Theory & Practice of Mosquito Larviciding

Insecticide Resistance Action Committee

www.irac-online.org

Objectives

Introduction and background

Mosquitoes are vectors of many human diseases, including malaria. The emergence of species resistant to insecticides widely used in vector control has the potential to severely impact on the control of these disease vectors.

The lack of available suitable alternative insecticides for vector control is becoming a serious issue. It is therefore vital that effective insecticide resistance management (IRM) strategies are implemented to ensure that the efficacy of existing compounds can be maintained for as long as possible. There are several larvicides which have totally different modes of action to currently available adulticides and therefore offer the opportunity to control resistant mosquitoes where the major classes of adulticide insecticides are resisted. For details on application of larvicides see IRAC Poster `Larviciding and Insecticide Resistance Management`.

This MoA (Modes of Action) is available at the IRAC website www.irac-online.org,

Malaria Control

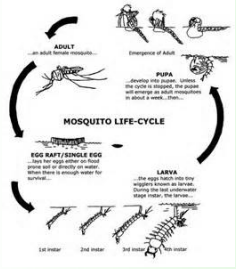
As malaria declines in many African countries there is a growing realization that new interventions need to be added to the front-line vector control tools of LLINs (long-lasting impregnated nets) and IRS (indoor residual spraying) that both target adult mosquitoes indoors. Larviciding provides the dual benefits of not only reducing numbers of house-entering mosquitoes, but, importantly, also those that bite outdoors and therefore are not vulnerable to LLINs or IRS. Of the larvicides that are recommended by the WHO Pesticide Evaluation Scheme (WHOPES), many have never been used to kill adult mosquitoes (except organophosphates) and are unaffected by the resistance mechanisms currently spreading through malaria vector populations in Africa. (Interim Position Statement - The role of larviciding for malaria control in sub-Saharan Africa WHO/GMP 2012). It is recommended that the impact of larval control on malaria is monitored through adult catches.

Objectives (Contd.)

Dengue Control

The role of larviciding in Dengue control is more defined and is one of the major interventions in the control of the dengue vectors *Aedes aegypti* and *Aedes albopictus.,* as their breeding sites are peri-domestic, well-defined, easier to find and not so widespread as for Anophelines. Before commencing treatment good surveys should be conducted to identify key breeding sites. Environmental management is also important with the removal of discarded containers, used tyres and regular emptying of plant containers and ant traps.

Note: When applying larvicides (especially in dengue control) it may be necessary to treat water storage containers used for drinking (potable water). If this is required only use products which have a WHO approval for use in potable water.



Nuisance mosquitoes

In many urban environments some mosquito species such as *Culex quinquefasciatus* can be a biting nuisance and not always a disease vector. However many authorities wish to control them to alleviate suffering of the local population or for example in tourist areas. These species usually have well defined breeding sites that can be located and treated to control the larvae.

Further information:

IRAC publication: Prevention and management of insecticide resistance in vectors of public health importance www.irac-online.org

WHO (2006): Pesticidesand their application WHO/CDC/NTD/WHOPES/GCDPP 6th edition, 114pp. www.who.int/whopes/en/

Application strategies

Dengue

The larviciding of breeding sites of *Aedes aegypti* and *Aedes albopictus* is a well known strategy, although success will depend on conducting detailed surveys, identification of the breeding sites and subsequent treatment with an appropriate larvicide. Failure to locate some of the breeding sites will result in later resurgence of the mosquito population. The breeding sites may be small and numerous so the more diligent the survey the better the results.

Nuisance mosquitoes

The same careful surveying and treatment of breeding sites also applies to control of urban *Culex* spp. However the breeding sites differ from *Aedes* spp. as they will often breed in water of higher organic matter or in drains, ditches etc.

Malaria

For the control of *Anopheles* spp. in malaria control programmes the use of larvicides can be beneficial as they allow the use of IGR`s (insect growth regulators) or biologicals that are not available as adulticides and therefore allow the implementation of a resistance management strategy. In addition the use of larvicides can give additive impact when integrated with LLINs or IRS treatments. Careful surveying and identification of breeding sites is essential. Larviciding may not be applicable for certain species such as forest associated species such as *An. dirus* etc. due to the difficulty in locating breeding sites or if the breeding sites are too widespread, such as *An. gambiae s.l.* in many parts of rural Africa. However in some situations, such as peri-urban environments and highlands, where larval habitats may be `few, fixed and findable` it may be possible to develop and sustain a larval control programme that will have a good impact. Anopheline larval control will work best and be most cost-effective in where habitats are seasonal and are accessible by ground crews, and in cooler parts of Africa where larval development is prolonged.

The choice or larvicide will depend on the sensitivity of the treatment site and other user requirements, e.g. are there non-target insects, crustacea, fish etc. that may be put at risk or is a larvicide required which will give long residual performance reducing the frequency of re-treatments. In addition any pre-existing resistance must be noted and larvicides avoided which have the same MoA.

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