Essential oils extracted by steam and vacuum distillations from annatto seeds showed mosquito repellency and larvicidal activities [5, 6]. The steam distillation involved simple water extraction. The vacuum distillation involved hexane extraction and silica gel separation. The use of hexane solvent extraction, followed by hexane distillation, followed by silica chromatographic separation and hexane distillation again to obtain a "vacuum distillate" is essentially un-practicable, cost-prohibitive, and occupationally unsafe large use of inflammable solvent(s). Mosquito larvicidal activity with this vacuum distillate was higher than that of steam distillate; however, the repellent activity of vacuum and steam distillates was relatively similar. The essential oil in steam distillate had ishwarane (53%), beta-selinene (6%) and other minor components. The essential oil in vacuum distillate had geranylgeraniol (23%), ishwarane (17%) and other minor components. The other study showed hexane extract of annatto seeds provided better mosquito repellency compared with alcohol extraction [7].

Brief Summary

The present application focuses on insect repellency products which are spatial repellents (high volatility compounds) and/or contact repellents (intermediate volatility compounds). Spatial repellents have strong odor and are effective at a distance for protecting people from insects reaching proximity, especially mosquitoes. The most commonly employed spatial repellents in nature are volatile essential oils, C10 terpenoids. Contact repellents have weaker odor. Insects usually land on treated surface and are then repelled. Plant-based contact repellents may be C15 terpenoids.

In one aspect, the present disclosure refers to a composition comprising ishwarane and geranyl-α-terpinene wherein the ratio of ishwarane to geranyl-α-terpinene is 40:60 to 60:40 by volume. In another aspect, the present disclosure refers to a composition comprising ishwarane, ~~geranylgeraniol and~~ geranyl-α-terpinene, 15-hydroxy-α-muurolene, geranylgeraniol, and cembrene, wherein the ratio of ishwarane to geranyl-α-terpinene is 40:60 to 60:40 by volume. In yet another aspect, the present disclosure refers to a method of repelling an arthropod away from human skin comprising applying topically the compound as described herein on the human skin. In a further aspect, the present disclosure refers to a method of killing an arthropod comprising contacting the composition as described herein to the arthropod. In a further aspect, the present disclosure refers to a method of repelling or killing an arthropod away from, or on human skin comprising topically applying the

composition as described herein on the human skin.

In one example of the disclosed composition, the composition comprises ishwarane,

Claims

1. A composition comprising ishwarane and geranyl-α-terpinene wherein the ratio of ishwarane to geranyl-α-terpinene is 40:60 to 60:40 by volume.

2. The composition of claim 1 further comprising geranylgeraniol.

3. A composition comprising ishwarane, geranyl-α-terpinene, 15-hydroxy-α-muurolene, geranylgeraniol, and cembrene, wherein the ratio of ishwarane to geranyl-α-terpinene is 40:60 to 60:40 by volume.

~~3.~~4. The composition of claim 1, further comprising 15-hydroxy-α-muurolene, cembrene and geranylgeraniol, wherein the concentration of ishwarane is from 5% to 25% of the total volume of the composition, the concentration of 15-hydroxy-α-muurolene is from 1% to 10% of the total volume of the composition, the concentration of geranyl-α-terpinene is from 10% to 25% of the total volume of the composition, the concentration of cembrene is from 1% to 15% of the total volume of the composition, and the concentration of geranylgeraniol is from 5% to 35% of the total volume of the composition.

5. The composition of claim 3, wherein the concentration of ishwarane is from 5% to 25% of the total volume of the composition, the concentration of 15-hydroxy-α-muurolene is from 1% to 10% of the total volume of the composition, the concentration of geranyl-α-terpinene is from 10% to 25% of the total volume of the composition, the concentration of cembrene is from 1% to 15% of the total volume of the composition, and the concentration of geranylgeraniol is from 5% to 35% of the total volume of the composition.

~~4.~~6. The composition of ~~claim 3~~claim 4 or claim 5, wherein the concentration of ishwarane is from 10% to 20% of the total volume of the composition, the concentration of 15-hydroxy-α-muurolene is from 3% to 17% of the total volume of the composition, the concentration of geranyl- α-terpinene is from 15% to 20% of the total volume of the composition, the concentration of cembrene is from 5% to 10% of the total volume of the composition, and the concentration of geranylgeraniol is from 10% to 30% of the total volume of the composition.

~~5.~~7. The composition of claim 4 or claim 5~~claim 3~~, wherein the total concentration of

ishwarane and 15-hydroxy-α-muurolene is from 1% to 40% of the total volume of the composition and the total concentration of geranyl-α-terpinene, cembrene and geranylgeraniol is from 10% to 70% of the total volume of the composition.

~~6.~~8. The composition of claim ~~5~~7, wherein the total concentration of ishwarane and 15-hydroxy-α-muurolene is from 5% to 30% of the total volume of the composition and the total concentration of geranyl-α-terpinene, cembrene and geranylgeraniol is from 15% to 60% of the total volume of the composition.

~~7.~~9. The composition of claim ~~6~~8, wherein the total concentration of ishwarane and 15-hydroxy-α-muurolene is from 10% to 20% of the total volume of the composition and the total concentration of geranyl-α-terpinene, cembrene and geranylgeraniol is from 20% to 50% of the total volume of the composition.

~~8.~~10. The composition of claim 4 or claim 5~~claim 3~~, wherein the concentration of ishwarane is 20% of the total volume of the composition, the concentration of 15-hydroxy-α-muurolene is 5% of the total volume of the composition, the concentration of geranyl-α-terpinene is 22% of the total volume of the composition, the concentration of cembrene is 10% and the concentration of geranylgeraniol is 6% of the total volume of the composition.

~~9.~~11. The composition of claim 4 or claim 5~~claim 3~~, further comprising at least one of peppermint oil, lemongrass oil, spearmint oil, cinnamon oil and oil of lemon eucalyptus.

~~10.~~12. The composition of claim 4 or claim 5~~claim 3~~, wherein the concentration of ishwarane is 9% of the total volume of the composition, the concentration of 15-hydroxy-α-muurolene is 5% of the total volume of the composition, the concentration of geranyl-α-terpinene is 16% of the total volume of the composition, the concentration of cembrene is 3% of the total volume of the composition, and the concentration of geranylgeraniol is 23% of the total volume of the composition.

~~11.~~13. A method of repelling an arthropod away from human skin comprising applying topically the composition of claim 1 or claim 3 on the human skin.

~~12.~~14. The method of claim ~~11~~13, wherein the arthropod is selected from the group consisting of insect and arachnid.

~~13.~~15. A method of killing an arthropod comprising contacting the composition of claim 4 or claim 5~~claim 2~~ to the arthropod.

~~14.~~16. The method of claim ~~13~~15, wherein the arthropod is selected from the group consisting of insect and arachnid.

~~15.~~17. A method of repelling or killing an arthropod away from, or on human skin comprising topically applying the composition of claim 4 or claim 5~~claim 3~~ on the human skin.

~~16.~~18. The method of claim ~~15~~17, wherein the arthropod is selected from the group consisting of insect and arachnid.

~~17.~~19. The method of claim ~~11~~13, wherein the composition is as effective as 20% of N,N-diethyl-3-methylbenzamide (DEET) of the total volume of the composition for a 2 hour repellency duration.

~~18.~~20. The method of claim ~~15~~17, wherein the composition has a LD50 from ~~about~~ 34 µl/L to ~~about~~ 282 µl/L in water at about 24 hour after application of the composition.

~~19.~~21. The method of claim ~~15~~17, wherein the composition has a LD95 from ~~about~~ 1.3 ml/L to ~~about~~ 4.5 ml/L in water at about 24 hour after application of the composition.