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Insecticidal activities of *Streptomyces* sp. KSF103 ethyl acetate extract against medically important mosquitoes and non-target organisms

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A potentially novel actinobacterium isolated from forest soil, *Streptomyces* sp. KSF103 was evaluated for its insecticidal effect against several mosquito species namely *Aedes aegypti*, *Aedes albopictus*, *Anopheles cracens* and *Culex quinquefasciatus*. Mosquito larvae and adults were exposed to various concentrations of the ethyl acetate (EA) extract for 24 h. Considerable mortality was evident after the EA extract treatment for all four important vector mosquitoes. Larvicidal activity of the EA extract resulted in LC_{50} at 0.045 mg/mL and LC_{90} at 0.080 mg/mL for *Ae. aegypti*; LC_{50} at 0.060 mg/mL and LC_{90} at 0.247 mg/mL for *Ae. albopictus*; LC_{50} at 2.141 mg/mL and LC_{90} at 6.345 mg/mL for *An. cracens*; and LC_{50} at 0.272 mg/mL and LC_{90} at 0.980 mg/mL for *Cx. quinquefasciatus*. In adulticidal tests, the EA extract was the most toxic to *Ae. albopictus* adults (LD_{50} = 2.445 mg/mL; LD_{90} = 20.004 mg/mL), followed by *An. cracens* (LD_{50} = 5.121 mg/mL; LD_{90} = 147.854 mg/mL) and then *Ae. aegypti* (LD_{50} = 28.873 mg/mL; LD_{90} = 274.823 mg/mL). Additionally, the EA extract exhibited ovicidal activity against *Ae. aegypti* (LC_{50} = 0.715 mg/mL; LC_{90} = 6.956 mg/mL), *Ae. albopictus* (LC_{50} = 0.715 mg/mL; LC_{90} = 6.956 mg/mL), and *An. cracens* (LC_{50} = 0.715 mg/mL; LC_{90} = 6.956 mg/mL), evaluated up to 168 h post-treatment. It displayed no toxicity on the freshwater microalga *Chlorella* sp. Beijerinck UMACC 313, marine microalga *Chlorella* sp. Beijerinck UMACC 258 and the ant *Odontoponera denticulata*. In conclusion, the EA extract showed promising larvicidal, adulticidal and ovicidal activity against *Ae. aegypti*, *Ae. albopictus*, *An. cracens*, and *Cx. quinquefasciatus* (larvae only). The results suggest that the EA extract of *Streptomyces* sp. KSF103 has the potential to be used as an environmental-friendly approach in mosquito control. The current study would serve as an initial step toward complementing microbe-based bioinsecticides for synthetic insecticides against medically important mosquitoes.

Aedes, *Anopheles* and *Culex* are prolific vectors of various mosquito-borne diseases, including dengue fever, Zika, Chikungunya, yellow fever, malaria and filariasis. Mosquitoes are becoming more prevalent and expanding their range due to climate change, socioeconomic conditions, and the ease of world travel today, triggering the rampant spread of mosquito-borne diseases worldwide[1]. Globally, mosquito-borne diseases are menacing more than four billion people in over a hundred countries. Because of their anthropophilic and host-seeking behaviour, along with the fact that they breed preferentially in artificial habitats within or near residential areas (particularly *Aedes* and *Culex*), mosquitoes are competent and epidemiologically significant species.

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