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Supplementary File 2

Supplementary Tables S1–S3

Antibiofilm and Quorum-sensing Agents Against Pseudomonas aeruginosa and Staphylococcus aureus: a Systematic Review of Preclinical Studies, 2022-2026

Ma'aitah, S., AlAmairyin, B. (2026). Journal of Basic and Applied Research in Biomedicine, 12(1): 33-50

Table S1. Search strategies

Database	Date of last search	Query (verbatim)	Filters / limits	Records retrieved	Note
PubMed	August 2026	(antibiofilm[tiab] OR "biofilm inhibitor*"[tiab] OR "biofilm inhibition"[tiab] OR "biofilm eradicat*"[tiab] OR "anti-biofilm"[tiab]) AND ("quorum sensing"[tiab] OR "quorum sensing inhibitor*"[tiab] OR "quorum quenching"[tiab] OR "QS inhibitor*"[tiab] OR "Quorum Sensing"[MeSH Terms]) AND ("Biofilms"[MeSH Terms] OR biofilm*[tiab]) NOT (clinical trial[pt] OR randomized controlled trial[pt] OR humans[MeSH Terms])	No date limit applied at the search stage; clinical trials, randomised controlled trials and records indexed to humans are excluded in the query itself. Restriction to 2022 onward and to P. aeruginosa or S. aureus/MRSA in the title was applied at the eligibility stage (title/abstract screening judged topic only) (Screening Log, PRISMA Tracker).	1122	Query supplied by the author.
Scopus	August 2026	TITLE-ABS-KEY((antibiofilm OR "biofilm inhibitor*" OR "biofilm inhibition" OR "biofilm eradicat*" OR "anti-biofilm") AND ("quorum sensing" OR "quorum sensing inhibitor*" OR "quorum quenching" OR "QS inhibitor*") AND ("biofilm*")) AND NOT TITLE-ABS-KEY("clinical trial" OR "randomized controlled trial" OR "randomised controlled trial") AND NOT SUBJAREA(MEDI)	No date limit applied at the search stage; clinical-trial terms and the Medicine subject area (MEDI) are excluded in the query itself. Restriction to 2022 onward and to the target organisms in the title was applied at the eligibility stage (title/abstract screening judged topic only).	2227	Query supplied by the author.

Table S2. Included studies (n = 252; condensed). The full table, with agents, models, concentrations, biofilm and QS results, is in Supplementary Table S2 (Excel).

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
1	Matijašević et al. (2025)	J Ethnopharmacol	10.1016/j.jep.2025.120466	Serbia	Natural product	P. aeruginosa	Direct	C. elegans	Toxicity only	N
2	Wen F, Wu Y, Yuan Y, Yang X, Ran Q, Gan X, Guo Y, Wang X, Chu Y, Zhao K (2024)	Appl Microbiol Biotechnol	10.1007/s00253-024-13067-9	China	Natural product	P. aeruginosa	Direct	Caenorhabditis elegans	Efficacy/infection outcome	N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
3	Ying J, Guo S, Pan Y, Li D, Tai Y, Li Y, Lin Q, Pan L, Huang D, Xiao H, Pan R, Xu X, Xie J, Lou Z, Li P (2025)	Front Cell Infect Microbiol	10.3389/fcimb.2025.1624927	China	Natural product	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	Y
4	Aboulwafa MM, Mostafa NM, Youssef FS, Eldahshan OA, Singab ANB (2025)	Sci Rep	10.1038/s41598-025-88824-5	Egypt	Natural product	P. aeruginosa	Indirect			N
5	Kim GS, Park CR, Kim JE, Kim HK, Kim BS (2022)	J Microbiol Biotechnol	10.4014/jmb.2107.07053	South Korea	Natural product	S. aureus/MRSA	Direct			Y
6	Chen H, Wu L, Su Y, Huang Z, Wang L, Xia Z, Huang H, Wang W, Fang J, Gu Z, Sun P, Zheng J (2022)	Curr Microbiol	10.1007/s00284-022-02914-5	China	Natural product	P. aeruginosa	Direct			N
7	Al-Rabia MW, Asfour HZ, Alhakamy NA, Abdulaal WH, Ibrahim TS, Abbas HA, Salem IM, Hegazy WAH, Nazeih SI (2024)	Front Cell Infect Microbiol	10.3389/fcimb.2024.1382289	Saudi Arabia/Egypt	Natural product	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	N
8	Leitão et al. (2024)	Microb Pathog	10.1016/j.micpath.2024.106663	Portugal	Natural product	P. aeruginosa	Direct			N
9	Cevikbas H, Ulusoy S, Kaya Kinayturk N (2024)	Sci Rep	10.1038/s41598-024-66888-z	Turkiye	Natural product	P. aeruginosa	Surrogate reporter			N
10	Hernandez-Moreno LV, Pabon-Baquero LC, Prieto-Rodriguez JA, Patino-Ladino OJ (2023)	Molecules	10.3390/molecules28176181	Colombia	Natural product	P. aeruginosa	Surrogate reporter			N
11	Saadati F, Shahryari S, Mohseni Sani N, Farajzadeh D, Shahbani Zahiri H, Vali H, Akbari Noghabi K (2022)	Sci Rep	10.1038/s41598-022-19103-w	Iran/Canada	Natural product	S. aureus/MRSA	Direct			N
12	Das S, Paul P, Ghosh Dastidar D, Chakraborty P, Chatterjee S, Sarkar S, Maiti D, Tribedi P (2023)	Appl Biochem Biotechnol	10.1007/s12010-022-04280-1	India	Natural product	P. aeruginosa	Direct			N
13	Li DD, Li H, Niu WX, Li H, Lee JH (2026)	Virulence	10.1080/21505594.2026.2712735	South Korea/China	Natural product	P. aeruginosa	Direct	Mouse; Tenebrio molitor larvae	Efficacy/infection outcome	N
14	Lima et al. (2025)	World J Microbiol Biotechnol	10.1007/s11274-025-04255-4	Brazil	Natural product	P. aeruginosa	Direct			N
15	Ben Soltana O, Barkallah M, Rima M, Bouaziz T, El Garah F, Abdelkafi S, Fendri I (2026)	Microb Pathog	10.1016/j.micpath.2026.108399	Tunisia/France	Natural product	P. aeruginosa	Direct			N
16	Pratiwi et al. (2026)	Pak J Biol Sci	10.3923/pjbs.2026.60.75	Indonesia	Natural product	Both species	Indirect	Zebrafish/fish	Toxicity only	N
17	Zhu YY, Jin Q, Wang ZJ, Wei MZ, Zu WB, Zhou ZS, Hu BY, Zhao YL, Qin XJ, Luo XD (2025)	Molecules	10.3390/molecules30122539	China	Natural product	S. aureus/MRSA	Direct	Mouse	Efficacy/infection outcome	N
18	Kocoz AN, Gokalsin B (2026)	World J Microbiol Biotechnol	10.1007/s11274-026-04886-1	Turkey	Natural product	P. aeruginosa	Direct			N
19	Raghoonanadan et al. (2025)	Bioorg Chem	10.1016/j.bioorg.2024.108046	South Africa	Natural product	P. aeruginosa	Surrogate reporter			N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
20	Hassan WHB, Abdel Ghani AE, Taema EA, Yahya G, El-Sadek ME, Mansour B, Abdel-Halim MS, Arafa AM (2025)	Sci Rep	10.1038/s41598-025-94486-0	Egypt	Natural product	P. aeruginosa	Direct			N
21	Turkey MS, Nazeam JA, Sherbiny FF, Alnasser SM, Abdo W, AL-Noshokaty TM, Abass SA (2026)	Sci Rep	10.1038/s41598-026-60341-z	Egypt/Saudi Arabia	Natural product	P. aeruginosa	Direct	Rat	Efficacy/infection outcome	N
22	Mahavy CE, Mol A, Andrianarisoa B, Duez P, El Jaziri M, Baucher M, Rasamiravaka T (2022)	Int J Mol Sci	10.3390/ijms23137199	Madagascar/Belgium	Natural product	P. aeruginosa	Direct			N
23	Karuppiah et al. (2022)	World J Microbiol Biotechnol	10.1007/s11274-022-03335-z	India	Natural product	S. aureus/MRSA	Direct			Y
24	Kamer AMA et al. (2023)	BMC Microbiol	10.1186/s12866-023-02861-6	Egypt	Natural product	S. aureus/MRSA	Direct	Rat	Efficacy/infection outcome	Y
25	Wen et al. (2024)	Phytomedicine	10.1016/j.phymed.2024.155590	China	Natural product	S. aureus/MRSA	Direct	Galleria mellonella	Efficacy/infection outcome	Y
26	Ghosh S, Lahiri D, Nag M, Dey A, Sarkar T, Biswas R, Dutta B, Mukherjee D, Pati S, Pattanaik S, Ray RR (2023)	Appl Biochem Biotechnol	10.1007/s12010-021-03797-1	India	Natural product	P. aeruginosa	Direct			N
27	Kim YG, Lee JH, Kim SH, Park SY, Kim YJ, Ryu CM, Seo HW, Lee JT (2024)	Int J Mol Sci	10.3390/ijms25042426	South Korea	Natural product	S. aureus/MRSA	Direct	Mouse	Efficacy/infection outcome	N
28	Ghosh C et al. (2023)	Arch Microbiol	10.1007/s00203-023-03762-y	India	Natural product	S. aureus/MRSA	Direct			N
29	Pei ZJ, Li C, Dai W, Lou Z, Sun X, Wang H, Khan AA, Wan C (2023)	Infect Drug Resist	10.2147/IDR.S387157	China	Natural product	S. aureus/MRSA	Surrogate reporter			N
30	Khalid SJ, Ain Q, Khan SJ, Jalil A, Siddiqui MF, Ahmad T, Badshah M, Adnan F (2022)	Saudi J Biol Sci	10.1016/j.sjbs.2021.10.064	Pakistan	Natural product	P. aeruginosa	Surrogate reporter			N
31	Abdel Bar FM, Alossaimi MA, Elekhnawy E, Alzeer MAA, Abo Kamer A, Moglad E, ElNaggar MH (2022)	Molecules	10.3390/molecules27227841	Saudi Arabia/Egypt	Natural product	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	N
32	Sierra-Quitian AG, Hernandez-Moreno LV, Pabon-Baquero LC, Prieto-Rodriguez JA, Patino-Ladino OJ (2023)	Plants (Basel)	10.3390/plants12091901	Colombia	Natural product	P. aeruginosa	Surrogate reporter			N
33	Dahibhate NL, Shukla SK, Kumar K (2022)	Front Pharmacol	10.3389/fphar.2022.890790	India	Natural product	P. aeruginosa	Direct			Y
34	Ilias et al. (2025)	Nat Prod Res	10.1080/14786419.2025.2588794	Algeria	Natural product	P. aeruginosa	Indirect			N
35	Sagar PK, Sharma P, Singh R (2024)	Avicenna J Med Biotechnol	10.18502/ajmb.v16i1.14171	India	Natural product	P. aeruginosa	Surrogate reporter			N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
36	Xie J, Huang Y, Chen H, Xia Z, Wang L, Yu X, Yang J, Xu J, Fan H, Zheng J (2026)	Food Sci Nutr	10.1002/fsn3.72034	China	Natural product	P. aeruginosa	Direct			N
37	Sagar PK, Sharma P, Singh R (2022)	J Pharmacopuncture	10.3831/KPI.2022.25.1.37	India	Natural product	P. aeruginosa	Surrogate reporter			N
38	Iobbi V, Parisi V, Bernabe G, De Tommasi N, Bisio A, Brun P (2023)	Plants (Basel)	10.3390/plants12213679	Italy	Natural product	Both species	Direct			Y
39	Wang F, Ding ZW, Wang YJ, Xu KZ, Dar OI, Wang M, Sethupathy S, Liu YY, Tang S (2025)	Front Microbiol	10.3389/fmicb.2025.1697407	China	Natural product	S. aureus/MRSA	Direct			Y
40	Rasamiravaka T et al. (2026)	Antibiotics (Basel)	10.3390/antibiotics15060623	Not captured	Natural product	P. aeruginosa	Direct			N
41	Santajit S, Tunyong W, Horpet D, Binmut A, Kong-Ngoen T, Wisessaowapak C, Thavorasak T, Pumirat P, Indrawattana N (2024)	Antibiotics (Basel)	10.3390/antibiotics13070613	Thailand	Natural product	S. aureus/MRSA	Direct			N
42	Ganesh PS, Veena K, Senthil R, Iswamy K, Ponmalar EM, Mariappan V, Girija ASS, Vadivelu J, Nagarajan S, Challabathula D, Shankar EM (2022)	ACS Omega	10.1021/acsomega.1c07178	India / Malaysia	Natural product	S. aureus/MRSA	In silico only			Y
43	Khan P, Waheed A, Azeem M, Parveen A, Yameen MA, Iqbal J, Ali M, Wang S, Qayyum S, Noor A, Naqvi TA (2023)	ACS Omega	10.1021/acsomega.3c03507	Pakistan	Natural product	P. aeruginosa	Direct			N
44	Sadeva IGKA, Wulandari PA, Prasetyo AV, Wahyuntika LPN, Rahadi PNK, Sasmana IGAP, Putra IMR, Darwinata AE (2022)	Biomedicine (Taipei)	10.37796/2211-8039.1364	Indonesia	Natural product	P. aeruginosa	Indirect			N
45	Tajani AS, Tehranizadeh Z, Fazly Bazzaz BS (2023)	Iran J Basic Med Sci	10.22038/IJBMS.2023.69016.15047	Iran	Natural product	P. aeruginosa	Direct			N
46	Chakraborty S, Baindara P, Sharma P, Jose T A, Kumaravel V, Manoharan R, Mandal SM (2024)	Antibiotics (Basel)	10.3390/antibiotics13080689	India / USA	Natural product	P. aeruginosa	In silico only			N
47	Al-Helo FK et al. (2025)	J Pharmacopuncture	10.3831/KPI.2025.28.3.229	Not captured	Natural product	P. aeruginosa	Direct			N
48	Riahi A, Mabudi H, Tajbakhsh E, Roomiani L, Momtaz H (2024)	AMB Express	10.1186/s13568-024-01732-1	Iran	Natural product	P. aeruginosa	Direct			N
49	Patel M, Siddiqui AJ, Ashraf SA, Surti M, Awadelkareem AM, Snoussi M, Hamadou WS, Bardakci F, Jamal A, Jahan S, Sachidanandan M, Adnan M (2022)	Microorganisms	10.3390/microorganisms10051026	India/Saudi Arabia	Natural product	P. aeruginosa	Surrogate reporter			N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
50	Prieto-Rodriguez JA et al. (2026)	Antibiotics (Basel)	10.3390/antibiotics15060627	Colombia (inferred from Piper cumanense being a Colombian species referenced)	Natural product	P. aeruginosa	Surrogate reporter			N
51	Mahendrarajan V, Lazarus H, Easwaran N (2024)	Heliyon	10.1016/j.heliyon.2024.e31898	India	Natural product	S. aureus/MRSA	Direct			Y
52	Qaralleh H, et al. (2023), J Pure Appl Microbiol / Jordan J Pharm Sci 26(4):307	J Pharmacopuncture	10.3831/KPI.2023.26.4.307	Jordan	Natural product	P. aeruginosa	Direct			N
53	Al-Mijalli SH, El Hachlafi N, Jeddi M, Abdallah EM, Assaggaf H, Qasem A, Lee LH, Law JWF, Aladhadh M, Alnasser SM, Bouyahya A, Naceiri Mrabti H (2023)	Biomed Pharmacother	10.1016/j.biopha.2023.115609	Saudi Arabia/Morocco/Malaysia	Natural product	Both species	Not assessed			N
54	Paunova-Krasteva T, et al. (2025), Pharmaceuticals 18:1824	Pharmaceuticals (Basel)	10.3390/ph18121824	Bulgaria	Natural product	P. aeruginosa	Indirect			Y
55	Qaralleh H, et al. (2024), Pharmaceuticals 17(3):386	Pharmaceuticals (Basel)	10.3390/ph17030386	Jordan	Natural product	P. aeruginosa	Direct			N
56	Karaca B, Kilonzo NK, Korkmaz S, Onar O, Yildirim O, Coleri Cihan A (2025)	Food Sci Nutr	10.1002/fsn3.70355	Turkiye	Natural product	S. aureus/MRSA	Direct			Y
57	Tritripmongkol P, Sangkanu S, Boripun R, Jeenkeawpieam J, Chuprom J, Nissapatorn V, Pereira MLD, Wilairatana P (2022)	Vet World	10.14202/vetworld.2022.2391-2398	Thailand	Natural product	S. aureus/MRSA	Surrogate reporter			N
58	Qin J, Yu L, Peng F, Ye X, Li G, Sun C, Cheng F, Peng C, Xie X (2023)	Front Microbiol	10.3389/fmicb.2023.1134207	China	Natural product	S. aureus/MRSA	Direct			N
59	Peppoloni S, Colombari B, Tagliazucchi D, et al. (2022)	Microorganisms	10.3390/microorganisms10122500	Italy (with Albanian co-authors)	Natural product	P. aeruginosa	Direct			N
60	Turkey M, Nazeam JA (2025)	AMB Express	10.1186/s13568-025-01886-6	Egypt	Natural product	P. aeruginosa	Direct			N
61	Orababa et al. (2026)	mSphere	10.1128/msphere.00494-26	United Kingdom	Natural product	S. aureus/MRSA	Direct			N
62	Balkrishna A, Bhatti S, Ngpoore NK, Jangid H, Varshney Y, Singh R, Nain P, et al. (2026)	The FASEB Journal	10.1096/fj.202600762R	India	Natural product	P. aeruginosa	Direct	C. elegans	Efficacy/infection outcome	N
63	Maldonado-Pérez et al. (2025)	Microbiology Research	10.3390/microbiolres16120263	Mexico	Natural product	S. aureus/MRSA	In silico only			Y
64	Biswas BB, Islam MN, Dey A, Bessho Y, Biswas NN (2025)	The Microbe	10.1016/j.microb.2025.100428	Bangladesh / Japan	Natural product	P. aeruginosa	Indirect			N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
65	Maravić-Vlahoviček et al. (2025)	Pharmaceuticals	10.3390/ph18091269	Croatia	Natural product	P. aeruginosa	Indirect			N
66	Balkrishna A, Ngpoore NK, Bhatti S, Varshney A, et al. (2025)	Applied Food Research	10.1016/j.afres.2025.101244	India	Natural product	P. aeruginosa	Direct	C. elegans	Efficacy/infection outcome	N
67	Ma X, Wang B, Jiang Y, Shi Y, Liu X, Chen Q (2026)	Food Quality and Safety	10.1093/fqsafe/fyag038	China	Natural product	S. aureus/MRSA	Direct			N
68	Martínez-Rodríguez et al. (2025)	Chemistry & Biodiversity	10.1002/cbdv.202502040	Mexico	Natural product	P. aeruginosa	Indirect			N
69	Warrier A, Satyamoorthy K, Murali TS (2025)	Current Microbiology	10.1007/s00284-025-04283-1	India	Natural product	P. aeruginosa	Direct			N
70	Shilpi JA, Sarker DK, Seidel V, Ali MT, Uddin SJ, Basak A, Chakraborty S, Khairuzzaman M, Nahar AU, Salam FBA (2026)	Current Pharmaceutical Biotechnology	10.2174/0113892010348855241113031323	Bangladesh/UK	Natural product	Both species	In silico only			N
71	Al-Monofy et al. (2025)	BMC Microbiology	10.1186/s12866-025-04234-7	Egypt	Natural product	P. aeruginosa	Direct	Rat	Efficacy/infection outcome	N
72	Zhong et al. (2026)	Microbiology Spectrum	10.1128/spectrum.02307-25	China	Natural product	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	Y
73	Shalmali K. et al. (2026)	Research Journal of Biotechnology	10.25303/217rjbt017025	India	Natural product	Both species	Surrogate reporter			N
74	Ramesh A, Kanagaraja A, Gopinath SCB, Raman P (2026)	Biotechnology and Applied Biochemistry	10.1002/bab.70139	India/Malaysia	Natural product	P. aeruginosa	Direct			N
75	Jana et al. (2025)	BMC Complementary Medicine and Therapies	10.1186/s12906-025-05062-y	India	Natural product	S. aureus/MRSA	Direct			N
76	Benaissa A, Tamfu AN, Bouali W, Bousselham A, Medjdoub H, Babali B, Busra AE, Kucukaydin S, Anouar EH, Ceylan O (2026)	Molecular Biology Reports	10.1007/s11033-026-12450-1	Algeria/Cameroon/Turkiye/Morocco	Natural product	P. aeruginosa	Surrogate reporter			N
77	Nath et al. (2026)	Microbiology Research	10.3390/microbiolres17040065	India	Natural product	P. aeruginosa	Direct			N
78	Alossaimi MA, Abdel Bar FM, Elekhnawy E, ElNaggar MH (2025)	PLOS One	10.1371/journal.pone.0335014	Saudi Arabia/Egypt	Natural product	S. aureus/MRSA	In silico only			Y
79	Khan S, Jain L (2025)	Research Journal of Pharmacy and Technology	10.52711/0974-360X.2025.00814	India	Natural product	Both species	Not assessed			N
80	Setiawati S, Sholikah EN, Nuryastuti T, Jumina J, Lisdiyanti P, Mustofa M (2024)	Journal of Applied Pharmaceutical Science	10.7324/JAPS.2024.144035	Indonesia	Natural product	S. aureus/MRSA	Not assessed			N
81	Hacioglu et al. (2024)	Journal of Antimicrobial Chemotherapy	10.1093/jac/dkae293	Turkey	Natural product	P. aeruginosa	Not assessed	C. elegans	Efficacy/infection outcome	N
82	Dehbashi et al. (2024)	Journal of Infection and Public Health	10.1016/j.jiph.2023.12.016	Iran	Natural product	Both species	Direct	Mouse	Efficacy/infection outcome	Y

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
83	Danaraj J, Uthirakrishnan U, Kumaresan S, Natarajan PK, Krishna J, Perumal AS, Selvakumar K, Karami Z, Pugazhendhi A (2024)	Journal of Environmental Chemical Engineering	10.1016/j.jece.2024.113086	India/Canada/Iran	Natural product	S. aureus/MRSA	Indirect			Y
84	Qaralleh H (2025)	Jordan Journal of Biological Sciences	10.54319/jjbs/180211	Jordan	Natural product	P. aeruginosa	Direct			N
85	Jin Y, Lin J, Shi H, Jin Y, Cao Q, Chen Y, Zou Y, Tang Y, Li Q (2024)	Microbiological Research	10.1016/j.micres.2024.127625	China	Natural product	S. aureus/MRSA	Direct	Galleria mellonella	Efficacy/infection outcome	N
86	Mandalari G, Minuti A, La Camera E, Barreca D, Romeo O, Nostro A (2023), Curr Microbiol 80:303	Current Microbiology	10.1007/s00284-023-03400-2	Italy	Natural product	S. aureus/MRSA	Not assessed			N
87	Nortje et al. (2025)	Archives of Microbiology	10.1007/s00203-025-04240-3	South Africa	Natural product	P. aeruginosa	Surrogate reporter			N
88	Qaralleh et al. (2025)	Microbial Biosystems	10.21608/mb.2025.383488.1314	Jordan	Natural product	P. aeruginosa	Direct			N
89	Aziz NA, Rollando, Monica E, Susanto FXH (2024)	HAYATI Journal of Biosciences	10.4308/hjb.31.3.474-485	Indonesia	Natural product	P. aeruginosa	Not assessed			N
90	Cinar Koc AS, Rizvanoglu SS, Eryilmaz M, Demirci B, Onder A (2024)	Ankara Universitesi Eczacilik Fakultesi Dergisi	10.33483/jfpau.1416623	Turkiye	Natural product	S. aureus/MRSA	Surrogate reporter			N
91	Ray et al. (2024)	Pharmaceutical Sciences Asia	10.29090/psa.2024.02.24.1347	India	Natural product	Both species	Direct			N
92	Das H. et al. (2024)	Indian Journal of Animal Research	10.18805/IJAR.B-4514	India	Natural product	S. aureus/MRSA	Indirect			N
93	Liu et al. (2024)	Frontiers in Microbiology	10.3389/fmicb.2024.1333526	China	Natural product	S. aureus/MRSA	Indirect			N
94	Lal et al. (2023)	Biomedical and Pharmacology Journal	10.13005/bpj/2736	India	Natural product	P. aeruginosa	In silico only			N
95	Noori HG, Tadjrobehkar O, Moazamian E (2023)	BMC Microbiology	10.1186/s12866-023-02957-z	Iran	Natural product	P. aeruginosa	Direct			N
96	Kiruthigha T, Pathoor NN, Veeraragavan GR, Ganesh PS (2024), Texila Int J Public Health 12(3)	Texila International Journal of Public Health	10.21522/TIJPH.2013.12.03.Art065	India	Natural product	P. aeruginosa	Indirect			N
97	Das H. et al. (2024)	Indian Journal of Animal Research	10.18805/IJAR.B-4415	India	Natural product	S. aureus/MRSA	Indirect			N
98	Nancy K. et al. (2023)	Research Journal of Biotechnology	10.25303/1810rjbt2350240	India	Natural product	Both species	Not assessed			N
99	Soni M, Pathoor NN, Viswanathan A, Veeraragavan GR, Ganesh PS (2024)	World Academy of Sciences Journal	10.3892/wasj.2024.265	India	Natural product	P. aeruginosa	Indirect			N
100	Le TT, Duong HT, Nguyen CH (2024)	Journal of Applied Pharmaceutical Science	10.7324/JAPS.2024.163764	Vietnam	Natural product	S. aureus/MRSA	Not assessed			Y
101	Benaissa et al. (2024)	Natural Product Communications	10.1177/1934578X241245234	Algeria	Natural product	P. aeruginosa	Surrogate reporter			N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
102	Piruthivraj P, Maha Swetha BR, Anita Margret A, Sherlin Rosita A, Rengasamy P, Krishnamoorthy R, Gatasheh MK, Elfaki Ibrahim K, Ansari S, Vijayakumar N (2024)	Journal of King Saud University - Science	10.1016/j.jksus.2024.103188	India/Saudi Arabia/USA	Natural product	S. aureus/MRSA	In silico only			N
103	Li et al. (2025)	Microbial Biotechnology	10.1111/1751-7915.70101	South Korea	Natural product	P. aeruginosa	Direct			N
104	Lavan et al. (2024)	Research Journal of Biotechnology	10.25303/1902rjbt060075	India	Natural product	P. aeruginosa	Surrogate reporter			N
105	Shevate S, Bankar A, Patil N (2022)	Journal of microbiology, biotechnology and food sciences	10.55251/jmbfs.5753	India	Natural product	P. aeruginosa	Surrogate reporter			N
106	Kasthuri et al. (2022)	Frontiers in Cellular and Infection Microbiology	10.3389/fcimb.2022.998540	India	Natural product	P. aeruginosa	Direct			Y
107	Ni K, Cai D, Lu J, Tian J (2022)	Applied Biochemistry and Biotechnology	10.1007/s12010-021-03682-x	China	Natural product	S. aureus/MRSA	Indirect			N
108	Mao et al. (2023)	Infection and Drug Resistance	10.2147/IDR.S406243	China	Natural product	S. aureus/MRSA	Direct			N
109	Eshboev F, Karakozova M, Abdurakhmanov J, Bobakulov K, Dolimov K, Abdurashidov A, Baymirzaev A, Makhnyov A, Terenteva E, Sasmakov S, Piyakina G, Egamberdieva D, Nazarov PA, Azimova S (2023)	Antibiotics	10.3390/antibiotics12071201	Uzbekistan/Russia	Natural product	Both species	Not assessed			Y
110	Lee et al. (2022)	Microbiology Spectrum	10.1128/spectrum.01330-22	South Korea	Natural product	S. aureus/MRSA	Direct			N
111	Wang X, Liu S, Zhao C, Zhang X, Ning Y, Lu F (2022), Rev Bras Farmacogn 32:455-459	Revista Brasileira de Farmacognosia	10.1007/s43450-022-00242-0	China	Natural product	S. aureus/MRSA	Direct			N
112	Bharti S, Nayaka S, Kumar R (2022)	Journal of microbiology, biotechnology and food sciences	10.55251/jmbfs.3163	India	Natural product	Both species	Surrogate reporter			N
113	Coimbra et al. (2022)	Antibiotics	10.3390/antibiotics11020146	Portugal	Natural product	S. aureus/MRSA	Not assessed			Y
114	Proctor CR, Taggart MG, O'Hagan BMG, McCarron PA, McCarthy RR, Ternan NG (2023)	Biofilm	10.1016/j.bioflm.2023.100128	UK	Natural product	P. aeruginosa	Not assessed			N
115	Debnath et al. (2026)	The Microbe	10.1016/j.microb.2026.100737	India	Natural product	P. aeruginosa	Direct			N
116	Bernal-Mercado AT, Juarez J, Valdez MA, Ayala-Zavala JF, Del-Toro-Sanchez CL, Encinas-Basurto D (2022)	Molecules	10.3390/molecules27030699	Mexico	Nanoparticle	P. aeruginosa	Surrogate reporter			N
117	Zahmatkesh et al. (2022)	World J Microbiol Biotechnol	10.1007/s11274-022-03384-4	Iran	Nanoparticle	P. aeruginosa	Indirect			Y

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118	Ahsan et al. (2026)	Int J Pharm	10.1016/j.ijpharm.2026.127218	Australia	Nanoparticle	P. aeruginosa	Not assessed			N
119	Shiralizadeh S, Alikhani MY, Farmany A, et al. (2025)	BMC Microbiol	10.1186/s12866-025-04083-4	Iran	Nanoparticle	P. aeruginosa	Direct			N
120	Esnaashari F, Azizi Alidoust F, Jafari N, Ghasemi M, Asadi Rahmani F, Sedaghat Safsari S, Zahmatkesh H (2026)	BMC Biotechnol	10.1186/s12896-026-01103-7	Iran	Nanoparticle	P. aeruginosa	Direct			N
121	Ramezani H et al. (2026)	BMC Biotechnol	10.1186/s12896-025-01087-w	Not captured	Nanoparticle	P. aeruginosa	Direct			N
122	Alipour-Khezri E, Moqadami A, Barzegar A, Mahdavi M, Skurnik M, Zarrini G (2024)	Viruses	10.3390/v16060897	Iran/Finland	Nanoparticle	P. aeruginosa	Direct			Y
123	Nouh HS, El-Zawawy NA, Shalamesh EM, et al. (2026)	Microb Cell Fact	10.1186/s12934-026-03091-x	Egypt	Nanoparticle	P. aeruginosa	Direct			Y
124	Jiang Y, Tang X, Wang A, et al. (2025)	Sci Rep	10.1038/s41598-025-23269-4	China	Nanoparticle	S. aureus/MRSA	Not assessed			N
125	Nath et al. (2025)	Naunyn Schmiedebergs Arch Pharmacol	10.1007/s00210-024-03651-1	India	Nanoparticle	P. aeruginosa	Indirect			N
126	Homaei S, Ghourchian H, Piri-Gharaghie T (2025)	Int Microbiol	10.1007/s10123-025-00697-w	Iran	Nanoparticle	P. aeruginosa	Direct			N
127	Abd El-Hamid MI, Ibrahim D, Elazab ST, Gad WM, Shalaby M, El-Neshwy WM, Alshahrani MA, Saif A, Algendy RM, AlHarbi M, Saleh FM, Alharthi A, Mohamed EAA (2024)	Front Cell Infect Microbiol	10.3389/fcimb.2023.1287426	Egypt/Saudi Arabia	Nanoparticle	S. aureus/MRSA	Direct	Mouse	Efficacy/infection outcome	N
128	Aflakian F, Hashemitabar G (2025)	Heliyon	10.1016/j.heliyon.2025.e42899	Iran	Nanoparticle	P. aeruginosa	Indirect			N
129	Kumar S, Paliya BS, Singh BN, Agrawal S (2025)	Nanomaterials (Basel)	10.3390/nano15211648	India/Ireland	Nanoparticle	P. aeruginosa	Direct			N
130	Khdir KA et al. (2025)	Nanoscale Adv	10.1039/d5na00898k	Iraq	Nanoparticle	P. aeruginosa	Direct			N
131	Eltayb EK, Alqahtani FY, Alkahtani HM, Alsarra IA, Alfaraj R, Aleanizy FS (2022)	Polymers (Basel)	10.3390/polym14173655	Saudi Arabia	Nanoparticle	P. aeruginosa	Indirect			Y
132	Bugyna L, Svantner L, Bilska K, Pribus M, Bujdakova H (2025)	Antibiotics (Basel)	10.3390/antibiotics14101010	Slovakia	Nanoparticle	S. aureus/MRSA	Direct			Y
133	Karthikeyan A, Thirugnanasambantham MK, Khan F, Mani AK (2025)	Antibiotics (Basel)	10.3390/antibiotics14010059	Not fully captured	Nanoparticle	P. aeruginosa	Surrogate reporter			N
134	Owrang M, Gholami A (2024)	Heliyon	10.1016/j.heliyon.2024.e38395	Iran	Nanoparticle	P. aeruginosa	Indirect			N

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135	Marsik D, Matatkova O, Kolkova A, Masak J (2024), Nanoscale Adv 6:3093	Nanoscale Adv	10.1039/d4na00064a	Czechia	Nanoparticle	P. aeruginosa	Indirect			Y
136	Mirfarjood Langarudy SH, Sigarchian M, Zahmatkesh H, Esnaashari F, Faezi Ghasemi M, Zamani H, Rasti B (2025)	ChemistrySelect	10.1002/slct.202500315	Not fully captured	Nanoparticle	S. aureus/MRSA	Direct			Y
137	He et al. (2026)	MicrobiologyOpen	10.1002/mbo3.70258	China	Nanoparticle	S. aureus/MRSA	Direct	Mouse	Efficacy/infection outcome	N
138	Dogheim GM, Shehat MG, Mahdy DM, Barakat HS, Abouelfetouh A, Ramadan AA (2025)	Scientific Reports	10.1038/s41598-025-95343-w	Egypt	Nanoparticle	S. aureus/MRSA	Direct			Y
139	Azimzadeh et al. (2025)	Scientific Reports	10.1038/s41598-025-00005-6	Iran	Nanoparticle	P. aeruginosa	Direct			Y
140	Jeong et al. (2026)	Asian Journal of Pharmaceutical Sciences	10.1016/j.ajps.2026.101118	South Korea	Nanoparticle	S. aureus/MRSA	Direct	Mouse	Efficacy/infection outcome	Y
141	Alenazi NA, Aleanizy FS, Alqahtani FY, Aldossari AA, Alanazi MM, et al. (2024)	Saudi Pharmaceutical Journal	10.1016/j.jsps.2023.101932	Saudi Arabia	Nanoparticle	S. aureus/MRSA	Indirect			Y
142	Badr-Eldin SM, Aldawsari HM, Ahmed OAA, Kotta S, Abualsunun W, Eshmawi BA, Khafagy E-S, Elbaramawi SS, Abbas HA, Hegazy WAH, Seleem NM (2024)	Nanotechnology Reviews	10.1515/ntrev-2023-0212	Saudi Arabia / Egypt / Oman	Nanoparticle	P. aeruginosa	Indirect	Mouse	Efficacy/infection outcome	N
143	Mazloumi et al. (2024)	Journal of Cluster Science	10.1007/s10876-024-02675-0	Iran	Nanoparticle	P. aeruginosa	Direct			Y
144	Al-Momani H, Almasri M, et al. (2023)	Scientific Reports	10.1038/s41598-023-35919-6	Jordan	Nanoparticle	P. aeruginosa	Direct			N
145	Dou J, Peng H, Li S, et al. (2025), BioMed Res 10.34133/bmr.0288	Biomaterials Research	10.34133/BMR.0288	China	Nanoparticle	S. aureus/MRSA	Not assessed	Mouse	Efficacy/infection outcome	N
146	Nafee N, Gaber D, Abouelfetouh A, Alseqely M, Empting M, Schneider M (2024)	International Journal of Nanomedicine	10.2147/IJN.S445955	Germany/Egypt	Nanoparticle	P. aeruginosa	Indirect			Y
147	Saleh et al. (2024)	BioNanoScience	10.1007/s12668-024-01573-z	Iraq	Nanoparticle	S. aureus/MRSA	Direct			Y
148	Naderi et al. (2025)	Microbiology Spectrum	10.1128/spectrum.01759-25	Iran	Nanoparticle	S. aureus/MRSA	Direct			Y
149	Lashaki et al. (2025)	Journal of Global Antimicrobial Resistance	10.1016/j.jgar.2025.01.010	Iran	Nanoparticle	P. aeruginosa	Direct			Y
150	Azimzadeh M, Greco G, Farmani A, Pourhajibagher M, Taherkhani A, Alikhani MY, Bahador A (2024)	Photodiagnosis and Photodynamic Therapy	10.1016/j.pdpdt.2024.103971	Iran/Switzerland	Nanoparticle	P. aeruginosa	Not assessed			Y
151	Ivanova et al. (2022)	International Journal of Molecular Sciences	10.3390/ijms23147632	Spain	Nanoparticle	P. aeruginosa	Surrogate reporter			Y

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152	Lencova S, Stiborova H, Munzarova M, Demnerova K, Zdenkova K (2022)	Frontiers in Microbiology	10.3389/fmicb.2022.857423	Czech Republic	Nanoparticle	S. aureus/MRSA	Not assessed			N
153	Ning et al. (2022)	Drug Delivery	10.1080/10717544.2022.2079768	China	Nanoparticle	S. aureus/MRSA	Direct			N
154	Abbas HA, Shaker GH, Mosallam FM, Gomaa SE (2022)	AMB Express	10.1186/s13568-022-01426-6	Egypt	Nanoparticle	S. aureus/MRSA	Direct	Mouse	Efficacy/infection outcome	N
155	Yan X, Hou S, Xing C, Zhang Y, Chang J, Xiao J, Lin F (2024)	Molecules	10.3390/molecules29102211	China	Synthetic/novel	P. aeruginosa	Indirect	C. elegans	Efficacy/infection outcome	Y
156	Arami N, Tajani AS, Hashemi M, Rezaei T, Ghodsi R, Soheili V, Fazly Bazzaz BS (2025)	Mol Biol Rep	10.1007/s11033-025-10270-3	Iran	Synthetic/novel	P. aeruginosa	Direct			N
157	Vetrivel et al. (2023)	Int Microbiol	10.1007/s10123-023-00338-0	India	Synthetic/novel	P. aeruginosa	Direct			Y
158	Mao S, Li Q, Yang Z, Li Y, Ye X, Wang H (2023)	J Enzyme Inhib Med Chem	10.1080/14756366.2023.2175820	China	Synthetic/novel	P. aeruginosa	Direct			Y
159	Ye X, Mao S, Li Y, Yang Z, Du A, Wang H (2023)	Molecules	10.3390/molecules28093879	China	Synthetic/novel	P. aeruginosa	Direct			N
160	Yadav A, Mahindru I, Yadav AK, et al. (2026)	Chem Biodivers	10.1002/cbdv.202502287	India	Synthetic/novel	P. aeruginosa	Surrogate reporter			N
161	Chaitanya KS, Yu TT, Chaudhari H, Orenkonday N, Kuthe PV, Kumar N, Dey RJ, Murugesan S, Chandra Sekhar KVG (2026)	RSC Adv	10.1039/d6ra00717a	India/Australia	Synthetic/novel	P. aeruginosa	Direct			Y
162	Liu J, Deng Y, Wang X, Luo P, Ding S, Zhang W, Uddin S, Li H, Li Y (2025)	Biofilm	10.1016/j.bioflm.2025.100326	China	Synthetic/novel	P. aeruginosa	Direct			N
163	Bernabe G, Marzaro G, Di Pietra G, Otero A, Bellato M, Pauletto A, Scarpa M, Sut S, Chilin A, Dall'Acqua S, Brun P, Castagliuolo I (2022)	Front Pharmacol	10.3389/fphar.2022.996871	Italy/Spain	Synthetic/novel	P. aeruginosa	Direct	Galleria mellonella	Efficacy/infection outcome	Y
164	Abo-Dya NE, Agha KA, Abbas HA, Abu-Kull ME, Alahmdi MI, Osman NA (2022)	ACS Omega	10.1021/acsomega.2c01667	Egypt/Saudi Arabia	Synthetic/novel	P. aeruginosa	Direct			N
165	Mensah CN, Ampomah GB, Mensah JO, Gasu EN, Aboagye CI, Ekuadzi E, Boadi NO, Borquaye LS (2022)	Heliyon	10.1016/j.heliyon.2022.e12581	Ghana	Synthetic/novel	P. aeruginosa	Indirect			N
166	Trognon J, Vera G, Rima M, et al. (2022)	Pharmaceuticals (Basel)	10.3390/ph15040417	France	Synthetic/novel	P. aeruginosa	In silico only			Y
167	Wang J, Yang JY, Durairaj P, Wen WH, Sabapathi N, Yang L, Wang B, Jia AQ (2024)	RSC Med Chem	10.1039/d4md00354c	China/USA	Synthetic/novel	P. aeruginosa	Direct			N
168	Liu Y, Su S, Yu M, Zhai D, Hou Y, Zhao H, Ma X, Jia M, Xue X, Li M (2022)	Front Pharmacol	10.3389/fphar.2022.959736	China	Synthetic/novel	S. aureus/MRSA	Direct			N

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169	Wei Z, Li T, Gu Y, Zhang Q, Wang E, Li W, Wang X, Li Y, Li H (2022), Front Chem 10:948687	Front Chem	10.3389/fchem.2022.948687	China	Synthetic/novel	P. aeruginosa	Direct	C. elegans	Efficacy/infection outcome	N
170	Ammar YA, Ragab A, Migahed MA, Al-Sharbasy S, Salem MA, Riad OKM, Mostafa H, Abd-Elmaksoud GA, Abusaif MS (2023)	RSC Adv	10.1039/d3ra04230h	Egypt	Synthetic/novel	P. aeruginosa	Direct			Y
171	Kim T, Tabassum N, Javaid A, Khan F (2025), Antibiotics 14:1240	Antibiotics (Basel)	10.3390/antibiotics14121240	South Korea	Synthetic/novel	S. aureus/MRSA	In silico only			N
172	Chen et al. (2026)	J Adv Res	10.1016/j.jare.2026.05.032	China	Synthetic/novel	P. aeruginosa	Direct	Mouse; Galleria mellonella	Efficacy/infection outcome	N
173	Lall et al. (2025)	Chemistry & Biodiversity	10.1002/cbdv.202501892	South Africa / USA	Synthetic/novel	S. aureus/MRSA	Not assessed			Y
174	Gonzalez-Cruz JA, Gonzalez-Gallardo G, Perez-Velazquez JR, Garcia-Mejia CD, et al. (2025)	ChemMedChem	10.1002/cmdc.202500521	Mexico	Synthetic/novel	Both species	Not assessed			N
175	Dundar Y, Kulahci MB, Kuyrukcu Ozturk O, Beyzi E (2025)	Fabad Journal of Pharmaceutical Sciences	10.55262/fabadeczacilik.1787503	Turkiye	Synthetic/novel	P. aeruginosa	Surrogate reporter			N
176	Huang et al. (2026)	Acta Pharmaceutica Sinica B	10.1016/j.apsb.2026.03.048	China	Synthetic/novel	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	N
177	Nikki, Bhopale AJ, Kharga K, Yerramsetti N, Kumar R, Kumar L, Yadav AK (2025)	Molecular Diversity	10.1007/s11030-024-10955-0	India	Synthetic/novel	P. aeruginosa	Surrogate reporter			N
178	Sim et al. (2025)	Microbial Biotechnology	10.1111/1751-7915.70280	South Korea	Synthetic/novel	S. aureus/MRSA	Direct			Y
179	Sim M, Kim YG, Lee JH, Lee J (2024)	International Journal of Molecular Sciences	10.3390/ijms252312830	South Korea	Synthetic/novel	S. aureus/MRSA	Direct			Y
180	Sabir S, Das T, Kuppusamy R, Yu TT, Willcox MD, Black DSC, Kumar N (2023)	Bioorganic Chemistry	10.1016/j.bioorg.2022.106226	Australia	Synthetic/novel	P. aeruginosa	Direct			Y
181	Murray et al. (2022)	Cell Chemical Biology	10.1016/j.chembiol.2022.02.007	United Kingdom	Synthetic/novel	Both species	Direct			N
182	Orlandi et al. (2023)	Antibiotics	10.3390/antibiotics12020228	Italy	Synthetic/novel	S. aureus/MRSA	Not assessed			N
183	Kim et al. (2022)	International Journal of Molecular Sciences	10.3390/ijms231810683	South Korea	Synthetic/novel	S. aureus/MRSA	Direct	C. elegans	Toxicity only	Y
184	Hrynchuk N, et al. (2022)	Mikrobiolohichnyi Zhurnal	10.15407/microbiolj84.03.039	Ukraine	Synthetic/novel	S. aureus/MRSA	Not assessed			N
185	Bajire SK, Prabhu A, Bhandary YP, Irfan KM, Shastry RP (2023)	World J Microbiol Biotechnol	10.1007/s11274-023-03655-8	India	Synthetic/novel	P. aeruginosa	Surrogate reporter	C. elegans	Efficacy/infection outcome	N
186	Omar AM, Mohammad KA, Almalki M, Abuelnaga KO, Ibrahim SRM, et al. (2025)	J Pharm Bioallied Sci	10.4103/jpbs.jpbs_1389_25	Saudi Arabia	Synthetic/novel	Both species	In silico only			N

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187	Salem et al. (2025)	BMC Microbiology	10.1186/s12866-025-03946-0	Egypt	Synthetic/novel	P. aeruginosa	Not assessed			N
188	Gomez AC, Lyons T, Mamat U, Yero D, Bravo M, Daura X, Elshafee O, Brunke S, Gahan CGM, O'Driscoll M, Gibert I, O'Sullivan TP (2022)	European Journal of Medicinal Chemistry	10.1016/j.ejmech.2022.114678	Spain/Ireland/ Germany	Synthetic/novel	Both species	Not assessed	Galleria mellonella	Efficacy/infection outcome	N
189	Feng et al. (2022)	BMC Microbiology	10.1186/s12866-022-02716-6	China	Synthetic/novel	P. aeruginosa	Direct			N
190	He X, Han B, Wang R, Guo Y, Kao RYT, Li H, Sun H, Xia W (2023)	RSC Chemical Biology	10.1039/d3cb00033h	China/Hong Kong	Synthetic/novel	P. aeruginosa	Indirect	Mouse	Efficacy/infection outcome	Y
191	Rossetto V, Moore-Machacek A, Woods DF, et al. (2023), Microbiology 169:001303	Microbiology	10.1099/mic.0.001303	Ireland (University College Cork) / Portugal	Synthetic/novel	P. aeruginosa	Indirect			N
192	Chadha J, Ahuja P, Mudgil U, Khullar L, Harjai K (2024)	Arch Microbiol	10.1007/s00203-024-04059-4	India	Combination (multi-class)	P. aeruginosa	Direct			N
193	Knap K, Kwiecien K, Ochonska D, Reczynska-Kolman K, Pamula E, Brzychczy-Wloch M (2024)	Pharmacol Rep	10.1007/s43440-024-00669-3	Poland	Combination (multi-class)	S. aureus/MRSA	Not assessed			N
194	Boon D, O'Rourke B, Carmody M, Woods DF, Gloe A, Platero-Rochart D, Sanchez-Murcia PA, McGlacken GP, Reen FJ (2026)	Microb Biotechnol	10.1111/1751-7915.70404	Ireland/Spain	Combination (multi-class)	P. aeruginosa	Direct			N
195	Meng X, Ning C, Lu X, Kang M, Yang Y, Yu Z, Wang Y, Sun Y, Guo H (2026)	Biomolecules	10.3390/biom16040598	China	Combination (multi-class)	P. aeruginosa	Direct			N
196	Ricafrente RML, Malalay AP (2026)	Cureus	10.7759/cureus.103643	Philippines	Combination (multi-class)	P. aeruginosa	Indirect			N
197	Lu X, Wang G, Xie Y, Tang W, Liu B, Zhang J (2023)	RSC Adv	10.1039/d2ra06696c	China	Combination (multi-class)	S. aureus/MRSA	Direct	Mouse	Efficacy/infection outcome	Y
198	Chen H, Ji PC, Qi YH, Chen SJ, Wang CY, Yang YJ, Zhou JW (2023)	Front Microbiol	10.3389/fmicb.2022.1029412	China	Combination (multi-class)	P. aeruginosa	Direct			N
199	Samreen, Ahmad I (2025)	3 Biotech	10.1007/s13205-025-04372-9	India	Combination (multi-class)	P. aeruginosa	Indirect	C. elegans	Toxicity only	Y
200	Gaalova-Radochova B, Kendra S, Jordao L, Kursawe L, Kikhney J, Moter A, Bujdakova H (2023)	Antibiotics (Basel)	10.3390/antibiotics12030441	Slovakia/Portugal/Germany	Combination (multi-class)	S. aureus/MRSA	Not assessed			N
201	Lavan S. et al. (2024)	Research Journal of Biotechnology	10.25303/1906rjbt01160126	India	Combination (multi-class)	P. aeruginosa	Indirect			N
202	Kunz Coyne AJ, Stamper K, Bleick C, Kebriaei R, Lehman SM, Rybak MJ (2024)	Microbiology Spectrum	10.1128/spectrum.03212-23	USA	Combination (multi-class)	S. aureus/MRSA	Not assessed			N
203	Hassan R.K. et al. (2025)	Bangladesh Journal of Infectious Diseases	10.3329/bjid.v12i2.86048	Iraq	Combination (multi-class)	P. aeruginosa	Direct			N

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204	Kong et al. (2023)	Microbiology Spectrum	10.1128/spectrum.03666-22	China	Combination (multi-class)	P. aeruginosa	Not assessed	Galleria mellonella	Efficacy/infection outcome	Y
205	Dey P, Parai D, Banerjee M, Hossain ST, Mukherjee SK (2024)	The Microbe	10.1016/j.microb.2024.100171	India	Combination (multi-class)	P. aeruginosa	In silico only			N
206	Biswas P, Bose S, Chakraborty S (2025)	World J Microbiol Biotechnol	10.1007/s11274-025-04304-y	India	Combination (multi-class)	P. aeruginosa	Indirect			Y
207	Koosehlar E, Mohabatkar H, Behbahani M (2024)	Int J Mol Cell Med	10.22088/IJMCM.BUMS.13.1.46	Iran	Peptide/enzyme	P. aeruginosa	In silico only			N
208	Twomey E, O'Connor PM, Coffey A, Kiste M, Guinane CM, Hill C, Field D, Begley M (2024)	Antibiotics	10.3390/antibiotics13040338	Ireland	Peptide/enzyme	S. aureus/MRSA	Not assessed			N
209	Aflakian et al. (2022)	Biofouling	10.1080/08927014.2022.2028280	Iran	Peptide/enzyme	P. aeruginosa	Not assessed			N
210	Nahar et al. (2025)	Curr Microbiol	10.1007/s00284-025-04200-6	South Korea	Peptide/enzyme	P. aeruginosa	Direct			N
211	Ahmad AAM, El-Naenaeey EY, Aloufi AS, Khalifa EK, Khamis T, Elmowalid GA, Abd El-Hamid MI (2025)	Front Cell Infect Microbiol	10.3389/fcimb.2025.1686764	Egypt/Saudi Arabia	Peptide/enzyme	S. aureus/MRSA	Direct			N
212	Curcic et al. (2025)	Biomed Pharmacother	10.1016/j.biopha.2025.118443	Serbia	Peptide/enzyme	P. aeruginosa	Direct	C. elegans	Efficacy/infection outcome	N
213	Albasri et al. (2026)	Microb Pathog	10.1016/j.micpath.2026.108739	Saudi Arabia	Peptide/enzyme	P. aeruginosa	Direct			N
214	Hamid SJ, Salih TM, Aziz TA (2025)	Pharmaceuticals (Basel)	10.3390/ph18101572	Iraq	Peptide/enzyme	P. aeruginosa	In silico only			N
215	Djokic L, Stankovic N, Galic I, Moric I, Radakovic N, Segan S, Pavic A, Senerovic L (2022)	Front Microbiol	10.3389/fmicb.2022.906312	Serbia	Peptide/enzyme	P. aeruginosa	Direct	Zebrafish/fish	Efficacy/infection outcome	N
216	Luo X, Wang S, Yang Y, Gao R, Yuan S, Yu J, Liu D, Tan X (2026), Front Microbiol 16:1752980	Front Microbiol	10.3389/fmicb.2025.1752980	China	Peptide/enzyme	P. aeruginosa	Not assessed			N
217	Baird R, Gogoi D, Forde L, et al. (2026), J Innate Immun 18:104-119	Journal of Innate Immunity	10.1159/000550256	Ireland	Peptide/enzyme	P. aeruginosa	Direct			Y
218	Dias SA, Pinto SN, Silva-Herdade AS, Cavaco M, Neves V, Tavares L, Oliveira M, Andreu D, Coutinho A, Castanho MARB, Veiga AS (2023)	ACS Infectious Diseases	10.1021/acsinfecdis.3c00195	Portugal/Spain	Peptide/enzyme	S. aureus/MRSA	Not assessed			Y
219	Porzio et al. (2023)	International Journal of Molecular Sciences	10.3390/ijms242317028	Italy	Peptide/enzyme	P. aeruginosa	Direct	Drosophila	Efficacy/infection outcome	N
220	Aflakian F, Rad M, Hashemitabar G, Lagzian M, Ramezani M (2023)	BULGARIAN JOURNAL OF VETERINARY MEDICINE	10.15547/bjvm.2021-0064	Iran	Peptide/enzyme	P. aeruginosa	Not assessed			N
221	Yue et al. (2023)	BMC Microbiology	10.1186/s12866-023-03052-z	China	Peptide/enzyme	S. aureus/MRSA	Direct			N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
222	Leistikow KR, May DS, Suh WS, Asensio GV, Schaenzer AJ, Currie CR, Hristova KR (2024)	mSystems	10.1128/msystems.00712-24	USA	Peptide/enzyme	S. aureus/MRSA	Direct			Y
223	Masihzadeh S, Amin M, Farshadzadeh Z (2023)	BMC Microbiology	10.1186/s12866-023-02886-x	Iran	Peptide/enzyme	P. aeruginosa	Not assessed	Mouse	Efficacy/infection outcome	N
224	van Gent ME, van der Reijden TJK, Lennard PR, de Visser AW, Schonkeren-Ravensbergen B, Dolezal N, Cordfunke RA, Drijfhout JW, Nibbering PH (2022)	Antibiotics	10.3390/antibiotics11050673	Netherlands	Peptide/enzyme	S. aureus/MRSA	Not assessed			N
225	Zhang et al. (2023)	Antimicrobial Agents and Chemotherapy	10.1128/aac.01358-22	China	Peptide/enzyme	P. aeruginosa	Direct			N
226	Deng et al. (2022)	Frontiers in Cellular and Infection Microbiology	10.3389/fcimb.2022.917038	China	Peptide/enzyme	Both species	Direct	Rabbit	Efficacy/infection outcome	N
227	Zhang et al. (2023)	Antimicrobial Agents and Chemotherapy	10.1128/aac.00307-23	China	Peptide/enzyme	P. aeruginosa	Direct	Rat	Efficacy/infection outcome	Y
228	Sajeevan A, Andrew DJ, Patra TN, Solomon AP, Dandela R (2025)	RSC Adv	10.1039/d5ra01722j	India	Repurposed	P. aeruginosa	Indirect			N
229	Mohan et al. (2024)	Int Microbiol	10.1007/s10123-024-00487-w	India	Repurposed	P. aeruginosa	Surrogate reporter			N
230	Esnaashari F, Rostamnejad D, Zahmatkesh H, Zamani H (2023)	World J Microbiol Biotechnol	10.1007/s11274-023-03690-5	Iran	Repurposed	P. aeruginosa	Direct			Y
231	Rastgar et al. (2022)	Arch Microbiol	10.1007/s00203-022-02930-w	Iran	Repurposed	P. aeruginosa	Not assessed			N
232	Jaber NA, Ghafil JA (2026)	Polim Med	10.17219/pim/224596	Iraq	Repurposed	P. aeruginosa	Direct			N
233	Macho M, Saha S, Konert G, Banerjee A, Ewe D, Hrouzek P, Urajova P, Saurav K (2022)	Microbiol Spectr	10.1128/spectrum.02232-22	Czech Republic/India	Repurposed	P. aeruginosa	Direct			Y
234	Hijazi DM, Dahabiyeh LA, Abdelrazig S, Alqudah DA, Al-Bakri AG (2023)	AMB Express	10.1186/s13568-023-01523-0	Jordan/UK	Repurposed	P. aeruginosa	Indirect			N
235	Khayat MT, Abbas HA, Ibrahim TS, Khayyat AN, Alharbi M, Darwish KM, Elhady SS, Khafagy E-S, Safo MK, Hegazy WAH (2022)	Biomedicines	10.3390/biomedicines10051169	Saudi Arabia/Egypt/Oman/USA	Repurposed	Both species	Direct	Mouse	Efficacy/infection outcome	N
236	Alyahyawy OY, Munshi RM, Badr-Eldin SM, Aldawsari HM, Abualsunun W, Abbas HA, Salem IM, Hegazy WAH, Nazeih SI (2025)	AMB Express	10.1186/s13568-025-01835-3	Saudi Arabia/Egypt	Repurposed	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	N
237	Lima EMF, de Almeida FA, Sircili MP, Bueris V, Pinto UM (2023)	Heliyon	10.1016/j.heliyon.2023.e14152	Brazil	Repurposed	P. aeruginosa	Direct			N

Ref #	Authors (Year)	Journal	DOI	Country	Agent class (primary)	Target organism	QS evidence tier	In vivo model	In vivo purpose	Cytotoxicity tested
238	Alfaraj R, Alkathiri FA, Alamri LA, Alnassar NB, Alanazi SH, Algarni RA, Alhabdan NS, Abuthnain RA (2025)	Front Microbiol	10.3389/fmicb.2025.1540997	Saudi Arabia	Repurposed	S. aureus/MRSA	Direct			Y
239	Mahfouz et al. (2026)	Scientific Reports	10.1038/s41598-026-64238-9	Egypt	Repurposed	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	N
240	Bernabè et al. (2025)	Antibiotics	10.3390/antibiotics14111116	Italy	Repurposed	P. aeruginosa	Direct			N
241	Nurfauziah P, Sultan AR, Helpia H, Aswad M (2026)	Trends in Sciences	10.48048/tis.2026.13430	Indonesia	Repurposed	S. aureus/MRSA	In silico only			N
242	Mirpour et al. (2024)	Molecular Biology Reports	10.1007/s11033-023-09071-3	Iran	Repurposed	P. aeruginosa	Direct			Y
243	Elfaky MA, Elbaramawi SS, Eissa AG, Ibrahim TS, Khafagy ES, Ali MAM, Hegazy WAH (2023)	Applied Microbiology and Biotechnology	10.1007/s00253-023-12522-3	Saudi Arabia/Egypt	Repurposed	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	N
244	Yam JKH, Tan LZW, Hong Z, et al. (2023)	Bioorganic & Medicinal Chemistry	10.1016/j.bmc.2023.117167	Singapore/China	Repurposed	P. aeruginosa	Direct	Mouse	Efficacy/infection outcome	N
245	Yuan et al. (2022)	Frontiers in Microbiology	10.3389/fmicb.2022.978502	China	Repurposed	P. aeruginosa	Direct	Mouse; C. elegans	Efficacy/infection outcome	N
246	Liang et al. (2022)	Int Microbiol	10.1007/s10123-021-00228-3	China	Probiotic/postbiotic	P. aeruginosa	Direct			N
247	Azami S, Arefian E, Kashef N (2022)	Arch Microbiol	10.1007/s00203-022-02770-8	Iran	Probiotic/postbiotic	P. aeruginosa	Direct			Y
248	Diaz MA, Vega-Hissi EG, Blazquez MA, Alberto MR, Arena ME (2024)	Antibiotics (Basel)	10.3390/antibiotics13040297	Spain / Argentina	Probiotic/postbiotic	S. aureus/MRSA	Indirect			Y
249	Aljohani AM, El-Chami C, Alhubail M, Ledder RG, O'Neill CA, McBain AJ (2023)	Front Microbiol	10.3389/fmicb.2023.1108273	UK	Probiotic/postbiotic	P. aeruginosa	Direct	Galleria mellonella	Efficacy/infection outcome	N
250	Mitsuwan W, Sornsenee P, Romyasamit C (2022)	Veterinary World	10.14202/vetworld.2022.299-308	Thailand	Probiotic/postbiotic	S. aureus/MRSA	Not assessed			N
251	Franco D et al. (2026)	Microorganisms	10.3390/microorganisms14051028	Italy	Phage	P. aeruginosa	Direct			N
252	Van et al. (2026)	Antimicrobial Agents and Chemotherapy	10.1128/aac.00925-25	USA	Phage	P. aeruginosa	Not assessed			N

Table S3. Operational definitions and rating rule of the in vitro risk-of-bias checklist

Item	Domain	Y (low concern) when the full text …	N when …	Unclear when …	First-pass rule used (what the script searched for)
1	Clear research question	States an aim or hypothesis about antibiofilm or anti-QS activity of a named agent.	Not applicable (no study was rated N).	Not applicable.	Set to Y for all studies (all included studies state an aim; screening already required this).
2	Strain characterisation	At least one named reference or collection strain (e.g. ATCC, PAO1, PA14, NCTC, DSM, MTCC, USA300, CIP) is used or the strain source is described.	Not applicable.	No named reference strain found (clinical isolates only, or strain not named).	Keyword match for collection codes or "reference/standard strain"; otherwise Unclear.

Item	Domain	Y (low concern) when the full text …	N when …	Unclear when …	First-pass rule used (what the script searched for)
3	Controls	Untreated, vehicle/solvent, growth, negative or positive control stated.	Full text mentions no control at all (treated as High risk).	Controls mentioned only in general terms, or no full text.	Keyword match: untreated, vehicle, DMSO, negative/positive/solvent/growth control.
4	Validated or standard assay	Biofilm or QS read-out uses an established method (crystal violet, MTT/XTT/resazurin, CLSM, SEM, qRT-PCR, violacein, pyocyanin, microtitre-plate method).	Not applicable.	No standard method named.	Keyword match for these methods; otherwise Unclear.
5	Dose range	More than one concentration, or a dose/concentration-dependent or sub-MIC series, is reported.	Full text reports a single concentration only.	Extraction row only, no full text.	≥2 numbers in the extracted concentration field, or keywords (serial, two-fold, range, sub-MIC, dose-dependent).
6	Statistics	A named test (ANOVA, t-test, Tukey, Dunnett, Mann–Whitney, Kruskal–Wallis, Bonferroni), software (GraphPad, SPSS) or p-value threshold is given.	Full text names no statistical test.	No full text.	Keyword match in the full text only.
7	Replication	Triplicate, ≥3 independent or biological replicates, or n ≥ 3 is stated.	Full text does not state replication.	No full text.	Keyword match in the full text only.
8	Cytotoxicity / selectivity	Mammalian-cell cytotoxicity, haemolysis, viability, toxicity or selectivity data are reported.	Full text reports none. Reported separately; does not by itself cause High risk.	No full text.	Keyword match (cytotox, hemoly, MTT, cell viability, HEK, HaCaT, Vero, selectiv, biocompat …).
9	Reproducibility / methods detail	Items 2, 5 and 7 are all Y (strain named, dose range, replication).	Any of items 2, 5, 7 is N.	Otherwise, or no full text.	Derived from items 2, 5 and 7.
Overall rating rule (as applied)					
High: item 3 is N, or three or more items are N.					
Low: at least 8 items are Y, item 3 is Y, and items 6 and 7 are not N.					
Moderate: every other study (including all studies rated from the extraction row without the full text).					
Item 10 (QS claim supported by direct QS assay) is the QS evidence tier and is not part of the overall rating.					
Note: the workbook legend on the QA - In Vitro tab describes a different, simpler rule (≥7 Y = Low; 4–6 = Moderate; <4 = High). It was not the rule applied and should be corrected.					
Provenance: custom checklist, not validated. Items were drawn from general preclinical reporting-quality criteria (CAMARADES-style and ToxRTool-style items); no formal citation or validation exists. Scope of the first pass: the script scanned the full text for 177 of the 252 in vitro appraisals. For the other 75 it was run on the extraction row only, so their items 6, 7 and 9 are Unclear (item 5 was scored from the extraction row and item 8 follows the coded cytotoxicity flag); the same applies to 8 of the 30 SYRCLE appraisals. Two reviewers checked all ratings against the full texts and made no corrections.					

Note: Study numbers in Table S2 follow the numbering used in the main manuscript.strobe