

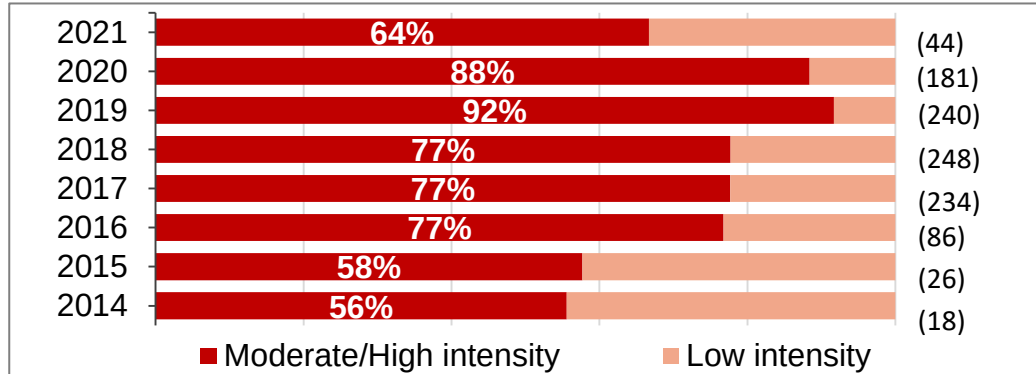


Global Insecticide Resistance and Vector Control trends and their implications for new tools, with a focus on impact and resistance monitoring

Sylvester Coleman – VCWG Kigali Rwanda, 15 April 2024

Widespread and increasing reports of insecticide resistance

- Increasing Pyrethroid Resistance Intensity



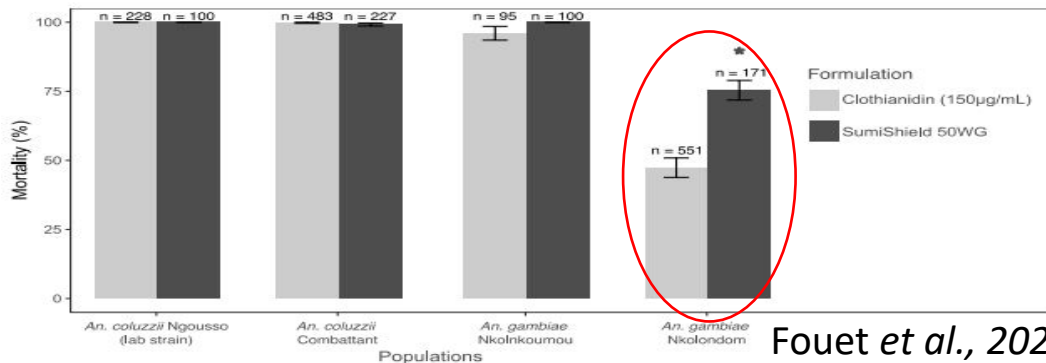
Data source: WHO Malaria Threats Map. Updated August 2022

- Clothianidin: resistance reported in some sites

Tropical Medicine and Infectious Disease MDPI

Article
***Anopheles funestus* Populations across Africa Are Broadly Susceptible to Neonicotinoids but with Signals of Possible Cross-Resistance from the GSTe2 Gene**

Tatiane Assatse ^{1,2,*}, Magellan Tchouakui ¹, Leon Mugenzi ¹, Benjamin Menze ¹, Daniel Nguiffo-Nguete ¹, Williams Tchappa ¹, Sevilor Kekeunou ² and Charles S. Wondji ^{1,3,4,*}



Fouet et al., 2024

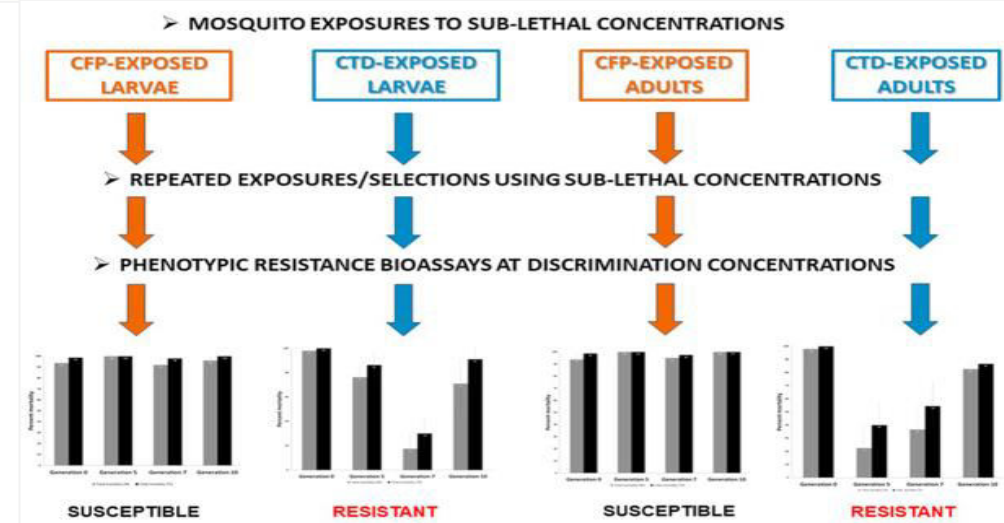
- Chlorfenapyr: Variability in IR tests across sites

Contents lists available at ScienceDirect
Current Research in Parasitology & Vector-Borne Diseases
 journal homepage: www.sciencedirect.com/journal/current-research-in-parasitology-and-vector-borne-diseases

ELSEVIER

Is *Anopheles gambiae* (*sensu stricto*), the principal malaria vector in Africa prone to resistance development against new insecticides? Outcomes from laboratory exposure of *An. gambiae* (*s.s.*) to sub-lethal concentrations of chlorfenapyr and clothianidin

Salum Azizi ^{a,b,*}, Njelembo J. Mbewe ^c, Hosiana Mo ^{a,b}, Felista Edward ^{a,b}, Godwin Sumari ^{a,b}, Silvia Mwacha ^{a,b}, Agness Msapalla ^{a,b}, Benson Mawa ^{a,b}, Franklin Mosha ^a, Johnson Matowo ^{a,b}



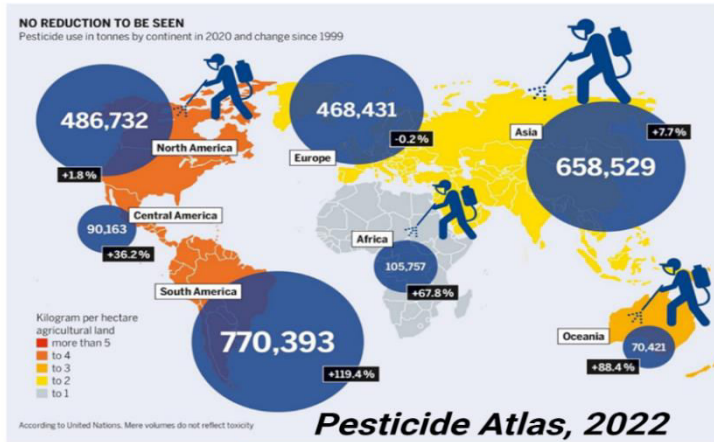
Key findings: High mortality rates in chlorfenapyr-selected mosquitoes 10th Gen.

- Some indications of possible resistance in the field in some countries; need to confirm

Validated/Putative mechanisms facilitated by different factors

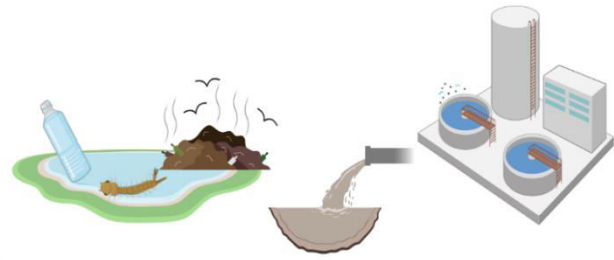
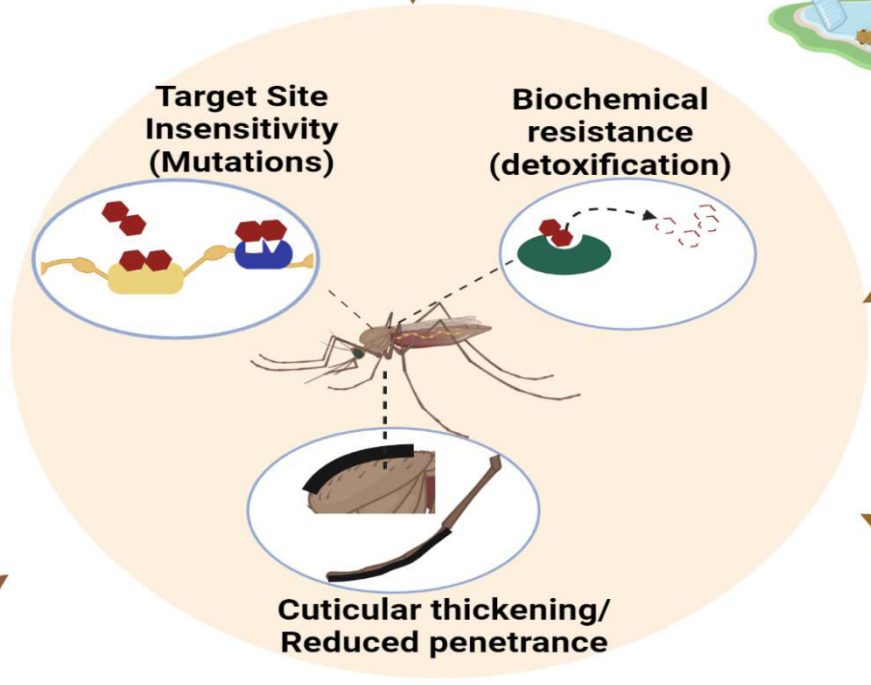


VECTOR CONTROL

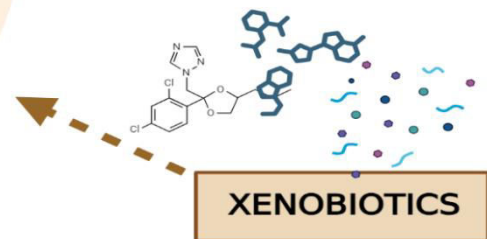


AGRICULTURAL PRACTICES

MICROBIOME



URBANIZATION



Operational Impact of IR and needs to address IR

What we know from literature

- ***Reduced efficacy of intervention***
 - Space spraying (*Sudsom et al., 2015*)
 - Reduced Temephos/Larviciding for *Aedes* control (*Sivabalakrishnan et al., 2023*)
 - household aerosolized insecticides products efficacy reduces (*Grey et al., 2018*)
 - Reduced efficacy of Standard ITNS (*Strode et al., 2014, Churcher et al 2016*)
 - Malaria resurgence in Uganda –possibly linked to IR to Clothianidin (*Epstein et al., 2023*)
- ***Sublethal Effects and Alternatives***
 - Delayed mortality and reduced fecundity in resistant vectors may partially counteract resistance.
(*Nwankwo, 2021; Grigoraki et al., 2021; Mwagira-Maina et al., 2021*)
- ***New Tools showing varying efficacy***

Feedback from key informant interviews

- ***NMEPs (East West and Southern Africa)***
 - Capacity building, lack of granularity of data-linked to inadequate funding & challenges effective IRM
 - Community engagement to adapt traditional methods
- ***Researchers/Academia***
 - Need to revisit standardized tests, Increased funding, Entomological surveillance should be seen as an intervention
- ***Program Implementers & Funders***
 - Promote community adaptations in VC interventions; Need to develop predictive tools for IR
- ***Product Manufacturers***
 - Challenges in R&D: narrow market profit margins, lengthy and costly approval processes
 - Donor fatigue: demonstrate impact of interventions
 - Propose shared insecticide deployment in both agricultural and public health sectors

Landscape Analysis VC: Challenges & Opportunities (1/2)

Insecticide Treated Nets

- ***Insecticide Resistance***: Limited chemical options for ITNs increase costs; high investment and time are required to market new products.
- ***Durability and quality perception issues***
 - With some ITNs lasting less than two years, creating significant coverage gaps.
 - Durability more policy-related than technical.
- ***Innovation Hurdles***: Economic risks deter first-in-class innovations; "me too" approvals are easier and less costly.
- ***Waste Management***: Interest in eco-friendly solutions like biodegradable packaging; regulatory challenges for alternative packaging methods.

Indoor Residual Spraying

- ***Need to demonstrate efficacy***: Need to document IRS' epidemiological and economic benefits to justify its use and investment.
- ***Cost Challenges***: The shift to more expensive non-pyrethroid insecticides has led to a significant decrease in IRS coverage, from 5.5% in 2010 to just 2.4% in 2021.
- ***Innovative Implementation***: Exploring district or community-based IRS strategies could offer cost-effective alternatives to large-scale
- ***Private Sector Engagement***: The potential for IRS expansion, offers a promising avenue to expand coverage and effectiveness.

Landscape Analysis VC: Challenges & Opportunities (2/2)

Attractive Targeted Sugar Baits

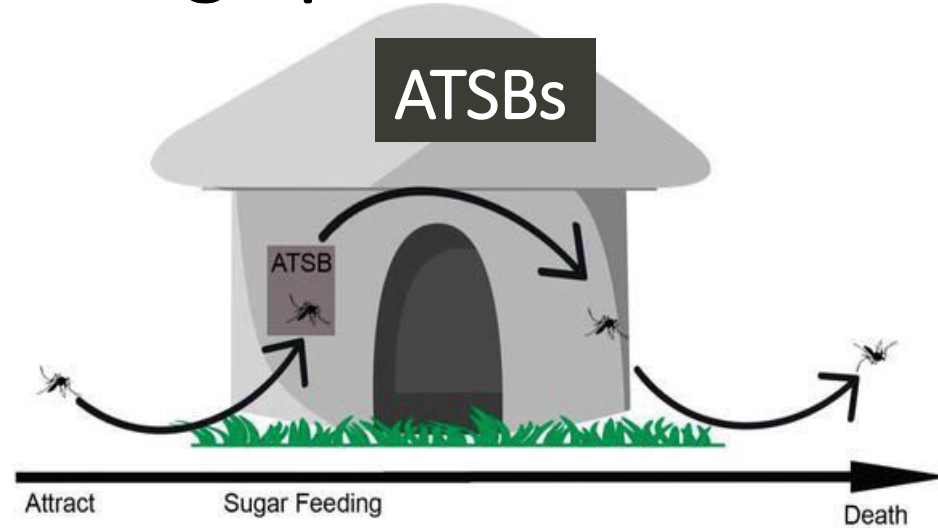
- ***Intellectual Property and Development:***
The pace of ATSB development is influenced by Intellectual Property challenges
 - There's significant potential for *Aedes* control in urban settings.
- ***Technical and Market Challenges:***
Refining attractants and toxicants is crucial, with the need for rigorous trials for approval, posing hurdles for rapid deployment.

Larval Source Management (LSM) - Integrating into National Malaria Programs

- ***Challenges in Scaling LSM:*** LSM faces barriers including limited funding, fragmented implementation, and complex execution, hindering its integration into national malaria control strategies.
- ***Technological Advances:*** Recent innovations in larvicide application technology offer effective, wide-area coverage, addressing "few, fixed, findable" habitat limitations and expanding LSM's applicability.
- ***Opportunities for Integration:*** LSM's role in resistance management and urban malaria control is increasingly recognized, necessitating its inclusion as a core intervention in vector control programs.

Expanding vector control for Humanitarian Emergencies: Selected tools with high potential

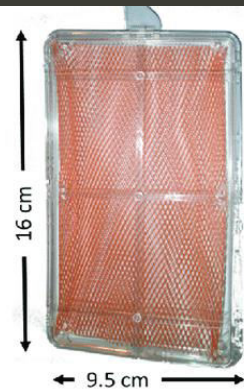
Larval control



Targeted IRS



Passive emanators



Treated textiles



Acknowledgements

