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Antibiofilm activity of *Andrographis paniculata*, Andrographolide and its derivatives: A Systematic Review

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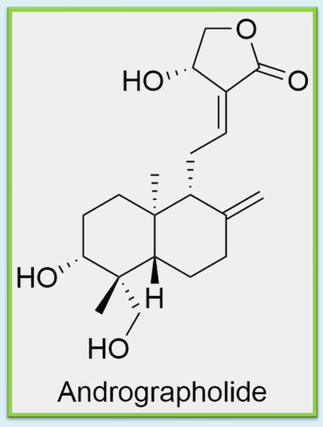
BACKGROUND

Biofilms exist naturally and contribute to antibiotic resistance significantly, making conventional treatments like antibiotics, phage therapy, quorum sensing (QS) inhibitors, and monoclonal antibody therapy inadequate to treat biofilm-associated diseases [1]. Therefore, finding alternative treatment is urgent to eradicate biofilms. *Andrographis paniculata* (Burm. f.) Wall. ex Nees (AP) is a well-known traditional herb for demonstrating diverse pharmacological actions, including antibiofilm properties [2]. Andrographolide, a secondary lead metabolite of AP, and its derivatives or analogues significantly inhibit biofilm formation [3]. Despite having a sizeable list of antibacterial actions, there is no attempt to establish AP's mechanisms of actions in combatting biofilms through comprehensive analysis using the documented literature.



Andrographolide

OBJECTIVE

To discuss AP's antibiofilm activity by considering various contributing factors that involved in the molecular pathway of eradication of biofilms.

METHODOLOGY

This study was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and synthesized the studies conducted from 2011 to 2020 in English language only.

RESULTS

A total of 125 articles were obtained from the search, and antibiofilm characteristics data were extracted from 23 articles and pooled together. We revealed a total of ten biofilm-forming species as following:

1. *Pseudomonas aeruginosa* (11)
2. *Escherichia coli* (4)
3. *Staphylococcus epidermidis* (2)
4. *Staphylococcus aureus* (1)
5. *Vibrio harveyi* (1)
6. *Serratia marcescens* (1)
7. *Salmonella typhimurium* (1)
8. *Klebsiella pneumoniae* (1)
9. *Enterococcus faecalis* (1)
10. *Proteus vulgaris* (1).

The biofilms were significantly inhibited by AP and its secondary metabolites up to 97% inhibition [4].

DISCUSSION

AP or metabolites significantly disrupt the QS system, especially *Las* and *Rhl* systems, resulted in a significant reduction of extracellular polymeric substances and virulence factors. They decreased the expression of biofilm-forming genes as well. Additionally, AP showed synergistic activity with silver nanoparticles or standard antibiotics like gentamicin and azithromycin [5].

CONCLUSIONS

In our opinion, AP or andrographolide is a great example of an antibiofilm agent and is a strong candidate for future therapeutics to combat the unmet needs of virulence factor production, biofilm formation and antibiotic resistance.

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