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Original Research Article

Flowers with Antibacterial Property- A survey in Meenachil Taluk

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ABSTRACT

99 flowers belonging to 42 families in Meenachil Taluk of Kottayam district, Kerala were screened for antibacterial properties by disc diffusion method. Both aqueous and petroleum ether extracts were tested against *Staphylococcus aureus*, subsp.aureus MTCC 96; *Escherichia coli* MTCC 443, *Pseudomonas aeruginosa* MTCC 741 and *Klebsiella pneumoniae* subsp. pneumoniae MTCC 432. In this assay 47 flowers belonging to 23 families exhibited mild to high degree of antibacterial activity. In 42 flowers, aqueous extracts and in 5 flowers petroleum ether extracts were found more antibacterial than the other. Aqueous extracts of *Moringa oleifera* Gaertn and *Plumeria obtusa* L. flowers were highly active against all the tested bacterial strains. The most sensitive bacterial strain was *P. aeruginosa* and the least sensitive was *K. pneumoniae.*

Keyword: Flowers; preliminary screening; disc diffusion; antibacterial; aqueous; petroleum ether extracts.

INTRODUCTION

Communities living in close knit with the environment learned to make use of plant parts or preparation thereof in maintaining the overall well-being and to ameliorate body's ailments. Ayurveda is a systematic and logical description of nature's healing power to balance the three doshas viz. Vata, Pitta and Kapha [1,2]. Pushp Ayurveda is a branch of Ayurveda where flower preparations were specifically used in healing various diseases [3,4]. The four whorled structure of flower consists calyx, corolla, androecium and gynoecium but plants modify and design them infinite ways to get a desired edge in the reproductive competitiveness [5]. A flower has to attract pollinators, ward off undesired visitors and pathogens in addition to keeping a phytochemical ambience suitable for pollen germination and double fertilization. Flowers

perform these tasks through the mediation of a number of phytochemicals such as flavonoids, terpenoids, alkaloids, sugars etc which acts flower pigments, volatiles, nectar and defense molecules [6,7,8]**.** Moreover many flowers do harbor friendly microflora [9]. Thus flowers form 'well replicated habitat islands' [10] and the phytochemical profile of a flower may be different from other parts of the plant.

The medicinal properties of flowers are due to the presence of bioactive phytochemicals in the flower extracts [11]. Kerala harbours 4694 species of flowering plants under 1418 genera and 188 families and 1170 of them are found some medicinal uses [12]. Kerala's rich biodiversity offer a good option to search for novel bioactive molecules to fight drug resistant pathogens.Traditional practices may give the necessary clues in our search for therapeutically valuable phytochemicals from the plant kingdom [13, 14]**.** Bioactivity guided screening of plant parts is an important initial strategy in drug discovery. Good activity indicates presence of biologically active secondary metabolites [15]. A rapid and simple assay will have the advantage of screening a large numbers of specimens. For instance Khanuja et al used cut petals directly in the agar disc diffusion method and screened 51 flowers belonging to 26 families of which 20 flowers belonging to 12 families found possessing antibacterial properties and suggested flower petals do synthesize bioactive molecules [16]. Many edible flowers are rich in antioxidants and other valuable nutrient molecules making them valuable nutraceutical products for human consumption [17, 18]. There are many studies currently going on to ascertain and validate the traditional therapeutic potential of different flowers [19, 20]. Flower specific pharmacognostical investigations may yield novel leads in the search for effective drugs. Here the authors subjected aqueous and petroleum ether extracts of flowers of 99 common species collected from Meenachil taluk in Kottayam district, to an antibacterial screening and compared bacterial sensitivity of each extract.

MATERIALS AND METHODS

Collection of flowers

Flowers of common plants were collected from the highland and midland areas of Meenachil Taluk in Kottayam district of Kerala during the months of November-April in the years 2013- 2014. Care taken to collect flowers from mostly serine areas undisturbed by vehicular pollution, chemical fertilizers or pesticides. Only fully blossomed flowers were collected and were immediately brought to lab for preparation of the extracts. The specimens were identified with the help of Flowering plants of Kerala Ver.2.0 (DVD) of N.Sasidharan published by KFRI, Peechi and http://www.flowersofindia.net/ and subsequently authenticated in the Department of Botany St Thomas College Pala. A total of 99 flowers belonging to 42 families were collected and used for antibacterial susceptibility tests. Their scientific name, family, local name, flower habit and antibacterial activities of extracts are shown in Table.1

Preparation of crude extracts

Flowers brought to the lab in fresh condition and were rinsed first in tap water followed by distilled water. All flower parts except pedicel and or peduncle were used. Using mortar and pestle 1 gram of fresh flower was grinded to a paste. A part of it is used to load sterile antibacterial discs of 6mm diameter made from whatman No 1 paper. The remaining part of paste is air dried and macerated in 10 ml petroleum ether for 24 hrs. Then solvent was expressed out through Whatman filter paper and is allowed to evaporate. The residue left was used to impregnate fresh disks.

Bacterial cultures

The test organisms include gram positive bacterial strain *Staphylococcus aureus*, subsp.aureus MTCC 96; gram negative bacterial strains *Escherichia coli* MTCC 443, *Pseudomonas aeruginosa* MTCC 741 and *Klebsiella pneumoniae* subsp. pneumoniae MTCC 432 procured from Institute of Microbial Technology, Chandigarh IMTECH lab.

Antibacterial assay

To assess the antibacterial properties of the flowers, disc diffusion method for antimicrobial susceptibility testing by Kirby Bauer et al. (1966) [21] was followed. Bacterial cultures of 0.5 McFarland standard was used to lawn Muller Hinton agar plates evenly using a sterile swab. Paper disks impregnated with flower extracts were placed on the surface of inoculated MH agar plates using sterile forceps making sure that entire portion of disk is in firm contact with agar surface. Standard antibiotics discs as positive control and discs with blank solvent as negative control were used. Agar plates were incubated for 18 to 20 hours at 37°C in an incubator.

RESULTS

Antibacterial activities of aqueous and petroleum ether extracts of 99 flowers were assessed by measuring zones of inhibition. Authors graded these zones of inhibition into four categories using '+' symbols. '+' means a zone of inhibition with a diameter below 10 mm indicating mild antibacterial sensitivity to extract; '++' means a zone of 11-15 mm indicating moderate sensitivity and '+++' means a zone diameter above 15mm indicating high sensitivity . '0' means no zone of inhibition and no demonstrated antibacterial property in the extracts. Results from the antibacterial assay of 99 flowers are shown in the Table 1.

Table 1: Antibacterial Activities of Aqueous and Petroleum Ether Extracts of 99 Flowers

Sl. No	Name of the plant	Family	Local name	Flower colour &inflorescence	Antibacterial activity							
					AQ extract				PE extract			
					S	E	P	K	S	E	P	K
1	*Acalypha hispida* Burm.f.	Euphorbiaceae	Poochavalan	Red, spike	+	+	+	+	0	0	0	0
2	*Ageratum conyzoides* L.	Asteraceae	Kumminnipaca	White, head in corymbose panicle	0	0	0	0	0	+	0	0
3	*Albizia chinensis* (Osbeck) Merr.	Fabaceae	Mottavaka	White, globose heads in fascicles	0	0	0	0	0	0	+	0
4	*Allamanda cathartica* L.	Apocynaceae	Manjakolambi	Yellow , cyme	0	0	0	0	+	+	+	0
5	*Alternanthera brasiliana* L.	Amaranthaceae	Joy weed	White, flower heads	0	0	0	0	0	0	0	0
6	*Anacardium occidentale* L.	Anacardiaceae	Kasumavu	Yellow &pink, bracteate panicle	+ +	+ +	+ +	0	0	0	0	0
7	*Antigonon leptopus* Hook.&Arn.	Polygonaceae	Thenpoovalli	Bright coloured, raceme	+	0	+ +	0	0	0	0	0
8	*Artocarpus heterophyllus* Lam.	Moraceae	Plavu	Yellow, in spike	0	0	0	0	0	0	0	0
9	*Asystasia dalzelliana*	Acanthaceae	Violet	Lilac or blue ,	+	+	+	0	0	0	0	0

	Sant.		Asystasia	raceme								
10	*Averrhoa bilimbi* L.	Oxalidaceae	Bilimbi	Dark pink ,cauliflorous panicles	+	+	+ +	+	+	+	+	0
11	*Bauhinia variegata* L.	Fabaceae	Chuvannaman daram	Pale purple, racemes	0	+	0	0	0	0	0	0
12	*Bauhinia acuminata* L.	Fabaceae	Veluthamanda ram	White, racemeose or cymose	0	+	0	0	0	0	0	0
13	*Biophytum sensitvum* (L.) DC.	Oxalidaceae	Mukkutti	Yellow,umbel	0	0	0	0	0	0	0	0
14	*Bougainvillea spectabilis* Wild.	Nyctaginaceae	Kadalasupoovu	White, bracteate cymes or pancicles	0	0	0	0	0	0	0	0
15	*Brugmansis suaveolens* (Humb.&Bonpl.ex Wild.) Bercht.& Presl	Solanaceae	Angle's trumpet	Pink,solitary	+	+	+	+	0	0	0	0
16	*Caesalpinia minisoides* Lam.	Fabaceae	Theemullu	Yellow racemes	+	+	+	+	0	0	0	0
17	*Caesalpinia pulcherima* L.	Fabaceae	Rajamalli	Flame red ,corymbose racemes	+ +	+	+ +	0	0	0	0	0
18	*Callistemon citrinus*	Myrtaceae	Bottle brush tree	Red, spike	+ + +	+ +	+ +	+	+	+	+	+
19	*Calotropis gigantea* (L.) W.T.Aiton	Asclepiadaceae (Apocynaceae)	Erikku	Pale purple, umbel like racemes	+	+	+	0	0	0	0	0
20	*Cananga odorata*(Lam.) Hook. f. & Thoms.	Annonaceae	Kattuchempak am	Yellowish green , cymes	+	+	+	0	0	0	0	0
21	*Camellia sinensis*	Theaceae	Tea plant	White,solitary	0	0	0	0	0	0	0	0
22	*Capsicum frutescens* L.	Solanaceae	Kanthari mulaku	White , solitary	0	+ +	0	0	+	+	+	0
23	*Carica papaya* L.	Caricaceae	Kapplam	Cream white , raceme	0	0	0	0	0	0	0	0
24	*Cassia fistula* L.	Fabaceae	Kanikonna	Yellow, drooping racemes	0	0	+	0	0	0	0	0
25	*Catharanthus roseus* (L.) G.Don.Gen.	Apocynaceae	Savamnari	Pink or white , solitary	0	0	0	0	+	0	+	0
26	*Centrosema pubescens* Sensu auct., non Benth.	Fabaceae	Kattupayar	Violet, solitary	0	0	0	0	0	0	0	0
27	*Chassalia curviflora* (Wall. ex Kurz) Thw.	Rubiaceae	Karutha amalppori	Purple ,panicles	+ + +	+	+ +	0	0	0	0	0
28	*Clerodendrum philippinum* Schauer	Verbenaceae	Chendumulla	White , condensed cyme	+	+	+	0	0	0	0	0
29	*Clerodendrum thomosonae* Balf. f.	Verbenaceae	Kadalapoovu	Bright coloured, cymose	0	0	0	0	0	0	0	0
30	*Clerodendrum infortunatum* L.	Verbenaceae	Periyiam	White flowers in Panicle	0	0	0	0	0	0	0	0
31	*Coccinia grandis* (L.) Voight,	Cucurbitaceae	Koval	White, solitary	0	0	0	0	0	0	0	0
32	*Codiaeum Variegatum*	Euphorbiaceae	Kozhivalan	Cream,spicate to	+	+	+	0	0	0	0	0

	(L.) Rumph. Ex A.Juss.			racemose	+						
33	*Coffea arabica* L.	Rubiaceae	Kappi	white ,fascicles	0	0	0	0	0	0	0	0
34	*Quisqualis indica* L.	Combretaceae	Thookuchethi	White to red , spike	0	0	0	0	0	0	0	0
35	*Crinum asiaticum* L.	Amaryllidaceae	Puzhatthali	White umbel	0	0	0	0	0	0	0	0
36	*Crotalaria retusa* L.	Fabaceae	kilukilikki	Yellow, racemes	0	+	+	0	0	0	0	0
37	*Curcuma aromatica* Salisb.	Zingiberaceae	Kattumanjal	Brownish yellow, solitary	0	0	0	0	0	0	0	0
38	*Datura stramonium* L.	Solanaceae	Ummam	White, solitary	+	+	+	+	0	0	0	0
					+	+	+	+				
39	*Erythrina suberosa* Roxb.	Fabaceae	Mullumurikku	Scarlet , racemose	0	0	0	0	0	0	0	0
40	*Euphorbia milii* Desmoul	Euphorbiaceae	Crown of Thorns	Red bracteate, cyathium	+	+	+	+	0	0	0	0
41	*Euphorbia pulcherrima* Willd. ex Klotzsch	Euphorbiaceae	wild ponisetta	Yellowish green, Cyathia	0	0	0	0	0	0	0	0
42	*Garcinia gummi-gutta* (L.) Robs.	Clusiaceae	Kodampuli	Yellowish white , fascicles	+	+	+	+	+	+	+	+
					+	+	+	+	+			
43	*Gliricidia sepium* (Jacq.) Kunth ex Walp.	Fabaceae	Cheema konna	Rose pink ,racemes	0	0	0	0	0	0	0	0
44	*Glycosmis arborea* (Retz.) DC.	Rutaceae	Panal	White,racemes	0	0	0	0	0	0	0	0
45	*Hamelia patens* Jacq.	Rubiaceae	Fire bush	Reddish yellow , cymose	+	+	+	0	0	0	0	0
					+	+	+					
46	*Heliconia psittacorum* L.f.	Heliconiaceae	Parakeet Flower	Bright bracteate , panicle	0	0	0	0	0	0	0	0
47	*Hevea braziliensis* (Willd. ex A. Juss.) Muell.-Arg	Euphorbiaceae	Rubber	Yellowish white, racemes	0	0	0	0	0	0	0	0
48	*Hibiscus rosa-sinensis* L.	Malvaceae	Chembarathi	Red,solitary	0	+	+	0	0	0	0	0
49	*Hibiscus vitifolius*	Malvaceae	Kattuvelluram	White, raceme	0	0	0	0	0	0	0	0
50	*Hippeastrum puniceum* (Lam.) Voss	Amarylli-daceae	Easter lily	Orange red, umbel	0	0	0	0	0	0	0	0
51	*Hydrangea macrophylla* (Thunb.) Ser. in DC.	Hydrangeaceae	Hydrangea	Blue, compact cyme	0	0	0	0	0	0	0	0
52	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Nattapoochedi	Blue, cymose racemes	0	0	0	0	0	0	0	0
53	*Ixora coccinea* L.	Rubiaceae	Chethi	Red,corymb	+	0	+	0	0	0	0	0
							+					
54	*Ixora finlaysoniana*Wall. ex G.Don	Rubiaceae	Vellathetchi	White	0	0	0	0	0	0	0	0
55	*Jasminum coarctatum* Roxb.	Oleaceae	Vellakattumulla	White ,cymes	0	0	0	0	0	0	0	0
56	*Jasminum angustifolium* (L.) Willd.	Oleaceae	Kattumulla	White solitary or groups of 3	0	0	0	0	0	0	0	0
57	*Jasminum multiflorum* (Burm. f.) Andr.	Oleaceae	Mulla	White few flowered cymes	0	0	0	0	0	0	0	0
58	*Jatropha curcas* L.	Euphorbiaceae	Kadalavanakku	Yellowish green panicled cymes	0	0	0	0	0	0	0	0
59	*Kyllinga nemoralis* (J. R & G. Forst.) Dandy ex Hutch. & Dalz.	Cyperaceae	Vallimuthanga	White globose spike	0	0	0	0	0	0	0	0

60	*Lantana camara* L.	Verbenaceae	Kongini	Mixed coloured umbel	0	0	0	0	0	0	0	0
61	*Mangifera indica* L.	Anacardiaceae	Mavu	Yellowish greeen,panicles	+++	0	+++	0	0	+	+	0
62	*Melastoma malabathricum* L.	Melastomataceae	Mashikkai	Reddisht purple, solitary	0	+	+	+	0	0	0	0
63	*Mimosa pudica* L.	Fabaceae	Thottavadi	Lilac or pink Heads	0	0	0	0	0	0	0	0
64	*Mimusops elengi* L.	Sapotaceae	Elangi	White ,fascicles	++++	+	+	+	+	+	+	+
65	*Mirabilis jalapa* L.	Nyctaginaceae	Nalumanichedi	Pinkcapitate cluster	0	0	0	0	0	0	0	0
66	*Momordica charantia* L.	Cucurbitaceae	Paval	Yellow, solitary	+	+	+	0	0	0	0	0
67	*Moringa oleifera* Gaertn.	Moringaceae	Muringa	White ,pancles	+++	+	+	+	+	+	+	0
68	*Musa acuminata* Colla.	Musaceae	Vazha	White ,Spike-bracts spacthaceous	0	+	0	0	0	0	0	0
69	*Mussaenda erythrophylla* Schum. & Thonn.	Rubiaceae	Mussaenda	White , panicle with enlarged sepal	0	0	0	0	0	0	0	0
70	*Myristica fragrans* Houtt.	Myristicaceae	Jathi	Yellow, cymes	0	0	0	0	0	0	0	0
71	*Ocimum sanctum* L.	Lamiaceae	Thulasi	Reddish pink, racemes	0	0	0	0	0	0	0	0
72	*Pajanelia longifolia* (Willd.) K. Schum.	Bignoniaceae	Payani	Crimson purple racemose panicles	+	+	+	+	0	0	0	0
73	*Pancratium triflorum* Roxb.	Amaryllidaceae	Kaattulli	White, umbels	0	0	0	0	0	0	0	0
74	*Phaseolus vulgaris*	Fabaceae	Beans	Pink,racemes	0	0	0	0	0	0	0	0
75	*Plumeria obtusa* L.	Apocynaceae	Vellachampakam	White,corymbose	+++	+	+	+	0	0	0	0
76	*Psidium guajava* L.	Myrtaceae	Pera	White,cymes	0	0	+	0	+	+	+	0
77	*Rauvolfia serpentina* (L.) Benth. ex Kurz.	Apocynaceae	Sarpagandhi	White , cymes	0	+	+	0	0	0	0	0
78	*Rhinacanthus nasutus* (L.) Kurz.	Acanthaceae	Nagamulla	White, panicled cyme	0	0	0	+	0	0	0	0
79	*Salvia splendens* Sellow ex Roem. & Schult.	Lamiaceae	Scarlet sage	Scarlet , racemose	0	0	0	0	0	0	0	0
80	*Sambucus canadensis* L.	Caprifoliaceae	American elderberry	White, large inflorescence	0	0	0	0	0	0	0	0
81	*Senna alata* (L.) Roxb.	Fabaceae	Chakrathakara	Yellow, spike	0	0	0	0	0	0	0	0
82	*Spathodea campanulata* P. Beauv.	Bignoniaceae	Thaneerkaimaram	Bright red , raceme	+	+	+	0	0	0	0	0
83	*Spathoglottis plicata* Blume	Orchidaceae	Ground orchid	Purple, inflorescence	0	0	0	0	0	0	0	0
84	*Spilanthes ciliata* Kunth	Asteraceae	Pallu vedana chedi	Yellow,heads	0	0	0	0	0	0	0	0
85	*Stachytarpheta indica*(L.) Vahl	Verbenaceae	Narivalan	Bluish pink, spikes	0	0	0	0	0	0	0	0

86	*Swietenia macrophylla* G. King	Meliaceae	Mahogani	Pale yello, panicles	+	+	+	0	0	0	0	0
87	*Syzygium jambos*	Myrtaceae	Champa	Pinkish white cyme	0	0	0	0	0	0	0	0
88	*Tabernaemontana divericata* (L.) R. Br. in Roem. & Schult	Apocynaceae	Nandiyar vattom	White , inflorescence	+ +	+	+	0	+	0	0	0
89	*Tecoma stans* (L.) Juss. Ex Kunth	Bignoniaceae	Manja arali	Yellow, panicles	0	0	+ + +	0	0	0	0	0
90	*Terminalia catappa* L.	Combretaceae	Badam	White or yellow green, raceme	0	0	0	0	0	0	0	0
91	*Theobroma cacao* L.	Sterculiaceae	Kokko	White or cream ,cauliflorous	0	0	0	0	0	0	0	0
92	*Thunbergia erecta* (Benth.) Anders.	Acanthaceae	Blue bell	Purple or white racemes	0	0	0	0	0	0	0	0
93	*Thunbergia fragrans* Roxb.	Acanthaceae	Noorvan valli	White ,solitary	0	0	0	+	0	0	0	0
94	*Thunbergia mysorensis* (Wight) Anders.ex Bedd.	Acanthaceae	Clock vine	Yellow, pendulous raceme	+	+	+	0	0	0	0	0
95	*Tithonia rotundifolia* Mill.	Asteraceae	Sunflower	Orange to red heads	0	0	0	0	0	0	0	0
96	*Trichosanthes cucumerina* L.	Cucurbitaceae	Padavalam	White , solitary	0	0	0	0	0	0	0	0
97	*Turnera subulata* Smith	Passifloraceae	Whie butter cup	Yellow, solitary	0	0	0	0	0	0	0	0
98	*Vigna pilosa* (Roxb.) Baker	Fabaceae	Kattupayar	Pinkish red racemes	0	0	0	0	0	0	0	0
99	*Wrightia tinctoria* (Roxb.) R. Br.	Apocynaceae	Dandapala	White , cymes	+ +	+	+	+	0	0	0	0

AQ- aqueous extract ; PE Petroleum ether extract ;Bacterial strains- S –S. aureus ; E- E. coli; P. aeruginosa; K- *K. pneumoniae*

Antibacterial activity: '+' indicates zone of inhibition is 7-10mm; '++': 11-15mm; '+++': 15 mm and above; '0': Nil

DISCUSSION

99 common flowers belonging to 42 families collected from different parts of Meenachil Taluk were assayed for antibacterial properties of their aqueous and petroleum ether extracts. 47 flowers belonging to 23 families exhibited mild to high degree of antibacterial properties (Table1). Though the number of tested species is not same between families and too few to assign any family specific pattern of antibacterial properties, some interesting observations can be made. In Apocynaceae all the tested flowers exhibited antibacterial activity whereas in Fabaceae it is only 6 out of 13. It is suggested that secondary metabolites rather 'reflect adaptations' and 'life strategies' of plants than strictly indicating any taxonomic lineages [22]. In the 99 flowers surveyed, 14 were solitary and 85 were inflorescences of which 8 and 39 respectively found possessing antibacterial properties.

Presence of antibacterial activities in 23 families out of 42 families indicates that many common flowers in the Meenachil Taluk contain bioactive secondary metabolites.

A comparison of activity of aqueous extracts and petroleum extracts clearly indicate that aqueous extracts contain more antibacterial secondary metabolites (Table 2). Aqueous extracts of 29 flowers were active against *S.aureus*, 34 against *E.coli*, 36 against *P. aeruginosa* and 16 against *K. pneumoniae*. The corresponding figures for petroleum extracts are 10, 10, 11 and 3 respectively.If we consider highly and moderately active aqueous and petroleum extracts these numbers become 12 and 2 against *S.aureus*; 9 and 2 against *E.coli*; 15 and 1 against *P. aeruginosa*; 5 and 0 against *K. pneumoniae* respectively.

Table 2: Number of Aqueous and Petroleum Ether Extracts with Antibacterial Activity

Sensitivity	S. aureus		E.coli		P. aeruginosa		K. pneumoniae	
	AQ	PE	AQ	PE	AQ	PE	AQ	PE
Low	18	8	25	9	22	10	11	3
Moderate	6	2	7	1	10	1	3	0
High	5	0	2	0	5	0	2	0
TOTAL	29	10	34	10	36	11	16	3

AQ- aqueous extract; PE- Petroleum ether extract

Bacterial sensitivity Low means 7-10mm zone of inhibition; Moderate-11-15mm; High- 15 mm

Aqueous extracts of *M.oleifera* and *P.obtusa* flowers produced highest sensitivity in all tested bacterial strains.In *M. oleifera,* petroleum ether extract is also found to be active against S*. aureus E. coli* and *P. aeruginosa.* Other flowers whose aqueous extracts exhibited mild to high antibacterial activities against all the four bacterial strains include *Acalypha hispida*; *Averrhoa bilimbi*; *Brugmansis suaveolens*; *Caesalpinia minisoides*; *Callistemon citrinus*; *Datura stramonium*; *Euphorbia milii*; *Garcinia gummi-gutta*; *Mimusops elengi*; *Pajanelia longifolia*; and *Wrightia tinctoria.* Flowers such as *Mangifera indica* and *Chasalia curviflora* were noted for their aqueous extracts' high antibacterial activity against two bacterial strains whereas *Anacardium occidentale* and *Hamelia patens* came up with moderate antibacterial activity against 3 bacterial strains. Flowers which exhibited significant antibacterial activities may be considered for detailed investigations.

CONCLUSION

Many of the common flowers in Meenachil Taluk of Kottayam district possess antibacterial properties. Four bacterial strains namely *S. aureus* and *E.coli*, *P. aeruginosa* and *K. pneumoniae*, were found highly sensitive to the aqueous extracts of *Moringa oleifera* and *Plumeria obtusa* flowers. These flowers are potential source of bioactive phytochemicals. Detailed phytochemical and pharmacognostical studies on these flowers are recommended.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interests.

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