



ENHANCEMENT OF PYRETHROID ACTIVITY WITH PARAQUAT AS AN ADJUVANT

CLAIM:

This technology provides a new use for the herbicide Paraquat (PQ) as a synergist for permethrin-treated long-lasting insecticidal nets (LLIN) bednets. This synergist re-sensitizes permethrin-resistant mosquitoes to permethrin while not readily degrading, ensuring the effective lifespan of permethrin/PQ treated bednets.

NOVELTIES:

This application is a novel use of the commercially available herbicide Paraquat (PQ). As an oxidative stressor, PQ breaks redox homeostasis in mosquitoes by depleting NADPH. NADPH is critically required for the cytochrome P450 system to detoxifying xenobiotics, including insecticides, which is the foundation of metabolic resistance to many insecticides. This allows PQ to sensitize mosquitoes to a broad range of insecticides.

FEATURES:

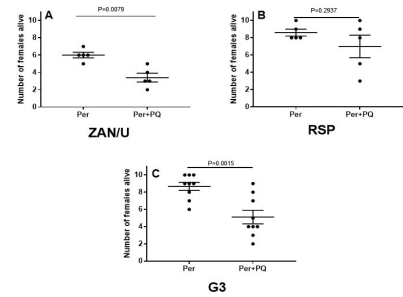
This synergist will restore sensitivity to permethrin in resistant mosquitoes. Since the insecticide/PQ combination lowers the effective dosage of insecticide, the half life of permethrin-treated bednet will be extended.

POTENTIAL APPLICATIONS:

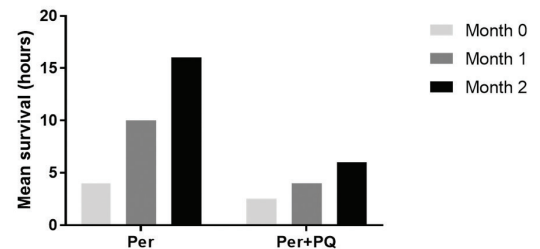
This product can be used as a synergist in insecticide-treated bednets as well as other insecticide impregnated materials.

MARKET SIZE:

Nets cost \$2-4, with 100-200 million bought. This gives a range of \$400 to \$800 million a year in market size.



Data 1. *Anopheles gambiae* strains ZAN/U, RSP, and G3 mosquitoes were assayed using the WHO cone test. Due to the difference in lethality, the ZAN/U and RSP strains were assayed using 25% of stock insecticide solution while the G3 strain was assayed using 10% of the solution. P-value is reported from an unpaired one-tailed student's t-test. PQ increased permethrin lethality in the susceptible strain, G3, and metabolically resistant strain ZAN/U. In the non-metabolically resistant strain (target site mutation), RSP, PQ did not increase lethality.



Data 2. Insecticide susceptible *Anopheles gambiae* G3 strain was exposed to permethrin treatment as found in commercially available nets. PQ was applied alongside this insecticide at a concentration lower than found in herbicidal applications. Co-application of permethrin and PQ increased death rate at a concentration of insecticide that would have been nontoxic. PQ can effectively reduce the amount of insecticide need to cause toxicity. PQ does not degrade overtime rapidly and therefore can extend the lifespan of the net.



INVENTOR(S) EXPERTISE

Cody Champion, Ph.D.

New Mexico State University

Jiannong (John) Xu, Ph.D.

New Mexico State University

Property of Arrowhead Center.
Do not duplicate/distribute.

For more information please contact:
Carlos Murguia at 575.646.2025 or ip@nmsu.edu