
Repellence of Essential Oil of *Nigella sativa* L. Seeds Against *Anopheles gambiae* and

Identification of the Active Blend

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Abstract

The objective of this study was to evaluate the repellence of the essential oil on *Nigella sativa* L. seeds using *An. gambiae* and identify the active constituents and blend. *Nigella sativa* L. seeds were ground and hydro-distilled. Then bioassays of essential oil were conducted on human skin against newly emerged female *An. gambiae* using DEET as the positive control. It was noted that the repellence (98.81±1.19 and 100.00±0.00 at a concentration of 0.01g/ml and 0.1g/ml respectively) of the essential oil against *An. gambiae* was comparable to that of DEET (100.00±0.00 and 100.00±0.00 at a concentration of 0.01g/ml and 0.1g/ml respectively) at higher concentrations; however, it showed lower repellence (36.97±1.81 and 50.41±2.87 against 51.11±13.33 and 86.22±4.51 of DEET at concentration of 0.0001g/ml and 0.0001g/ml respectively) at lower concentrations. GC-MS and GC-EAD (Gas Chromatography-linked Electro Antennography) analyses of the essential oil led to the identification of eight bioactive constituents namely α -thujene (**19**), longifolene (**21**), 1, 2, 3, 4, 5-pentamethylcyclopentane (**18**), α -pinene (**20**), β -pinene (**22**), tetradecane (**24**), cymene (**11**), and α -longipinene (**37**). Subtractive bioassays to characterize the constituents that contributed most to the repellence of the oil were then carried out. The most repellent blend was found to contain (+)- β -pinene (**41**), (-)- β -pinene (**42**), (+)- α -pinene (**39**), (-)- α -pinene (**40**), α -longipinene (**37**), tetradecane (**24**) and 1,2,3,4,5 pentamethylcyclopentane (**18**) (RD₇₅ = 1.630) though less repellent than DEET (RD₇₅=1.630). Bioassay of pure (+)- α -pinene (**39**) and (-)- α -pinene (**40**) showed that (+)- α -pinene (**39**) was a better repellent than (-)- α -pinene (**40**). More studies need to be undertaken on the essential oil of *N. Sativa* seeds to determine the optical stereochemistry of the α -pinene (**20**) and β -pinene (**22**) and also establish whether α -thujene (**19**) and longifolene (**21**) contribute to repellency or not against *An. gambiae*. These results form the basis of development of the appropriate blends for personal protection against *An. gambiae*.

Keywords: Malaria, *Nigella sativa* L. seeds, *Anopheles gambiae*, blend

