamilnadu. J. Ethanopharmacol., 112:189-191.
13. Pavithra, G. M., Siddiqua, S., Naik, A. S., Kekuda, P. T. R. & Vinayaka, K. S. (2013). Antioxidant and antimicrobial activity of flowers of *Wendlandia thyrsoidea*, *Olea dioica*, *Lagerstroemia speciosa* and *Bombax malabarium*. J. Appl. Pharm. Sci., 3(6): 114-120.
14. Viswanad, V., Aleykutty, N. A., Jaykar, B., Zachariah, S. M. & Thomas, L. (2011). Studies on antimicrobial and antioxidant activity of methanolic extract of *Samadera indica.* Int. J. Pharm. Sci. Rev. Res., 11(2): 59-64.
15. Winter, C. A., Risley, E. A. & Nuss, G. W. (1962). Carrageenan-induced edema in hind paw of the rat as an assay for anti-inflammatory drugs. P. Soc. Exp. Biol. Med., 111: 544–547.
16. Singh, S., Majumdar, D. K. & Rehan, H. M. S. (1996). Evaluation of anti-inflammatory potential of fixed oil of *Ocimum sanctum (Holybasil)* and its possible mechanism of action. J. Ethnopharmacol., 54:19-26.
17. Bhangale, J. O., Chaudhari, S. R., Shete, R. V. and Kale, B. N. (2010). Antinociceptive and anti inflammatory effects of *Tectona grandis* (L.) bark. Pharmacologyonline., 2:856-864.
18. Chung, Y., Chien, C., Teng, K. & Chou, S. (2006). Antioxidative and mutagenic properties of Zanthoxylum ailanthoides Sieb & zucc. Food Chem., 97:418-425.
19. Bhangale, J., Patel, R., Acharya, S. & Chaudhari, K. (2012). Preliminary Studies on Anti-Inflammatory and Analgesic Activities of *Jasminum sambac* (L.) Aiton in Experimental Animal Models. Am.J. PharmTech Res., 2(4):1-10.
20. Perianayagam, J. B., Sharma, S. K. & Pillai, K. K. (2006). Anti-inflammatory activity of *Trichodesma indicum* root extract in experimental animals. J. Ethanopharmacol., 104:410-414.
21. Adedapa, A., Sofidiya, M. O., Inaphosa, V., Inaya, B., Masika, P. J. & Afolayan, A. J. (2008) Antiinflammatory and analgesic activities of the aqueous extract of *Cussonia Paniculata* stem bark. Rec. Nat. Prod., 2(2):46-53.
22. Dagar, H. S. & Chagtitai, S. A. (1989). *Trichosanthes bracteata* (lam) voight (Cucurbetaceae) a promising ethanomedicinal taxon in Andaman and Nicobar Islands. Indian J. Appl. Pure. Biol., 4(2):131-132.

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