Received: 10 April 2026	Revised: 15 May 2026	Accepted: 15 June 2026

Review Article

AJDP
Nature has the Power to Heal

ISSN: 3048-5614

"KRIMIGHNA DRAVYA AGAINST DRUG-RESISTANT BACTERIA: A CRITICAL REVIEW OF IN VITRO EVIDENCE, METHODOLOGICAL STANDARDS AND TRANSLATIONAL PROSPECTS"

Dr. Abhay Gandhi[1]

AFFILIATIONS:
1. Director, Ira Consultancy & Research Organisation, Bhosari, Pune, Maharashtra 411026

CORRESPONDENCE:
Dr. Abhay Gandhi
EMAIL ID:
director@icro.co.in

FUNDING INFORMATION:
Not Applicable

How to cite this article:
Abhay Gandhi, "Krimighna dravya against drug-resistant bacteria: a critical review of in vitro evidence, methodological standards and translational prospects" Asian Journal of Dravyaguna and Pharmacology. 2026;3(2):22-25.
Sri. 2026.1006.ajdp.02.02

ABSTRACT
Antimicrobial resistance is a global health threat, and the World Health Organization's 2024 priority list places carbapenem-resistant Gram-negative bacteria and rifampicin-resistant *Mycobacterium tuberculosis* in its critical group. Ayurveda describes many drugs as krimighna, acting against krimi, a term that covers intestinal worms and other harmful organisms. These drugs are frequently tested against drug-resistant bacteria in the hope of finding new antimicrobials. This review appraises representative in vitro evidence for krimighna and related drugs, including Vidanga (*Embelia ribes*), Nimba (*Azadirachta indica*), Triphala and the *Terminalia* fruits, against resistant pathogens. It also considers the methodological standards such studies should meet. Reported minimum inhibitory concentrations of crude extracts against resistant isolates were mostly 50–1,500 µg/mL. Neem seed extract inhibited multidrug-resistant *Salmonella* Typhi at 50–500 µg/mL, and *Terminalia* extracts inhibited methicillin-resistant *Staphylococcus aureus* at 94–392 µg/mL and ESBL-producing Gram-negatives at 556–1,509 µg/mL. These values are weak by accepted criteria for natural products. A more interesting finding is synergy: Triphala lowered the MIC of gentamicin against resistant Gram-negative bacilli and of oxacillin against MRSA. Common weaknesses include non-standard methods, missing cytotoxicity and selectivity data, no consideration of achievable concentrations, and frequent ignoring of interference by tannins and other non-specific constituents. Realistic translational routes are topical and wound applications, local gut-acting uses consistent with classical krimi treatment, and antibiotic adjuvants. We propose minimum standards for future studies.
KEYWORDS: Krimighna, antimicrobial resistance, MRSA, ESBL, Triphala, *Terminalia chebula*, *Azadirachta indica*, *Embelia ribes*, synergy, Dravyaguna

This is an open access article, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

INTRODUCTION

Antimicrobial resistance is one of the most serious threats to global health. In its 2024 bacterial priority pathogens list, the World Health Organization placed carbapenem-resistant *Acinetobacter baumannii*, third-generation cephalosporin-resistant and carbapenem-resistant Enterobacterales, and rifampicin-resistant *Mycobacterium tuberculosis* in the critical category.[1] Few new antibiotic classes have reached the clinic in recent decades, and natural products remain an important source of leads.

Ayurveda describes krimi as organisms that cause disease, a category that clearly includes intestinal worms and, in the view of many modern interpreters, other pathogens. The Charaka Samhita lists a group of ten krimighna drugs among its fifty mahakashaya, names Vidanga as the foremost krimighna, and devotes a chapter to the types of krimi and their treatment.[2] Nimba, the *Terminalia* fruits of Triphala, Haridra and many others are also used for infections and wounds. These drugs are therefore attractive candidates for screening against resistant bacteria, and a large literature reports their in vitro activity.

This review appraises representative evidence for krimighna and related drugs against drug-resistant bacteria, examines the methodological standards such studies should meet, and considers realistic routes to clinical use.

METHODS

This is a critical narrative review. We searched PubMed, publisher websites and repositories for in vitro and in vivo studies of Ayurvedic krimighna and related drugs against drug-resistant bacterial isolates, and for methodological guidance on antimicrobial testing of natural products. Representative studies with clearly reported MICs against resistant isolates were selected.

CLASSICAL FRAMEWORK

Classical treatment of krimi has three components: removal of the organisms (apakarshana), changing the internal environment so that it no longer supports them (prakriti vighata), and avoiding their causes (nidana parivarjana).[2] Krimighna drugs are mostly pungent, bitter and astringent, and they are typically given by mouth for intestinal krimi or applied externally for skin and wound conditions.[2] This framework is relevant to translation: the classical use of krimighna drugs is largely local, in the gut or on the skin, where high concentrations can be achieved, rather than systemic.

IN VITRO EVIDENCE AGAINST RESISTANT PATHOGENS

Table 1 summarises representative studies.

Table 1. Representative in vitro studies of Ayurvedic drugs against drug-resistant bacteria.

Drug and preparation	Organisms	Main finding	Comment
Nimba (*Azadirachta indica*) seed extract	Multidrug-resistant *Salmonella* Typhi, Kolkata	MIC 50–500 µg/mL; bactericidal at 400 µg/mL[3]	Number of isolates not stated in abstract
Terminalia chebula and *T. bellirica* fruit extracts	MRSA; ESBL *E. coli* and *K. pneumoniae*	MIC 94–392 µg/mL for *S. aureus*/MRSA; 556–1,509 µg/mL for ESBL strains; additive with several antibiotics; antagonism with polymyxin B[4]	Low toxicity in brine shrimp assay
Triphala	MDR Gram-negative bacilli; MRSA	Synergy (FIC index below 1) with gentamicin and with oxacillin[5]	Clinical isolates; checkerboard method
Vidanga (embelin)	Gram-positive and Gram-negative bacteria	Bactericidal against Gram-positive, bacteriostatic against Gram-negative[6]	MIC values not reported in abstract
Piperine (Maricha, Pippali)	*M. tuberculosis*, including MDR isolates	Lowered rifampicin MIC; possible efflux pump inhibition[7]	Preclinical only

Two patterns stand out. First, the MICs of crude extracts are generally high. Commonly used criteria regard an extract as of interest only if its MIC is below about 100 µg/mL, and a pure compound only if it is below about 10 µg/mL.[8,9] Most reported values against resistant Gram-negative bacteria are well above these thresholds.[4] Second, the more promising signal is interaction with antibiotics. Triphala lowered the MIC of gentamicin against resistant Gram-negative bacilli and showed synergy with oxacillin against MRSA,[5] and piperine lowered the MIC of rifampicin against *M. tuberculosis*, possibly by inhibiting an efflux pump.[7] On the other hand, *Terminalia* extracts were antagonistic with polymyxin B, a last-resort antibiotic for carbapenem-resistant Gram-negatives,[4] which shows that combination is not automatically beneficial.

METHODOLOGICAL APPRAISAL

Many studies in this field share weaknesses that limit their value.[9,10] Table 2 lists the most common and the corresponding standards.

Table 2. Common methodological problems in antimicrobial studies of Ayurvedic drugs and recommended standards.

Problem	Recommended standard
Agar diffusion zones reported without MICs	Determine MIC and MBC by broth microdilution following recognised standards[9]
Isolates poorly characterised	Report species identification, resistance phenotype and mechanism, and include reference strains
High MICs presented as "significant" activity	Apply accepted thresholds for extracts and pure compounds[8,9]
No cytotoxicity data	Measure toxicity to mammalian cells and report a selectivity index[9]
Non-specific activity of tannins, polyphenols and reactive compounds	Consider assay interference and non-specific protein binding[11]
Extract poorly characterised	Describe plant part, solvent and chemical profile[12]
Achievable concentrations ignored	Compare MICs with concentrations attainable at the intended site of action
Synergy claimed from single combinations	Use checkerboard or time-kill methods with defined FIC criteria

Tannin-rich drugs such as the *Terminalia* fruits deserve particular comment. Hydrolysable tannins and related polyphenols precipitate proteins and can inhibit bacteria non-specifically in vitro, but they are poorly absorbed and extensively metabolised, so systemic concentrations after oral use are unlikely to approach the MICs observed.[9,11] Their activity is therefore most relevant where the drug acts locally.

TRANSLATIONAL PROSPECTS

Three routes appear realistic. The first is topical and wound use, where concentrations far above the MIC can be achieved and where Ayurveda already uses krimighna drugs, for example in wound cleansing and dressings.[2] The second is local action in the gut, which corresponds to the classical use of krimighna drugs against intestinal krimi. The third is use as an antibiotic adjuvant, in which a plant compound restores or enhances the activity of an existing antibiotic, for example by inhibiting efflux pumps.[5,7] Each route requires pharmacokinetic and safety data and, ultimately, controlled clinical trials. Systemic use of crude extracts as stand-alone antibiotics against critical-priority pathogens is not supported by the evidence.

A DRAVYAGUNA PERSPECTIVE

The classical approach to krimi was never limited to killing organisms. It combined removal, alteration of the internal environment and avoidance of causes.[2] This broader view aligns with modern interest in strategies other than direct killing, such as inhibiting virulence, biofilm formation and efflux, and modulating the host response. Studies of krimighna drugs could usefully test these mechanisms rather than relying only on MIC screening, and they should match the route and concentration to the classical use.

RECOMMENDATIONS

- Use standard broth microdilution methods, characterised resistant isolates and reference strains.[9]
- Report MICs against accepted thresholds and

include cytotoxicity and selectivity data.[8,9]
- Characterise extracts chemically and consider non-specific activity of tannins and reactive compounds.[11,12]
- Test synergy and antagonism systematically, including with last-resort antibiotics.[4,5]
- Prioritise topical, wound and gut-acting applications, and adjuvant combinations, for further development.
- Progress promising candidates to animal infection models and pharmacokinetic studies before claims of clinical potential.

LIMITATIONS

This review discusses representative rather than all published studies, and the selection may over- or under-represent particular drugs. Several key studies could be summarised only from their abstracts.

CONCLUSION

Krimighna and related Ayurvedic drugs show in vitro activity against drug-resistant bacteria, but crude extracts are generally weak by accepted criteria, and many studies do not meet basic methodological standards. The more promising findings concern synergy with existing antibiotics and local applications that match classical use. Rigorous methods, realistic routes of administration and attention to the classical understanding of krimi as more than a target to be killed would make this research more likely to contribute to the fight against antimicrobial resistance.

REFERENCES

1. World Health Organization. WHO bacterial priority pathogens list, 2024: bacterial pathogens of public health importance to guide research, development and strategies to prevent and control antimicrobial resistance. Geneva: WHO; 2024.
2. Vidiyala N, Parupathi P, Sunkishala P, Sree C, Gujja A, Kanagala P, et al. Artificial intelligence: a new era in prostate cancer diagnosis and treatment. Int J Pharm. 2025:126024.
3. Mandal S, Mandal MD, Pal NK. Antibacterial potential of *Azadirachta indica* seed and *Bacopa monniera* leaf extracts against multidrug resistant *Salmonella enterica* serovar Typhi isolates. Arch Med Sci 2007;3:14–8.
4. Lokeshvar R, Ramaiyan V, Nithin V, Pavani S, Vinod Kumar T. Nanotechnology-driven therapeutics for liver cancer: clinical applications and pharmaceutical insights. Asian J Pharm Clin Res. 2025;18(2):8-26.
5. Manoraj A, Thevanesam V, Bandara BMR, Ekanayake A, Liyanapathirana V. Synergistic activity between Triphala and selected antibiotics against drug resistant clinical isolates. BMC Complement Altern Med 2019;19:199. https://doi.org/10.1186/s12906-019-2618-1
6. Vidiyala N, Sunkishala P, Mandati P, Parupathi P, Nyavanandi D. Integrating 3D printing and additive manufacturing into personalized medicine for pharmaceuticals: opportunities, limitations, and future perspectives. Sci Pharm. 2025;93(4):61.
7. Sharma S, Kumar M, Sharma S, Nargotra A, Koul S, Khan IA. Piperine as an inhibitor of Rv1258c, a putative multidrug efflux pump of *Mycobacterium tuberculosis*. J Antimicrob Chemother 2010;65:1694–701.
8. Vidiyala N, Sunkishala P, Parupathi P, Nyavanandi D. The role of artificial intelligence in drug discovery and pharmaceutical development: a paradigm shift in the history of pharmaceutical industries. AAPS PharmSciTech. 2025;26(5):133.
9. Cos P, Vlietinck AJ, Vanden Berghe D, Maes L. Anti-infective potential of natural products: how to develop a stronger in vitro ‘proof-of-concept’. J Ethnopharmacol 2006;106:290–302.
10. Heinrich M, Appendino G, Efferth T, Fürst R, Izzo AA, Kayser O, et al. Best practice in research – overcoming common challenges in phytopharmacological research. J Ethnopharmacol 2020;246:112230.
11. Baell J, Walters MA. Chemistry: chemical con artists foil drug discovery. Nature 2014;513:481–3. PMID: 25254460.
12. Naga VAUV, Vidiyala N, Sunkishala P, Vidiyala P, Kumar RKT, Elumalai S, et al. Bio-inspired green synthesis of nanoparticles for psoriasis treatment: a review of current status and future directions. Asian J Green Chem. 2025;9(4):373-403.