Electronic Supplementary Material (ESI) for Natural Product Reports.

Supplementary Information

The action of phytochemicals in biofilm control

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Table S1 – A curated overview of the antibiofilm properties of plant extracts: effects on biofilm prevention, dispersal, eradication, regrowth preclusion, and related events, from December 2008 to December 2021.

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Acacia macrostachya*	*S. aureus* (ATCC 25923), *E. coli* (ATCC 25922), and *P. aeruginosa* (ATCC 27853)	Inhibition of efflux pumps and biofilm formation	1
Extracts of *Acacia senegal* and *Azadirchta indica* [(1)]	*S. aureus, S. epidermidis, Staphylococcus simulans, E. coli*, and *Pseudomonas* spp.	Inhibition of biofilm formation	2
Extract of *Acalypha wilkesiana* (9EA-FC-B)	MRSA (ATCC 43300)	Reduction of biofilm formation and cell adhesion. Inhibition of penicillin-binding protein expression	3
Extract of *Achillea ageratifolia* subsp. *Serbica* [(2)]	*P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation	4
Extract of *Achyranthes aspera* [(3)]	*S. mutans* (clinical isolate)	Interference with EPS production and reduction of biofilm formation. Interaction with OmpR subfamily and glycosyltransferase	5
Extracts of *Acorus calamus; Colocasia esculenta;* and *Vitex trifolia*	*H. pylori* (clinical isolate)	Reduction of preformed biofilm mass	6
Extract of *Acroptilon repens*	*P. aeruginosa* (PAO1 and clinical isolates)	Reduction of biofilm formation and expression level of exotoxin A gene	7
Extracts of *Actinidia deliciosa* (sanquinarine and hydroxyflavone) and *Syzygium aromaticum*	*A. baumanni* (ATCC 19606 and RS 307)	Disruption of preformed biofilm. Reduction of EPS, protein, and eDNA content	8
Extract of *Adhatoda vasica* Nees.	*S. pneumoniae* (R6 strain)	Reduction of biofilm formation and reduction of preformed biofilm cells viability	9
Extract of *Adiantum philippense*	*S. flexneri* (MTCC 1457), *S. aureus* (MTCC 96), *P. aeruginosa* (MTCC 741), and *E. coli* (MTCC 9537)	Reduction of biofilm formation and EPS production. Interaction with the active site residues of adhesin proteins, IcsA, Sortase A, OprD, and EspA. Distortion of preformed biofilms	10
Extract of *Aegle marmelos*	*E. coli* (ATCC 25922), *Salmonella typhi* and *P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation and cell adhesion	11
Extracts of *Agrimonia eupatoria*	*P. mirabilis* and *P. aeruginosa* (clinical isolates)	Reduction of biofilm formation	12
Extract of *Aidia genipiflora* [(4)]	*E. coli* (ATCC 25922), *S. aureus* (ATCC 25923) and *P. aeruginosa* (ATCC 27853)	Inhibition of biofilm formation and efflux pump	13
Extracts of *Alisma orientale; Cornus officinalis; Dioscorea batatas; Paeonia suffruticosa; Poria cocos;* and *Rehmannia glutinosa*	*Fusobacterium nucleatum* (ATCC 25586)	Reduction of biofilm formation	14

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extracts of *Allium ampeloprasum* var. *holmense*	*L. monocytogenes* (ATCC 7644), *E. coli* (DSM8579), *P. aeruginosa* (DSM50071), *Pectobacterium carovotorum* (DSM 102074), and *S. aureus* (ATCC 25923)	Reduction of biofilm formation and inhibition of cell adhesion. Reduction of preformed biofilm mass	15
Extract of *Allium cepa* (quercetin 4'-O-*β*-D glucopyranoside)	*C. violaceum* (CV12472), *P. aeruginosa* (PAO1 and clinical isolate), and *A. hydrophila* (clinical isolate)	Anti-QS activity (reduction of LasB elastase, violacein, and pyocyanin production). Reduction of biofilm formation and inhibition of EPS production and swarming motility	16
Extract of *Allium orientale* [5]	*E. coli* (ATCC 25922), *B. subtilis* (ATCC 6633), S. *aureus* (ATCC 25923), and *P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation. Antimutagenic activity	17
Extracts of *Allium sativum*	*S. aureus, B. cereus, S. pneumoniae, P. aeruginosa, E. coli* and *K. pneumoniae* (clinical isolates)	Reduction of biofilm formation, cell adhesion and preformed biofilms metabolic activity	18
Extract of *Allium sativum*	*P. aeruginosa* (clinical isolate)	Anti-QS activity (reduction of AHL, alginate, pyoverdin, pyochelin, and phospholipase C production). Reduction of biofilm formation	19
Extract of *Allium sphaerocephalon*	*S. aureus* (ATCC 25923) and *B. subtilis* (ATCC 6633), *E. coli* (ATCC 25922) and *P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation and antimutagenic activity	20
Extract of *Alnus japonica* (quercetin and tannic acid)	MSSA (ATCC 25923 and ATCC 6538) and MRSA (ATCC BAA-1707)	Inhibition of biofilm formation. Downregulation of expression of *icaA, icaD* (intercellular adhesion), *aur, splA, sspA* (expression of several protease genes), *agrA* (a QS gene), and *sigB* genes (a virulence factor gene)	21
Extracts of *Aloe vera; Azadiractha indica; Coriandrum sativum; Eucalyptus globulus; Mentha avensis;* and *Pongamia pinnata.*	*B. cereus* (clinical isolate)	Reduction of biofilm formation and EPS production	22
Extracts of *Aloysia gratíssima; Baccharis dracunculifolia; Coriandrum sativum;* and *Lippia sidoides* [6]	*S. mutans* (UA159)	Inhibition of biofilm formation	23
Extract of *Alternanthera philoxeroides*	*P. aeruginosa* (MTCC 2488)	Reduction of biofilm formation, swarming motility, and EPS production	24
Extract of *Ammi majus*	*S. epidermidis, S. aureus, Staphylococcus auricularis, S. mitis, S. salivarius,* and *S. pneumoniae* (clinical isolates)	Reduction of biofilm formation	25

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Amommum tsao-ko Crevost et Lemarie*	*Salmonella* typhimurium (ATCC 50013), *S. aureus* (ATCC 6538), *P. aeruginosa* (ATCC 9027), and *C. violaceum* (ATCC 12472)	Anti-QS (inhibition of violacein production). Inhibition of swarming motility and reduction of biofilm formation	26
Extracts of *Anabasis articulata; Cymbopogon schoenanthus; and Salvia chudaei*	*Micrococcus luteus* (clinical isolate) and *S. aureus* (ATCC 25923)	Reduction of biofilm formation. Alteration of biofilm architecture and surface colonization	27
Extract of *Anacardium occidentale*	*S. aureus* (ATCC 29213 and clinical isolate) and *S. epidermidis* (ATCC12228 and clinical isolate)	Inhibition of biofilm formation and eradication of preformed biofilm	28
Extracts of *Anadenanthera colubrina*; *Commiphora leptophloeos*; *Myracrodruoun urundeuva*, *Pityrocarpa moniliformis;* among others [7]	*P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation	29
Extract of *Andrographis paniculata* [8]	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation and inhibition of EPS production	30
Extracts of *Andrographis paniculata; Berberis aristata; Camellia sinensis; Cyperus rotundus;* and *Holarrhena antidysenterica* [9]	*E. coli* (clinical isolate)	Anti-QS activity (interaction with Lux S and Pilin receptors). Reduction of biofilm formation and cell adhesion	31
Extract of *Andrographis paniculata* and *Holarrhena antidysentrica*	*S.* typhimurium (MTCC 733 and clinical isolate)	Reduction of biofilm formation. Increase in metal chelating activity of ferrous ions	32
Extract of *Anethum graveolens*	*C. violaceum* (ATCC 12472 and CV026) and *Serratia marcescens* (clinical isolate)	Anti-QS activity (inhibition of prodigiosin, violacein, protease, and lipase production and downregulation of expression of *flhD, bsmA*, and *fimC* genes). Reduction of biofilm formation. Inhibition of swarming and cells adhesion	33
Extracts of *Anogeissus acuminata* and *Mallotus roxburghianus* Muell	*P. aeruginosa* PAO1 and *C. violaceum* (MTCC 2656)	Anti-QS activity (interaction with LasR protein and reduction of pyocyanin, alginate, and violacein production). Reduction of elastolytic and staphylolytic activity. Reduction of biofilm formation and inhibition of EPS production	34
Extract of *Anthemis stiparum* subsp. *Sabulicola* [10]	*S. aureus* (ATCC 25923 and ATCC 6538), *S. epidermidis* (MU 30), *S. mutans* (CNCTC 8/77), *M. luteus (NRRL B-4375), B. subtilis* (ATCC 6633), and *B. cereus* (RSKK 863)	Reduction of biofilm formation and inhibition of anticholinesterase activity	35
Extract of *Antrodia cinnamomea*	*S.* typhimurium (SL1344 and ATCC 14028) *C. violaceum* (ATCC 12472)	Anti-QS activity (downregulation of transcription of genes *fljB* and *flhD* (flagellar regulation), *fimD* (motility); *arcZ, sroC, csrB, csgD* and *adrA* (biofilm formation); *hilA, invA* and *invH* (adhesion and invasion); *pipB* and *orf245* (type III secretion system 1); *sdiA* and *srgE* (QS); and *sodC* (survival in macrophages); and inhibition of violacein production). Reduction of biofilm formation and	36

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
		inhibition of swimming motility. Disruption of biofilm architecture	
Extract of *Apium graveolens* [11]	*C. violaceum* (CV12472) and *P. aeruginosa* PAO1	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation and inhibition of swarming, swimming, and twitching motilities	37
Extracts of *Apuleia leiocarpa; Harpochilus neesianus;* and *Poincianella microphylla*	*S. epidermidis* (ATCC 35984)	Prevention of biofilm formation and cell adhesion	38
Extracts of *Arachis hypogaea; Cajanus cajan; Canavalia ensiformis; Phaseolus; Pisum sativum; Trigonella foenumgraecum* and *Triticum aestivum*	*S. mutans* (MTCC 890)	Inhibition of biofilm formation and cell adhesion	39
Extract of *Arctium lappa*	*K. pneumoniae* (clinical isolate), *C. violaceum* (ATCC 12472), and *S. marcescens* (MTCC 97)	Anti-QS activity (inhibition of prodigiosin and violacein production and downregulation of expression of *LuxS (*QS*)*, *mrkD* (biofilm formation)*,* and *treC (*capsular polysaccharide modification*)* genes). Reduction of biofilm formation and anti-*β*-lactamase activities. Disruption of preformed biofilms	40
Extract of *Arctium lappa* [12]	*E. coli, P. mirabilis,* and *S. marcescens* (clinical isolates)	Anti-QS activity (inhibition of violacein and prodigiosin production). Reduction of biofilm formation and biofilm thickness. Inhibition of swarming motility and cell surface hydrophobicity	41
Extracts of *Arnica montana; Petasites album; Petasites hybridus;* and *Rhodiola rosea*	*E. Coli* (clinical isolate)	Reduction of biofilm formation	42
Extract of *Asphodelus microcarpus* [13]	*E. coli* (ATCC 7075), *S. aureus* (ATCC 6538)*, Staphylococcus haemoliticus* (clinical isolate), and *Bacillus clausii* (isolated from a commercial product, Enterogermina)	Reduction of biofilm formation	43
Extract of *Astragalus angulosus*	*S. epidermidis* (clinical isolate)	Reduction of preformed biofilm mass	44
Extract of *Avicennia marina* [14]	*P. fluorescens*	Inhibition of biofilm formation and cell adhesion. Disruption of preformed biofilm and reduction of biofilm mass	45
Extract of *Azadirachta indica* (catechin; among others [15])	*P. gingivalis (*ATCC33277) and *Alcaligenes faecalis* (clinical isolate)	Anti-QS activity (reduction of LuxS protein activity). Reduction of biofilm formation and preformed biofilm cells viability. Reduction of preformed biofilm cells viability, genomic DNA and RNA content, carbohydrates, and EPS production	46
Extracts of *Azadirachta indica; Cinnamomum zeylanicum; Centella asiatica*; *Mentha spicata*;	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation	47

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Psidium guajava spices; and *Syzygium aromaticum*			
Extract of *Baccharis psiadioides* [16]	*E. faecalis* (clinical isolate) and *S. epidermidis* (ATCC 95984)	Reduction of biofilm formation, cell adhesion, and preformed biofilm cells viability	48
Extract of *Bacopa monnieri* (bacoside A)	*S. aureus* (MTCC 96) and *P. aeruginosa* (MTCC 2488)	Reduction of preformed biofilm cells viability and EPS production	49
Extracts of *Banisteriopsis caapi; Mimosa hostilis; Peganum harmala;* and *Psychotria viridis*	*A. baumannii* (LMG 1025) and *C. violaceum* (ATCC 12472)	Anti-QS activity (inhibition of violacein production). Inhibition of biofilm formation	50
Extracts of *Barringtonia acutangula* and *Holoptelia integrifolia* (caffeic acid; catechol; tannic acid; and vanillin)	*P. aeruginosa* (ATCC 27853) and *S. aureus* (ATCC 25923)	Reduction of biofilm formation and cell adhesion	51
Extract of *Bellis perennis*	*P. aeruginosa* (ATCC 27853 and clinical isolate), *P. fluorescens* (clinical isolate), *S. epidermidis* (clinical isolate), *S. aureus* (ATCC 25923 and clinical isolate), *M. luteus* (NRLL B-4375), *B. subtilis* (ATCC 6633), and *C. violaceum* (CV026 and ATCC 12472)	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation and inhibition of swarming motility	52
Extract of *Bellis sylvestris* (caffeic and rosmarinic acids; among others [17])	*P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation	53
Extract of *Berginia ciliata; Clematis grata;* and *Clematis viticella*	*P. aeruginosa* PAO1	Reduction of biofilm formation	54
Extract of *Bergenia crassifolia*	*S. mutans* (ATCC 25175)	Prevention of biofilm formation and reduction of cell adhesion. Reduction of preformed biofilm cells viability and inhibition of EPS production (by inhibiting glucosyltransferases)	55
Extracts of *Betula pendula; Equisetum arvense, Galium odoratum; Herniaria glabra; Urtica dioica;* and *Vaccinium vitis-idaea* [18]	*E. coli* (clinical isolate)	Reduction of biofilm formation. Alteration in the cell surface hydrophobicity. Reduction of swimming motility and expression of *P. fimbriae* and curli expression	56
Extract of *Boesenbergia rotunda*	*E. faecalis* (ATCC 29212), *F. nucleatum* (ATCC 25586), and *Treponema denticola* (ATCC 35405)	Inhibition of biofilm formation	57
Extract of *Boesenbergia rotunda* (panduratin A)	*E. faecalis* (ATCC 29212 and clinical isolate) and *Enterococcus faecium* (clinical isolate)	Eradication of preformed biofilm	58

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Boswellia serrata* (acetyl-11-keto-*β*-boswellic acid)	*S. mutans* (ATCC 25175) and A*ctinomyces viscosus* (ATCC 15987)	Reduction of biofilm formation and preformed biofilm mass	59
Extracts of *Bruguiera cylindrica* and *Laguncularia racemosa* [19]	*E. coli* K-12 (ATCC 25404)	Reduction of biofilm formation and cell adhesion. Enhance the intracellular and extracellular ROS and pre-grown biofilm detachment	60
Extract of Burdock Leaf [20]	*E. coli* (ATCC 25922) and *S. aureus* (6538)	Reduction of biofilm formation	61
Extract of *Calendula Officinalis*	*Salmonella, Shigella dysenteriae, S. flexneri,* and *Shigella sonnei* (clinical isolates)	Reduction of biofilm formation and inhibition of cell adhesion	62
Extract of *Callistemon citrinus* (8-desmethyl eucalyptin; eucalyptin; and pulverulentone A)	MRSA (ATCC 33591) and MSSA (ATCC 25923)	Reduction of biofilm formation and biofilm thickness. Inhibition of styphyloxanthin production	63
Extracts of *Calotropis gigantea; Eclipta prostrata*; *Moringa oleifera;* among others [21]	*E. coli* (clinical isolate)	Reduction of biofilm formation	64
Extract of *Camellia kissi wall* [22]	*P. aeruginosa* PAO1 and *C. violaceum* (MTCC 2656)	Anti-QS activity (inhibition of pyocyanin and violacein production and interaction with LasR protein). Reduction of biofilm formation and inhibition of swimming and swarming motilities	65
Extracts of *Camellia sinensis* and *Curcuma longa* [23]	*S. aureus* (ATCC 25923*), E. faecalis* (ATCC 29212), *L. monocytogenes* (ATCC 7644), *P. aeruginosa* (ATCC 27853), *S. typhi* (ATCC 14028), *E. coli* (ATCC 25922), *C. violaceum* (CV12472 *and* CV026)	Anti-QS activity (inhibition of violacein, tyrosinase, urease, and anticholinesterase production/activity). Reduction of biofilm formation and inhibition of swimming and swarming motilities	66
Extracts of *Camellia sinensis*; *Humulus lupulus; Ocimum basilicum; Olea europaea;* Propolis; *Ruta graveolens*; and *Styrax benzoin*	*P. aeruginosa* (clinical and environmental isolate)	Anti-QS activity (downregulation of *lasI, lasR, rhlI, and rhlR* genes and inhibition of pyocyanin production). Reduction of biofilm formation and inhibition of twitching motility	67
Extracts of *Camellia sinensis* var. *assamica Salvadora persica*	*S. mitis (ATCC 49456), S. sanguinis (*ATCC BAA-1455), *and A. viscosus* (ATCC 43146)	Reduction of biofilm formation, cell adhesion, cell surface hydrophobicity, and plaque accumulation. Partial synergism between *Salvadora persica* and *Camellia sinensis* var. *assamica*	68
Extract of *Capparis spinosa* [24]	*S. marcescens* (FJ584421), *P. aeruginosa* PAO1, *E. coli* (ATCC 10536) *P. mirabilis* (ATCC 7002) and *C. violaceum* (CV026 and ATCC 12472)	Anti-QS activity (inhibition of violacein production and reduction of rhamnolipid production). Reduction of biofilm formation and EPS production. Inhibition of swimming and swarming motilities	69
Extract of *Capsicum baccatum*	*P. aeruginosa* PA14 and *S. epidermidis (*ATCC 35984)	Prevention of biofilm formation and cell adhesion	70
Extract of *Carex pumila* [25]	*P. aeruginosa* (PA14 and PAO1), and *E. coli* O157:H7 (ATCC 43895)	Inhibition of biofilm formation and reduction of pyocyanin production	71

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Carum copticum* [26]	*B. cereus* (ATCC 1298), *S. aureus* (ATCC 1189) *P. aeruginosa* (ATCC 27853), *E. coli* (ATCC 35218), *A. baumannii* (ATCC 1611) *and K. pneumoniae* (ATCC 700603)	Prevention of biofilm formation. Inhibition of metabolic activity of preformed biofilm cells and disruption of biofilm structures. Reduction of dehydrogenase activity	72
Extract of *Centella asiatica* (asiatic acid; kaempferol; and quercetin)	*C. violaceum* (ATCC12472, ATCC31532, and CV026) and *P. aeruginosa* PAO1 (clinical isolate)	Anti-QS activity (inhibition of pyocyanin and violacein production and elastolytic and proteolytic activities). Reductio of biofilm formation and inhibition of swarming motility	73
Extracts of *Ceratonia siliqua; Origanum majorana; Plantago Ovata; Salvia rosmarinus;* and *Senna acutifolia*	*Prevotella intermedia* (clinical isolate)	Reduction of biofilm formation and cell adhesion	74
Extract of *Chamaemelum nobile*	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation and swarming motility	75
Extract of *Chelidonium majus; Corydalis cava; Corydalis cheilanthifolia; Corydalis pumila;* and *Fumaria vaillantii* [27]	*S. aureus* (ATCC 6538) and *P. aeruginosa* (ATCC 15442)	Reduction of biofilm formation and preformed biofilm cells viability	76
Extract of *Chilean propolis* [28]	*S. mutans* (clinical isolate)	Reduction of biofilm formation	77
Extract of *Chlamydomonas reinhardtii*	*S. enterica* (MTCC 9844) and *V. harveyi* (MTCC 7771)	Anti-QS activity (inhibition of protease and urease production). Inhibition of biofilm formation, cell adhesion, and alteration of cell surface hydrophobicity. Eradication of preformed biofilms and decreased metabolic activity of preformed biofilms cells. Reduction in total EPS, extracellular DNA content, and swimming and swarming motilities	78
Extract of *Chondrus crispus;* juglone; and usnic acid	*Cobetia marina* (ATCC 25374) and *Marinobacter hydrocarbonoclasticus* (ATCC 49840)	Reduction of biofilm formation and cell adhesion	79
Extract of *Chromolaena odorata* [29]	*P. aeruginosa* (ATCC 10145)	Reduction of biofilm formation and alteration in biochemical composition of biofilm extracellular matrix	80
Extract of *Chromolaena odorata*	*P. aeruginosa* (ATCC 10145)	Reduction of preformed biofilm cells viability. Alteration and downregulation of expression of biofilm cytoplasmic proteins	81
Extract of *Cinnamomum* (cinnamaldehyde)	MRSA (clinical isolate)	Reduction of biofilm formation	82
Extracts of *Cinnamomum glaucescens; Ficus hispida; Trema orientalis;* among others [30]	*S. aureus* (clinical isolate)	Reduction of biofilm formation	83

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extracts of *Cinnamomum verum; Eugenia caryophyllata; Origanum majorana;* and *Thymus vulgaris*	*E. coli, K. pneumoniae, A. baumanii, P. aeruginosa, Citrobacter freundii, K. oxytoca, Salmonella enteridis, S.* typhimurium*, Salmonella zinzibar, Salmonella livingstone, Salmonella derby, Salmonella heidelberg,* and *Corynebacterium striatum, S. aureus* (clinical isolates)	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation	84
Extracts of *Cinnamomum verum*; *Lavandula angustifolia; Mentha piperita;* and *Syzygium aromaticum* [31];	*C. violaceum* (CV12472, CVO26, and CV31532) and *P. aeruginosa* PAO1	Anti-QS (inhibition of violacein production) and reduction of swarming motility	85
Extracts of *Cinnamomum zeylanicum; Cuminum cyminum; Pimpinella anisum*; and *Syzygium aromaticum*.	*S. aureus* (ATCC 6538)*, S. epidermidis* (ATCC 14990), *E. faecalis* (ATCC 29212), *S. pyogenes* (ATCC 1915*), E. coli* (ATCC 8739), *P. aeruginosa* (ATCC 27853), *A. hydrophila* (ATCC 7966), *P. mirabilis* (ATCC 10005), *and K. pneumoniae* (ATCC 13883)	Disruption of preformed biofilm	86
Extracts of *Cinnamomum zeylandicum* (t*rans*-cinnamaldehyde); *Eugenia caryophyllus* (eugenol); and *Origanum glandulosum* (carvacrol)	*C. jejuni* (NCTC 11168)	Reduction of biofilm formation. Downregulation of genes encoding for motility systems (*flaA, flaB,* and *flgA*) and expression of NapA protein required for oxidative stress response. Reduction of expression of stress response (*cosR,* and *ahpC*), cell surface modifying genes (*waaF*), expression of chaperone protein DnaK, and bacterioferritin required for biofilm formation. Reduction of preformed biofilm cells viability and loss of EPS	87
Extracts of *Cinnamomum zeylanicum* (*trans*-cinnamaldehyde); *Origanum majorana* (terpinen-4-ol)*;* and *Thymus vulgaris* (thymol)	*E. coli* (SZMC 0582), *L. monocytogenes* (SZMC 21307), *P. putida* (SZMC 291T), and *S. aureus* (SZMC 110007)	Inhibition of biofilm formation. Disappearance of three-dimensional structure of preformed biofilms	88
Extract of *Citrullus lanatus*	*P. aeruginosa, K. pneumoniaee, E. coli, S. aureus,* and *S. typhi* (clinical isolates)	Inhibition of biofilm formation	89
Extracts of *Citrullus lanatus* and *Musa paradisiaca*	*S. mutans* and *E. coli* (clinical isolate)	Reduction of biofilm formation	90
Extract of *Citrus limon*	*B. subtilis* (RSKK245)*, S. aureus* (RSKK2392), *S.* typhimurium (RSKK19), *E. faecalis* (ATCC8093)*, E. coli* (ATCC 11229), *L. monocytogenes* (ATCC 7644)*,* and *Yersinia enterocolitica*	Reduction of biofilm formation	91

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
	(NCTC11174)		
Extracts of *Citrus aurantifolia; Citrus bergamia; Citrus limon; Citrus paradisi;* and *Cymbopogon flexuosus* [32]	MSSA and MRSA (clinical isolates)	Reduction of biofilm formation, preformed biofilm cells viability and disruption of biofilm structure	92
Extract of *Citrus limonoids* [33]	*V. harveyi* (BB170, BB886, BB120, JAF483, JAF553, BNL258, and JAF548)	Anti-QS activity (inhibition of bioluminescence and influence of cell-cell signaling pathway by modulating *luxO* expression and RNA chaperone *hfq*). Reduction of biofilm formation	93
Extracts of *Citrus limonum* and *Zingiber officinale*	*Klebsiella ornithinolytica, K. oxytoca,* and *Klebsiella terrigena* (clinical isolates)	Reduction of biofilm formation	94
Extract of *Clitoria ternatea*	*P. gingivalis* (ATCC 33277)	Reduction of biofilm formation	95
Extract of *Codonopsis lanceolata*	*L. monocytogenes* (KACC 12671), *S. aureus* (KACC 10196), *S.* typhimurium (KCCM 40253), and *Shigella boydii* (KACC 10792)	Reduction of preformed biofilm cells viability	96
Extract of *Copaifera langsdorffii*	*S. pneumoniae, S. aureus, E. faecalis, S. epidermidis, Staphylococcus haemolyticus*, and *Staphylococcus capitis* (clinical isolates)	Inhibition of biofilm formation	97
Extracts of *Coriandrum sativum; Mentha piperita;* and *Pimpinella anisum* [34]	*S. aureus* (CCUG 4151) and *E. coli* (CCUG 17620)	Inhibition of biofilm formation and cell adhesion. Reduction of preformed biofilm cells viability	98
Extracts of *Coriandrum sativum; Ribes nigrum;* and *Sambucus nigraflower* [35]	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation	99
Extract of *Cotinus coggygria* [36]	*S. aureus* (ATCC 4330, ATCC 29213, and clinical isolate)	Eradication of preformed biofilms	100
Extract of *Couroupita guianensis* (indirubin)	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation	101
Extract of *Croton nepetaefolius* (casbane diterpene)	*S. mutans* (clinical isolate)	Inhibition of biofilm formation	102
Extract of *Croton nepetaefolius* (casbane diterpene)	*P. fluorescens* (ATCC 13525), *P. aeruginosa* (ATCC 10145 and CGCT111), *K. oxytoca (*ATCC 13182), *K. pneumoniae* (ATCC 11296), *E coli*	Reduction of biofilm formation and interference with the preformed biofilms	103

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
	*(*K12 MG 1655 and CECT 434), *S. epidermidis* CECT231 and CECT4183), and *S. aureus* (ATCC)		
Extract of *Cucurbita pepo*	S. pyogenes (clinical isolate)	Reduction of biofilm formation	104
Extracts of *Cuminium cymium; Curcuma longa; Elettaria cardamomum; Murraya koenigii* [37], *Myristica fragrans; Trigonella foenum graceum;* and *Zingiber officinale*	*P. aeruginosa* PAO1 *P. fluorescens* (MTCC 9856), *Pseudomonas fragi* (MTCC 2458), *P. putida* (MTCC 10510), *Psedomonas lundensis* (MTCC 4392), *Pseudomonas psychrophila* (PSPF19), *C. violaceum* (CV12472, CVO26, and CV31532)	Anti-QS activity (inhibition of violacein, pyocyanin, and pyoverdin production). Reduction of biofilm formation and inhibition of cell adhesion, and swimming, swarming, and twitching motilities. Decrease of preformed biofilm metabolic activity and EPS production	105
Extract of *Cuminum cyminum* (methyl eugenol; lauric acid; linalool; and capric acid)	*C. violaceum* (ATCC 12472), *P. aeruginosa* PAO1, *P. mirabilis* (ATCC 7002), and *S. marcescens* (clinical isolate)	Anti-QS activity (inhibition of violacein production, interference with AHL activity (3-oxo-C12-HSL)). Reduction of biofilm formation, biomass, EPS production, swimming, and swarming motilities	106
Extract of *Curcuma longa*	*P. aeruginosa* and *S. aureus* (clinical isolates)	Reduction of biofilm formation and cell adhesion	107
Extract of *Curcuma longa* [38]	*S. mutans* (ATCC 25175)	Inhibition of biofilm formation and cell adhesion	108
Extracts of *Lagerstroemia speciosa* (trimethyl(4-(2-methyl-4-oxo-2-pentyl) phenoxy) silane; cyclotrisiloxane; hexamethyl and 2-propanol-1- methoxy)	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation and absence of extracellular matrix structure	109
Extract of *Cymbopogon citratus* and *Rosmarinus officinalis*	MRSA (clinical isolate)	Reduction of biofilm formation. Synergistic antibiofilm activity of *C. citrates* and *R. officianalis*	110
Extracts of *Cynodon dactylon; Pisonia alba;* and *Plumeria alba*	*S. aureus, S. typhi*, *P. aeruginosa* (clinical isolates), and *C. violaceum* (MTCC 2656)	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation	111
Extracts of *Cytinus hypocistis* and *ruber*	*S. epidermidis* (ATCC 35984)	Reduction of biofilm formation	112
Extract of *Dendrophthoe falcata* [39]	*A. hydrophila* (ATCC 7966), *C. violaceum* (ATCC 12472), and *V. harveyi* (MTCC 3438)	Anti-QS activity (inhibition of violacein activity). Inhibition of biofilm formation and disintegration of biofilm architecture	113
Extract of *Diocleinae* subtribe (*Canavalia ensiformis, Canavalia maritima* and *Canvalia boliviana)*	*S. mutans* (UA 159)	Reduction of biofilm formation	114

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extracts of *Dolichos lablab; Epimedium brevicornum* (icariin); *Malus pumila*; *Polygonum cuspidatum* (resveratrol); and *Rhodiola crenulata* (salidroside)	*P. acnes* (clinical isolate)	Reduction of biofilm formation and metabolic activity	115
Extracts of *Dorycnium herbaceum* and *Melilotus albus*	*P. aeruginosa* (ATCC 27853 and clinical isolate)	Reduction of biofilm formation	116
Extract of *Dracaena draco* [40]	*S. aureus* (ATCC 25923) and *S. epidermidis* (RP62A)	Reduction of biofilm formation and cell adhesion	117
Extracts of *Echinacea angustifolia; Mentha piperita; Rosmarinus officinalis; Thymus vulgaris;* among others [41]	*L. monocytogenes* (ATCC 19111 and clinical isolate)	Inhibition of cell attachment. Reduction of metabolic activity of preformed biofilm cells	118
Extract of *Elaeagnus rhamnoides* (ellagic acid; epicatechin; quercetin; and ursolic acid)	*S. aureus* (ATCC 43300 and clinical isolate)	Reduction of biofilm formation and cell adhesion	119
Extract of *Elletaria cardamomum* [42]	*E. coli* O157:H7 and *S.* typhimurium JSG 1748	Reduction of biofilm formation	120
Extract of *Empetrum nigrum*	*S. typhi, P. aeruginosa, P. fluresence, Proteus vulgaris, P. mirabilis, K. pneumoniae, Enterobacter aerugenes, Acinetobacter,* and *E. coli* (clinical isolates)	Reduction of biofilm formation. Inhibition of cell adhesion, and swarming motility	121
Extracts of *Enantia chlorantha*	*E. coli* (clinical isolate)	Inhibition of biofilm formation	122
Extract of *Enydra fluctuans* [43]	*P. aeruginosa* (ATCC 27853 and clinical isolate), *E. coli* (ATCC 25922 and clinical isolate), and *Salmonella enteritidis, S. typhi, Salmonella paratyphi, S. flexneri, V. cholerae*, and *S. aureus* (clinical isolates)	Anti-QS activity (interaction with LasR protein) and reduction of biofilm formation	123
Extract of *Equisetum hyemale*	*P. aeruginosa* PAO1	Reduction of biofilm formation	124
Extract of *Erythrina poeppigiana*	*S. aureus* (ATCC 25923) and *K. pneumoniae* (ATCC 70603)	Reduction of biofilm formation and cell adhesion. Disruption of preformed biofilm	125
Extract of *Eucalyptus globulus*	*S. aureus* (ATCC 6538 and clinical isolate) and *C. violaceum* (ATCC 12472)	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation and inhibition of swarming motility and cell adhesion. Eradication of preformed biofilms	126

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extracts of *Eucalyptus camaldulensis* and *Liquidamber orientalis* [44]	*P. aeruginosa* PAO1	Reduction of biofilm formation and swarming motility	127
Extracts of *Eucalyptus globulus methanol* and *Juglans regia*	*S. aureus* (ATCC 25923 and clinical isolate)	Reduction of biofilm formation and cell adhesion. Disruption of preformed biofilm. The combinations of extracts were revealed to be slightly more effective but neither additive nor synergistic effects were observed	128
Extract of *Eucalyptus sideroxylon* flowers [45]	*S. aureus* (ACL51, MRSA, and clinical isolate) and *P. aeruginosa* (ATCC 27853)	Inhibition of biofilm formation	129
Extract of *Eugenia brasiliensis* [46]	*Lactobacillus acidophilus* (ATCC 4356)	Reduction of preformed biofilm cells viability	130
Extract of *Euodia ruticarpa* [47]	*C. jejuni* (NCTC 11168)	Anti-QS activity (inhibition of AI-2). Reduction of biofilm formation and cell adhesion	131
Extract of *Euphorbia hirta* [48]	*P. aeruginosa* (ATCC 27853 and clinical isolate) and *E. faecalis* (ATCC 29212)	Inhibition of biofilm formation and cell adhesion. Eradication of preformed biofilm	132
Extract of *Ficus benjamina var. comosa*	*P. aeruginosa, E. coli,* and *B. cereus*	Reduction of biofilm formation	133
Extract of Ficus natalensis	*E. coli* (ATCC 35218), *S. aureus* (ATCC 43300) and *P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation and cell adhesion	134
Extract of *Ficus Sansibarica* [49]	*E. coli* (ATCC 29922 and ATCC 35218) and *S. aureus* (ATCC 29213 and ATCC 43300)	Reduction of biofilm formation and cell adhesion	135
Extract of Galla Rhois (methyl gallate and gallic acid)	*S. mutans* Ingbritt	Reduction of biofilm formation and cell adhesion	136
Extract of *Garcinia mangostana*	*S. mutans* (ATCC 25175) *and P. gingivalis* (ATCC 33277)	Inhibition of preformed biofilm growth	137
Extract of *Garcinia mangostana* (α-mangostin)	*S. mutans* (UA159)	Reduction of preformed biofilm cells viability and inhibition of biofilm cell glycolysis	138
Extract of *Ginkgo biloba* (GBSPII-1)	*S. aureus* (CVCC1882)	Reduction of biofilm formation and inhibition of *ica*A, *ica*B, *ica*C, and *ica*D gene expression (reduction of PIA secretion)	139
Extract of *Ginkgo biloba* (ginkgoneolic acid)	*S. mutans* (ATCC 25175)	Inhibition of biofilm formation, acid production, and cell adhesion. Reduction of preformed biofilm development and disruption of biofilm integrity	140
Extract of *Ginkgo biloba* and ginkgolic acids	*E. coli* (157:H7 (ATCC 43894 and ATCC43894) and K-12 (BW 25113)), MSSA (ATCC 25923 and ATCC 6538), and MRSA (ATCC BAA 1707)	Inhibition of biofilm formation and reduction of swarming motility and fimbriae formation. Downregulation of curli genes and prophage genes	141

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Glycine max* and *Juglan regia*	*P. aeruginosa, Pseudomonas minosa, Pseudomonas maltophila, K. pneumoniae, K. oxytoca, Klebsiella granulomatis* (clinical isolates)	Inhibition of biofilm formation and cell adhesion. Reduction of cell surface hydrophobicity	142
Extract of *Glycyrrhiza glabra* (licoricone; glycyrin; and glyzarin)	*A. baumannii* (clinical isolate, ATCC 19606, and ATCC 17978) and *A. tumefaciens* A136	Anti-QS activity (downregulation of expression of AI synthase gene (*abaI)*). Reduction of biofilm formation and twitching motility	143
Extract of grapefruit seed	*S. aureus* (clinical isolate) and *E. coli* (O157:H4 FRIK 125 and ATCC 25922)	Inhibition of biofilm formation. Alteration in the cell surface hydrophobicity and cell aggregation. Reduction of cell adhesion, EPS production, swimming, and swarming motilities. Degradation of preformed biofilm	144
Extract of *Hakea sericea*	S. aureus (ATCC 25923 and clinical isolate) and MRSA (clinical isolate)	Reduction of biofilm formation	145
Extracts of *Halimeda gracilis* and *Sargassum wightii* [50]	*P. aureginosa, E. coli,* and *V. parahaemolyticus*	Reduction of biofilm formation. Metal chelation activity	146
Extract of *Hamamelis virginiana* (cerium nitrate, chitosan and hamamelitannin)	*S. aureus* (ATCC 29213 and clinical isolate), *S. epidermidis* (ATCC 155 and clinical isolate), and *A. baumannii* (ATCC 19606 and clinical isolate)	Reduction of biofilm cells metabolic activity	147
Extracts of *Hamamelis virginiana; Juglans regia; Persea americana; Pfaffia paniculata;* and *Rosmarinus officinalis*	*K. pneumoniae* (MDR (367725,386546,400381) and ATCC 4352))	Reductions of biomass and metabolic activity of preformed biofilm	148
Extract of *Helichrysum italicum* [51]	*S. epidermidis* (ATCC 35984)	Reduction of biofilm formation	149
Extract of *Helicteres isora* [53]	*B. cereus* (PTCC 1015), *B. subtilis* (PTCC 1720), *S. aureus* (PTCC 1112), and *Staphylococcus* saprophyticus (PTCC 1440)	Prevention of biofilm formation and reduction of cell adhesion. Removal of preformed biofilms	150
Extracts of *Hemidesmus indicus; Hydnocarpus laurifolia;* and *Pongamia pinnata*	*Pseudomonas alcaligenes* (MN689677), *Enterobacter xiangfangensis* (MN689678) and *Bacillus paralicheniformis* (MN689683)	Reduction of biofilm formation	151
Extract of *Herba patriniae*	*P. aeruginosa* (PAO1, pMS402, pKD-pslM, pKD-pelA, pKD-algU, pKD-ppyR, pKD-algA, and pKD-bdlA)	Reduction of biofilm formation and inhibition of several key genes involved in this process (*algU*, *algA*, *pslM*, and *bdlA*). Decrease in EPS production and alteration of biofilm structure. Promotion of swarming motility	152
Extract of *Hibiscus rosa sinensis* (luteolin; myricetin; naringenin; and protocatechuic acid)	*H. pylori* (ATCC 51932)	Reduction of biofilm formation	153

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Hibiscus sabdariffa* [54]	MRSA clinical isolate	Inhibition of biofilm formation	154
Extract of *Hibiscus tiliaceus*	*P. aeruginosa*	Reduction of biofilm formation	155
Extract of *Humulus lupulus* (gallic acid; resveratrol; and rutin)	*S. aureus (ATCC 29213 and clinical isolate), S. epidermidis (ATCC 12228 and clinical isolate),* and *Cutibacterium acnes (ATCC 11827)*	Inhibition of biofilm formation	156
Extract of *Hymenocallis littoralis* [55]	*S. aureus* (NCIM 2654)	Reduction of biofilm formation, cell adhesion (interaction with Sortase A and Als3), and ROS production	157
Extract of *Hypericum brasiliense*	MRSA (clinical isolate)	Reduction of biofilm formation and preformed biofilm mass	158
Extract of *Hypericum perforatum* (hypericin; hyperforin; isomer of adhyperforin; isomer of furohyperforin; and isomers of octadecadienoic acid)	*S. aureus* (agr P3-YFP strains, UAMS-1 and UAMS-929)	Anti-QS activity (interaction with agr system). Inhibition of biofilm formation	159
Extract of *Hyptis suaveolens* [56]	*E. coli* (ATCC10536), *P. mirabilis* (ATCC 7002), *K. pneumoniae* (ATCC 10031), *P. vulgaris* (ATCC 49132), *S. marcescens* (clinical isolate), *and C. violaceum* (ATCC 12472)	Anti-QS activity (inhibition of prodigiosin, violacein, and protease production). Inhibition of biofilm formation and reduction of swimming and swarming motility	160
Extracts of *Iris* species [57]	*S. aureus* (ATCC 25923), *P. aeruginosa* (CCM 3955), *S. gordonii* (DSMZ 6777), *Veillonella parvula* (DSMZ 2008), *F. nucleatum* (DSMZ 15643), *and Actinomyces naeslundii* (DSMZ 43013)	Anti-QS activity (inhibition of homoserine lactones-mediated luminescence production responding to AI-1 and AI-2 systems). Reduction of formation, cell adhesion, and preformed biofilm mass	161
Extract of *Isodon rubescens* (rubesanolides C–E)	*S. mutans* (UA159)	Reduction of biofilm formation	162
Extract of *Juglans regia* [58]	*S. epidermidis, S. haemolyticus, Staphylococcus hominis, S. capitis, Staphylococcus xylosus, Staphylococcus cohniiand,* and *S. saprophyticus*	Inhibition of biofilm formation and reduction of preformed biofilm cells viability	163
Extract of *Juglans regia*	*S. aureus (ATCC 25923), S. epidermidis (CIP 106510), E. faecalis (ATCC 29212), M. luteus (NCIMB 8166), L. monocytogene (ATCC 19115), B. cereus (ATCC 14579), S.* typhimurium	Reduction of biofilm formation and preformed biofilms metabolic activity	164

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
	(ATCC 14028), E. coli (ATCC 35218), Vibrio alginolyticus (ATCC 33787), V. paraheamolyticus (ATCC 17802), and *P. aeruginosa (ATCC 27853).*		
Extracts of *Juniperus communis var. communis; Juniperus communis var. saxatilis Pall.; Juniperus drupacea* Labill.*; Juniperus oxycedrus* subsp. *Macrocarpa;* and *Juniperus oxycedrus* subsp. *oxycedrus*	*S. aureus* (ATCC 6538P)	Inhibition of biofilm formation. Metal chelation activity (ferrous ions)	165
Extracts of *Juniperus communis var. communis; Juniperus communis var. saxatilis Pall.; Juniperus drupacea* Labill.*; Juniperus oxycedrus* subsp. *macrocarpa;* and *Juniperus oxycedrus* subsp. *oxycedrus*	*S. aureus* (ATCC 6538P and clinical isolate)	Reduction of biofilm formation, cell adhesion, and preformed biofilm mass	166
Extract of *Kaempferia pandurata* (panduratin A)	*S. mutans* (ATCC 25175) and *S. sanguis* (ATCC 10556)	Reduction of biofilm formation and preformed biofilm cells viability	167
Extract of *Kalanchoe blossfeldiana* (quercetin and quercetin 3-O-*β*-D-glucoside)	*P. aeruginosa* (MTCC 2453)	Anti-QS activity (inhibition of prodigiosin and protease production and reduction of AHL levels). Reduction of biofilm formation, biofilm thickness, and flagella-mediated swarming motility. Disruption of preformed biofilms and inhibition of EPS production	168
Extract of *Kalanchoe pinnata* (quercetin and rutin)	*E. coli* (EAEC 042)	Reduction of biofilm formation	169
Extract of *Lagenaria siceraria*	*P. aeruginosa* (ATCC 27853), *E. coli* (ATCC 35218), *S. aureus* (ATCC 25923), *S. pyogenes* (ATCC 19615)*, and S. pneumoniae* (ATCC 6303)	Reduction of biofilm formation	170
Extracts of *Larrea divaricata; Lycium chilense*; *Schinus fasciculatus; Tagetes minuta;* and *Tessaria absinthioides*	*Bacillus* and *Staphylococcus* genera (clinical isolates)	Reduction of biofilm formation and cell adhesion	171
Extract of *Laurus nobilis* [59]	*S. aureus* (ATCC 6538 and clinical isolate)	Inhibition of cell adhesion. Reduction of biomass and metabolic activity of preformed biofilm	172
Extract of *Laurus nobilis* (alginate; laminaran; and fucoidan)	*S. epidermidis* (CIP 444)	Reduction of preformed biofilm mass	173

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Lavandula angustifolia* [60]	*C. jejuni* (NCTC 11168)	Reduction of biofilm formation, cell adhesion and motility mechanisms. Downregulation of genes important for biofilm formation. Degradation of preformed biofilm	174
Extract of *Lawsonia inermis*	MRSA (isolate from bovine mastitis)	Reduction of biofilm formation	175
Extracts of licorice root; purple coneflower flower; purple coneflower stem; sage leaves; and slippery elm inner bark [61]	*S. pyogenes* (ATCC 19615, ATCC 49399, and clinical isolate)	Reduction of biofilm formation, biofilm cells and alterations in the morphology of biofilm	176
Extract of *Limonia acidissima*	*A. hydrophila* (clinical isolate)	Reduction of biofilm formation, swimming and swarming motilities, and metabolic activity	177
Extract of *Linum usitatissimum*	*E. coli, K. pneumonia, S. aureus,* and *P. aeruginosa (clinical isolates)*	Reduction of preformed biofilm mass	178
Extract of *Lonicera caerulea* var. *emphyllocalyx*	*S. pyogenes* (clinical isolate)	Reduction of biofilm formation and cell surface hydrophobicity	179
Extract of *Macleya cordata* (A2-phosphatidyl choline; chelerythrine; dihydroxybenzofuran; pro-anthocyanidin; sanguinarine)	*S. aureus* (ATCC 6538P) and *S. epidermidis* (ATCC 35984)	Reduction of biofilm formation	180
Extracts of *Mangifera indica* [62]	*P. aeruginosa* PAO1, *A. hydrophila* (WAF38), and *C. violaceum* (12472, CV31532, and CVO26)	Anti-QS activity (reduction of violacein, elastase, protease, pyocyanin, and chitinase production). Inhibition of biofilm formation and reduction of EPS production, and swarming motility	181
Extract of *Mangifera indica* (methyl gallate)	*P. aeruginosa*, *S. aureus* and *E. coli* (clinical isolates)	Disruption and inhibition of biofilm formation	182
Extract of *Malva sylvestris* [63]	*P. aeruginosa (ATCC 9027), E. coli (ATCC 10536), K. pneumoniae (ATCC 10031), S. aureus (ATCC 29737),* and *E. faecalis (ATCC 29212)*	Reduction of biofilm formation	183
Extracts of *Matayba oppositifolia* and *Spondias purpurea*	*S. aureus* (MRSA ATCC 43300)	Inhibition of biofilm formation	184
Extract of *Matricaria chamomilla*	*S. mutans* (ATCC 25175 and clinical isolate), *Lactobacillus sp., Streptococcus sobrinus* (clinical isolates)	Reduction of biofilm formation, biofilm thickness, viability cells, and EPS biovolum	185
Extracts of *Matricaria recutita* and *Melissa officinalis* [64]	*S. mutans* (LMG 14558T) and *S. sobrinus* (LMG 14641)	Reduction of biofilm formation and cell adhesion	186

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Melastoma malabathricum*	*S. mutans* (ATCC 25175)	Reduction of biofilm formation and cell adhesion. Leakage of bacterial contents	187
Extract of *Melastoma malabathricum* (8-methyl-1-undeceneh; exanoic acid; propanenitrile; and 1-decene)	*S. mutans* (ATCC 25175)	Reduction of biofilm formation and cell adhesion	188
Extract of *Melocactus zehntneri* (uronic, glucuronic ursolic, and oleanolic acids)	*S. epidermidis* (70D MRSE)	Reduction of biofilm formation and reduction of preformed biofilm maas. Ferric and iron chelating activity	189
Extract of *Mentha piperita* [65]	*P. aeruginosa* PAO1, *A. hydrophila* (WAF38), E. coli (pEAL08-2 and MG4/pKDT17), and *C. violaceum* (CV026)	Anti-QS activity (interaction with LasR and decrease the AHL levels; inhibition of Las and pqs QS systems; reduction of violacein, LasB Elastase, protease, and chitinase production/activity). Reduction of biofilm formation and swarming motility and inhibition of EPS production	190
Extract of *Mentha piperita*	*S. aureus* (MU 38, MU 40, MU 46, MU 47), *S. epidermidis* (MU 30), *P. aeruginosa* (MU 187, MU 188, MU 189), *P. fluorescens* (MU 180, MU 181)	Reduction of biofilm formation	191
Extract of *Mentha piperita* (menthol)	*B. subtilis* and *P. aeruginosa*	Reduction of preformed biofilm mass	192
Extract of *Mentha pulegieum* [66]	*A. baumannii* (clinical isolate)	Reduction of biofilm formation and damage of biofilm structure. Eradication of preformed biofilm and reduction of metabolic activity	193
Extract of *Mitracarpus frigidus*	*S. aureus* (ATCC 33591 and ATCC 33592) and *S. pyogenes* (ATCC 10096)	Reduction of biofilm formation and cell adhesion. Disruption of preformed biofilm and alteration of biofilm matrix composition (reduction of carbohydrate and protein contents)	194
Extracts of *Monodora myristica* and *Xylopia aethiopica* [67]	*S. aureus* (ATCC 25923), *E. coli* (ATCC 25922), *C. violaceum* (CV12472) and *P. aeruginosa* PAO1	Anti-QS activity (inhibition of violacein, cholinesterase, tyrosinase, and urease production/activity). Reduction of biofilm formation and inhibition of swimming and swarming motilities	195
Extract of *Montrichardia linifera*	*S. aureus* (ATCC 29213)	Reduction of biofilm formation and cell adhesion	196
Extract of *Moringa oleifera*	*S. aureus* (ATCC 25923 and isolates from the dairy industry)	Inhibition of biofilm formation and the polysaccharide slime production. Reduction of preformed biofilms cells viability	197
Extracts of *Moringa oleifera*	*B. subtilis (*JS-2004) and *E. coli* (ATCC 25922)	Reduction of biofilm formation	198
Extract of *Moringa oleifera*	*S. aureus* (MTCC 740) *and P. aeruginosa* (MTCC 741)	Reduction of biofilm formation and cell adhesion. Disruption of preformed biofilms and reduction of metabolic activity	199

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extracts of *Moringa oleifera* and *Rosmarinus officinalis* [68]	*S. aureus* (clinical isolate)	Reduction of biofilm formation and cell adhesion	200
Extract of *Morus alba*	*S. mutans* (MTCC 1943 and clinical isolate) and *S. sanguinis* (clinical isolate)	Reduction of biofilm formation, dry weight, and EPS content	201
Extracts of *Morus alba* and *Vitis vinifera* (gallic; coumaric; ferulic; chlorogenic; and caffeic)	*S. aureus, P. aeruginosa, E. coli,* and *S. typhi*	Reduction of biofilm formation	202
Extract of *Musa acuminata* (5-hydroxymethylfurfural; among others [69])	*P. aeruginosa* PAO1 (wild-type strain)	Anti-QS activity (downregulation of expression of *lasI, rhlR, rhlI,* and *lasR* genes and inhibition of virulence production such as protease, LasA protease, LasB elastase, pyocyanin, alginate, and rhamnolipid production). Reduction of biofilm formation, cell adhesion, and cell surface hydrophobicity. Inhibition of biofilm proteins production and EPS production. Disruption of preformed biofilms	203
Extract of *Mussaenda roxburghii* (2*α*,3*β*,19*α*,23-tetrahydroxyurs-12-en-28-oic acid; *β*-sitosterol glucoside; lupeol palmitate; and myoinositol)	*P. aeruginosa* (MTCC 2488)	Anti-QS activity (Interference with LasR, PilB, PilY1, and PilT proteins). Reduction of biofilm formation, swarming motility, and EPS production	204
Extract of *Myrtus communis* (myrtenol)	*S. aureus* (clinical isolate)	Inhibition of biofilm formation	205
Extract of *Myrmecodia pendans*	*S. mutans* (ATCC 25175)	Reduction of biofilm formation and preformed biofilm mass	206
Extract of *Najas minor* [70]	*E. coli* (ATCC 25922), *P. mirabilis* (clinical isolate), and *P. aeruginosa* (ATCC 27853 and clinical isolate).	Reduction of biofilm formation	207
Extract of *Nerium oleander* [71]	*P. aeruginosa*	Reduction of biofilm formation and metabolic activity	208
Extract of *Nocardiopsis*	*P. mirabilis* BDUMS 2 (KY617769), *E. coli* BDUMS 3 (KY617770), *C. violaceum* (ATCC 12472)	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation and cellular disruption in biofilm architecture	209
Extract of *Nymphaea alba* [72]	*S. aureus* (ATCC 6538 and clinical isolate)	Reduction of biofilm formation	210
Extract of *Ocimum tenuiflorum* (eugenol; linalool; among others [73])	*P. aeruginosa* (ATCC 10145)	Anti-QS activity (interaction with lasA and lasB proteins, reduction of AHL levels, and decrease of pyocyanin, rhamnolipid, LasA and LasB production). Reduction of biofilm formation, swarming motility, and the protein and	211

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
		carbohydrate content of EPS. Inhibition of DNA and RNA genomic content	
Extract of Oregano and thyme red oil (carvacrol; linalool; thymol; among others [74])	*E. coli* 6:H1 CFT073 (ATCC 700928)	Reduction of biofilm formation, fimbriae formation, and swarming motility	212
Extract of *Origanum haussknechtii* [75]	*P. aeruginosa* (ATCC 27853), *S. aureus* (ATCC 29213), and *E. coli* (ATCC 25922)	Reduction of biofilm formation	213
Extracts of *Origanum heracleoticum; Origanum vulgare; Thymus vulgaris and Thymus serpyllum* (carvacrol; thymol; among others [76])	*S. enteritidis* (clinical isolate)	Inhibition of biofilm formation, eradication of preformed biofilms, and reduction of metabolic activity	214
Extracts of *Origanum vulgare; Salvia officinalis, Syzygium aromaticum;* and *Zingiber officinale* [77]	*S. pyogenes* (ATCC 19615, ATCC 49399, and clinical isolate)	Reduction of biofilm formation. Eradication of preformed biofilms, alteration in morphological of biofilm, and reduction of metabolic activity	215
Extract of *Penstemon centranthifolius* (4‴-O–acetylverbascoside and verbascoside)	*E. coli* (UTI 189)	Reduction of biofilm formation	216
Extract of *Pericarpium Citri Reticulatae* (methyl N-methylanthranilate)	*P. aeruginosa* (ATCC 9027)	Anti-QS activity (reduction of pyocyanin, elastase, rhamnolipid production/activity, interference with the LasI-OdDHL-LasR, RhlI-BHL-RhlR and PqsA-PQS-PqsR QS systems and suppression of QS and Biofilm formation related genes (*rhlR; rhlI; lasB; lasI; lasR; pqsR; rhlAs; pqsA; lasA; pslA; chiC;* and *pelF*)). Reduction of biofilm formation and increases in ROS production	217
Extract of *Phaleria macrocarpa*	*S. mutans*	Reduction of biofilm formation and cell adhesion	218
Extract of *Phyllanthus emblica*	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation and cell adhesion	219
Extract of *Piper betle*	*V. harveyi* (MTCC 3438)	Anti-QS activity (inhibition of bioluminescence). Reduction of biofilm formation, cell adhesion, and EPS production. Disruption of architecture of biofilms and inhibition of swimming motility	220
Extract of *Piper betle*	*P. aeruginosa* PAO1 (MTCC 3541)	Anti-QS activity (inhibition of pyocyanin production). Reduction of biofilm formation and swarming, swimming, and twitching motilities	221
Extract of *Piper betle* [78]	*S. marcescens* (clinical isolate)	Anti-QS activity (inhibition of prodigiosin, protease, and lipase production, and downregulation of expression of *fimA, fimC,* and flhD (fimbrial genes) *bsmA* and *bsmB* (C4-HSL mediated QS genes)). Reduction of biofilm formation and inhibition of swarming motility, EPS production, and cell surface hydrophobicity	222

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Piper betle* (4-chromanol and eugenol)	*S. mutans* (ATCC 25175) and *Aggregatibacter actinomycetemcomitans* (ATCC 33384)	Inhibition of biofilm formation and eradication of preformed biofilm	223
Extract *of Piper marginatum* [79]	*E. faecalis* (ATCC 29212), *S. sanguinis* (ATCC15300), *S. aureus* (ATCC6538), *E. coli* (ATCC8739), *S. enterica* (ATCC13076), *P. aeruginosa* (ATCC9027).	Reduction of biofilm formation	224
Extract of *Piper regnellii* (conocarpan; eupomathenoid-5; and eupomathenoid-6)	*S. aureus* (ATCC 25923), MRSA, and MSSA (clinical isolates)	Reduction of biofilm formation, cell adhrence and preformed biofilm metabolic activity	225
Extract of *Pistacia atlantica* [80]	*S. aureus* (ATCC 6538) and *P. aeruginosa* (ATCC 9027)	Reduction of biofilm formation	226
Extract of *Pittosporum tetraspermum* (isosteviol)	*E. coli* (ATCC 25922), *S. typhi* (clinical isolate), and *P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation and cell adhesion	227
Extract of *Platismatia glaucia* and *Pseudevernia furfuracea* [81]	*S. aureus* (ATCC 25923) and *P.* mirabilis (ATCC 12453)	Prevention of biofilm formation	228
Extract of *Pleione maculata* (gallic acid and quercitin)	*S. aureus, K. pneumoniae*, and *P. mirabilis* (clinical isolates)	Reduction of biofilm formation and cell adhesion	229
Extract of *Plumbago rosea* (plumbagin)	*S. aureus* (ATCC 35556)	Disruption of preformed biofilm and increases of ROS production	230
Extract of *Pogostemon*	*S. pyogenes* (clinical isolate)	Reduction of preformed biofilm mass and disruption of fatty acid membrane of biofilms	231
Extract of *Polypodium vulgare*	*E. coli* CFT073 (ATCC 700928 and clinical isolate)	Reduction of biofilm formation and cell aggregation	232
Extract of *Pongamia pinnata* [82]	*S. epidermidis* (MTCC 435)	Reduction of biofilm formation and cell aggregation. Disintegration of preformed biofilm and decrease of preformed biofilm cell viability. Several alterations in the morphological organization of biofilm cells	233
Extract of *Poria cocos* and pachymic acid	*E. coli* (clinical isolate)	Reduction of biofilm formation	234
Extract of *Potentilla erecta*	*S. aureus* (CCM 4223)	Reduction of biofilm formation	235
Extract of *Potentilla* species (*Potentilla fruticosa*; among others [83])	*S. mutans* (CAPM 6067), *S. sobrinus* (CAPM 6070), and *S. sobrinus/downei* (CCUG 21020)	Reduction of biofilm formation and synthesis of insoluble glucan	236

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Potentilla visianii* [84]	*E. coli* (ATCC 25922), *S. aureus* (ATCC 25923), *S. enterica* and *B. subtilis* (ATCC 6633)	Reduction of biofilm formation and preformed biofilm mass	237
Extracts of *Prangos acaulis* [85]	*S. mutans* (PTCC 1683)	Reduction of biofilm formation and strong interactions with glucosyltransferase	238
Extracts of *Prunus avium* [86]	*P. aeruginosa* PAO1	Anti-QS activity (interference with LasR, RhlR, and PqsR QS receptors). Reduction of biofilm formation and inhibition of swarming motility	239
Extract of *Prunus avium* [87]	*Enterobacter sp.* UJA37p	Reduction of biofilm formation and preformed biofilm mass	240
Extract of *Psidium Guajava* [88]	*E. coli, K. pneumoniae, P. aeruginosa, S. marcescens, S. aureus, S. epidermidis,* and *S. pyogenes*	Reduction of biofilm formation	241
Extract of *Punica granatum*	*S. sanguinis* (ATCC 10556) and *F. nucleatum* (ATCC 25586)	Reduction of biofilm formation	242
Extract of *Punica granatum* (ellagic acid)	*S. aureus* (ATCC 11632), *S. aureus* MRSA (ATCC 33591) and *E. coli* (ATCC 10536),	Reduction of biofilm formation and disruption of preformed biofilms. Decrease in the surface area covered and the thickness of biofil	243
Extract of *Punica granatum* (malic acid; citric acid punicalagin; and ellagic acid)	*B. cereus* (ATCC 11778), *B. subtilis* (ATCC 6633), and *E. faecalis* (ATCC 29212)	Reduction of biofilm formation	244
Extracts of *Punica granatum; Rosmarinus officinalis;* and *Tetradenia riparia*	*S. aureus* (ATCC 29213), MRSA (clinical isolate), and MSSA (clinical isolate)	Reduction of preformed biofilm cells viability and disruption of biofilm structure	245
Extract of *Quercus cerris*	*S. aureus* and MRSA (clinical isolates)	Reduction of biofilm formation	246
Extract of *Quercus infectoria* (tannic acid)	MRSA and MSSA (clinical isolates)	Reduction of biofilm formation and alteration in cell surface hydrophobicity	247
Extract of Red wines [89]	MSSA (ATCC 25923 and ATCC 6538) and MRSA (ATCC BAA-1707)	Inhibition of biofilm formation and reduction of hemolytic activity	248
Extract of *Rhodomyrtus tomentosa*	*S. aureus* and *S. epidermidis* (clinical isolates)	Reduction of biofilm formation and preformed biofilm cell viability	249
Extract of *Rosa rugose* [90]	*C. violaceum (*CV026*), E. coli* K-12, and *P. aeruginosa* PAO1	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation and cell aggregation. Inhibition of swarming motility	250
Extract of *Rosmarinus officinalis*	*K. pneumoniae* (clinical isolate)	Reduction of preformerd biofilm mass	251
Extract of *Rosmarinus officinalis*	*B. subtilis* (ATCC 6633), *B. cereus* (RSKK 863), *S. aureus* (ATCC 25923 and clinical isolate),	Reduction of biofilm formation	252

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
	P. aeruginosa (ATCC 29212, ATCC 27853, and clinical isolate), *S. epidermidis* (clinical isolate), and *P. fluorescens* (clinical isolate)		
Extract of *Rosmarinus officinalis* (1,8-cineole)	*E. coli* (clinical isolate)	Reduction of preformed biofilm cell viability	253
Extracts of *Rosmarinus officinalis; Satureja montana;* and *Thymus vulgaris* [91]	*S.* typhimurium (ATCC 1408, LT2 DT104, and clinical isolate)	Reduction of biofilm formation, cell adhesion and biofilm metabolic activity	254
Extract of *Rubus ulmifolius* [92]	*S. aureus* (clinical isolate)	Reduction of biofilm formation and cell adhesion	255
Extract of *Ruellia patula* [93]	*S. aureus* (MTCC 96) and *P. aeruginosa* (MTCC 4673)	Reduction of biofilm formation and cell adhesion	256
Extract of *Rumex dentatus* [94]	*P. aeruginosa* (ATCC 27853 and clinical isolate)	Inhibition of biofilm formation	257
Extract of *Salvadora persica* [95]	*S. capitis, S. epidermidis, Staphylococcus heamolyticus, S. hominis, Staphylococcus warneri, S. xylosus, S. saprophyticus*, *S. aureus* (ATCC 25923), *P. aeruginosa* PAO1, and *C. violaceum* (ATCC 12472 and CV026)	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation and inhibition of swarming motility	258
Extract of *Salvadora persica* [96]	*S. mutans* (clinical isolate) and *C. violaceum* (ATCC 12472)	Anti-QS activity (interference with OmpP and Lux proteins) and reduction of biofilm formation	259
Extract of *Salvia austriaca* (7-(2-oxohexyl)-taxodione)	*S. aureus* (ATCC 29213)	Reduction of biofilm formation, cell adhesion, and preformed biofilm cells viability	260
Extrac of *Satureja hortensis* [97]	*Prevotella nigrescens* (AHN 8293)	Reduction of biofilm formation	261
Extracts of *Satureja hortensis* and *Thymus daenensis* [98]	*S. aureus* (ATCC 25923 and clinical isolate)	Anti-QS activity (downregulation of *hld* gene expression). Reduction of biofilm formation and disruption of preformed biofilm	262
Extract of *Scorzonera mackmeliana* (coumarin)	*S. epidermidis* (CIP 444)	Reduction of biofilm formation and biofilm eradication	263
Extract of *Scutia buxifolia* [99]	*S. aureus* (ATCC 25923)	Reduction of biofilm formation	264
Extract of *Securidaca longepedunculata*	*P. aeruginosa* PAO1 and *C. violaceum* CV026	Anti-QS activity (reduction of violacein production) and reduction of biofilm formation	265

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Senna siamea*	*E. coli* (WDCM 00013 and clinical isolate)	Reduction of preformed biofilm mass and cell adhesion	266
Extract of *Sesbania grandiflora*	*V. cholerae* (ITDI 0063)	Reduction of biofilm formation	267
Extract of *Sesbania grandiflora*	*S. aureus*	Reduction of biofilm formation, protein, and carbohydrate content of EPS	268
Extract of *Sophora alopecuroides* [100]	*S. epidermidis* (ATCC 35984, BF^{+})	Reduction of biofilm formation	269
Extract of *Sterculia lychnophora*	*S. mutans* (ATCC 25175)	Reduction of biofilm formation and pH-induced by *S. mutans*	270
Extract of *Symplocos racemosa* (symploquinones)	*S. mutans* (ATCC 25175), *S. aureus* (ATCC 4330) and *P. mirabilis* (ATCC 12453)	Reduction of biofilm formation	271
Extract of *Taraxacum Officinale* [101]	*S. aureus* (ATCC 25923)	Reduction of biofilm integrity. Leakage of intracellular electrolytes including K^{+}, Ca^{2+}, Na^{a+}	272
Extract of *Tephrosia purpurea* [102]	*Lactobacillus casei, S. mutans, S. aureus* and *k. pneumoniae* (clinical isolates)	Reduction of biofilm formation	273
Extract of *Terminalia arjuna* (baicalein and quercetin)	*E. coli* (ATCC 8739) and *S. aureus* (ATCC 6538)	Inhibition of biofilm formation and disruption of preformed biofilm. Alteration of biofilm architecture and reduction of cell adhesion	274
Extract of *Terminalia bellerica*	*S. mutans* (MTCC 890)	Inhibition of biofilm formation and reduction of cell adhesion	275
Extract of *Terminalia catappa*	*P. aeruginosa* (ATCC 10145), *C. violaceum* (JCM 1249 and CV026 (NCTC 13278))	Anti-QS activity (inhibition of violacein production) and reduction of biofilm formation and maturation	276
Extract of *Teucrium polium* [103]	*S. aureus* (AH133-GFP)	Inhibition of biofilm formation	277
Extracts of Thai Herbal recipes [104]	*P. aeruginosa* (ATCC 10145)	Reduction of biofilm formation and eradication of preformed biofilm. Reduction of metabolic activity of preformed biofilm	278
Extracts of Thai Herbal recipes [105]	*S. epidermidis* (ATCC 35984)	Inhibition of biofilm formation and reduction of preformed biofilm mass	279
Extract of *Thymus vulgare* (thymol; carvacrol; among others [106])	*P. fluorescens* (clinical isolate) and *C. violaceum* (CV026)	Anti-QS activity (suppression/reduction of production of AHLs, motility, flagella (flgA) gene expression, violacein production, and adhesion of bacterial cells). Reduction of biofilm formation, swimming motility, and metabolic activity	280
Extracts of Torrontes wine	*P. aeruginosa* (ATCC 27853 and a strain HT5) and *S. aureus* (ATTC 6538, and a strain HT1)	Reduction of biofilm formation and metabolic activity of preformed biofilm. Metal chelation with affinity to iron	281

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Trachyspermum* ammi [107]	*S. mutans* (ATCC 700610)	Anti-QS activity (suppression of *gtfB, gtfC, gtfD, ftf, relA, spa P, vic R, smu0160,* and *gbpB* genes). Reduction of biofilm formation and cell adhesion. Disruption of accumulation and structural organization of EPS	282
Extract of *Trachyspermum ammi* ((4aS, 5R, 8aS) 5, 8a-di-1-propyl-octahydronaphthalen-1-(2H)-one)	*S. mutans* (ATCC 700610)	Reduction of biofilm formation and cell adhesion. Reduction of water-insoluble glucan synthesis and inhibition of pH reduction. Reduction of biofilm hydrophobicity	283
Extract of *Trapa natans* [108]	*P. aeruginosa* (PAO1 DSMZ, 22644, 22644, PA14, PA14-R3 (*ΔlasI* Prsal::lux), and PAO1 *ΔpqsA* (CTX lux::pqsA)) and *C. violaceum* (CV026 and PAOJP2/pKD-rhlA (*ΔrhlA* PrhlA::lux))	Anti-QS activity (inhibition of pyocyanin, violacein, and elastase production and LasR, and PqsR activity). Reduction of biofilm formation and swarming motility	284
Extract of *Trapa natans* [109]	*E. coli* (ATCC 25922), *P. mirabilis* (clinical isolate) and *P. aeruginosa* (ATCC 27853 and clinical isolate)	Reduction of biofilm formation	285
Extract of *Triumfetta welwitschii* [110]	*P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation and capsular polysaccharide and eDNA content	286
Extract of *Urginea maritima* [111]	*P. aeruginosa* (ATCC 27853, ATCC 9027, and clinical isolate) and *S. aureus* (ATCC 25923, ATCC 9144, and clinical isolate).	Reduction of biofilm formation	287
Extract of *Vaccinium macrocarpon*	*E. coli* (CFT073 and MG1655)	Reduction of biofilm formation	288
Extract of *Vaccinium virgatum* (caffeic acid; chlorogenic acid; and quercetin)	*S. epidermidis* (ATCC 35984) and *P. aeruginosa* PA14	Reduction of biofilm formation and cell adhesion	289
Extract of *Vaccinium vitis-idaea* [112]	*S. mutans* (ATCC 25175)	Reduction of biofilm formation	290
Extract of *Vernonia auriculifera* [113]	*S. aureus* (ATCC 43300), *K. pneumonia* (ATCC 700603), and *E. faecium* (ATCC 19434),	Reduction of biofilm formation and cell adhesion	291
Extracts of *Verbascum pinnatifidum* and *Verbascum antinori*	*E. coli* (NRRL B-3704), *P. aeruginosa* (ATCC 27853), *P. vulgaris* (ATCC 13315), *A. baumanii* (ATCC 19606), *B. subtilis* (ATCC 6633), *S. aureus* (ATCC 6538P), and *S. haemolyticus* (ATCC 43252)	Reduction of biofilm formation and metabolic activity	292
Extract of *Verbascum thapsus*	*S. mutans* (1683ATCC35.668), *S. sanguinis* (1449CIP53.15) and *S. salivarius* (1448CIP55)	Inhibition of biofilm formation	293

Plant extract(s)	Bacterial specie(s)	Effect(s) on biofilm and related events	Reference
Extract of *Vernonia condensata*	*S. aureus* (ATCC 25923), (ATCC 29213) and MRSA (1485279)	Reduction of biofilm formation and cells adhesion	294
Extract of *Vetiveria zizanioides* [114]	MRSA (ATCC 33591 and clinical isolate)	Reduction of biofilm formation and rupture of preformed biofilm. Inhibition of EPS and slime layer production. Downregulation of *fnbA, fnbB,* and *clfA* genes (initial cell adhesion)	295
Extract of *Viburnum foetens* (n-octacosanoic acid)	*S. mutans* (UA159)	Inhibition of biofilm formation and cell adhesion. Alteration of biofilm architecture, reduction in biofilm thickness, and disruption of cell aggregation capacity	296
Extract of *Vinca minor* (kaempferol-3-O-(6Orham-nosyl-glucoside)-7-Oglucoside; vincoside; chloro genic acid; and dihydroxybenzoic acid)	*P. mirabilis* (clinical isolate)	Reduction of biofilm formation	297
Extract of *Vitis rotundifolia* [115]	*S. aureus* (ATCC 35548, ATCC 12600-U, and ATCC 29247), *S.* typhimurium*, S. sonnei* (ATCC 259319), and *E. coli* O157:H7	Reduction of biofilm formation and eradication of preformed biofilm	298
Extract of *Vitex trifolia*	*P. aeruginosa* (clinical isolate)	Anti-QS activity (reduction of protease, elastase, and pyocyanin production). Reduction of biofilm formation and EPS production. Inhibition of swimming motility	299
Extract of *Warburgia ugandensis (*warburganal; polygodial; α-linolenic acid; and ugandenial A)	*S. epidermidis* (1457) and *S. aureus* (USA 300)	Reduction of biofilm formation and preformed biofilm mass	300
Extract of Wheat-bran	*S. aureus* (clinical isolate)	Anti-QS activity (downregulation of AHLs levels). Inhibition of biofilm formation and disruption of preformed biofilm	301
Extract of *Zingiber officinale*	*P. aeruginosa* (ATCC 27853*), P. mirabilis* (clinical isolate) and *E. coli* (ATCC 25922)	Reduction of biofilm formation	302
Extract of *Zingiber officinale* (zingiberene; β-esquiphellandrene; bisabolene; curcumene)	*P. aeruginosa* (ATCC 10145)	Reduction of biofilm formation and the eDNA production	303
Extract of *Ziziphus jujuba* (catechin; alphitolic acid gallocatechin; and quercitrin)	*S. mutans* (UA159)	Reduction of biofilm production	304
Extract of *Ziziphus nummularia*	*P. aureginosa* (ATCC 15442).	Reduction of biofilm formation	305
Extract of *Zygophyllum coccineum* [116]	S. pneumoniae (ATCC 6303), S. aureus (ATCC 29213), P. aeruginosa (ATCC 27853), and E. coli (ATCC 25922)	Prevention of biofilm formation, eradication of preformed biofilms, and increased of ROS production	306

Note: Plant extracts constituents - 1) Acetic acid; acetoacetic acid; 1,3-benzodioxole; ethanol; 6-hydroxy-7-methyl-oct-3-enedithioic acid; 25-dietheno-8H,22H-diindeno[2,1-q:1',2'-r][1,4,7,10,13]pentaoxacyclodocosin; 2-(2'-methoxyphenyl)-4,4-dimethyl-2-oxazoline; 2H-Pyran-2-one, 3-bromo-4,6-dimethyl; 1H-Indole-2,3-dione; hexaoxacyclooctadecane; cyclohexane; hexaoxacyclooctadecane; cyclohexane; dodecatrien-1-al; hexadecatetraen-3-ol; and cyclopentanol. **2)** Chlorogenic acid; caffeic acid; myricetin; apigenin; luteolin; hexanal; lavender lactone; camphor; borneol;bornyl acetate; caryophyllene oxide; 1-hexadecene; 1-octadecene; hexahydrofarnesyl acetone; hexadecanoic acid; 1-eicosene; (Z,Z)-9,12-octadecadienoic acid; (Z)-9-octadecenoic acid; tricosane; 5-methyl-5-(4,8,12-trimethyltridecyl)dihydro-2(3H)-furanone; tetracosane; eicosanyl acetate; pentacosane; hexacosane; docosyl acetate; heptacosane; octacosane; tetracosyl acetate; nonacosane; triacontane; hentriacontane; *α*-tocopherol; sesamin; octacosyl acetate; stigmasta-5,22-dien-3*β*-ol; stigmast-5-en-3*β*-ol; and *α*-amyrin. **3)** 3-Hydroxyoxolan-2-one; oxane-2,6-dione; 1,4-dimethylpiperazine; methylglyoxal; 4-hydroxy-2,5-dimethylfuran-3-one; 4-methoxyphenol; N-(3-methylbutyl)-N-pentylnitrous amide; 3,3-diethyl-1-methyldiaziridine; N-methyl-N-propan-2-ylnitrous amide; 2,3,4,5-tetrahydroxypentanal;3,5-dihydroxy-6-methyl-2,3-dihydropyran-4-one; 4-hydroxyoxolan-2-one; 3,5-dihydroxy-2-methylpyran-4-one; benzene-1,2-diol; 1-(furan-2-yl)ethane-1,2-diol; 5-(hydroxymethyl)furan-2-carbaldehyde; nonanoic acid; 4-ethenyl-2-methoxyphenol; hexyl 3-oxobutanoate; 2,6-dimethoxyphenol; 3-hydroxy-4-methoxybenzaldehyde; (2R,3R,4S,5S,6R)-2-[(2S,3S,4S,5R)-3,4-dihydroxy-2,5-bis(hydroxymethyl) oxolan-2-yl] oxy-6-(hydroxymethyl) oxane-3,4,5-triol; 2-(hydroxymethyl)-2-nitropropane-1,3-diol; 2-hydroxy-5-methylbenzene-1,3-dicarbaldehyde; 1-methoxy-3,5-dimethylbenzene; (1R,2S,3S,4R,5R)-6,8-dioxabicyclo[3.2.1]octane-2,3,4-triol; 1-(3,5-dimethoxyphenyl)ethanone; oxan-4-ol; 5,5-diethyl-1-methyl-1,3-diazinane-2,4,6-trione; 1-(4-hydroxy-3,5-dimethoxyphenyl)ethanone; 4-[(E)-3-hydroxyprop-1-enyl]-2-methoxyphenol; tetradecanoic acid;1-(2,6-dihydroxy-4-methoxyphenyl)butan-1-one; 3-methyl-1-(4-phenylbenzoyl)-2-propan-2-ylimidazolidin-4-one; 1-ethyl-2,3,4,5,6-pentamethylbenzene; ethyl hexadecanoate; (E)-3-(4-hydroxy-3,5-dimethoxyphenyl) prop-2-enal; 2-hydroxy-4-methoxy-3,5,6-trimethylbenzoic acid; henicosan-11-ylbenzene; 2,7-diphenyl-1H-indole; 2-[2-[(E)-2-[4-(dimethylamino)phenyl]ethenyl]-6-phenylpyran-4-ylidene]propanedinitrile; (3S,10S,13R,14R,17R)-17-[(2R,5S)-5,6-dimethylheptan-2-yl]-10,13-dimethyl-2,3,4,7,11,12,14,15,16,17-decahydro-1H-cyclopenta[a]phenanthren-3-ol; 4,7-dimethoxy-1,1,4a-trimethyl-8-propan-2-yl-10,10a-dihydro-9H-phenanthren-2-one; 1-chloroicosane; 3-(4-chlorophenyl)-1,2,3,4-tetrahydropyrido[1,2-a]benzimidazole-1,2-dicarboxylic acid; (E)-3,5-bis(4-hydroxyphenyl)pent-4-ene-1,2-diol; tetratetracontane; 2,6-ditert-butyl-4-diazoniophenolate; (2R,3R,11bS)-2-[(6,7-dimethoxy-3,4-dihydroisoquinolin-1-yl)methyl]-3-ethyl-9,10-dimethoxy-2,3,4,6,7,11b-hexahydro-1H-benzo[a]quinolizine; 9-dodecyl-1,2,3,4,4a,5,6,7,8,8a,9,9a,10,10a-tetradecahydroanthracene; 2-prop-1-en-2-ylpyrazine; 7-amino-4-chloro-3-(cyclohexylmethoxy)isochromen-1-one; (1R,3aS,5aR,5bR,7aR,9S,11aR,11bR,13aR,13bR)-3a-(hydroxymethyl)-5a,5b,8,8,11a-pentamethyl-1-prop-1-en-2-yl-1,2,3,4,5,6,7,7a,9,10,11,11b,12,13,13a,13b-hexadecahydrocyclopenta[a]chrysen-9-ol; hexacosane; 4,4,6a,6b,8a,11,11,14b-octamethyl-1,2,4a,5,6,6a,7,8,9,10,12,12a,14,14a-tetradecahydropicene-3,13-dione; and (4,5-dimethyl-7a-prop-1-en-2-yl-2,3,3a,5,6,7-hexahydro-1H-inden-4-yl)metanol. **4)** Oleanonic acid; 4-hydroxy cinnamic acid docosyl ester; *β*-stigmasterol; *β*-sitosterol; and D-mannitol. **5)** Protocatechuic acid; (+)-catechin; *p*-hydroxy benzoic acid; chlorogenic acid; caffeic acid; (-)-epicatechin; ferulic acid; benzoic acid; rosmarinic acid; and apigenin. **6)** Cyclohexanone; 3-hexen-1-ol; β-pinene; *p*-cymene; *trans*-pinocarveol; *trans*-pinocamphone; *cis*-pinocamphone; 2-decen-1-ol; 1-decanol; *trans*-pinocarvyl acetate; thymol; carvacrol; ethyl ester benzenepropanoic; *trans*-caryophyllene; 2-dodecen-1-ol; germacrene D; bicyclogermacrene; *trans*-nerolidol; spathulenol; caryophyllene oxide; guaiol; epi α-cadinol; 2-tetradecen-1-ol; and bulnesol. **7)** *Allamanda blanchetii*; *Melocactus zehntneri; Buchenavia tetraphylla; Jatropha mutabilis; Chamaecrista desvauxii; Chamaecrista cytisoides; Libidibia ferrea; Parkinsonia aculeata; Senna macranthera; Senna splendida; Bauhinia acuruana; Dioclea grandiflora; Myroxylon peruiferum; Piptadenia viridiflora; Sida galheirensis; Stigmaphyllon paralias; Eugenia brejoensis; Ouratea blanchetiana; Polygala boliviensis*; and *Polygala violacea*. **8)** Andrographolide; 3-methyl-2, 4, 5 -trioxol—tertbutylimidazolidine; decosandic acid and 4-dimethyl; methyl ester; cyclobuta; di thiophene octa hydro; methyl1-methyl-2-butenyl ether; ethyl N-allylcarbamate; and indolzine-3-methyl. **9)** Berberine; berbamine; oxycanthine; epigallocatechin gallate; epicatechin gallate; gallic acid; N-acyl cyclopentylamine; heptane-1,2,3-triol; conessine; neoconessine; holarrhenine; cyperone; acopaene; cyprotene; andrographolide; neoandrographolide; and andrographiside. **10)** Cumene; *α*-pinene; camphene; 6-methyl-5-heptene-2-one; *β*-pinene; o-cymene; eucalyptol (1,8 cineol); limonene; *γ*-terpinen; camphor; borneol; isogeranial; *α*-terpineol; 2-decanone or 3-decanone; N-dodecane; *δ*-elemene; neryl acetate; *β*-damascenone; decanoic acid; *α*-copaene; methyleugenol; *β*-bourbonene; *β*-elemene; *β*-caryophyllene; *β*-gurjunene; seychellene; *α*-humulene; alloaromadendren; aromadendrane <dehydro->; sesquicineole <dehydro->; sesquicineole <7-epi-1,2-dehydro->; germacrene d; *δ*-selinene; *β*-himachalene; (E,Z)-*α*-farnesene; 1,5-cycloundecadiene, 8,8-dimethyl-9-methylene; *β*-bisabolene; *γ*-cadinene; *δ*-cadinene; isoamyl salicylate; *cis*-3-hexenyl benzoate;*γ*-elemene; spathulenol; caryophyllene oxide; globulol;

isoaromadendrene epoxide; ledene oxide-(II); cubenol; cedren-3-one <2-epi-*α*>; hexenyl phenyl acetate <(3Z)->; t-cadinol; *β*-eudesmol; *α*-cadinol; edusmol <7-epi-*α*>; khusinol; *α*-bisabolol; *cis*-Z-*α*-bisabolene epoxide; nuciferol <(Z)->; farnesol <2Z,6E)->; *γ*-costol; cedryl acetate; farnesyl acetate <(2Z,6E)->; E−10-pentadecenol; pimaradiene; hexadecanoic acid; thunbergol; hexadecanoic acid, trimethylsilyl ester; heneicosane; 1,18-nonadecadien-7,10-dione; epimanool; tricosane; pentacosane. **11)** 1,19-Eicosadiene; benzenemethanol; hexanoic acid; 1-propanone; and naphthalene. **12)** Caffeoyl-hexose-hydroxyphenol; dicaffeoylquinic acid; quercetin 3-vicianoside; coumaroylquinic acid; and quercetin 3-O-glucuronide. **13)** 5-O-caffeoylquinic acid; luteolin −6-C- glucoside; luteolin −6-C- acetilglucoside; cichoric acid; luteolin-C-glucoside; cumaril exosa malic acid; and luteolin. **14)** 12,15-Octadecadiynoic acid, methyl ester; cyclohexanol,1-methyl-4-(1-methylethenyl), acetate; undecane; 2-cyclohexen-1-one, 2-methyl-5-(1-methylethen yl); bergamotol, Z-à-*trans*; diethyl phthalate; 2-furanmethanol, tetrahydro-à,à,5-trimethyl-5-(4-meth yl-3-cyclohexen-1-yl); 5,8,11,14-eicosatetraenoic acid, methyl ester, (all-Z); 2H-pyran-3-ol, tetrahydro-2,2,6-trimethyl-6-(4-methyl-3-cyclohexen-1-yl)-[3S-[3à,6à(R*)]]; E-8-methyl-9-tetradecen-1-ol acetate; 1,2-benzenedicarboxylic acid, bis(2-methylpropyl) ester; (E)-tonghaosu; pentadecanoic acid, 14-methyl, methyl ester; hexadecanoic acid; ethyl (9z,12z)-9,12-octadecadienoate; 9-octadecenoic acid; phytol; 12-methyl-e,e-2,13-octadecadien-1-ol; 1,2-benzenedicarboxylic acid; campesterol; stigmasterol; and á-sitosterol. **15)** Propanoic acid; 4-amino-4,5-dihydro-2(3H)-furanone; glycerin; 2,3-pentanedione, 4-methyl; quercetin; 1-methyl-5-oxo, methyl ester; phenol, 2-methoxy-3-(2-propenyl); phenol; 2-methoxy-4-vinylphenol; 2(4H)-benzofuranone, 5,6,7,7a-tetrahydro-4,4,7a-trimethyl; quinoline, 2-ethyl; nimbolide; nimbin; 5-bromopentanoic acid; azadirachtin; 4-decenoic acid, 3-methyl-(E); à-D-glucopyranoside; 3-heptanol, 3,5-dimethyl; and 4-decenoic acid. **16)** *α*-Thujene; *α*-pinene; canphene; verbenene; sabinene; *β*-pinene; myrcene; *α*-phellandrene; *δ*-3-carene; *α*-terpinene; para-cymene; limonene; (z)-ocimene; ocimene; *γ*-terpinene; (z)-sabinenehydrate; terpinolene; para-cymenene; linalool; *α*-fenchol; (E)-pinocarveol; borneol; terpinen-4-ol; *α*-terpineol; *trans*-carvil acetato; *α*-cubebene; *α*-ylangene; isoledene; *α*-copaene; *α*-funebrene; *β*-elemene; longifolene; *α*-gurjunene; *β*-caryophyllene; *β*-gurjunene; aromadendrene; *α*-himachalene; *α*-humulene; alloaromadendrene; *γ*-gurjunene; γ-muurolene; *γ*-curcumene; D-germacrene; *β*-selinene; viridiflorene; valencene; *α*-muurolene; α-germacrene; *β*-himachalene; *γ*-cadinene; *δ*-cadinene; (E)-cadin-1(2).4-diene; *α*-cadinene; oxygenated sequiterpenes; ledol; sphatulenol; viridiflorol; and *α*-muurolol. **17)** Hydroxycinnamate; caffeic acid; chlorogenic; neochlorogenic acid; 4,5-dicaffeoylquinic; 3,5-dicaffeoylquinic acids; rosmarinic acid; luteolin-7-O-*β*-d-glucuronide; quercetin7-O-*β*-d-glucuronide; quercetin-3-O-*β*-d-glucopyranoside; uercetin-3-O-*β*-d-arabinopyranoside; rutin; kaempferol-3-O-*β*-d-glucopyranoside; kaempferol-3-O-*β*-d-galattopyranoside; kaempferol-3-O-*β*-d-arabinopyranoside; nicotiflorin; kaempferol-3-robinobioside; kaempferol-3-neohesperidoside; glucoside of 3-hydroxy-1-(4-hydroxy-3,5-dimethoxyphenyl)-1-propanone; byzantionoside B; gusanlungionoside D; $C_{25}H_{42}O_{12}$; and $C_{25}H_{40}O_{12}$. **18)** Apigenin derivative; quercetin-3-arabinopyranoside; quercetin-xyloside; quercetino-3-rhamnoside; quercetin-glucoside; quercetin-galactoside; quercetin-glucuronide; quercetin derivative; quercetin-3-O-(4 bis-3-hydroxy-3-methylglutaryl)-*α*-rhamnoside; kaempherol ramnohexoside; kaempherol diglycoside; rutin; isorhamnetin rhamnose-hexose; quercetin dihexoside; hexoside-rhamnoside kaempferol and hydroxyferulic acid derivative; kaempherol-di-rhamnosyl-hexoside; kaempherol-trihexoside; quercetin-hexoside-rhamnoside-hexoside; epicatechin; catechin; dimer procyanidin (A/B); trimer procyanidin A/B2; iridoide; aucubioside; coumaroyl iridoide; protocatechuic acid; *p*-coumaric acid; 3-FQA feruloylquinic acid; quinic acid derivative; quinic acid; caffeoyl tartrate; protocatechuic acid glucoside; ferulic acid pentose derivative; coumaroylglucose; 3-p-coumaroylquinic acid; 5-p-coumaroylquinic acid; *p*-coumaric acid derivative; coumaroylquinic acid; *p*-coumaric acid derivative; ferulic acid derivative; 4'-caffeoylquinic acid; caffeoylquinic acid; 5'-caffeoylquinic acid; 4 FQA tri-feruloylquinic acid *trans*; feruloylquinic acid isomer; 4 FQA tri-feruloylquinic acid *cis*; 5 FQA tri-feruloylquinic acid; coumaroyl-hexose hydroxyphenol; coumaroyl-hexose-hydroxyphenol; caffeoyl-hexose-hydroxyphenol; caftaric acid and hexose derivative; caffeic acid derivative; dicaffeoylquinic acid; dicaftaric acid; and DHPPG (3,4'-dihydroxypropiophenone-3-*β*-D-glucoside). **19)** Spermine; spermidine; 2-hydroxyphenyl acetic acid; caffeic acid; salicylic acid; *p*-coumaric acid; isorhapontin; kynurenic acid; *p*-hydroxybenzoic acid; abscisic acid; taxifolin; baicalin (baicalein-7-oglucuronide); spiraeoside (quercetin-40-O-glucopyranoside); gibberellin-A4; cyanidin-3-O-rutinoside; syringaldehyde; 7-acetoxy-4-methyl coumarin; naringenin; rutin; quercetin; tiliroside; sinapic acid; zygophyloside-k; kaempferol 3,7-di-O-*α*-L-rhamnoside; isorhamnetin-3-orutinoside; hyperoside(quercetin-3-o-galactoside); luteolin; isorhamnetin-3-oglucoside; zygophyloside-; cinnamaldehyde; zygophyloside-f; 3-o-[*β*-d-quinovo pyranosyl] quinovic acid-28-β-d-gluco pyranosyl ester; kaempferol-3-O-*α*-lrhamnoside; 3-O-[β-d-gluco pyranosyl] quinovic acid; apigenin; kaempferide; isorhamnetin; and formononetin. **20)** 5-Methyl-2-hexanone; 3-methyl-5-hexanone; 3-methyl-3,4-divinylcyclohexene; 6-methyl-2-hepatnone; *p*-ethyltoluene; 2-octanone; 2,2,6-trimethylcyclohexan-1-one; 6-octen-2-one, (6Z); 6-methyl-5-hepten-2-one; *cis*-3-hexen-1-ol; 1h-pyrazole, 4,5-dihydro-5,5-dimethyl-4-(1-methylethylidene)-trans-2-hexen-1-ol; 1-octen-3-ol; 5-hepten-2-ol. 6-methyl; 3,5,5-trimethyl-2-hexene; 2-undecyne; bornylene; linalool; *p*-pentadecanol; 3,5-heptadien-2-one,6-methyl, (3E); 0.93 *trans*-2-octen-1-ol; *β*-cyclocitral; tricyclol3.3.0.0 (2.8)loctan-3-one.8-methyl; 1,3-cyclohexadiene-1-carboxaldehyde,2,6,6-trimethyl; acetophenone; acetic acid, 2-chloro,nonyl ester; 2.7-octadien-1-ol; borneol; propiophenone; 3-buten-1-ol, 2-methyl-4-(2,6,6-trimethyl-1-cyclohexen-1-yl), (E); 4,8-Dimethyl-1-nonanol; 3,4-dimethylbenzaldehyde; *β*-

damascenone; 7,8-dihydro-b-ionone; aromadendrene,dehydro36 20.09 0.59 benzyl alcohol; phenylethyl alcohol; *β*-ionone; 4-(2,6,6-trimethyl-cyclohex-a-enyl)-butan-2-ol; 3(2H)-Furanone, 2-hexyl-5-methyl; caryophyllenyl alcohol; cyclohexanemethanol,4-ethenyl-a,a,4-trimethyl-3-(1-methylethenyl), (1R,3S,4S); 7-methoxy-2,2,4,8-tetramethyltricyclo[5.3.1.0(4,11)]undecane; 2-pentadecanone,6,10,14-trimethyl45 22.67 0.77 cedrol; 1,8(2H,5H)-naphthalenedione, hexahydro-8a-methyl, *cis*47 23.08 1.09 2-naphthalenemethanol,1,2,3,4,4a,5,6,7-octahydro-a,a,4a,8-tetramethyl, (2R,4aR); agarospirol; cyclohexanecarboxylicacid, ethenyl ester; hinesol; megastigmatrienone; *α*-eudesmol; *β*-eudesmol; isoaromadendrene epoxide; 2,6-heptadien-1-ol,2-methyl-6-[(1S)-4-methyl-3-cyclohexen-1-yl], (2E); 2,4-Di-tert-butylphenol; cycloisolongifolene,8,9-dehydro; longipinocarveol, *trans* 59 26.08 0.33 2,6-heptadien-1-ol,2-methyl-6-[(1S)-4-methyl-3-cyclohexen-1-yl], (2E); diisobutylphthalate; g-gurjunenepoxide-(2); and ethanone,1-(2-hydroxy-4,6-dimethoxyphenyl). **21)** *Acacia catechu; Aegle marmelos; Artocarpus heterophyllus; Artemisia dubia; Azadirachta indica; Boerhavia diffusa; Chrysanthemum indicum; Cinnamomum camphora; Cinnamomum tamala; Eupatorium adenophorum; Hypericum uralum; Lawsonia inermis; Mangifera indica; Morus alba; Nyctanthes arbortristis; Ocimum tenuifolium; Oxalis lantifolia; Pistia stratiotes; Prunus persica; Shorea robusta; urtica parviflora;* and *Zingiber oficinale.* **22)** Phytol; olean-12-ene; *β*-amyrin; *α*-amyrin; 2R-acetoxymethyl-1,3,3-trimethyl-4t-(3-methyl-2buten-1-yl) -1T-cycloh; 2,4,4-trimethyl-3 hydroxymethyl-5A-(3Methyl-but-2enyl) cyclohexen. **23)** Gallic acid; thearubigin; gallocatechin; epigallocatechin; epicatechin; gallocatechin gallate; epicatechin gallate; ferulic acid; curcumin; demethoxycurcumin; and bisdemethoxycurcumin. **24)** Methoxyacetic acid; 2 2-butyl-1-octanol; 1-nonadecene; 1,2-benzenedicarboxilic acid; cyclononasiloxane; silikoneft; pentasiloxane; 6-nitro-1H-quinazoline-2,4-dione; homovanillic acid; 9H-fluoren-2-amine, N,N-dimethyl-7-nitro; cyclodecasiloxane, eicosamethyl; 3-isopropyoxy-1,1,1,5,5,5-Hexamethyl-3 (Trimethyl siloxy) Trisiloxane; and acetic acid. **25)** 6-Aminoflavone; apigenin; betulinic acid; biphenyl; caffeic acid; catechol; chrysin; *p*-coumaric acid; curcumin; daidzein; diphenylmethane; transferulic acid; fisetine; flavone; genistein; hydroquinone; 4-hydroxybenzoic acid; 6-hydroxyflavone; kaempferol; luteolin; oxyresveratrol; phloretin; phloroglucinol; quercetin; resorcinol; *trans*-resveratrol; shikimic acid; sinapic acid; *cis*-stilbene; *trans*-stilbene; syringic acid; tannic acid; and vanillic acid. **26)** Thymol; *ϒ*-terpinene; *p*-cymene; cyclobutene, 2-propenylidene; 2-pentanone, 4-hydroxy-4-methyl; *p*-xylene; 2-methoxy-4; phenol, 4-methoxy-2,3,6-trimethy; nandrolone phenpropionate; retinoic acid; androst-4-en-11-ol-3,17-dione, 9-thiocyanato; 1,2-benzenedicarboxylic acid, isodecyl octyl ester; stigmasterol; 2H-1-Benzopyran-3,4-diol, 2-(3,4-dimethoxyphenyl)-3,4-dihydro-6-methyl; pentanoic acid, 2,2,4-trimethyl-3-carboxyisopropyl, isobutyl ester; apiol; (1ar-(1aα,5aβ,9ar))-5a,9,9-trimethyloctahydrobenzo(d)cycloprop(c)oxepin-2,4-dione; 2′,4′-dimethoxy-3′-methylpropiophenone; caffeine; naphthalene, 1,2,3,4,4a,5,6,7-octahydro-4a-methyl; estra-1,3,5 (10)-trien-17*β*-ol; 9-octadecenoic acid, methyl ester, (E); *trans*-13-octadecenoic acid, D-homo-24-nor-17-oxachola-20,22-diene-3,7,16-trione, 14,15:21,23-diepoxy-4,4,8-trimethyl, (5*α*,13*α*,14*β*, and durohydroquinone. **27)** Protopine derivative; allocryptopine; coptisine; berberine; chelidonine derivative; chelidonine; chelerythrine; tetrahydroberberine; tetrahydrocoptisine; coptisine derivative; sanguinarine; and protopine. **28)** Apigenin; daidzein; genistein; kaempferol; myricetin; pinocembrin; quercetin; rutine; caffeic acid; cape; chlorogenic acid; p-coumaric acid; ferulic acid; and gallic acid. **29)** Caryophyllene; germacrene d; *β*-cadienene; copaene; caryophyllene; 1,4,7,-cycloundecatriene, 1,5,9,9-tetramethyl-Z,Z,Z; *γ*-cadinene; germacrene D; O-menth-8-ene; *δ*-cadinene; palmitic acid; and 9,12,15-octadecatriene-1-ol (Z,Z,Z). **30)** *Smilax zeylanica; Syzygium praecox; Bischofia javanica; Sloanea stercidiaceae; Actinodaphne obovata; Dysoxylum gotadhora; Syzygium anacardiifolium; Elaeocarpus serratus; Beilschmiedia roxburghiana; Acacia pennata.; Holigarna caustica; Mikania micrantha; Bombax ceiba; Stereospermum chelonoides; Pterygota alata,* and *Michelia champaca*. **31)** Eugenol; *β*-caryophyllene; iso-caryophyllene; napthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methyl ethyl); 1,6-octadiene-ol-3,7-dimethyl acetate; *α*-caryophyllene; and caryophyllene oxide. **32)** α-Pinene; methyl heptenone; myrcene; limonene; linalool; citronellal; neral; geranial; geranyl acetate; β-carypohyllene; β-pinene; α-terpinene; para cymene; *γ*-terpinene; *trans*-α-bergamotene; β-bisabolene; decanal; nootkatone; α-thujene; sabinene; terpinolene; and linalyl acetate. **33)** Ichangin; isoobacunoic acid; isolimonic acid; deacetyl nomilinic acid 17*β*-d-glucopyranoside; and isoobacunoic acid 17*β*-d-glucopyranoside. **34)** *α*-thujene; *α*-pinene; camphene; sabinene; 1-octen-3-ol; *β*-pinene; myrcene; 3-octanol; *α*-phellandrene; *α*-terpinene; *p*-cymene; limonene; 1,8-cineole; (Z)-*β*-ocimene; *γ*-terpinene; (E)-sabinene hydrate; octanol; terpinolene; (Z)-sabinene hydrate; linalool; nonanal; amyl isovalerate; camphor; menthone; menthofuran; isomenthone; neomenthol; borneol; menthol; 4-terpineol; isomenthol; *α*-terpineol; neoisomenthol; estragole; decanal; (E)-dihydrocarvone; linalyl formate; citronellol; carvone; piperitone; geraniol; (E)-2-decenal; (Z)-anethole; neomenthyl acetate; (E)-anethole; dihydroedulan I; menthyl acetate; undecanol; geranyl acetate; *β*-bourbonene; dodecanal; (E)-*β*-caryophyllene; *α*-caryophyllene; (E)-*β*-farnesene; (E)-2-dodecenal; *γ*-himachalene; germacrene D; *β*-selinene; bicyclogermacrene; spathulenoL; caryophyllene oxide; and globulol. **35)** Ursolic acid; oleanolic acid; 2-hexylfuran; linalool oxide; 10-undecenal; 4-ethylcamphor; dodecenal; caryophyllene oxide; 12(13)-EpOME; and (E)-12,13-dihydroxy-11-methoxyoctadec-9-enoic acid. **36)** Quinic acid; galloyl hexose; gallic acid; galloylshikimic acid; protocatechuic acid hexoside; methyl gallate; trigalloyl hexoside; tetragalloyl hexoside; tetragalloyl hexoside; myricetin glucoside; trigallic acid; pentagalloyl hexoside; myricetin rhamnoside; quercetin glucoside; methyl digallate; methyl trigallate; and quercetin rhamnoside. **37)** Monoterpenes caryophyllene; caryophyllene oxide; cinnamaldehyde; *α*-, *β*-phellandrene; eugenol; ledol;

phytol; geraniol; citronela; and campesterol. **38)** Toluene; 2-furfuryl alcohol; 1,8-cineole; terpinolene; 2-nonanol; *trans*-dihydro-*α*-terpineol; 4-terpineol; *p*-cymen-8-ol; *α*-terpineol; 2-decanone; *cis*-3-hexadecene; *cis*-anethole; 2-undecanone; 2-methoxy-4-vinylphenol; *δ*-elemene; piperitenone; *β* –elemene; *α*-cedrene; *β* –caryophyllene; *γ* -elemene; *α*-humulene; *trans*-*β*-farnesene; *ar*-curcumene; *α*-zingiberene; *β*-sesquiphellandrene; *trans*-*γ*-bisabolene; germacrene B; *ar*-turmerol; dihydro-*ar*-turmerone; *trans*-*β*-elemenone; *ar*-turmerone; *α*-turmerone; germacrone; curlone; bisabolone; *trans*-*α*-atlantone; palmitic acid; hexadecane-1,2-diol; nonadecanone; linoleic acid; and linolenic acid. **39)** Furan, 3-butyltetrahydro-2-methyl, *trans*; propane, 1-isocyano; cyclopentanone, 2,5-dimethyl; acetamide, N-methyl-N-(2-propynyl); 1,2,4,5-tetrazine, 3,6-bis(1-methylethyl); 1-penten-3-one, 4-methyl; 1,2,4,5-tetrazine, 3,6-diethyl; phosphorodiamidic acid, tetramethyl, pentachlorophenyl ester [phenol, pentachloro, tetramethylphosphorodiamidate]; 1H-1-benzazepine-2,5-dione, 4-bromo-3-hydroxy; yohimban-16-carboxylic acid, 17-hydroxy-10-methoxy, methyl ester, (16á,17à)-[excelsinine]; 8-(2,5-dimethyloanilino) naphthao-1,2-quinone; 2-amino-5-[3,4-dichlorophenyl]-3-cyano-4-methylthiophenen; *trans*-1,2-cyclohexanedicarbonitrile; 2-phenyl-4-(isopropyloxycarbonyl)-6-methyl-3h-imidazo[1,5-b]pyridazine-5,7-dione; 1-à-3-à-dihydroxyallobetulane; benzene, [(3,3,5,5 tetramethylcyclohex-1-en-1-yl)thio]; 1,2-benzenedicarboxylic acid, dipentyl ester [phthalic acid, dipentyl ester]; aluminium, tetraethylbis (æ-methylaminato)di; 2,3-diphenyl-6-acetyl-7-methoxy-2,3- dihydro-4(1h)-quinolinone; propanenitrile, 3-chloro; and 1-butyne. **40)** 7,4′-Dihydroxyflavane; 3′,7-dihydroxy-4′-methoxy-8-methylflavane; 4′,7-dihydroxy-3′-methoxy-8-methylflavane; 4′,7-dihydroxy-3′-methoxyflavane; 4′,7-dihydroxy-8-methylflavane; 4′,5-dihydroxy-7-methoxy-8-methylflavane; 7-hydroxy-3-(4-hydroxybenzyl) chromane; 7-hydroxy-3-(4-hydroxybenzyl)-8-methylchromane; 7-hydroxy-3-(4-hydroxybenzyl)-8-methoxylchromane; 7-hydroxy-3-(4-hydroxybenzyl)-5-methoxychromane; 7-hydroxy-3-(4-hydroxybenzyl)-chroman-4-one; 5,7-dihydroxy-3-(4-hydroxy-benzyl)-chroman-4-one; 5,8-dihydroxy-7-methoxy-3-(4-hydroxy-benzyl)-chroman-4-one; 5,7-dihydroxy-6-methoxy-3-(4-hydroxy-benzyl)-chroman-4-one; 5,7-dihydroxy-6-methyl-3-(4-hydroxy-benzyl)-chromane-4-one; and 5,7-dihydroxy-6,8-dimethyl-3-(4-hydroxy-benzyl)- chromane-4-one. **41)** *Agathosma betulina; Allium sativum; Aloe vera; Aspalathus linearis; Camellia sinensis; Glycyrrhiza glabra; Hypericum perforatum; Leptospermum petersonii; Melaleuca alternifolia; Syzygium aromaticum;* and *Vaccinium macrocarpon.* **42)** A-Thujene; a-pinene; sabinene; b-pinene; myrcene; *p*-cymene; limonene; 1,8-cineole; g-terpinene; linalool oxide; terpinolene; linalool; tetrahydro linalool; a-terpineol; *cis*-sabinene hydrate; acetate; geraniol; linalool acetate; geranial; a-terpinyl acetate; geranyl acetate; g-elemene; a-farnesene; nerolidol; n-hexadecanoic acid; and fatty acids. **43)** Campesteryl ferulate; 24-methylcholestanol ferulate; 1,2-diferuloylgentiobiose 1; paeoniflorin; dihydrokaempferol-3-O-rutinoside; (-)-epicatechin-(2a-7)(4a-8)-epicatechin 3-O-galactoside; neoeriocitrin; luteolin-7-O-malonyl-glucoside; luteolin-7-O-rhamnoside; diosmetin-7-O-rutinoside; tetramethylscutellarein (4′,5,6,7-tetramethoxyflavone); kaempferol-3-O-(6″-malonyl-glucoside); quercetin-3-O-rutinoside; quercetin-3-O-(OH-FA) sophoroside; quercetin-3-O-(SI) sophoroside 7-O-glucoside; isorhamnetin-3-O-rutinoside; spinacetin-3-O-(2″-feruloylglucosyl)(1- > 6)-[apiosyl(1- > 2)]-glucoside; 6′′-O-acetyldaidzin; laricitrin-3-O-hexoside; sesaminol-2-O-triglucoside; secoisolariciresinol di-O-glucoside; lariciresinol-sesquilignan; demethyloleuropein; arbutin; and ligstroside-aglycone. **44)** *β*-Sitosterol; stigmasterol; stigmastenol; tetradecane; hexadecane; eicosane; docosane; tetracosane; gallic acid; 1,2-benzenedicarboxylic acid; benzoic acid; ferulic acid; cinnamyl cinnamate; and glycerol. **45)** Jensenone; grandinol; homograndinol; dehydro-eucalyptusdimer C; eucalyptusdimer A/B; sideroxylonal A/B/C; loxophlebal A; eucalyprobusone A; myrciaphenone B; eucalmainoside A; eucalmainoside C/myrciaphenone A; eucalmainoside B; macrocarpal E/eucalyptone/eucalyptals B/E; macrocarpal J/I; eucalrobusone R/O; (iso)leptospermone; macrocarpal A/B/D/K/H/L-eucalyptin A/B; eucalyptal A/C/eucalrobusone D; eucalyptone G; macrocarpal C/G; euglobals G1-G12/R; galloylglucose; globulusin A; cypellocarpin B; cypellocarpin C; eucalmaidin D/cypellogin A/B; globulusin B/eucaglobulin/cypellocarpin A; dihydrocypellocarpine C; quercetin O-sophoroside; quercetin rutinoside; quercetin O-arabinopyranoside-gallate; hydroxytetramethoxy-flavone-O-glucopyranoside; isorhamnetin O-rutinoside; quercetin O-glucopyranoside-gallate; luteolin O-rutinoside; quercetin O-arabinofuranoside/quercetin O-arabinopyranoside; homoorientin; quercetin O-glucopyranoside; Quercetin O-rhamnoside; Kaempherol O-glucopyranoside/luteolin O-glucopyranoside; trimethoxykaempferol; isorhamnetin; desmethyl eucalyptin; sideroxylin; gallic acid; chlorogenic/neochlorogenic acid; ferulic acid; O-galloyl-O-HHDP-glucose; tri-O-galloylglucose; epicatechin gallate; tellimagradin I; coumaroyl-digalloylhexoside; sinapaldehyde; ellagic acid; methylellagic acid acetyl hexoside; ellagic acid deoxyhexoside; dimethylellagic acid hexoside; methylellagic acid; dimethyl ellagic acid; trimethyl ellagic acid; hydroxy-O-acetylhydroshengmanol-O-xylopyranoside; asiatic acid lactone; betulin; hydroxy ursolic/betulinic acid; euscaphic/asiatic/arjunolic acid; trihydroxy-oxoursenoic acid; nor-ursene-diol; acetyl ursolic/acetyl oleanolic acid/acetobetulinic acid; O-coumaroyl maslinic/alhitolic acid; eucalyptic acid; lupeol acetate; eucalyptanoic acid; bryocoumaric acid; O-coumaroyl tormentic acid; ursolic/oleanolic/betulinic acid; 4-methoxycinnamoyloleanolic acid methyl ester; ursolic acid lactone; nor triterpene; trihydroxy octadecenoic acid; hydroxy tetracosanoic acid; hydroxy octadecadienoic acid; vomifoliol; and withanolide A. **46)** Catechin or epicatechin; ellagic acid pentoside; quercetin hexoside; cyanidin-3-arabinoside or cyanidin-3-xyloside; delphinidin-3-pentoside; cyanidin-3-galactoside or cyanidin-3-glucoside; delphinidin-3glucoside; and malvidin-3-glucoside. **47)** Evodiamine, rutaecarpine, evocarpine, 1-methyl-2-nonyl-4(1H)-quinolinone; 1-

Me-2-(Z-6-undecenyl)-4(1H)-quinolinone; 1-Me-2-(4Z,7Z-tridecadienyl)-4(1H)-quinolinone; 1-Me-2-(pentadecatrienyl)-4(1H)-quinolinone; 1-Me-2-(pentadecatrienyl)-4(1H)-quinolinone; 1-Me-2-undecyl-4(1H)-quinolinone; 1-Me-2-(6Z,9Z-pentadecadienyl)-4(1H)-quinolinone; 1-Methyl-2-tridecyl-4(1H)-quinolinone; 1-Me-2-(6Z/10Z-pentadecenyl)-4(1H)-quinolinone; and 1-Me-2-(6Z/10Z-pentadecenyl)-4(1H)-quinolinone. **48)** Megastigmatrienone; 6,10,14-trimethyl-2-pentadecanone; methyl palmitate; methyl ester of 3-(3,5-di-tert-butyl-4-hydroxyphenyl)-propionic acid; palmitic acid; methyl linolenate; phytol; linoleic acid; 2-monopalmitin; 2-monostearin; squalene; vitamin-E; neophytadiene; campesterol; clionasterol; alnulin or skimmiol; β-amyrin; cycloartenol; *α*-amyrin. **49)** Lupeol acetate; cycloart-23-ene-3,25-diol; sitosterol; 5,7,4'-trihydroxyflavan-3-ol; epicatechin; and isovitexin. **50)** Methane, sulfinylbis; 1,3-difluoro-2-propanol; dimethylsulfoxonium formylmethylid; (CH3)2NCl; benzene; methylthiophosphonamidic acid, s-methyl ester; dimethyl sulfoxide; cyclohexasiloxane, dodecamethyl; pyridine 2,4-dimethyl; and dimethyl sulfone. **51)** Helichrytalicine A-C; acronyline; acetophenone derivatives; benzodihydrofuran; gnaphaliol; tremetone bitalin A (12-hydroxytremetone); aglycone of desmethylyangonine-4-O-*β*-d-glucopyranoside; 3,4-dihydroxy benzoic acid; tiliroside; helichrysroside; Gnaphaliin A; 3-methylethergalangin; and ursolic. **53)** Formic acid, 1-methylethyl ester; 1-butanol,2- methyl; hexadecanoic acid; 1-octen-3-ol; heptadecen-(8) -carbonic acid-(1); octadecnoic acid; and berberine. **54)** Trichloromethane; methane,oxybis; trichloromethane; phenol, 2,4-bis(1,1-dimethylethyl); methane,bromodichloro; fumaric acid, 2-methylpent-3-yl tridecyl ester; acetyl chlorid; ethane,2,2-dichloro-1,1,1-trifluoro; ethane,1,2,2-trichloro-1,1-difluoro; dichloroacetic acid,heptadecyl ester; pentaflouropropionic; acid,pentadecyl ester; acetic acid,chloro-octadecyl ester; erythro-9,10-dibromopentaacosane; fumaric acid,cyclohexylheptadecyl ester; and phenol,2,2,methylenebis (6-(1,1-dimethylethyl)-4-methyl. **55)** 4 – Methylesculetin; 4 – methylumbelliferyl *β*-D- glucuronid; apigenin 7-(4'', 6'' diacetylalloside)-4' - alloside; catechin 7-O-apiofuranoside; epicatechin 3-O- *β*-D-glucopyranoside; methylisoeugenol; quercetin 5,7,3',4'-tetramethyl ether 3-rutinoside; and emodic acid. **56)** Octanoic acid; N-decanoic acid; undecanoic acid; tetradecanoic acid; oxirane, [(tetradecyloxy)methyl]; 3-tetradecene, (Z); N-Hexadecanoic acid; diethylene glycol monolaurate; phytol; 1,3;2,5-dimethylene-l-rhamnitol; 1-phenanthrenemethanol, 1,2,3,4,4a,9,10,10a-octahydro-1,4a-dimethyl-7-(1-methylethyl), [1R-(1à,4aá,10aà)]; hexaethylene glycol monododecyl ether; diazoprogesterone; spiro[androst-5-ene-17,1'-cyclobutan]-2'-one, 3-hydroxy-, (3á,17á); and 2H-pyran, and 2-(7-heptadecynyloxy) tetrahydro. **57)** *Iris pallida; Iris versicolor; Iris lacteal; Iris carthaliniae;* and *Iris germanica*. **58)** Protocatechuic acid; gallic acid; 1,4,5-naphthalenetriol; (S)-isosclerone; (S)-2,3-dihydro-(S)-hydroxy-2-methyl-1,4 naphtoquinonen; ferulic acid; *trans*-ferulic acid; 6-epi-7 isocucurbic acid; sinapaten; elenolide; 6-propyldecane; palmitic acid ;oleic acid; *γ*-L-glutamyl-DL-methionine sulfoxide; ellagic acid; quercetin; myricetin; *p*-coumaroylquinic acid; α-idroxyjuglone-4obD-glycoside; chlorogenic acid; farnesiferol B and C; 1-hexacosanol; foetidin; nevskin; β-sitosterol; kaempferol-arabinoside; juglanin; adenosine-3',5'-biphosphate; adenosine-5'-phosphosulfate; tocopherol; avicularin; 3-o-acetyl-episamarcadin; ellagic acid-hexoside; HHDP-hexoside; neocretanin; trisjuglone; procyanidin dimer; rutin; galloyl-HHDP-hexoside; di-HHDP-hexoside; castacrenin E; acutissimin A; and castacrenin F. **59)** Tricyclene; *α*-pinenea; camphene; sabinenea; *β*-pinenea; *α*-phellandrenea; 1,8-cineolea; *γ*-terpinene; *cis*-sabinene hydrate; linaloola; terpinen-4-ola; *α*-terpineol; *α*-terpinyl acetatea; eugenola; *α*-yalangene; *β*-cubebene; *β*-longipinene; methyl eugenola; α-gurjunene; (E)-caryophyllenea; α-guaiene; *cis*-*β*-guaiene; bicyclogermacrene; *α*-bulnesene; *trans*-cadinene; *δ*-cadinene; elemicin; spathulenol; caryophylene oxidea; globulol; *β*-eudesmol; *α*-cadinol; and 5-iso-cedranol. **60)** *α*-Pinene; camphene; *β*-pinene; hexyl acetate; *p*-cymene; 1,8-cineol; *cis*-linalool oxide (furanoid); *trans*-linalool oxide (furanoid); linalool; octen-3-yl-1-acetate; camphor; nerol oxide; borneol; *cis*-linalool oxide (pyranoid); terpinen-4-ol; *α*-terpineol; hexyl butanoate; cuminaldehyde plus hexyl-2-methyl butanoate; linalyl acetate; lavandulyl acetate; thymol; neryl acetate; geranyl acetate; caryophyllene oxide; and *α*-bisabolol. **61)** Naringin; asparegene; rosmarinic acid; liquirtin; borneol and/or linalool and/or *α*-terpineol and/or *β*-pinene; asparagine; *γ*-terpinene and/or mycrene and/or *β*-pinene and/or *α*-pinene; kaempferol; caftaric acid; chlorogenic acid; caffeic acid; cynarin; echinacoside; cichoric acid; quercetin; caryophyllene oxide; oleanolic acid; ursolic acid and/or betulinic acid; and *β*-carotene. **62)** 1,3,5-Triazine-2,4,6-triamine; 1,2,3-propanetriol, monoacetate; 4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl; 2-furancarboxaldehyde, 5-(hydroxymethyl); 1,2,3-benzenetriol; benzoic acid, 4-hydroxy; 1,2,3,4,5,6,7,8-octahydro-2-naphthol, 4-methylene-2,5,5-trimethy; tetradecanoic acid; pluchidiol; hexadecanoic acid, methyl ester; N-hexadecanoic acid; 9,12,15-octadecatrienoic acid, methyl ester; phytol; 9,12,15-octadecatrienoic acid, (Z,Z,Z); stigmast-5-en-3-ol, (3.β.); and lupeol. **63)** Ethyl iso-allocholate; 9,12-octadecadienoic acid, methyl ester; 6,9,12,15-docosatetraenoic acid, methyl ester; cyclopropanedodecanoic acid, 2-octyl, methyl ester; 1-hexadecanoic acid (hydroxymethyl)-1,2-ethanediyl ester; 7-methyl-z-tetradecen-1-ol acetate; 3-methyltricosane; oleic acid, 3-(octadecyloxy) propyl ester; z-12-pentacosene; 1-heptacosanol; and 17-pentatriacontene. **64)** 3-O-Caffeolyquinic acid; dicaffeoylquinic acid; ferulic acid glucoside; caffeic acid; methoxyflavone glucoside; glucose ferulate; dicaffeoylquinic acid isomer; flavone glycoside; luteolin glucuronide; salvianolic acid I isomer; luteolin-7-O-glucoside; dicaffeoylquinic acid isomer; rosmarinic acid isomer; apigenin glucuronide derivative; rosmarinic acid; apigenin-7-O-glucoside; flavonol glucoside; flavonol glucoside; salvianolic acid I isomer; lithospermic acid isomer; ferulic acid; caffeic acid derivative; apigenin acetyl glycoside; apigenin acetyl glycoside; luteolin glucuronide; apigenin acetyl glycoside; salvianolic acid B isomer;

methoxyflavone glucoside; apigenin glycoside; ferulic acid derivative; apigenin; ferulic acid glucoside; and ferulic acid derivative. **65)** Menthol; menthone; neoisomenthol; isomenthone; menthyl acetate; 2-isopropyl-5-methylcyclohexanol; piperitone; and limonene. **66)** *p*-Xylene; *α*-pinene; cyclohexanone, 3-methyl; *β*-pinene; 3-octanol; 3-octanol, acetate; *α*-terpinolen; isopulegone; d-isomenthone; menthol; pulegone; piperitone; and piperitenone. **67)** 1-Monolinoleoylglycerol; 6,9,12-octadecatrienoic acid benzyl ester; 3-hydroxyspirost-8-en-11-one; ethyl-3,4,5-trimethoxybenzoate; palmitic (hexadecanoic) acid; ursodeoxycholic acid; 3-carene; eucalyptol; 2-hydroxy-4-methylbenzoic acid; abietic acid; and 3,21-dihydroxypregnan-4-one. **68)** Dibutyl phthalate; 4-dodecanol; hexanedioic acid, bis (2-ethylhexyl); Z6, Z9-pentadecadien-1-ol; heptane, 2,2,3,3,5,6,,6-heptamethyl; 1,2-benzenedicarboxylic acid, mono(2-ethylhexyl) ester; hentriacontane; 1-nonene, 4,6,8-trimethyl; 1-hexanol, 2-ethyl-2-propyl; squalene; trimethyl (4-tert-butyphenoxy silane; tetracontane-1,40-diol; D.L.α-tocopherol; tetrapentacontane and dotriacontane; oxirane, hexadecyl; β-amyrin; 2,4,6-cycloheptatrien-1-one,3,5- bis-trimethylsilyl; cineole; camphor; borneol; verbenone; and ferruginol. **69)** 1,2-Cyclopentanedione; 2,4-dihydroxy-2,5-dimethyl-3(2H)-furanone; pentanoic acid; cyclopentane, 1-acetyl-1,2-epoxy; 2,6-dimethyl-7-octen-3-ol; N-methyl-N-nitroso-2-propanamine; 2,3-dihydro-3,5-dihydroxy-6-methyl-4h-pyran-4-one; 1,2,3-propanetriol; 2-hexene, 3,4,4-trimethyl; 1,2,3-propanetriol, 1-acetate; acetoxyacetic acid, nonyl ester; allyloxydi(tert-butyl)silane; lactone G; xanthosine; *cis*-vaccenic acid; N-hexadecanoic acid; N-nonadecanol-1; 9,12-octadecadienoic acid; and 9,12,15-octadecatrienoic acid. **70)** Dihydroactinidiolide; heptadecane; methyl tetradecanoate; loliolide; octacosane; neophytadiene (isomer I); hexahydrofarnesyl acetone; neophytadiene (isomer II); neophytadiene (isomer III); nonadecane; methyl hexadecanoate; ethyl hexadecanoate; eicosane; methyl linoleate; heneicosane; methyl linolenate; *γ*-hexadecalactone; (E)-phytol; methyl octadecanoate; docosane; (E)-phytyl acetate; tricosane; and 5-methyl-5-(4,8,12-trimethyltridecyl)dihydro-2(3H)-furanone. **71)** 2-Thujene; *α*-terpineol; *α*-pinene; *α*-terpenyl acetate; borneol; spathulenol; and octanone. **72)** HHDP Hexoside; galloyl quinic acid; ellagic acid; digalloyl hexoside; digalloyl quinic acid; myricetin hexoside; digalloyl HHDP hexose pedunculagin I; galloyl HHDP-hexoside; protocatechuiic hexoside; myricetin pentoside; lagerstannin B derv; brevifolin; galloyl HHDP hexose (isostrictinin); vescalin or castalin/ tergallagic C-glucoside; valoneic acid dilactone; digallic acid; pentagalloyl hexose; bis- HHDP-hexose (casuariin); methyl gallate; dimers of tergallagic-ohexoside; trigalloyl hexose; syringic acid hexoside; lagerstannin C; caffeic acid hexoside; galloyl ellagic acid; phyllanthusin U; *p*-coumaroyl quinic acid; isorh derv; punicalin A; galloyl shikimic acid; quinic acid; vesgalagin or castalagin; gallic acid; phyllanthusiin B; dehydrated tergallagic C-hexoside; lagerstannin B (flavogalloylhhdp-gluconic acid); phyllanthusiin C; tellimagrandin I isomer (digalloylhhdp-hexose); granatin A/lagerstannin A; monogalloyl hexose; ethyl gallate; tetragalloyl hexose; heptagalloyl hexose; pedunculagin I isomer; castalgin derv; casuarinin/galloyl bis-HHDP-glucose; quercetin pentoside; granatin B; catechin or epicatechin; quercetin hexoside; HHDP-trigalloyl hexose tellimagrandin II/pterocaryanin C isomer; kaempferol glucuronide hexoside; kaempferol; isorhamnetin hexoside; isorhamnetin; apigenin; apigenin 8 C-hexoside; kaempferol 7 hexoside; hexagalloyl hexose; chebulagic acid; dehydrogalloyl-HHDP-hexoside; myricetin; pentagalloyl HHDP hexose; and apigenin 7 hexoside. **73)** *α*-Pinene; 5-hydroxy-1-methyl-camphene; *β*-pinene; limonene*α*-pinene; 5-hydroxy-1-methyl-camphene; *β*-pinene; limonene; linderol; *β*-terpineol; 6-epi-betacubebene; 7-methyltheophylline; copaene-4,12-diol; *α*-cubebene; methyl eugenol; *β*-caryophyllene; *γ*-humulene; germacrene e;cubebol; *α*-cadinene; cubebanol; and phenyl derivatives. **74)** 3-Octanol; *ρ*-cymene; 1,8-cineole; camphor; 1-borneol; 4-terpineol; *α*-terpineol; eugenol; *β*-caryophyllene; *δ*-cadinene; (-)-caryophyllene oxide; humulene oxide; veridiflorol; *α*-pinene; camphene; linalool oxide; isoborneol; carvacrol methyl ether; and carvol. **75)** Rosmarinic acid; caffeic acid; chlorogenic acid; (+)-catechin; and 3,4-dihydroxybenzoic acid. **76)** Tryciclene; *α*-thujene; *α*-pinene; camphene; sabinense; *β*-pinene; 1-octen-3-ol; myrcene; *α*- phellandrene; *Δ*-3-carene; *α*-terpinene; *p*-cymene; *β*-phellandrene; 1.8-cineole; (Z)-*β*-ocimene; (E)-*β*-ocimene; *trans*-decahydro-naphthalene; χ-terpinene; *cis*-sabinene hydrate; terpinolene; *p*-menth-2.4(8)-diene; *cis*-decahydro-naphthalene; undecane; linalool; camphor; menthone; borneol; terpinen-4-ol; *α*-terpineol; *trans*-dihydrocarvone; dodecane; dihydrocitronellol; thymol methyl ether; carvacrol methyl ether; carvone; tetrahydrocitronellene; carvenone; 1-tridecene; bornyl acetate; isobornyl acetate; tridecane; thymol acetate; carvacrol acetate; α-ylangene; *α*-copaene; *α*-cubebene; *β*-bourbonene; tetradecane; *trans-β*-caryophyllene; aromadendrene; *α*-humulene; χ-muurolene; germacrene-D; χ-amorphene; viridiflorene; *α*- muurolene; *β*-bisabolene; χ-cadinene; *δ*-cadinene; spathulenol; caryophyllene oxide; 1.10-diepicubenol; 10-epi-χ-eudesmol; τ-cadinol (epi-α-cadinol); epi-α-muurolene; and cadalene. **77)** *α*-Pinene; camphene; myrcene; *α*-terpinene; *β*-pinene; camphor; *p*-cymene; *γ*-terpinene; *α*-thujone; *β*-thujone; fenchyl alcohol; thymol; bornyl acetate; 2-undecanone; carvacrol; eucalyptol; eugenol; *trans*-caryophyllene; humulene; eugenyl acetate; *β*-bisabolene; *cis*-verbenol; cedrene; benzocyclobutane; isothymol methyl ether; chavicol; ledene; citral 2; and zingiberene. **78)** Eugenol; 3,5-dimethoxycinnamic acid, trimethylsilyl ester; 2,6,10-trimethyl,14-ethylene-14-pentadecne; oxirane, tetradecyl; 3,7,11,15-tetramethyl-2-hexadecen-1-ol; hexadecanoic acid; benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy, methyl ester; 9,12-octadecadienoic acid (Z,Z), methyl ester; linolenic acid; phytol; octadecanoic acid, methyl ester; and 2,6,10-trimethyl,14-ethylene-14-pentadecne. **79)** Sabinene; *β*–pinene; *β*-myrcene; o–cymene; limonene; *cis-β*-ocymene; *trans-β*-ocymene; linalool; bornyl acetate: tridecane; ciclosativene; *α*–copaene; *β*–bourbonene; *cis*–methyl isoeugenol; *β*–selinene; *trans*–caryophyllene; germacrene D; *trans*–nerolidol; myristicin;

cis–eudesma 6,11–diene; *γ*-muurolene; *δ*–cadinene; elemicin; γ–asarone; spathulenol; caryophyllene oxyde; *α*–muurolol; elemol acetate; viridiflorol; and *α*–cadinene. **80)** *α*-Pinene; *β*-pinene; delta-3-carene; l-limonene; verbenene; camphene; oleic acid; *β*-myrcene; campholenealdehyde; benzene,1-methyl-3-(1-methylethyl); *trans*-pinocarveol; 2,4-pentadienamide; palmitic acid; fencholenic aldehyde; cyclotrisiloxane; and verbenone. **81)** 2,5-Dimethyl-1,3-benzenediol; 3-chloro-2,6-dihydroxy-4-methylbenzaldehyde; 2,6-dihydroxy-4-methylbenzaldehyde; methyl 2,4-dihydroxy-6-methylbenzoate; methyl 3-formyl-2,4-dihydroxy-6-methylbenzoate; methyl 2,4-dihydroxy-3,6-dimethylbenzoate; ethyl 3-formyl-2,4-dihydroxy-6-methylbenzoate; 5-pentyl-1,3-benzenediol; methyl 2,4-dihydroxy-3,5,6-trimethylbenzoate; isopropyl 3-formyl-2,4-dihydroxy-6-methylbenzoate; 5,7-dihydroxy-6-methylphtalide; methyl 5-chloro-3-formyl-2,4-dihydroxy-6-methylbenzoate; methyl hexadecanoate; ethyl 5-chloro-3-formyl-2,4-dihydroxy6-methylbenzoate; methyl (Z,Z)-9,12-octadecadienoic acid; methyl (Z)-9-octadecenoate; 5-(2-oxoheptyl)-resorcinol; olivetonide; tetracosane; pentacosane; trimethyl 2-hydroxyheptadecane1,2,3-tricarboxylate; and 30-nor-21*α*-hopan-22-one. **82)** N-Hexadecanoic acid; 2-(1,3-benzodioxol-5-yl)furo[2,3-h]chromen-4-one; 2,2-dimethylindane-1,3-dione; octadecanoic acid; 2H-pyran-2-one, tetrahydro-6-tridecyl; acetamide; N-(aminocarbonyl); *cis*-9-octadecenoic acid; Z,Z-3,15-octadecadien-1-ol acetate; diazene; bis[2,6-bis(1-methylethyl) phenyl]; 1(3H)-isobenzofuranone, 3-propylidene- (Z); 1,2,2-trimethyl-1-aza-spiro [2.3] hexane; 1,9-cyclohexadecadiene; 9,12-octadecadien-1-ol, (Z,Z); and acetamide. **83)** *Potentilla argentea; Potentilla erecta; Potentilla anserina; Potentilla grandiflora; Potentilla norvegica; Potentilla thuringiaca; Potentilla pensylvanica; Potentilla crantzii;* and *Potentilla nepalensis.* **84)** *p*-Coumaric acid; chlorogenic acid; vanilic acid; syringic acid; 3-HBA; 3,5-DHBA; ferulic acid; catechin; epicatechin; rutin; and quercetin. **85)** α-Thujene; *P*-cymene; α-pinene; camphene; β-pinene; myrcene; α-terpinene; d-limonene; ar-curcumene; α-humulene; 3-ethylidene-2-methyl-1-hexen-4-yne; germacrene d; terpineol; caryophyllene; and nero. **86)** Protocatechic acid; catechin hydrate; chlorogenic acid; caffeic acid; vanillin; *p*-coum acid; benzoic acid; *o*-coumaric acid; cinnamic acid; epicatechin; rutin; hesperidin; eriodictiol; quercetin.$2H_2O$; and luteolin. **87)** (–)-Catechin; aromadendrin-7-O-glucoside; benzoic acid; (–)-taxifolin; (+)-aromadendrin; naringenin-7-O-glucoside; dihydrowogonin-7-O-glucoside; sakuranetin-5-O-glucoside; liquiritin; (–)-naringenin; apigenin; (+)-dihydrowogonin; pinocembrin isomer; sakuranetin; (+)-pinocembrin; and chrysin; tectochrysin. **88)** Caryophyllene; *α*-cubebene; (+)-epi-bicyclosesquiphellandrene; acetic acid, 7-hydroxy-1,3,4,5,6,7-hexahydro-2H-naphthalen-4*α*-ylmethyl ester; globulol; 2-methylene-6,8,8-trimethyltricyclo[5.2.2.0(1,6]undecan-3-ol; *β*-caryophyllene oxide; 2-naphthalenol, 2,3,4,4a,5,6,7-octahydro-1,4a-dimethyl-7-(2-hydroxy-1-methylethyl); isoaromadendrene epoxide; (3E,12Z)-nonadeca-1,3,12-triene-5,14-diol; hexahydrofarnesyl acetone; 4,4,8-trimethyltricyclo[6.3.1.0(1,5)]dodecane-2,9-diol; ethyl palmitate; 2-(2-ethylhexoxycarbonyl)benzoic acid; tert-butyl 1-[4-(2,6-ditert-butyl-4-methoxyphenoxy)-3-nitro-4-oxobutyl]pyrrolidine-2-carboxylate; D-friedoolean-14-en-3-one; and stigmast-4-en-3-one. **89)** 3,5-Dihydroxybenzoic acid; 4-hydroxybenzoic acid; betulinic acid; catechin; epicatechin; gallic acid; phloroglucinol; pyrocatechol; quercetin; resorcinol; *trans*-resveratrol; salicylic acid; sinapic acid; tannic acid; quercetin, and vanillic acid. **90)** Gallic acid; catechin; epicatechin; epigallocatechin gallate; epicatechin gallate; quercetin; benzoic acid; quercetin glucoside; tannin; and kaempferol. **91)** Tricyclene; *α*-thujene; *α*-pinene; camphene; verbenene; sabinene; *β*-pinene; 1-octen-3-ol; 3-octanone; *β*-myrcene; *β*-terpinene; *α*-phellandrene; *δ*-3-carene; *α*-terpinene; *p*-cymene; limonene; 1,8-cineole; eucalyptol; *γ*-terpinene; *trans*-sabinene hydrate; *α*-terpinolene; terpinolene; linalool; 2,3-dimethyl-2,3 dihydropyridine; pinocarveol; camphor; isoborneol; borneol; isopinocamphone; terpinen-4-ol; cuminol; *α*-terpineol; endo-isocamphonone; *α*-terpinene; verbenone; thymol methyl ether; linalyl acetate; bornyl acetate; thymol; *p*-cymene-3-ol; carvacrol; *α*-terpinyl acetate; carvacrol acetate; *β*-bourbonene; *β*-caryophyllene; aromadendrene; *α*-humulene; lavandulyl acetate; *α*-amorphene; *γ*-cadinene; *δ*-cadinene; spathulenol; caryophyllene oxide; humulene epoxide; and t-cadinol. **92)** Kaempferol-3-O-(60-*p*-coumaroyl)-b-D-glucopyranoside; quercetin; kaempferol-3-O-a-L-arabinopyranoside; rubanthrone A; kaempferol-3-O-(60-feruloyl)-b-D-glucopyranoside; rubanthrone B; kaempferol-3-O-b-D-galactoside; rubanthrone C; quercetin-3-O-b-D-glucuronide; caffeic acid; quercetin-3-O-b-D-glucoside; tormentic acid; quercetin-3-O-a-L-rhamnoside; ursolic acid; quercetin-3-O-glucuronide; euscaphic acid; luteolin-7-O-b-D-glucuronide; oleanolic acid; kaempferol-3-O-glucuronide; 2*α*-hydroxyursolic acid; kaempferol-3-O-b-D-glucuronide; ferulic acid; kaempferol-3-O-b-D-glucoside; tiliroside; tormentic acid-28-glucoside; corosine; 23-hydroxy tormentic acid; gallic acid; euscaphic acid-28-glucoside; nigaichigoside; ursolic acid-28-glucoside; 3-caffeoylquinic acid; 1,4-dicaffeoylquinic acid; 5-caffeoylquinic acid; 4-caffeoylquinic acid; kaempferol; and ellagic acid. **93)** d-Mannose; 9-octadecenoic acid, [2-phenyl-1,3-dioxolan-4-yl]methyl ester, ci; dodecanoic acid, 2-(acetyloxy)-1-[(acetyloxy)methyl] ethyl ester; tetradecanoic acid; cholestan-3-ol, 2-methylene, (3a,4A); cyclopropanebutanoic acid, 2-[[2-[[2-[[2 pentylcycloprophyl)methyl]cyclopropyl]methyl]cyclopropyl] methyl]-mehyl ester; N-hexadecanoic acid; 9-hexadecanoic acid; oleic acid; octadecanoic acid; 3',8,8'-trimethoxy-3-piperidyl-2,2'-binaphthalene1,1',4,4'-tetrone; dodecanoic acid, 10-methyl, methyl ester; hexadecanoic acid, butyl ester; hexadecanoic acid, octadecyl ester; 9-octadecenoic acid[Z],2,3,-dihydroxyprophyl ester; hexadecanoic acid, 1-[hydroxymethyl]-1,2-ethanediyl ester; 9-octadecenoic acid[Z],2-hydroxy-1[hydroxymethyl] ehtyl ester; 2,6,10,14,18-pentamethyl-2,6,10,14,18-eicosapentaene; 4,5,6,7-tetrahydroindoxazen-5-ol-4-one, 3-[10-phendecyl]; *α*-tocoferol; 1H-inden-1-one,2,3-dihydro-5,6-dimethoxy-3-methyl; aspidospermidin-17-ol, 1-acetyl-19,21-eposy-15,16-dimethoxy; 9-

octadecene, 1-methoxy, (E); and b(9a)-homo-19-norpregna-9(11), 9a-dien-20-one, 3(dimethylamino)-4,4,14-trimethyl-(3a,4a); tetradecanoic acid; cyclopropanebutanoic acid, 2-[[2-[[2-[[2-pentylcycloprophyl)methyl]cyclopropyl]methyl]cyclopropyl]methyl]-mehyl ester. **94)** Sabinene bicyclo(3.1.0)hexane; α-pinene; bicyclo(3.1.1)heptan,6,6-dimethyl;eucalyptol; biocyclo(3.1.1)heptan-3-one,2,6,6-trimethyl; hydrazine; α-bourbonene. **95)** Gallic acid; caftaric acid; chlorogenic acid; cicoric acid; catechin; caffeic acid; siringic acid; dicaffeoylquinic acid; sinigrin; ellagic acid; rutin; ferulic acid; rosmarinic acid; taxifolin; *α*-indole 3 carboxilic; spiraeosid; miricetin; kampherol and biochanin-A. **96)** Benzaldehyde; benzyl chloride; ethanone, 2-hydroxy-1-phenyl; benzyl isocyanate; benzyl nitrile; benzenecarboxylic acid;l-[-]-4-hydroxy-1-methylproline; benzaldehyde, 4-methoxy; benzaldehyde, 3-methoxy; 2-coumaranone; benzeneacetic acid; 3-benzyloxy-1-nitro-butan-2-Ol; benzaldehyde, 4-(phenylmethoxy); benzene isothiocyanate; 2-(3'-phenylpropyl)-5-ethylpyridine; (Z,Z)-à-farnesene; N- benzylacetamide; benzyl (6Z,9Z,12Z)-6,9,12-octadecatrienoate; 1,3-cyclohexanedicarbohydrazide; benzylidenebenzylamine; 3à-hydroxy-3-methyl-6-phenyl-4-piperidone; decanoic acid, methyl ester; docosanoic acid, ethyl ester; acetophenone benzyloxime; benzamide, N-(4-methylphenyl); and pyrrole-2-carboxylic acid, 4-hydrazonomethyl-3,5-dimethyl, ethyl ester. **97)** Carvacrol; thymol; borneol; terpineol; linalool; cymene; myrcene; β-pinene; and α-pinene. **98)** *α*-Thujene; *α*-pinene; camphen; *β*-pinene; *β*-myrcene; *α*-phellandrene; *δ*-3-carene; *α*-terpinene; *p*-cymene; limonene; z-*β*-ocimene; e-*β*-ocimene; *γ*-terpinene; *α*-terpinene; linalool; borneol; e-2-caren-4-ol; 4-terpineol; *trans*-chrysanthenyl acetate; thymol; carvacol; *α*-copaene; *trans*-caryophyllene; aromadendrene; ledene; *γ*-cadinene; *δ*-cadinene; spathulenol; caryophyllene oxide; and *β*-phellandrene. **99)** Gallic acid; chlorogenic acid; caffeic acid; rutin; isoquercitrin; quercitrin; and quercetin. **100)** Alopecurone (A-L); sophoraflavone G; 2',4',7-trihydroxy-8-lavandulylflavanone; 4',7-dihydroxyflavanone 7-O-*β*-d-glucopyranoside; 4',7-dihydroxy-8-prenylflavanone; *β*-d-glucosyl-4'-O-methylisoflavone; 2',4',5,7-tetrahydroxy-6-prenylisoflavone; 2-(4-hydroxyphenyl)-2,3-dihydrobenzofuran-3,4,6-triol; leachianol D; (−)-maackiain-3-O-*β*-d-glucoside; and 3',4',5,7-tetrahydroxyflavone. **101)** Chlorogenic acid; caffeic acid; rutin; luteolin; and ferulic acid. **102)** 3H-Pyrazol-3-one; 2,4-dihydro-2,4,5-trimethyl; di-glyceraldehyde dimer; 2-hexanol; 2,5-dimethyl-(S)-4-hydroxy-3-methylacetophenone; sucrose; 3',5'-dimethoxy-acetophenone; 3-O-methyl-d-glucose; 4-((1E)-3-hydroxy-1-1propenyl)-2-methoxyphenol; 2-ally-1,4-dimethoxy-3-methyl-benzene; 2-phenyl-2,3-dihydro-1,5-benzothiazepin-4(5h)-one; and 2-[1-hydroxy-2-(7-phenyl-2,3,6,7-tetrahydro-1H-[1,4] diazepin-5-yl)-vinyl]-4-methoxy-phneol. **103)** 4*β*,5*α*-epoxy-7*α*H-germacr-10(14)-en,1*β*-hydroperoxyl,6*β*-ol; 4*β*,5*α*-epoxy-7*α*H-germacr-10(14)-en-6*β*-ol-1-one; *β*,5*β*-epoxy-7*α*H-germacr-10(14)-en,1*β*-hydroperoxyl,6*β*-ol; 4*α*,5*β*-epoxy-7*α*H-germacr-10(14)-en,1*β*-hydroperoxyl,6*α*-ol; 10*α*,1*β*;4*β*,5*α*-diepoxy-7*α*H-germacrm-6-ol; teucladiol; 4*β*,6*β*-dihydroxy-1*α*,5*β*(H)-guai-9-ene; oplopanone; oxyphyllenodiol A; eudesm-3-ene-1,6-diol; rel-1*β*,3*α*,6*β*-trihydroxyeudesm-4-ene; arteincultone; 7,4'-O-dimethylscutellar-ein(5,6-dihydroxy-7,4'-dimethoxyflavone); salvigenin; teucardoside; and poliumoside. **104)** *Maranta arundinacea; Oroxylum indicum; Commelina benghalensis; Curcuma longa; Areca catechu; Oryza sativa; Garcinia mangostana; Ceiba pentandra; Aloe barbadensis; Coccinia grandis; Senna siamea; Chromolaena odorata;* and *Tinospora crispa*. **105)** *Maranta arundinacea; Oroxylum indicum; Commelina benghalensis; Curcuma longa; Areca catechu; Oryza sativa; Garcinia mangostana; Ceiba pentandra; Aloe barbadensis; Coccinia grandis; Senna siamea; Chromolaena odorata;* and *Tinospora crispa*. **106)** *α*-Pinene; *β*-myrcene; *α*-terpinene; ρ-cymene; limonene; 1,8-cineol; *γ*-terpinene; *cis*-*β*-terpineol; linalol; camphor; borneol; terpinene-4-ol; methyl thymyl ether; methyl thymyl ether (isomer); *trans*-caryophyllene; *γ*-cadinene; *trans*-calamene; caryophyllene oxide;and *γ*-cadinol. **107)** 2-Isopropyl-5-methyl-phenol; oleic acid; octadecanoic acid; (3*β*,24S)-stigmast-5-en-3-ol; lupeol acetate; hexadecanoic acid; stigmasta-5,22-dien-3*β*-ol; lup-20(29)-en-3-yl acetate; 2-isopropyl-5-methyl-phenol; lup-20(29)-en-3*β*-ol; lup-20(29)-en-3yl acetate; N-hexatriacontane; oleic acid; N-hexacosane; *β*-stigmasterol; and cholest-5-en-3*β*-ol. **108)** Gallic acid hexoside (with different isomers); gallic acid; protocatechuic acid; *p*-hydroxybenzoic acid; *p*-coumaric acid hexoside; caffeic acid; *p*-coumaric acid; ellagic acid; *p*-coumaroyl-di-galloyl-o-glucose; ferulic acid; quercetin; pinobanksin; naringenin; rhamnetin; naringenin-7-O-hexoside; kaempferol di-O-hexoside (with different isomers); rutin; kaempferol-3-O-glucoside; quercetin 3-O-rhamnoside; and quercetin 3-O-galactoside. **109)** Neophytadiene (isomer II); neophytadiene (isomer iii); nonadecane; ethyl hexadecanoate; 1-octadecanol; (E)-phytol (E)-phytyl acetate; tricosane; 5-methyl-5-(4,8,12-trimethyltridecyl) dihydro-2(3H)-furanone; hinokiresinold; pentacosane; heptacosane; octacosane; (All E)-squalen; nonacosane; and *α*-tocopherol. **110)** Quinic acid; chlorogenic acid; catechin; apigenin 6-C-arabinoside 8-glucoside; vitexin; methylkaempferol-hexose; luteolin; apigenin; apigenin-7-O-glycuronyl; umbelliferone; luteolin derivative; 6,8-Di-*C*-*β*-glucupyranosylapigenin; 5,4'-dihydroxy-7,3'-dimethoxy8-methyl homoisoflavanone; malonyl-monocinnamoylquinic acid; and quinic acid derivative. **111)** Pentan-1-ol; 3,4-hexanedione; hexamethyl-2-p-nitrophenyl-oxadiazol; cyclotrisiloxane; phenylethane; 3-methylbutyl acetat; α-pinene; α-pinene(2,4,6-octatriene); o-xylene(1,3-dimethyltrisulfane-benzaldehyde); pentana; 2-pentoxyethyl trifluoroacetate; 2,2,5,5-tetramethylhexane; 2,3,3-trimethylbicyclo[2.2.1]heptan-2-ol; cyclohexasiloxane; 4-allyl-2-methoxyphenol. **112)** Q-3-O-[4''-(3-hydroxy-3-methylglutaroyl)]-*α*-rhamnopyranoside, Q-3-O-*α*-rhamnopyranoside, Q-3-O-*β*-galactopyranoside, Q-3-O-*β*-glucopyranoside, and Q-3-O-*α*-arabinofuranoside, quercetin-3-O-[4''-(3-hydroxy-3-methylglutaroyl)]-*α*-rhamnopyranoside, Q-3-O-*α*-rhamnopyranoside, and (+)-catechin. **113)** Lupenyl acetate; *α*-amyrin; *β*-amyrin; *β*-amyrin acetate; sitostero; friedelanone; friedelin acetate; farnesylamine; and oleanolic acid. **114)** Methyl steviol; *α*-eudesmol; cyclosativen;

trichoacorenol; 2-propenoic acid, tetradecyl ester; 6-isopropenyl-4,8a-dimethyl-1,2,3,5,6,7,8,8a-octahydro-naphthalen-2-ol; *α*-gurgujene; methyl zizanoate; *γ*-himachalene; 2,3,5,5,8A-pentamethyl-6,7,8,8a-tetrahydro-5h-chromen-8-ol; valerenic acid; valerenyl acetate; germacrone; 12-oxatetracyclo[4.3.1.1(2,5).1(4,10)]dodecane, 11-isopropylidene; nootkatone; 1H-2-Indenone,2,4,5,6,7,7a-hexahydro-3-(1-methylethyl)-7a-methyl; 1,4-dimethyl-2-cyclohexylbenzene; longifolene; campasterol; and 9.β.-acetoxy-3,5.α.,8-trimethyltricyclo[6.3.1.0(1,5)]dodec-3-ene. **115)** Caffeic acid hexoside; monogalloyl glucose; galloyl-HHDP-glucose; gallic acid; digalloyl glucose; catechin; epicatechin; epicatechin gallate; pentagalloyl glucose; ellagic acid hexoside; ellagic acid; ellagic acid xyloside; ellagic acid rhamnoside; delphinidin 3,5-diglucoside; cyanidin 3,5-diglucoside; and peonidin 3,5-diglucoside. **116)** Galactinol; caffeic acid mod; hirsutine; 1-O-b-D-glucopyranosyl sinapate mod; homoorientin; vitexin-2”-O-rhamnoside; vitexin-2”-O-rhamnoside Iisomer; mannitol; galactinol; (–)-epigallocatechin; casuarinin; (galloyl) methyl gallate; epigallocatechin 3,5-digallate; delphinidin; myricitrin; myricetin-3-xyloside glycoside; myricitrin glycoside; and robinetin trimethyl ether mod.

Table S2 – Phytochemicals with photosensitizing activity and produced antibiofilm effects.

Phytochemical(s)	Light source parameter(s)	Bacterial species	Biofilm effect(s) and related events	Reference
Aloe emodin	435 ± 10 nm; 0.08 W/cm^2; 72 J/cm^2; 10 min	MRSA (clinical isolate), *S. aureus* (ATCC 29213), *S. pneumoniae* (ATCC 49619), MDR S. pneumoniae (clinical isolate), vancomin-resistant *E. faecalis* (clinical isolate), and *E. faecalis* (ATCC 29212)	Reduction of preformed biofilm cells viability	307
5-aminolevulinic acid (5-ALA)	633 ± 10 nm; 360 J/cm^2	MSSA and MRSA (clinical isolates)	Reduction of preformed biofilms cells viability. Potentiation of sensitivity to conventional antibiotics after aPDI treatment	308
5-ALA	635 nm; 100, 200, 300 J/cm^2;	MRSA (ATCC 43300)	Eradication of preformed biofilm mass and alteration of biofilm morphology	309
5-ALA	633 ± 10 nm; 100 mW/cm2; 60 min	S. aureus (USA300	Reduction of preformed biofilm cells	310
5-ALA	25.2 mW/cm2; 210 J/cm2; 180 min	*S. epidermidis* and *E. coli* (clinical isolates); *P. aeruginosa* (ATCC 27853) and *S. aureus* (ATCC 25923)	Reduction of preformed biofilm cells viability	311
Berberine	405 nm;20 mW/cm^2; 15 min	*E. coli* (DH5α) and *S. aureus* (ATCC 6538)	Eradication of preformed biofilms	312
Caffeic acid	365, 385, and 400 nm; 500, 1000, or 2000 mW/cm^2; 4min	*S. mutans*	Eradication of preformed biofilm cells viability	313
Chlorin-e6	660 nm; 19 mW/cm^2; 15 J/cm^2; 13.25 min	*S. mutans* (UA159)	Reduction of preformed biofilm cells viability and biofilm lactic acid production	314
Chlorin-e6	405 ± 10 nm; 100 mW/cm^2; 12 J/cm^2 (2 min); 90 J/cm^2 (15 min)	*Moraxella catarrhalis* 7169, *S. pneumoniae* EF3030 (serotype 19F), and *Haemophilus influenzae* (clinical isolates)	Reduction of preformed biofilm cells viability and regrowth event 24 h posttreatment	315
Curcumin	380-515 nm; 1200 mW/cm^2; 4 min	*E. faecalis* (ATCC 29212)	Eradication of preformed biofilm mass	316
	450 nm;1000-1400 mW; 300-420 J/cm^2; 5 min		Reduction of preformed biofilm mass and disrupted the biofilm structure	317
	455±30 nm; 40 mW/cm^2; 75 J/cm^2; 1,870 s		Reduction of preformed biofilm cells viability	318
Curcumin	400–700 nm; 150 mW/cm^2; 270 J/cm^2; 30 min	*Listeria innocua* (NCTC 11288)	Reduction of preformed biofilm cells viability	319
Curcumin	455–460 nm; 1.8 mW/cm^2;	*L. monocytogenes* (ATCC 19115, ATCC 13932, ATCC	Reduction of biofilm formation and preformed	320

Phytochemical(s)	Light source parameter(s)	Bacterial species	Biofilm effect(s) and related events	Reference
	3.24 J/cm^2; 60 min	7644, and clinical isolate)	biofilm cells viability. Alteration of biofilm architecture and reduction of cell adhesion. Downregulation of expression of virulence genes (*inlA, hlyA*, and *plcA*)	
Curcumin	450 nm; 40 mW/cm^2; 19.2-115.2 J/cm^2; 10 cycles	*S. pyogenes* (clinical isolate)	Reduction of biofilm formation and biofilm cell adhesion. Potentiation of sensitivity to conventional antibiotics after aPDI treatment	321
Curcumin	450 nm; 67 mW/cm^2; 20.1 J/cm^2; 5 min	MRSA (ATCC 25923)	Reduction of preformed biofilm cells viability	322
Curcumin	455–460 nm; 3.80 mW/cm^2; 0.23 J/cm^2 (1 min); 0.69 J/cm^2 (3 min); 1.14 J/cm^2 (5 min); 2.28 J/cm^2 (10 min); 6.84 J/cm^2 (30 min)	*V. parahaemolyticus* (ATCC 17802 and clinical isolates)	Inhibition of biofilm formation, EPS production, and preformed biofilm cells eradication. Downregulation of expression of virulence genes (*tdh* and *toxR*) and biofilm formation genes: oxyR (interference with fimbrial gene expression) and aphA, luxR, opaR (QS regulators)	323
Curcumin	455 ± 30 nm; 40 mW/cm^2; 37.5 J/cm^2 (935 s); 75 J/cm^2 (1870 s)	Oral bacteria (total streptococci, mutans streptococci, and total lactobacilli) clinical isolates	Reduction of preformed biofilm cells viability and biofilm lactic acid production	324
Curcumin	455 ± 30 nm; 40 mW/cm^2; 75 J/cm^2; 1923 s	Oral bacteria from dental caries (clinical isolate)	Reduction of preformed biofilm cells viability	325
Curcumin	455 ± 30 nm; 40 mW/cm^2; 75 J/cm^2; 1870 s	Oral bacteria from infected dentin (clinical isolate)	Reduction of preformed biofilm cells viability	326
Curcumin	455 nm; 33.58 mW/cm^2; 10.8 J/cm^2 (5 min); 21.6 J/cm^2 (10 min); 32.4 J/cm^2 (15 min); 43.2 J/cm^2 (20 min)	*S. mutans* (UA159 ATCC 700610), and MRSA (ATCC 33591)	Reduction of biofilm formation and preformed biofilm cells viability	327
Fagopyrin F	450 nm; 5 or 10 J/cm^2	*S. mutans* (KCTC 3298)	Disruption of preformed biofilm and reduction of biofilm formation	328
Gallic acid	365 nm; 2646 ± 212 μW/cm2; 60 min	E. coli O157:H7 (ATCC 700728)	Reduction of biofilm metabolic activity, biofilm formation, and preformed biofilm cells viability	329
Hypericin	660 nm, 100 mW; 100 J/cm^2 (30 s); 166 J/cm^2 (50 s)	*P. acnes* (ATCC 6919)	Reduction of preformed biofilm cells viability	330
Hypericin	602 ± 10 nm; 14 mW/cm^2; 8 J/cm^2 (10 min); 25 J/cm^2 (30	MSSA (ATCC 29213) and MRSA (ATCC 33591)	Eradication of preformed biofilm cells viability	331

Phytochemical(s)	Light source parameter(s)	Bacterial species	Biofilm effect(s) and related events	Reference
	min)			
Hypericin	589 nm; 100 mW; 40 J/cm^2; 10 min	*Staphylococcus saprophyticus* subsp. bovis (DSM 18669)	Eradication of preformed biofilms	332
Hypocrelin B	400–780 nm; 0.08 W/cm^2; 72 J/cm^2; 300 s	*S. aureus* (ATCC 29213), *E. faecalis* (ATCC 29212), *S. pneumoniae* (ATCC 49619), *E. coli* (ATCC 25922) and *K. pneumoniae* (ATCC 700603), MRSA (clinical isolate) and VRE (ATCC 51299) and MDR *S. pneumonia* (clinical isolate) Plancktonic state and Biofilm	Eradication of preformed biofilm cells viability	333
Riboflavin	375 nm; 3 mW/cm2; 30 min	S. mutans (ATCC 25175)	Reduction of preformed biofilm mass	334
Riboflavin	450 nm; 40 W/m2	MRSA and MDR E. coli	Reduction of biofilm formation and preformed biofilm mass	335
Thymol	405 nm; 55 mW/cm^2; 50 J/cm^2 (22.5 min); 75 J/cm^2 (30 min); 80 J/cm^2 (24 min)	MRSA and *P. aeruginosa* (clinical isolates)	Reduction of biofilm formation and eradication of preformed biofilms	336

Table S3 – A curated overview of the antibiofilm properties of plant extracts and phytochemicals combined with antibiotics: effects on biofilm prevention, dispersion, eradication, regrowth prevention, and related events, from December 2008 to December 2021.

Plant extract(s)/Phytochemical(s)	Antibiotic(s) and/or phytochemical(s)	Bacterial species	Biofilm effects(s) and related events	Reference
Ajoene	Ciprofloxacin	*P. aeruginosa PAO1*	Reduction of biofilm formation and inhibition of swimming, swarming and twitching motilities. Disruption of architecture of biofilms and Increases the biofilm susceptibility to antibiotics reducing the dose of antibiotic required (synergistic effect)	337
Horseradish juice extract and ajoene	Tobramycin	*P. aeruginosa* PAO1 (clinical isolate)	Reduction of preformed biofilm cells viability. Increases the biofilm susceptibility to antibiotics increasing the reduction of preformed biofilm mass compared with compounds alone (synergistic effect)	338
A-type proanthocyanidin	Gentamicin	*P. aeruginosa* (ATCC 9027 and PAO1-pTDK-GFP)	Inhibition of biofilm formation, cell adhesion, and swarming motility. Disruption of preformed biofilm and iron chelation activity. Potentiates the effect of gentamicin (synergistic effect)	339
Baicalein	Vancomycin	*S. aureus* 17546 (t037)	Anti-QS activity (downregulation of agrA, RNAIII, and sarA regulators and *ica* gene). Reduction of biofilm formation, cell adhesion, staphylococcal enterotoxin A production and *α*-hemolysin production. Disruption of preformed biofilms and increased the biofilm permeability of vancomycin	340
Baicalein, cis-2-decenoic acid, Iodine, luteolin, monolaurin, and rosmarinic acid	Doxycyclin	*B. burgdorferi* sensu stricto (B31) and *Borrelia garinii* (CIP103362).	Reduction of preformed biofilm cell viability. Combinations of doxycycline with phytochemicals increase biofilm eradication. Reduction of concentrations of phytochemicals and antibiotics when used together (additive effect)	341
Berberine, cinnamaldehyd, eugenol, and thymol	Streptomycin	*L. monocytogenes* (CMCC 54004) and *S.* typhimurium (SL1344)	Reduction of biofilm formation and disruption of architecture of biofilms. Synergistic effect between thymol or cinnamaldehyd with streptomycin against *L. monocytogenes* and between cinnamaldehyd or eugenol with streptomycin against *S.* typhimurium. Meanwhile, the other combinations exhibited an additive effect	342
Betulinic acid, glycyrrhetinic acid, and ursolic acid	Ofloxacin, ciprofloxacin, cefepime, cefotaxime, and ceftriaxone	*V. cholerae* (C6709)	Anti-QS activity (interaction with cyclic di-GMP sensor VpsT, AI-2 sensor kinase LuxP-LuxQ, and transcriptional activator HapR). Reduction of preformed biofilm mass and EPS production and content. Decrease of extracellular gelatinase activity. Potentiates the action of antibiotic (additive effect between ursolic acid and cefotaxime)	343

Plant extract(s)/Phytochemical(s)	Antibiotic(s) and/or phytochemical(s)	Bacterial species	Biofilm effects(s) and related events	Reference
Carvacrol, citral, eugenol, linalool, and thymol	Oxytetracycline	*A. hydrophila (*ATCC 7966 and clinical isolate*), Aeromonas veronii, Raoultella ornithinolytica,* and *C. freundii* (clinical isolate)	Reduction of biofilm formation and potentiation of action of antibiotic (additive effect)	344
Carvacrol, *p*-cymene, eugenol, *γ*-terpinene, and thymol	Tetracycline	*S. aureus* (ATCC 25923 and clinical isolate)	Reduction of biofilm formation and cell adhesion. Inhibition of efflux pump. Increased of reduction of preformed biofilm when phytochemicals and antibiotics are used together (synergistic effect)	345
Carvacrol, eugenol, and Thymol	Nalidixic acid	*S.* typhimurium (LT2 DT104, ATCC 1408, and clinical isolate)	Reduction of preformed biofilm mass and inhibition of efflux pumps. Increased of biofilm susceptibility to antibiotics (synergistic effect)	346
Extracts of *Cinnammonum zeylanicum, Mentha piperita, Origanum vulgare,* and *Thymus vulgaris* [(1)]	Norfloxacin, oxacillin, and gentamicin	*S. aureus* (ATCC 29213), *E. faecalis* (ATCC 29212), *S. epidermidis,* and S. *aureus* (clinical isolates)	Reduction of preformed biofilm mass. Increased of disruption of preformed biofilm cells, when phytochemicals and antibiotics are used together (synergistic effect)	347
Curcumin	Azithromycin and gentamicin	*P. aeruginosa* PAO1 (pME3846 (rhlI-lacZ; Tcr))	Anti-QS activity (reduction of C12-HSL and C4-HSL and downregulation of expression of *lasI, lasR, rhlI, and rhl*). Reduction of biofilm formation, swarming and twitching motilities. Furthermore, the combination of azithromycin and curcumin proved the greatest inhibitory effect (synergistic effect)	348
Curcumin	Penicillin, erythromycin, ciprofloxacin, and vancomycin (for Gram-positive strains), ampicillin, ceftriaxone, cefepime, gentamicin, amikacin, imipenem, and meropenem (for Gram-positive strains)	*E. coli, K. pneumoniae, C. freundii, P. aeruginosa, S. aureus,* and *E. faecalis*	Inhibition of preformed biofilm cells viability. Increased of biofilm susceptibility to antibiotics (synergistic effect)	349
Ellagic acid	Tetracycline	*P. acnes* (MTCC 1951 and clinical isolate)	Reduction of biofilm formation and EPS production. Tetracycline potentiates ellagic acid to exhibit an antibiofilm effect	350
Eugenol	Gentamicin	*P. aeruginosa* (PAO1 and clinical isolate)	Anti-QS activity (downregulation of expression of lasI, lasR, rhlI, and rhlR, interaction with LasR and RhlR receptors and virulence factors	351

Plant extract(s)/Phytochemical(s)	Antibiotic(s) and/or phytochemical(s)	Bacterial species	Biofilm effects(s) and related events	Reference
			(extracellular polysaccharides, rhamnolipid, elastase, protease, pyocyanin, and pyoverdine)). Reduction of biofilm formation. Increases the biofilm susceptibility to antibiotics (synergistic effect)	
Extract of *Acacia dealbata, Buxus sempervirens* (lupeol, betulin, hederagenin**,** ursolic acid, and oleanolic acid), *Centaurea nigra, Eupatorium cannabium,* and *Prunus spp. plants,*	Erythromycin, ciprofloxacin, and tetracycline	*S. aureus* (CECT 976, SA1199B, RN4220, XU212, and clinical MRSA strain MJMC001)	Reduction of biofilm formation. Potentiation of biofilm susceptibility to antibiotics	352
Extract of *Buchanania lanzan*	Gentamicin	*E. coli* (MTCC 2939) and *P. aeruginosa* (MTCC 2453)	Reduction of biofilm formation and preformed biofilm cells viability. Potentiation of biofilm susceptibility to antibiotics (synergistic effect)	353
Extracts of *Chelidonium majus* and *Corydalis cheilanthifolia*	Amoxicillin	*H. pylori* 8064	Reduction of biofilm formation and preformed biofilm mass. Increases the biofilm susceptibility to antibiotics reducing the dose of phytochemical and antibiotics (synergistic effect)	354
Extracts of *Cinnamomum verum, Mentha piperita, Punica granatum* [(2)], *Rosmarinus Officinalis* [(2)], *Syzygium aromaticum, Thymus vulgaris*, and *Zingiber officinale*	Imipenem, ceftazidime, cefepime, gentamycin, norfloxacin, ofloxacin, ciprofloxacin, levofloxacin, and piperacillin, amikacin, gatifloxacin, nalidixic acid, tobramycin	*P. aeruginosa* (clinical isolate)	Reduction of biofilm formation, and swarming, twitching, swimming motilities. Eradication of preformed biofilm. Increases of biofilm susceptibility to antibiotics reducing the dose of phytochemical and antibiotics (synergistic effect)	355
Extract of *Cinnamomum zeylanicum* (type A procyanidin)	Nitrofurantoin	*E. coli* (clinical isolate)	Reduction of biofilm formation and downregulation of fimbriae adhesins (*focA, fimA, fim H,* and *papG*) alone or combined with antibiotics. Enhanced of biofilm susceptibility to antibiotics (synergistic effect)	356
Extract of *Citrus sinensis* (rutin)	Gentamicin	*P. aeruginosa* MTCC 2488	Reduction of biofilm formation, cell adhesion, EPS production, and thickness of biofilm. Enhanced of biofilm susceptibility to antibiotics (synergistic effect)	357

Plant extract(s)/Phytochemical(s)	Antibiotic(s) and/or phytochemical(s)	Bacterial species	Biofilm effects(s) and related events	Reference
Extract of *Curcuma longa* (curcumin)	Bacitracin, clindamycin, azithromycin, and erythromycin	*E. coli* (ATCC 10536), *P. aeruginosa* PAO1, *P. mirabilis* (ATCC 7002), *S. marcescens* (clinical isolate), and *C. violaceum* (ATCC 12472 and CV026)	Anti-QS activity (inhibition of violacein, prodigiosin, rhamnolipid, and alginate production). Inhibition of biofilm formation and swimming and swarming motilities. Increases of biofilm susceptibility to antibiotics (synergistic effect)	358
Extract of garlic (ajoene)	Tobramycin	*P. aeruginosa* (PAO1 and clinical isolate) and *E. coli*	Anti-QS activity (reduction of rhamnolipid, C4-HSL, and 3-oxo-C12-HSL production) and reduction of biofilm formation. Enhanced of biofilm susceptibility to antibiotics (synergistic effect)	359
Extract of *Himatanthus drastic*	Ciprofloxacin	*K. pneumoniae* (ATCC 10031)	Reduction of biofilm formation and potentiation of biofilm susceptibility to antibiotics (synergistic effect)	360
Extract of *Lavandula coronopifolia* [3]	Ciprofloxacin	*P. aeruginosa* (clinical isolate and ATCC 12924)	Reduction of biofilm formation and increases of biofilm susceptibility to antibiotics (synergistic effect)	361
Extract of *Lavandula x intermedia* Emeric ex Loisel. [4], *Mentha arvensis* [4], *Origanum vulgare, Satureja montana,* and *Thymus vulgaris*	Erythromycin	*S. agalactiae* (ATCC 13813 and clinical isolate), *Lactobacillus* spp. (clinical isolate)	Reduction of biofilm formation and preformed biofilm cells viability. Synergistic effect between all extract and erythromycin	362
Extract of maple syrup (gallic acid, catechol, catechaldehyde, and syringaldehyde)	Ciprofloxacin	*E. coli* (ATCC 700928), *P. mirabilis* (HI4320), and *P. aeruginosa* PAO1 (ATCC 15692), PA14 (UCBPP-PA14))	Reduction of biofilm formation and preformed biofilm mass. Inhibition of efflux pump activity. Repression of expression of genes associated with multiple drug resistance (emrA, acrB, and marC in CFT073; acrA and marC in HI4320; oprM, mexA, and mexX), motility (fliC, flhD, motB, fimH, fimA, papA2, flaA and flh, fliC and fleQ), virulence determinants (chuA, cysJ, plcH, phzS, and pvdA), adhesion (fimH, fimA, papA2, atfB, cupA1, and pelA), and biofilm formation (uvrY, ureD, and lasB). Increases of biofilm susceptibility to antibiotics (synergistic effect)	363
Extract of *Parinari curatellifolia*	kanamycin	*Mycobacterium smegmatis*	Inhibition of biofilm formation and synergistic effect between the extract and kanamycin	364

Plant extract(s)/Phytochemical(s)	Antibiotic(s) and/or phytochemical(s)	Bacterial species	Biofilm effects(s) and related events	Reference
Extract of *Sambucus williamsii* ((+)-medioresinol)	Ampicillin, cefotaxime, and chloramphenicol	*E. faecium* (ATCC 19434), *S. aureus* (ATCC 25923), *P. acnes* (ATCC 6919), *E. coli* O-157 (ATCC 43895), *E. coli* (ATCC 25922) and *P. aeruginosa* (ATCC 27853)	Reduction of biofilm formation and preformed biofilms cells viability. Increases of biofilm susceptibility to antibiotics (synergistic effect)	365
Extract of *Scutellaria baicalensis* (baicalin)	Levofloxacin, tobramycin, amikacin, and ceftazidime	*P. aeruginosa* (PAO1 and *ΔlasI-ΔrhlI*)	Anti-QS activity (decrease of QS signaling molecules 3-oxo-C12-HSL and C4-HSL; repression of *lasI, lasR, rhlI, rhlR, pqsR,* and *pqsA* genes and inhibition of LasA protease, LasB elastase, pyocyanin, rhamnolipid, motilities, and exotoxin). Reduction of biofilm formation, cell adhesion, and preformed biofilm cells viability. Synergistic effect between baicalin and erythromycin	366
Extract of *Syzygium cumini* (N-hexanoyl-dl-homoserine lactone; malvidin; petunidin; and cyanidin.)	Ofloxacine, Tetracycline, and Chloramphenicol	*K. Pneumoniae* (clinical isolate), *C. violaceum* CV026 (CECT 5999), and *C. violaceum* (MTCC2656)	Anti-QS activity (inhibition of violacein production). Inhibition of biofilm formation and EPS production. Enhanced of biofilm susceptibility to antibiotics (synergistic effect)	367
Gallic acid and tannic acid	Tobramycin	*P. aeruginosa* (ATCC 15729 and PAO1 clinical isolate)	Reduction of biofilm formation and preformed biofilm cells viability. Increases of biofilm susceptibility to antibiotics reducing the dose of antibiotic required (synergistic effect)	368
Hordenine	Netilmicin	*P. aeruginosa* PAO1	Anti-QS activity (reduction of acyl-homoserine lactones levels and suppression of *lasI, lasR, rhlI,* and *rhlR*). Reduction of biofilm formation, disruption of preformed biofilms, and swimming and swarming. Enhanced the susceptibility of antibiotics (synergistic effect)	369
Hordenine	Tobramycin, gentamycin, or amikacin	*P. aeruginosa* PAO1 (ATCC 15692 and clinical isolate)	Anti-QS activity (downregulation the expression of *oprL* (membrane lipoprotein synthesis), *pelB* (extracellular matrix biosynthesis, biofilm development, and aminoglycoside resistance), *nirS* (biofilm development and nitric oxide synthesis), and *lasI, lasR, rhlI, rhlR, pqsH,* and *pqsR* genes). Reduction of expression of aminoglycoside target acetyltransferase aacA29a and acetyltransferase subunit aacA29b, and interaction with LasR and RhlR receptors) Reduction of biofilm formation and preformed biofilm cells viability. Alteration of biofilm architecture. No synergistic or antagonistic effect was observed	370
Extract of *Humulus lupulus*	Oxacillin, vancomycin,	*S. aureus* (ATCC 29213)	Inhibition of biofilm formation and reduction of cell adhesion. Reduction	371

Plant extract(s)/Phytochemical(s)	Antibiotic(s) and/or phytochemical(s)	Bacterial species	Biofilm effects(s) and related events	Reference
(xanthohumol) [5]	linezolid		of preformed biofilm cells viability. Enhances of biofilm susceptibility to antibiotics reducing the dose of antibiotic and extract required (synergistic effect)	
Hydroxycoumarin, indole-3-carbinol, salicylic acid, and saponin	Tetracycline, erythromycin, and ciprofloxacin	*E. coli* (CECT 434), *S. aureus* (CECT 976, RN4220, SA1199B, and XU212) and *C. violaceum* (ATCC 12472)	Anti-QS activity (inhibition of violacein production). Reduction of biofilm formation, swimming, swarming and sliding motilities. Decrease of preformed biofilm cells viability. Synergistic/additive effect between phytochemicals and antibiotics	372
Linolenic acid	Tobramycin	*P. aeruginosa* (ATCC 27853 and clinical isolate)	Anti-QS activity (reduction of expression of *lasI, lasR, rhlI,* and *rhlR* genes, attenuation of virulence factor-related genes, and inhibition of pyocyanin production, lasA and azocasein activities). Reduction of preformed biofilm mass and metabolic activity. Inhibition of swarming motility. Potentiation of biofilm susceptibility to antibiotics reduces the dose of antibiotic required (synergistic effect)	373
Morin, pyrrolidine, quercetin, quinine, and reserpine	Ciprofloxacin, erythromycin, and tetracycline	*S. aureus* (SA1199B, RN4220 and XU212)	Reduction of biofilm formation and preformed biofilms cells viability. Inhibition of NorA efflux pump. Synergistic effect between phytochemicals and antibiotics	374
Naringin	Ciprofloxacin and tetracycline	*P. aeruginosa* (MTCC 2488)	Reduction of EPS production, swimming and swarming motility. Alteration of biofilm morphology and decrease of preformed biofilm mass. Potentiation the biofilm susceptibility to antibiotics (synergistic effect)	375
Nicotinic Acid	Imipenem	*P. aeruginosa* (clinical isolate)	Inhibition of biofilm formation. Potentiation of biofilm susceptibility to antibiotic reducing nicotinic acid and imipenem doses (synergistic effect)	376
Petunidin	Kanamycin, erythromycin, and tetracycline	*K. pneumoniae* (PUFST23) and *C. violaceum* (CV026 and MTCC 2656)	Anti-QS activity (interaction with LasR receptor and inhibition of violacein production). Reduction of biofilm formation and EPS production. Enhances of biofilm sensitivity to antibiotics (synergistic and partial synergistic effect)	377
Reserpine	Ciprofloxacin, gentamicin, erythromycin, and cloxacillin	*S. aureus* (MTCC 96)	Reduction of biofilm formation, EPS production and preformed biofilm metabolic activity. Interaction with virulence regulatory proteins (AgrA, AtlE, Bap, IcaA, SarA, and SasG. Additive effect between phytochemical and antibiotics	378
Thymol and Piperine	Amikacin, kanamycin, and	*S. enteritidis, S. typhi,*	Inhibition of biofilm formation and eradicating the preformed biofilm.	379

Plant extract(s)/Phytochemical(s)	Antibiotic(s) and/or phytochemical(s)	Bacterial species	Biofilm effects(s) and related events	Reference
	streptomycin	*S.* typhimurium*, and Salmonella choleraesuis* (clinical isolates)	Potentiation of biofilm susceptibility to antibiotics reduces the dose of antibiotic and phytochemicals required (synergistic effect)	
Tryptanthrin	ciprofloxacin	*V. cholerae* (569B, L362, N16961, Y1286, T-00, MCV09, W4-13, and MAL-15)	Anti-QS activity (interaction with LuxO protein). Reduction of biofilm formation and motility. Potentiation of biofilm susceptibility to antibiotics (synergistic effect)	380
Vitexin	Azithromycin and gentamicin	*P. aeruginosa* (MTCC 2488)	Anti-QS activity (inhibition of production of protease, pyoverdin, and pyocyanin and binding affinity for *LuxR, LasA, Las B,* and *Lasl* genes). Reduction of biofilm formation and cell adhesion. Synergistic effect between phytochemical and antibiotics	381
Zingerone	Ciprofloxacin	*P. aeruginosa* PAO1	Reduction of biofilm formation, preformed biofilm mass and swimming, swarming and twitching motilities. Potentiation of effect of antibiotic	382

Note: Plant extracts constituents - **1)** n-propyl acetate; propanoic acid, ethyl ester; butanoic acid, 2-methyl-, methyl ester; *α*-tricyclene; artemisia triene; *α*-thujene; *α*-pinene; camphene; benzaldehyde;1-octen-3-ol; 3-octanone; *β*-myrcene; 3-octanol; 2-carene; eucalyptol; *p*-cymene; *α*-terpinolene; *β*-phellandrene; limonene; salicylaldehyde; *γ*-terpinene; *p*-cymenene; hydrocinnamic aldehyde; phenylethyl alcohol; camphor; (E)-*β*-terpineol; isopulegol; menthone; D,L-isoborneol; menthol; terpinen-4-ol; verbenone; pulegone; carvenone; o-anisaldehyde; piperitone; benzyl benzoate; n-valeric acid; caryophyllene oxide; *β*-bisabolene; *γ*-muurolene; cinnamaldehyde, o-methoxy; *β*-farnesene; alloaromadendrene; (E)-cinnamic acid; coumarin; *β*-gurjunene; (E)−*β*-caryophyllene; *β*-bourbonene; *α*-copaene; linalool isobutyrate; *α*-ylangene; cubenene; durenol; carvacrol; thymol; *p*-cymen-7-ol; bornyl acetate and (E)-cinnamaldehyde. **2)** Pyrogallol; benzoic; chlorogenic; catechol; protocatchuic; vanillic; gallic; *P*-OH-benzoic; rosmarinic; ellagic; α-coumaric; ferulic; caffeic; salycilic; *P*-coumaric; cinnamic and iso-ferulic. . 3**)** Quinic acid; malic acid; caffeic acid derivative; eucomic acid; syringic acid 4-O-hexoside; 2-(4-hydroxybenzyl)-malic acid; sinapoyl trihydroxybenzoic acid; rosmarinic acid malate; N-acetyltryptophan; catechin; methyl trihydroxybenzoic acid malate; sinapic acid 3-O-glucoside; dihydrosinapic acid hexoside; resveratrol glucosid; isoscutellarein-8-O-glucuronide; rosmarinic acid; resveratrol glucoside; luteolin-7-O-hexouronide; apigenin di-C-hexoside; apigenin-7-O-hexournide I; apigenin-7-O-hexouronide II; hypolaetin 4′-O-methyl ether-O-hexoside-O-rhamnoside I; hypolaetin-4′-O-methyl ether-O-hexoside-O-rhamnoside II; isorhamnetin O-hexoside-O-rhamnoside; hypolaetin di-O-rhamnoside; luteolin-7-O-glucoside; hypolaetin 4′-O-methyl ether-8-glucuronide-O-rhamnoside; acacetin-O-hexouronic acid; apigenin-O-caffeoyl rhamnoside; methoxy leteolin-7-O-hexoside; tricin-O-feruloyl rhamnoside; crismaritin-O-caffeoyl rhamnoside; luteolin-7,3′-dimethyl ether; apigenin; binaringenin methyl ether; methoxy amentoflavone; dihydrobilobetin; acacetin; dimethoxy amentoflavone; penta methoxy dihydro biapigenin; kayaflavone and dihydrokayaflavone. **4)** *α*-Thujene; *α*-pinene; camphene; sabinene; *β*-pinene; *β*-myrcene; *p-c*ymene; limonene; 1,8-cineole; *cis*-ocimene; *trans*-ocimene; *γ*-terpinene; terpinolene; linalool; camphor; isopulegol; menthone; borneol; isomenthone; terpinen-4-ol; menthol; *α*-terpineol; pulegone; piperitone; linalyl acetate; lavandulyl acetate; menthyl acetate; *β*-bourbonene; *β*-caryophyllene; germacrene D and caryophyllene oxide. **5)** (+)-catechin; (−)-epicatechin; neochlorogenic acid; chlorogenic acid; cryptochlorogenic acid; feruloylquinic acid; quercetin and kaempferol derivatives

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