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Antimicrobial Activity of Extract from *Hermetia illucens* (Black Soldier Fly) Larvae against Multi Drug-Resistant (MDR) Human Pathogenic Bacteria

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Aims and Objectives

- ✓ The main aim of this study was the identification and characterization of natural products that can act as antibacterial agents isolated from the fat of *Hermetia illucens* (Hi) larvae.
- ✓ The objective of this research was to investigate the action of compounds derived from *Hermetia illucens* larvae fat.
- ✓ Most researchers focused on the protein section (Peptides) as antimicrobial agents against G^{-ve}, while for the first time we focused on the fat (FFAs) part as a new source for antimicrobial agents against MDR bacteria (G^{+ve} & G^{-ve}) that cause severe diseases for human and animal.
- ✓ Employment the AWME in treatment of MDR bacteria

Materials and methods

- New extraction reagent was developed to extract the bioactive molecules from the fat of BSF larvae.
- The extraction solution was composed of a mixture of water (d. H₂O), methanol (Me-OH), and hydrochloric acid (HCl) with ratio (90:9:1%), respectively.
- The 3 g of compressed BSFL fat extracted using our extraction solution under sterilized conditions for 24h.
- Aqueous layer was isolated and concentrated under vacuum.
- Concentrated extract kept at 4 °C until use.
- AWME was tested against Human pathogenic bacteria (*K. pneumonia M9* and *Bacillus subtilis*).
- IZD, MIC, MBC, and IC₅₀

Introduction

- For many years, antimicrobial agents have been used indiscriminately in aquaculture, which have led to a high rate of resistant or multi-drug-resistant bacteria. This problem has boosted the search for functional, and alternatives with safe.
- Several recent studies that reported the antimicrobial activity of the larvae hemolymph and maggot extract as well as of secretions are promising for the development of new therapeutically valuable antibiotics, particularly in defense of multi-resistant “super bugs”.
- BSFL fat is rich in medium-chain lauric acid with known antimicrobial activity towards the disruption of the bacterial cell membrane. Additionally, it contains a high nutritional value of unsaturated oleic (18:1, n-9) and linoleic acids.
- BSFL does not accumulate pesticides or mycotoxins.
- Our study indicated for the first time that fatty acids from BSFL fat killed and eradicated MDR bacteria.

Results and discussion

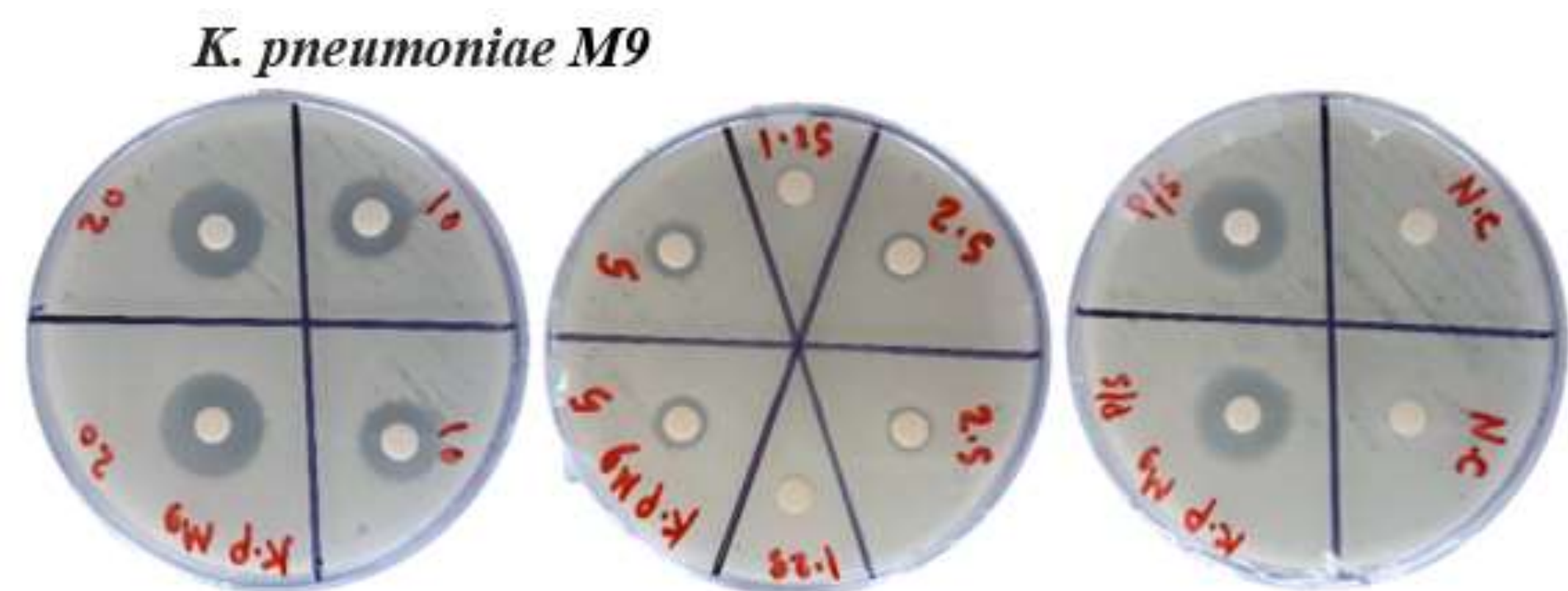


Figure 1. Inhibition and killing of human pathogenic bacteria. The inhibition zone diameters were measured after 12 h and 24 h of overnight incubation of the discs loaded on Petri dishes agar seeded with *K. pneumoniae M9*.

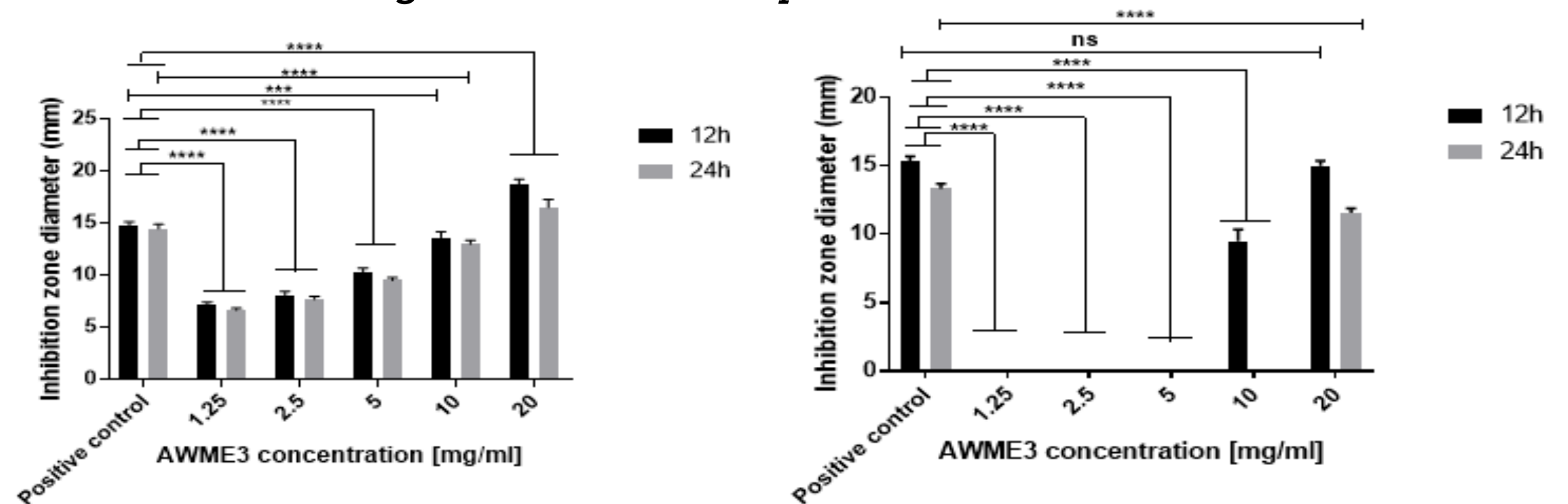


Figure 2. Antimicrobial sensitivity of AWME3 against a) *K. P M9*, and b) *B. subtilis*. The bacteria strains were subjected to concentrations of 1.25, 2.5, 5, 10, 20 mg/ml of AWME3 of BSFL fat. The IZD were measured after 12 h and 24 h of incubation Penicillin - streptomycin (p/s) used as an antibacterial positive control. Data were analysed by two-way ANOVA, followed by Tukey Multiple Comparisons Test. Data represented as significant difference as compared to Positive control and p value was ranged between **P = 0.0018. and ****P < 0.0001.

Conclusions

- ✓ New protocol was developed to extract bio-active compounds from BSFL fat.
- ✓ GC-MS analysis indicated that AWME contains 33 compounds that were SFAs & USFAs.
- ✓ Antimicrobial properties for AWME were determined for the first time against pathogenic bacteria strains *K. pneumoniae* and *B. subtilis*
- ✓ BSFL fat consider as a great reservoir for FFAs and its derivatives that proved to new alternatives for antibiotics in treatment the MDR bacteria.

References

Marusich, E.; Mohamed, H.; Afanasev, Y.; Leonov, S. Fatty acids from hermetia illucens larvae fat inhibit the proliferation and growth of actual phytopathogens. *Microorganisms* **2020**, *8*, 1–21, doi:10.3390/microorganisms8091423.

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