

# Digital tools for entomological surveillance and interventions monitoring: DHIS2 modules and Malaria Threats Map



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15<sup>th</sup> Annual Meeting of the RBM Vector Control Working Group

5 February 2020

Global **Malaria** Programme



**World Health  
Organization**



## WHO standard DHIS2 Modules for entomology and vector control

### Purpose:

- Facilitate the collection and interpretation of data from routine/programmatic entomological surveillance and vector control interventions monitoring at national level
- Integrate entomology and VC data into National Health Information/Disease surveillance Systems.

### Activities covered:

- **Insecticide resistance monitoring** (discriminating concentration, intensity and synergist-insecticide bioassay; and molecular and biochemical assays)
- IRS campaign results
- IRS quality and residual efficacy (i.e. cone bioassays)
- LLIN campaign results
- LLIN bio efficacy
- Breeding sites mapping
- Adult surveillance



WHO - Standard modules for entomology and vector control

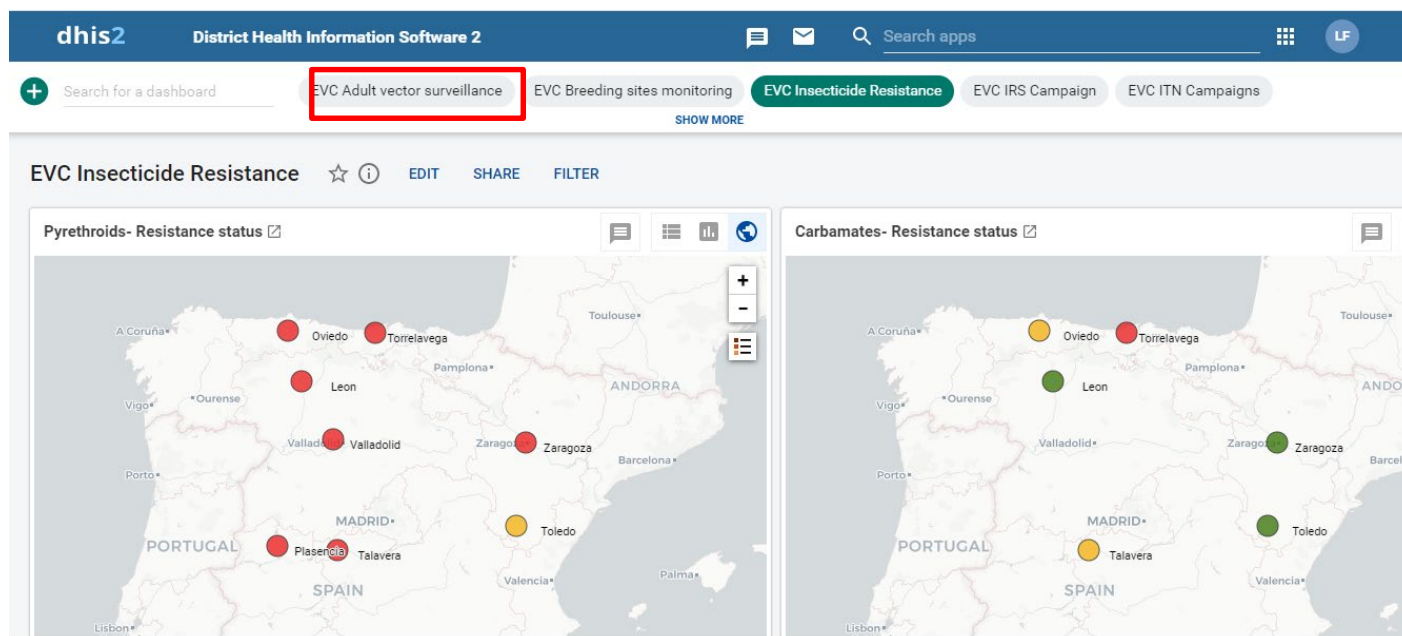
This is a demo of the WHO  
DHIS2 standard modules for  
entomology and vector control



## A DHIS2 package

- A data collection form (with standard variables aligned with WHO how-to guides, e.g. Test procedures for Insecticide Resistance monitoring in malaria vectors).
- Indicators: campaign coverage, mosquito mortality, mosquitos densities
- Dashboards: maps, line and bar charts, tables.

Demo: <http://ento2.ngrok.io/hmis/> (dummy data)

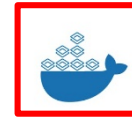




## Implementation:

1. Customization to national context (docker images library)
2. Integration into the national health information system
3. Prospective data collection
4. Historical data “rescue”

d2-docker



The screenshot shows the GitHub repository page for 'whogmp/dhis2-data'. The repository name is 'whogmp/dhis2-data' and it is described as 'dhis2 data repo'. It was last pushed 2 days ago. The 'Tags' section lists five tags: '2.30-ENTO', '2.30-ENTO-MG', '2.30-ENTO-DEMO-DATA', '2.30-ENTO-KE', and '2.30-ENTO-MZ'. Each tag has a small Docker icon next to it.

## Countries supported in 2019:

Mozambique, The Gambia, Madagascar and Ghana.

## Metadata distribution

Making metadata available on:

[https://www.who.int/malaria/areas/vector\\_control/dhis-tools/en/](https://www.who.int/malaria/areas/vector_control/dhis-tools/en/)



## Malaria Threats Map

Tracking biological challenges to malaria control and elimination

English



### VECTOR INSECTICIDE RESISTANCE

Resistance of malaria mosquitoes to insecticides used in core prevention tools of treated bed nets and indoor residual sprays threatens vector control effectiveness



### PARASITE pfhpr2/3 GENE DELETIONS

Gene deletions among some malaria parasites cause false negative diagnostic test results, complicating case management and control



### PARASITE DRUG EFFICACY AND RESISTANCE

Resistance of malaria parasites to artemisinin – the core compound of the best available antimalarial medicines – threatens antimalarial drug efficacy



### INVASIVE VECTOR SPECIES

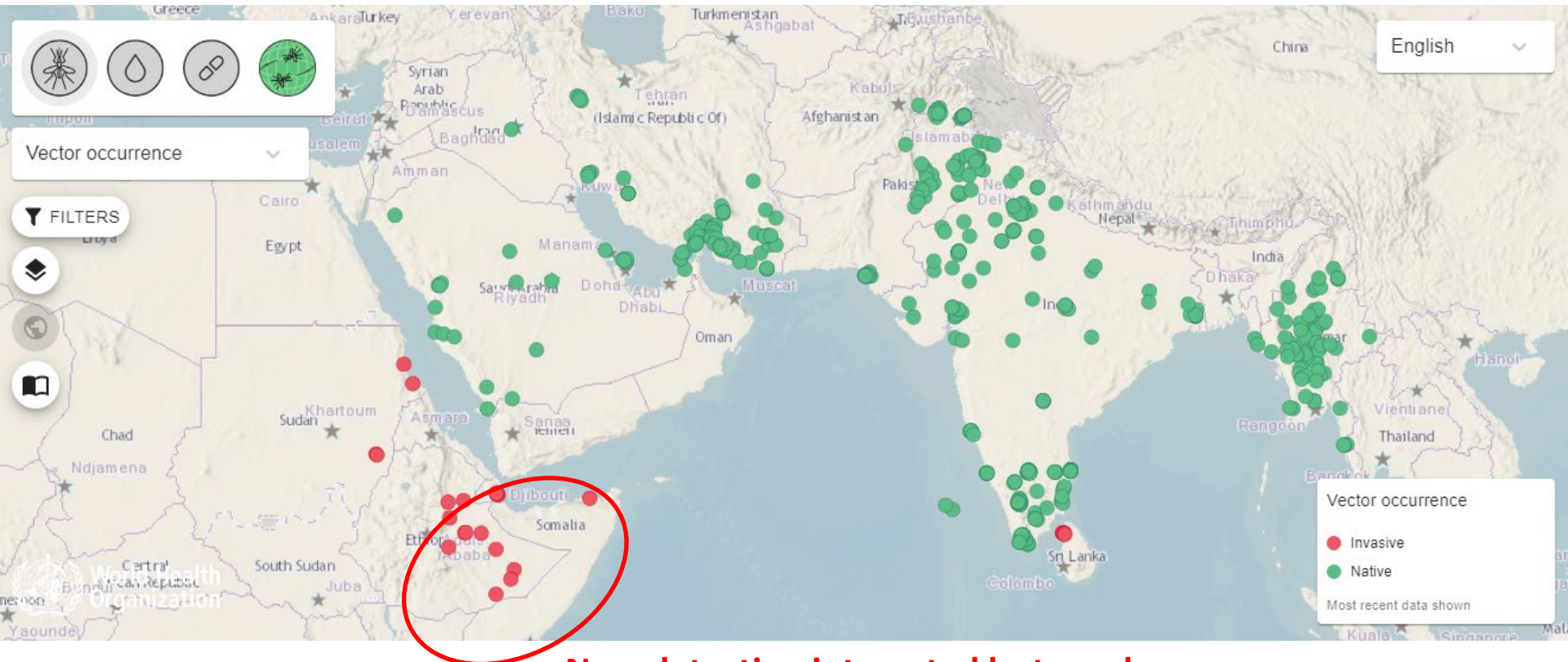
The spread of anopheline mosquito vector species and their establishment in ecosystems to which they are not native poses a potential threat to the control and elimination of malaria

<https://www.who.int/malaria/maps/threats-about/en/>

# Malaria Threats Map: developments in 2019



New theme showing the distribution of *Anopheles stephensi*. Other species will be included as detections are reported



# Malaria Threats Map: developments in 2019



## Wizard to guide users through MTM

### Malaria Threats Map

Tracking biological challenges to malaria control and elimination

English

#### Welcome to Malaria Threats Map!

You are at a WHO official platform created to present the magnitude and spread of four biological challenges for malaria control and elimination.

This wizard will show how to use the platform

< 1 / 10 >

CLOSE



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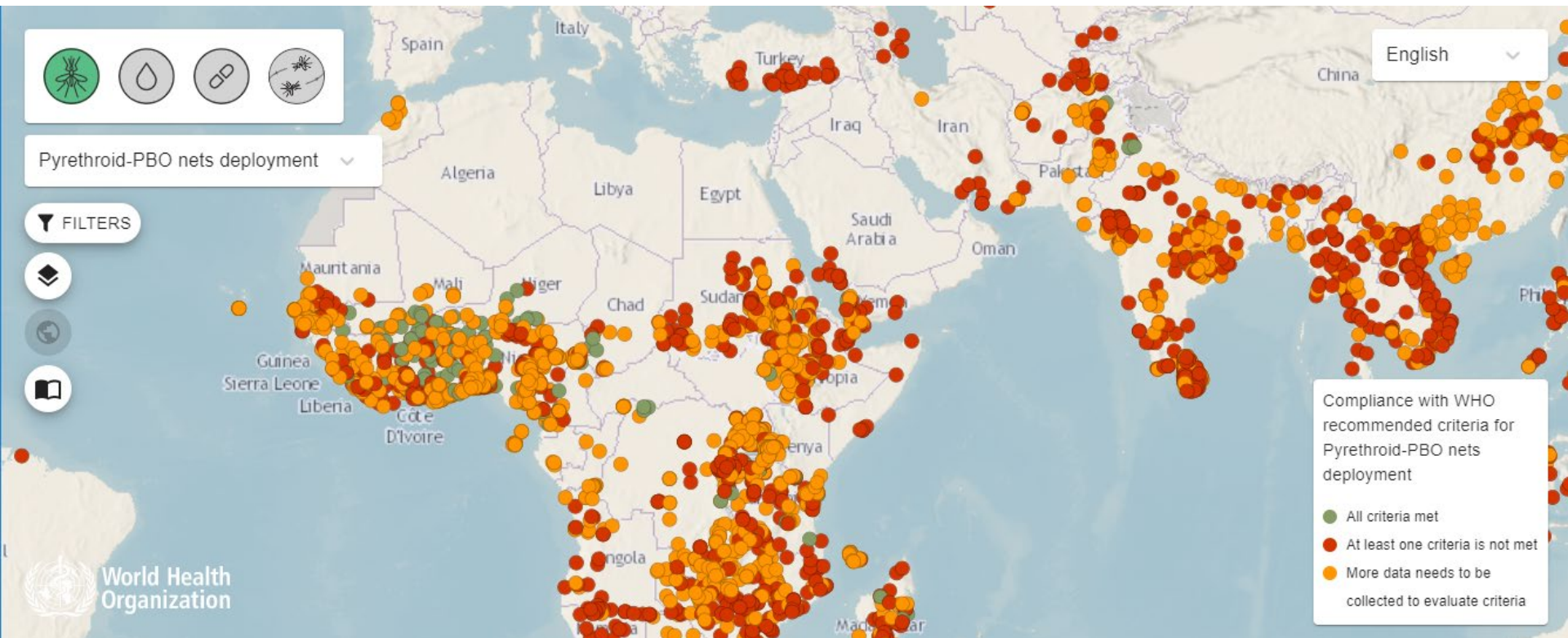
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# Malaria Threats Map: developments in 2019



## Maps to guide the deployment of pyrethroid – PBO nets

*Based on WHO recommended criteria for deployment*



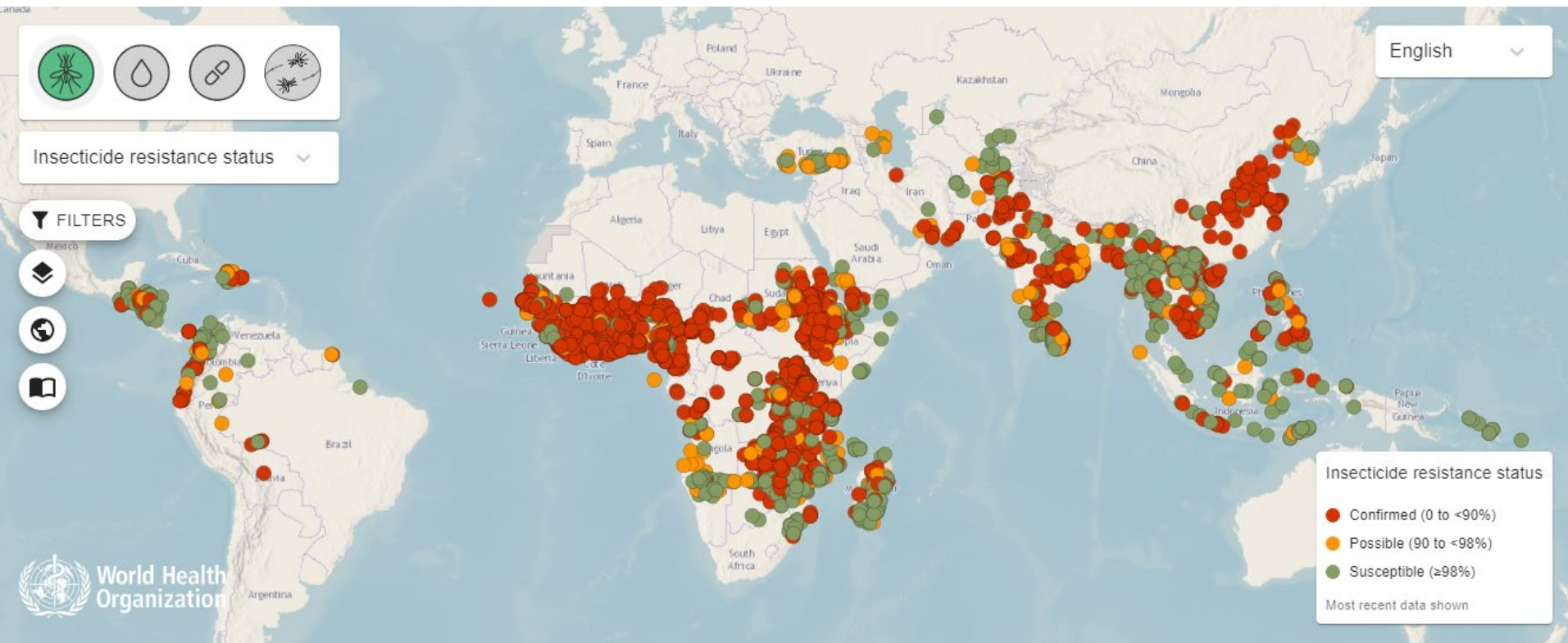


# Malaria Threats Map: developments in 2019



## Much more and better insecticide resistance data

- 34503 study results from 1955 to 2019
- 89 countries
- 4312 geographical sites

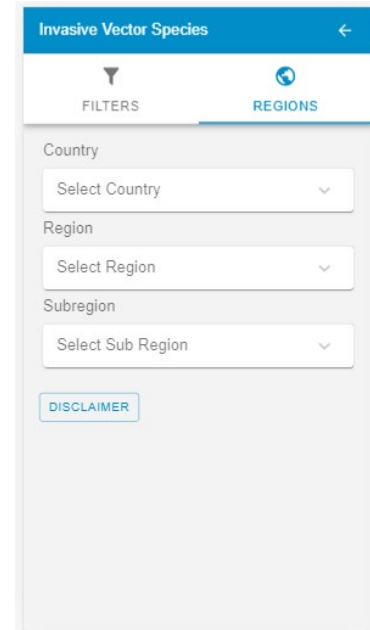
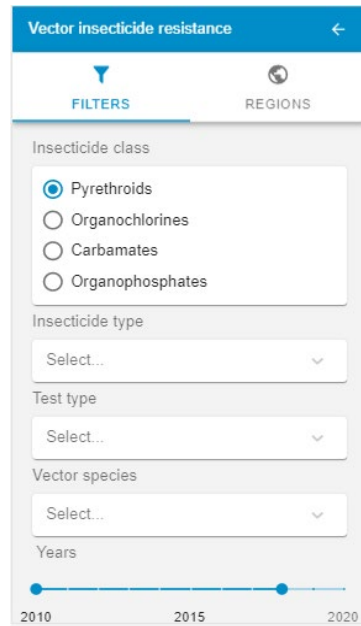
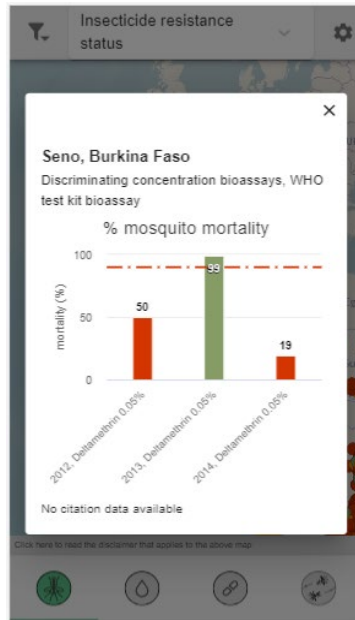
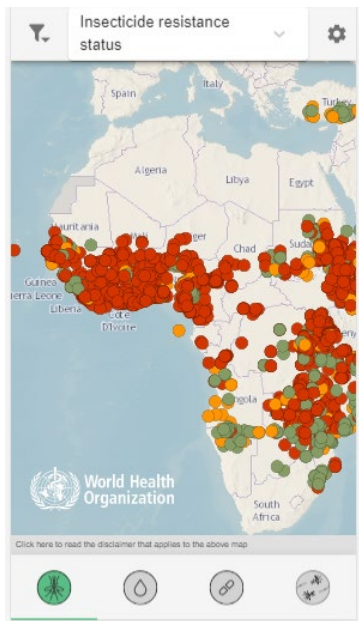




## Routing to facilitate sharing visualizations

[https://apps.who.int/malaria/maps/threats/?theme=prevention&mapType=prevention%3A0&insecticideClass=CARBAMATES&insecticideTypes=&assayTypes=MOLECULAR\\_ASSAY%2CBIOCHEMICAL\\_ASSAY%2CSYNERGIST-INSECTICIDE\\_BIOASSAY&synergistTypes=&species=An.funestus+s.l.&vectorSpecies=&surveyTypes=&deletionType=HRP2\\_PROPORTION\\_DELETION&plasmodiumSpecies=P.\\_FALCIPARUM&drug=DRUG\\_AL&mmType=1&endemicity=false&countryMode=false&storyMode=false&storyModeStep=0&filterOpen=true&filtersMode=filters&years=2011%2C2016](https://apps.who.int/malaria/maps/threats/?theme=prevention&mapType=prevention%3A0&insecticideClass=CARBAMATES&insecticideTypes=&assayTypes=MOLECULAR_ASSAY%2CBIOCHEMICAL_ASSAY%2CSYNERGIST-INSECTICIDE_BIOASSAY&synergistTypes=&species=An.funestus+s.l.&vectorSpecies=&surveyTypes=&deletionType=HRP2_PROPORTION_DELETION&plasmodiumSpecies=P._FALCIPARUM&drug=DRUG_AL&mmType=1&endemicity=false&countryMode=false&storyMode=false&storyModeStep=0&filterOpen=true&filtersMode=filters&years=2011%2C2016)

## Improve visualization for mobile devices





## Improved acknowledgements for data curation and source references

**Umren**

**Species:** *An. stephensi* s.l.  
**Sampling period:** 2012  
**Sampling method:** Not reported  
**Species identification method:** morphology, dna sequencing

Dykes, CL, Das, MK, Eapen, A, Batra, CP, Ghosh, SK, Vijayan, VA, Mishra, S and Singh, OP. (2016). Knockdown Resistance (*kdr*) Mutations in Indian *Anopheles stephensi* (Diptera: Culicidae) Populations. *Journal of Medical Entomology*, 53(2):315-20

**Acknowledgement for data curation**  
Sinka & Massey, HuniBug project

**Soroti, Uganda**  
Discriminating concentration bioassays, WHO test kit bioassay

**% mosquito mortality**

Year / Treatment	Mortality (%)
2012, Bendiocarb 0.1%	85

Abeku et al. (2017) Insecticide resistance patterns in Uganda and the effect of indoor residual spraying with bendiocarb on *kdr* L1014S frequencies in *Anopheles gambiae* s.s.. *Malar J.* 2017 Apr 20;16(1):156

**Acknowledgement for data curation**  
VectorBase- [www.vectorbase.org](http://www.vectorbase.org)

# Malaria Threats Map: plans for 2020



## Data download feature

- To allow download of Drug Efficacy, Insecticide Resistance and Invasive species data
- To understand and track data use
- Data use subjected to the [Terms and Conditions of use for WHO data compilations, aggregations, evaluations and analyses](#)



Data download

CLOSE

1

Welcome message

2

Personal contact details

3

Purpose of data download

4

Filter the data

Select Theme

Vector insecticide resistance

Select Dataset

Select...

BACK

NEXT

DOWNLOAD



## Map export feature

To export maps and add them to reports and presentations.

## Time slider

to show temporal trends in threat evolution.

**Insecticide Resistance and Drug Efficacy status updates** generated automatically as new data comes in and corresponding to / informing Global Reports.

## User subscription to threat alerts

To send alert messages to subscribers when a threat expands geographically or a new threat emerges.

## Improved collection of user feedback

to help better understand user needs and inform next phases of development.

# Digital solutions to facilitate global reporting



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**[NEW] WHO MetaDataSync**  
(DHIS2 app for data synchronization)

+



Global Malaria Programme

World Malaria Report 2019

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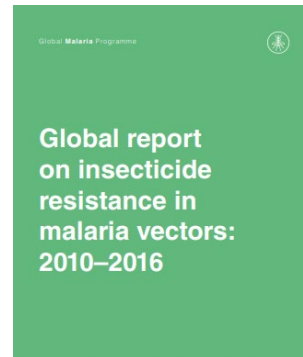
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World Health Organization



To request support for implementing the DHIS2 modules:

[fernandezl@who.int](mailto:fernandezl@who.int)

To submit questions or suggestions about Malaria Threats Map:

[gmp-maps@who.int](mailto:gmp-maps@who.int)

To report data on detections of invasive vector species:

[vectorsurveillance@who.int](mailto:vectorsurveillance@who.int)



To receive regular updates on WHO's vector control work:

WHO Vector Control Updates : [www.who.int/vector-control](http://www.who.int/vector-control)

GMP Newsletter: [http://www.who.int/malaria/news/sign\\_up\\_form/en/](http://www.who.int/malaria/news/sign_up_form/en/)

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