



Insecticide Resistance Action Committee

Insecticide Resistance: why it matters, and what we can do about it

Swiss TPH: Winter Symposium 2016

Mark Hoppé

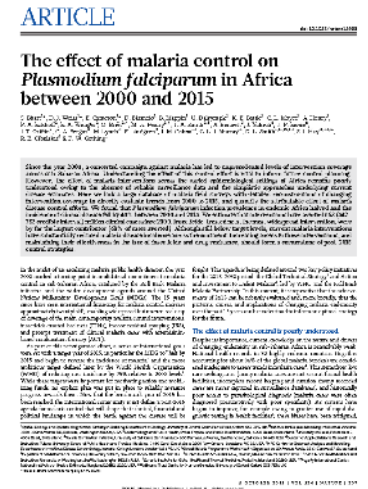


IRAC?

- Insecticide Resistance Action Committee (IRAC)
 - Specialist technical group of the agrochemical industry association CropLife International
 - Formed in 1984
 - Provides a coordinated industry response to the development of resistance in insect and mite pests
- “Resistance Management for Sustainable Agriculture and Improved Public Health”

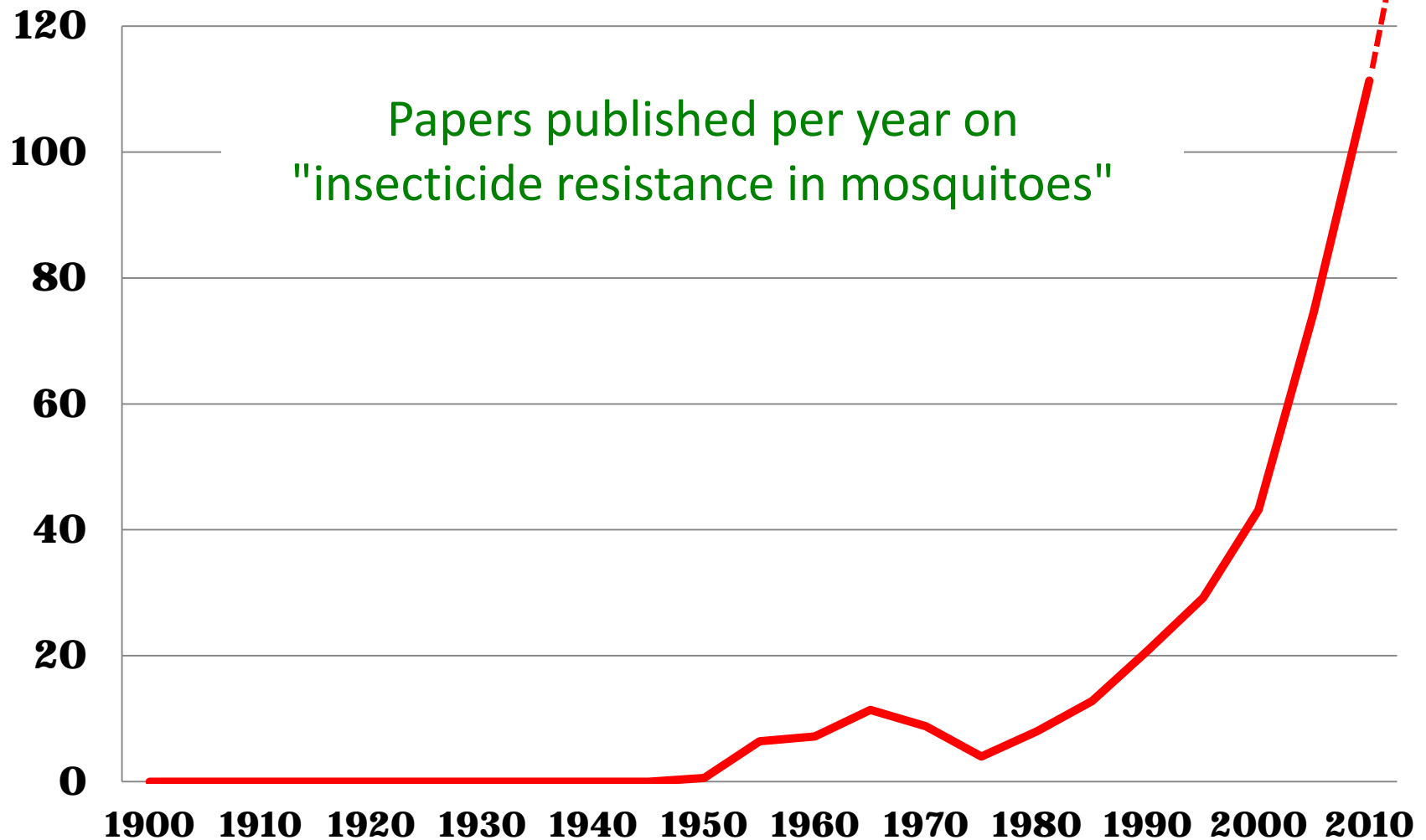
Insecticide Resistance

- It has been estimated that between 2000 and 2015, ca. 450 million cases of malaria have been averted as a result of pyrethroid treated LLINs (Bhatt et al 2015)



- Any significant reduction in their efficacy due to resistance, will greatly impact these gains

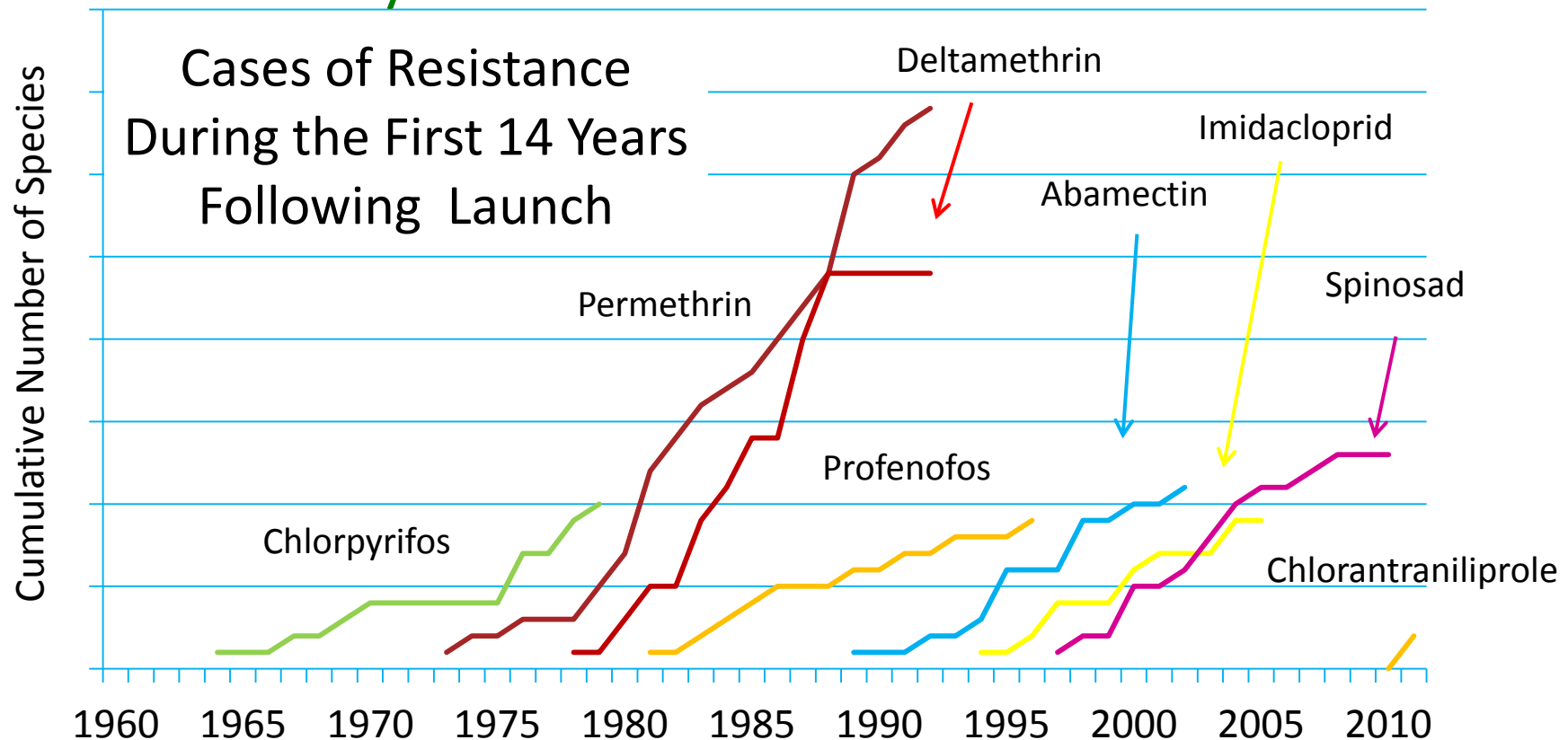
Insecticide Resistance



Source: Medline search, Trina Padoll 2013

Insecticide Resistance

- Resistance can, and will, eventually develop to any commercially used insecticide



Insecticide Resistance

- Mosquitoes don't become resistant to insecticides *per se*...
- They can, and do, become resistant to insecticide based control interventions
- Pedantic semantics?
 - Highlights that how we undertake vector control will impact the development of resistance

Insecticide Resistance

- IRAC definition:

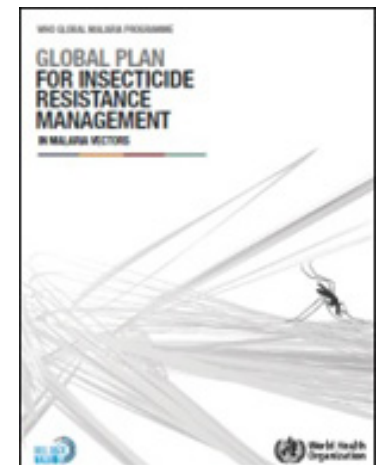
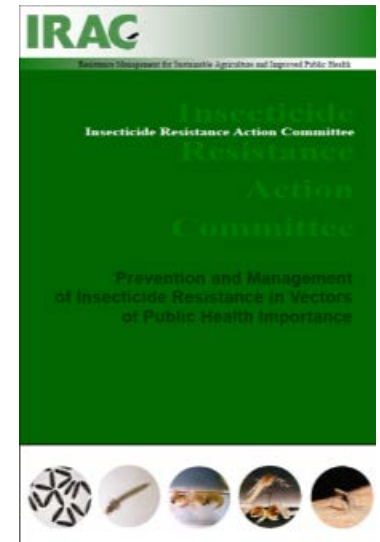
“A heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species”

Insecticide Resistance

- Susceptibility of an insect population to a class of insecticides can change, without it becoming “resistant”
- However, understanding changes in susceptibility is key to managing resistance
 - Once you have resistance, it may be too late...

Insecticide Resistance Management

- Rotations
- Mosaics
- Mixtures
 - of insecticides with different modes of action, to which the target population is susceptible
 - However, this implies that you have multiple effective insecticides with different MoA



Insecticide Resistance Management

- Why don't we have sufficient insecticides to undertake effective IRM in Vector Control?



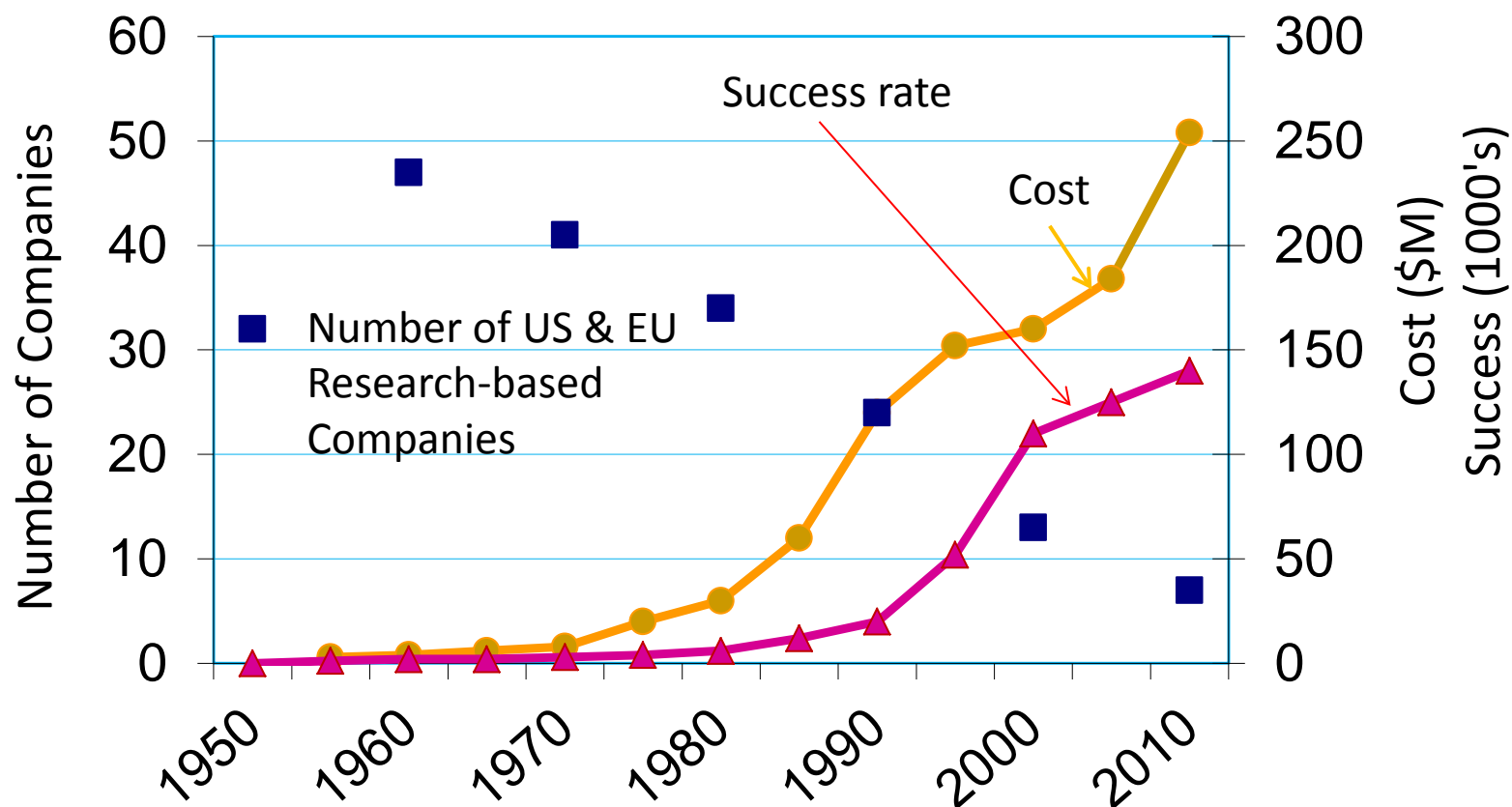
Relative market value



Agricultural and non-crop
insecticides \$54 Billion

Vector Control \$1 Billion

Fewer new insecticides



Success rate = number of cpds that need to be screened for each product found

Data from GT Brooks 1974, RL Metcalf 1980, W. Klassen 1995 Philips McDougal, 2003, CropLife 2011

Vector Control



- Unlike Crop Protection, the Vector Control adulticide market is not conducive to product innovation
→ fewer products for IRM
 - Relatively small size vs cost of development of novel mosquito adulticide
 - Tender business encourages development of products that “satisfy” not “excel”
 - Entrance to regulated market through “equivalence” destroys motivation to invest in innovation

Loss of insecticides

- Existing insecticides can be lost from the market, or their uses restricted
 - More stringent regulation
 - Insecticide resistance
 - Market dynamics
 - “Supra-regulatory” pressure
 - Market size/structure
 - Relationship of VBD and poverty



Loss of insecticides

- In agriculture this has lead to products being lost, but others with features that are perceived to be more desirable, being developed

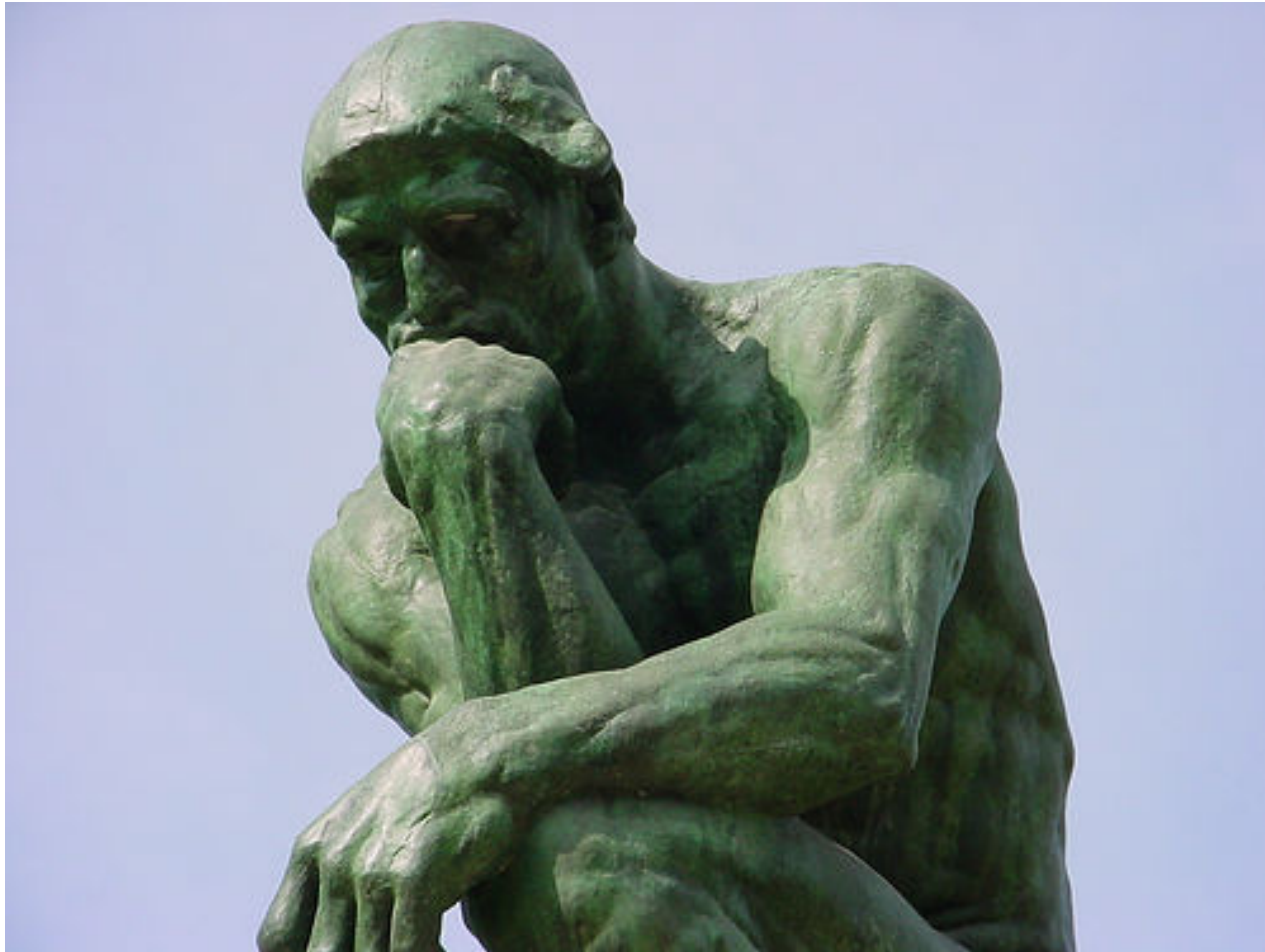


Loss of insecticides

- Agriculture has had an active pipeline of new insecticides; historically, VC has not...



IRM: Cost or Investment?



IRM: cost or investment?

- Cost:
 - Measured by financial and opportunity costs
 - Short term view
- Investment: not so easy to measure...
 - DALY, GDP, GNW (Gross National Well-being)?
 - ROI, Short/medium/long-term?
 - NPV, assuming business as usual, paradigm shift, eradication?
 - Value of maintaining insecticide susceptibility



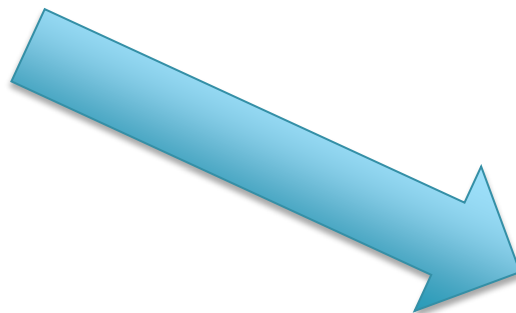
Valuing susceptibility

- Value of susceptibility = Cost of resistance?
- Susceptibility should be considered a “public good”
 - Can we put a value on it, and distribute it more equitably?



Change our thinking

Holding out for next resistance breaking insecticide



Implementing “resistance resilient VC programmes”

Resistance resilient programmes

- Integrated Vector Management (IVM) – holistic approach to VC – undertaking all activities that minimise mosquito interaction with humans
- Insecticides should not be the only intervention to be considered
 - Even more important when novel insecticides come to the market



Susceptibility, not resistance

- To protect a property from fire, we use a smoke detector, not a detector of big piles of ash



Resistance
monitoring



Susceptibility
monitoring

Resistance Management Strategies

- Information is valuable, but lack of information should not be an excuse for inactivity
- However, efficacy of the VC programme must be maintained
 - IRM does not mean using ineffective VC interventions
 - Use effective interventions in ways that maintain their long-term efficacy



Resistance Resilient Programmes

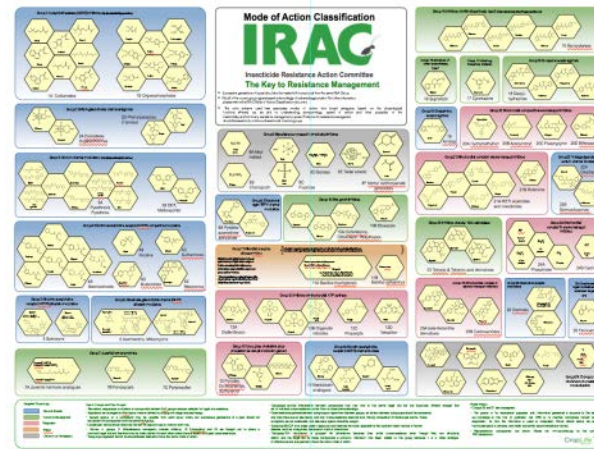
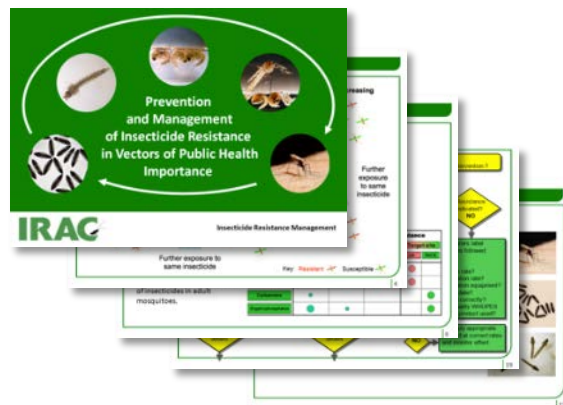
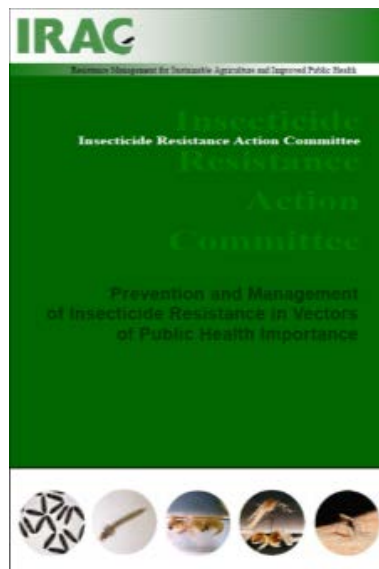
- IRM, within the context of Integrated Vector Management (IVM), taking a holistic and systems approach
- IVM activities should be applied regardless of evidence of susceptibility change
- Aim to maintain effectiveness of the VC programme, and its constituent parts for as long as possible
 - Where to draw the boundary of the system?
 - IVM to support prevention/management of drug resistance?

Insecticide Resistance:

why it matters, and **what we can do about it**

- Continued support for the development of new VC interventions
- Research/modelling to identify the value of insecticide susceptibility, and the best way to preserve, and equitably distribute it
- Evaluate and report the value of IRM activities in VC, not just the cost
- Education in, and implementation of, IRM in the context of IVM – building “resistance resilient vector control programmes”

Sources of information on IRM



www.ircac-online.org

Thank you for your attention

With thanks to the IRAC Public Health Team

