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Antiquorum sensing activity of Aloe barbadensis miller resin against Chromobacterium violaceum

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Abstract:

Background: Chromobacterium violaceum (C. violaceum) is a Gram-negative, rod-shaped facultatively anaerobic bacterium implicated with recalcitrant human infections. In recent years it has been considered as an opportunistic pathogen leading to complications in hospitalized patients.
Materials and methods: Aloe bardenesis resin dissolved in 1 ml of distilled water and the different concentration of extract (10μl, 20μl, 30μl) was loaded into discsl. The zone anti-quorum sensing activity was measured by standard scale.
Result: The Aloe bardenesis significantly inhibited the violacein pigment production in concentration dependent manner.
Conclusion: Aloe bardenesis holds good as a promising natural alternative medicine to inhibit the quorum sensing of Chromobacterium violaceum.

Keywords:** Aloe bardenesis, **Chromobacterium violaceum**, Muller hinton agar (MHA), **quorum sensing**, **environment.

Introduction:

Chromobacterium violaceum (*C. violaceum*) is a Gram-negative, rod-shaped facultatively anaerobic bacterium implicated with recalcitrant human infections (Venkatramanan *et al.*, 2020). It is a motile bacterium and is now considered as an opportunistic pathogen in health-care settings (Nayyar, Sethi and Vashishth, 2019). It is part of the normal flora of water and soil of tropical and subtropical regions of the world. Quorum sensing (or quorum signalling) is the ability to detect and respond to cell population density by gene regulation and quorum sensing is basically a cell to cell communication in which cells produce, detect and respond to extracellular molecules called autoinducers. Quorum sensing relies upon the interaction of a diffusible signal molecule with

a transcriptional activator protein to couple gene expression with cell population density (Brelles-Mariño and Bedmar, 2001).

Chromobacterium violaceum is a saprophytic, gram-negative bacterium which has now been widely used in quorum sensing research. Among the Qs regulated traits of this bacterium, violacein production has received the maximum attention (Kothari, Sharma and Padia, 2017) and this process depends on the production, release, and group-wide detection of signal molecules which are known as autoinducers. The autoinducers in gram-negative bacteria are typically homoserine lactones (HSLs). LuxI-type enzymes involved in the production of HSLs, and LuxR-type cytoplasmic proteins act as the receptors of HSL. LuxR-type receptors can be stabilized by binding with autoinducers, and this stabilization enables the dimerization, binding of DNA, and the transcription of QS target genes. LuxI/R signaling cascades are essential for the virulence in many pathogenic bacteria, and the virulence of these bacteria can be prevented by disabling these circuits with small molecules and now cvil synthesizes the autoinducer C10-homoserine lactone (C10-HSL), CviR is a cytoplasmic DNA binding transcription factor that activates gene expression following binding to C10-HSL (Stauff and Bassler, 2011) and thus the cascade of events leading to production of violaceum pigment and virulence factors which leads to infection in human beings.Aloe-Vera a cactus-like plant that grows in hot, dry climates. It's cultivated in subtropical regions around the world, including the southern border areas of Texas, New Mexico , Arizona, and California.Historically, aloe has been used for skin conditions and was thought to enhance baldness and promote wound healing. Aloevera is employed topically (applied to the skin) and orally Oral submucous fibrosis, burning mouth syndrome, burns, and radiation-induced skin toxicity. Oral use of Aloevera is promoted for weight loss, diabetes, hepatitis, and inflammatory bowel disease (a group of conditions caused by gut inflammation that has Crohn's disease and ulcerative colitis) and for the antiinflammatory property and antibacterial property of aloevera we used this for inhibiting the violaceum pigment and inhibit the quorum sensing in *Chromobacterium violaceum.*
Chromobacterium violaceum exoproteomic preliminary studies confirmed the production of proteins identified as virulence factors (such as a collagenase, flagellum proteins, metallopeptidases, and toxins), allowing us to better understand its pathogenicity mechanisms. *C. violaceum*, several other virulence factors were identified including a collagenase (CV_2001), which may be involved in tissue necrosis and cytopathic effects and the biofilm formation by this bacterium is more fatal in medical and veterinary clinical settings. Aim of the study is to develop resistance against chromobacterium violaceum quorum sensing activity by miller resin of aloevera bardenesis. Our team has extensive knowledge and research experience that has translate into high quality publications(Krishnamurthy *et al.*, 2009; Abdul Wahab *et al.*, 2017; Eapen, Baig and Avinash, 2017; Ravindiran and Praveenkumar, 2018; Subramaniam and Muthukrishnan, 2019; Anita *et al.*, 2020; Kumar *et al.*, 2020; Rajasekaran *et al.*, 2020; Arumugam, George and Jayaseelan, 2021; Dhanraj and Rajeshkumar, 2021)

Materials and methods:

Control strain of *C. violaceum* (CV1) was subcultured in Luria bertani (LB) broth and culture was incubated at 30 degree celsius in a shaker incubator. The optical density was adjusted to 0.5 Mcfarland standards. Muller Hinton Agar (MHA) was prepared and poured on the sterile petri-plate. Subsequently, using a well cutter 8 mm diameter were punched into the agar medium and the extract was loaded into each well. The plates were incubated at 30 degree celsius for 24 h. After 24 h of incubation the zone of inhibition was measured using a standard scale.

Results:

Antimicrobial activity of *Aloevera barbadensis* resin was tested against the control strain of *C. violaceum* (CV1). A different concentration of extract inhibited the violacein pigment production in *C. violaceum* (CV1). The result shows that the extract of *Aloevera barbadensis* resin inhibited the quorum sensing system in the concentration dependent manner (Figure 2).

Figure 1 : *Aloe bardenesis* miller resin extract

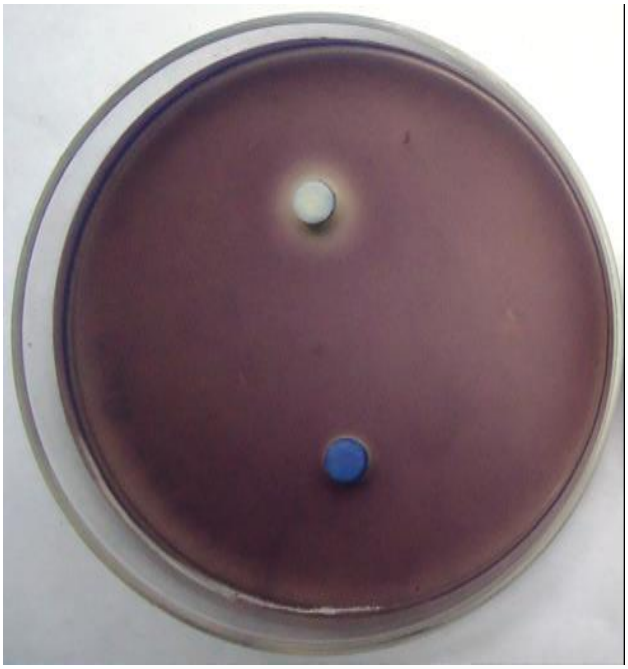

Figure 2: *Aloe bardenesis* (20µl) miller resin inhibited the violacein pigment production (zone of inhibition) in *Chromobacterium violaceum* .

Discussion:

Figure 2 shows that 20 µl *Aloe bardenesis* miller resin inhibiting the violaceum pigment and thus stopping the quorum sensing activity of the chromobacterium violaceum and thus showing the pigment inhibition more greatly than any other concentration and thus proving the *Aloevera bardenesis* miller resin is effective against the *Chromobacterium violaceum* and thus helps in Antiquorum sensing activity and in previous study there is an Inhibition of Quorum Sensing and Biofilm Formation in *Chromobacterium violaceum* by Fruit Extracts of *Passiflora edulis (Venkatramanan et al., 2020)* and there is further studies made on another species of gram negative bacteria like *Pseudomonas aeruginosa* by inhibiting it with the essential oils using critical CO_2 method to evaluate its antiquorum sensing and antibacterial activity (Ganesh, Sankar Ganesh and Ravishankar Rai, 2015) and further study made on In vitro antibiofilm activity of Murraya koenigii essential oil extracted using supercritical fluid CO_2 method against Pseudomonas aeruginosa PAO1(Ganesh and Vittal, 2015) and various study suggest various bioactive compounds and not that much inhibitory in lower concentration and our extract

show inhibition in much lower concentration than other compounds and thus *Aloe bardenesis* can be used for therapeutic purpose and further study is needed to identify the bioactive compound in *Aloe bardenesis* responsible for it.

Conclusion:

The present study was undertaken to study the quorum sensing inhibitory effect of Aloe vera resin against *C. violaceum.* At varying concentrations it rendered a promising inhibitory effect on the quorum sensing produced by *C. violaceum*. However further experimental evaluations need to be done to report on the bio-active compounds from the resin that can be developed as a novel drug to curb the menace of systemic infections.

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