

COULD THE RECURRENT MALARIA OUTBREAKS IN THE HIGH-RISK MALARIA PROVINCE OF HAUT UELE BE EXPLAINED BY PYRETHROID RESISTANCE?

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BACKGROUND

- Insecticide resistance (IR) seriously threatens the efficacy of vector control interventions.
- Despite wide distribution and use of impregnated bednets, situations have not changed much as a result of the emergence of pyrethroid IR among mosquito population in malaria endemic areas of Africa.
- This study aimed at providing baseline insecticide resistance data to suggest vector control intervention strategies.

Study site : Haut Uélé province, Isiro, DRC

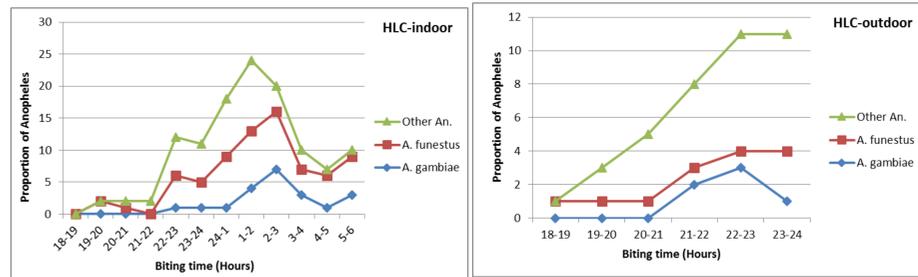


RESULTS

Mosquito density and Species composition

- Overall, 301 female Anopheles mosquitoes collected during the survey:
 - 26% *Anopheles gambiae* species
 - 40% *Anopheles funestus* species
 - 34% other Anopheles species
- Mosquitoes used in bioassays not included in the total collection.

Biting behaviour



Feeding and resting behaviour

- Bigger proportion of Anopheles endophagic (feeding indoor) and endophillic (resting indoor).

Indoor Resting density (IRD)

- *A.gambiae* to *A.funestus* to other Anopheles IRD was 3.9, 5.7 and 5.2 respectively.

Suggestive diurnal biting

- 41% of overall female Anopheles collected indoor showed extended biting during daytime.

METHODS

Study site

- 2 villages: Haut-Uélé province, Isiro, Northeastern Democratic Republic of Congo (DRC).
- Province experiences recurrent outbreaks of malaria (malaria endemic area), Last in May 2016.
- MSF-Switzerland launched an emergency response to treat malaria cases and provide rapid diagnostic tests to the health centres.

Time:

- August 2016

Mosquito collection

- Human landing catches (HLC) : between 6pm and 6am indoors and 6pm– 12pm outdoors for 6 days.
- Morning indoor resting catches (MIRC) : between 6am – 8:30am for 6 days.
- Pyrethrum spray catches (PSC) : in 20 houses between 8:30am – 12am (due to long distances between houses) for one day.
- Larval collection (LC) : using the standard dipping method in villages near Pawa health zone.

Mosquito identification

- Key morphological identification of malaria vectors, adapted from Giles MT and Coetzee M, 1987 was used for field identification.
- 10% species confirmation by PCR.

Bioassays

- Only 2-3 days old reared adult female Anopheles mosquitoes used for insecticide resistance testing.
- Performed bioassays with 4 classes of WHO & WHOPES approved insecticide impregnated papers: DDT (4%), Deltamethrin (0.05%), Bendiocarb (0.1%) and Pirimiphos methyl (1.0%).
- All exposed mosquitoes and controls were held for a 24-hour recovery period.
- Mortality was recorded after 24 hours of post exposure to insecticides.
- All tests were undertaken at 25°C ± 2°C.

ELISA assay

- Enzyme-linked Immunosorbent assay (ELISA): used to detect *Plasmodium falciparum* circumsporozoite (CS) protein in the head and thoracic portions of individual Anopheles mosquitoes.

Table 1: Resistance status

Insecticide	Resistance	KD60 (%)
Pyrethroid (Deltamethrin, 0.05%)	29 %	59
Organochloride (DDT, 4%)	82%	29
Carbamate (Bendiocarb, 0.1%)	9%	76
Organophosphate (Pirimiphos methyl, 1.0%)	0%	75

KD60: proportion of Anopheles knocked down after 60 minutes

Entomological indicators

- Man biting rate (MBR): 20.08 bites per person per night observed.
- Sporozoite rate (SR): 2%.
- Entomological inoculation rate (EIR): 0.4 infective bites per person per night.

DISCUSSION

- Early biting, 19-20 hours hlc and additional possible extended diurnal biting threatens control measures.
- Pyrethroid resistance pose another huge challenge to control strategies (bednet impregnation).
- Unexpectedly for this study area, no IRS activity was reported.
- Study limitations: lack of seasonality comparison, as well as short study duration.

CONCLUSION

- **Personal protective measures:** recommended during early biting times when population is not protected under the bednet (use of repellent).
- **Pyrethroid resistance:**
 - Pyrethroid resistance alone is not responsible for the malaria outbreak in DRC.
 - Routine rotation of insecticides recommended.
 - Synergist incorporation into the pyrethroids to boost their efficacy and effectiveness.
 - Employment of integrated vector management strategies.
 - Active surveillance system.

Acknowledgement

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