Mixtures for Insecticide Resistance Management in mosquito Vector Control

Insecticide Resistance Action Committee

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Introduction:

Insecticides have been extensively used since the 1940s to control the mosquito vectors of disease, and have been a vital component in the fight against malaria. However, resistance has developed and is widespread in populations of the major mosquito vector species. As insecticide resistance continues to develop and spread, there is a real danger that these valuable tools will be lost. The use of insecticide mixtures, as part of an Insecticide Resistance Management (IRM) programme, is one approach that can be used to combat this.





Definition:

For the purpose of Vector Control, an insecticide mixture can be considered as an application or material which contains two or more insecticides presented in such a way that the target mosquito will be exposed to both, or all, insecticides when coming into contact with the application, residual deposit or treated material.

Rational:

The rational for using mixtures for resistance management is the assumption that: if resistance to one class of insecticides is rare, resistance to two separate classes of insecticide will be extremely rare. When encountering a mixture, an insect with reduced susceptibility to one mixture partner will be controlled by the second, and *vice versa*. Hence, the probability of resistance to either partner in the mixture developing is greatly reduced. For this to be true, the prevalence of resistance to either mixture partner must be very low in the exposed population, or the benefit of the mixture for resistance management is greatly reduced.

Mixtures for efficacy:

To increase the effectiveness of a given insecticidal product, mixtures of insecticides may prove useful, even when there is reduced susceptibility to one mixture. For example, there is evidence that whilst some mosquitoes resistant to pyrethroids may not be killed on exposure to a pyrethroid, they may still be irritated or repelled from resting on the treated surface. Mixing a pyrethroid with a non-pyrethroid may therefore increase the overall effectiveness of the mixture. However, where pyrethroid resistance is already present in the target mosquito population, such a mixture has limited value for IRM.

To be useful for insecticide resistance management, a mixture should have the following attributes:

- Both, or all, insecticides should be applied at a rate such that they would be insecticidally effective on the target population, if applied alone.
- The insecticides should be applied in such a way that there is a very high probability that the target mosquito will be exposed to both/all insecticides during a single exposure incident.
- The bioavailability of the insecticides in the mixture should be equivalent. That is, an insecticidally effective residue of both/all mixture partners should remain throughout the expected duration of the residue or life of a treated material. The residual efficacy of one partner should not fall so that the target mosquitoes are exposed only to an insecticidally effective dose of a single insecticide.
- There should be no evidence of cross resistance between the mixture partners.

Conclusion:

IRM must be an integral part of all vector control programmes. Using insecticides in such a way that their effectiveness is maintained, is a stewardship responsibility of the commercial companies that market them. It is also a stewardship duty of those who design and implement the vector control programmes that utilise them.

For further information refer to the IRAC publications: "Prevention and management of insecticide resistance in vectors of public health importance" available for download at www.irac-online.org

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