Malaria Transmission dynamics and Insecticide Resistance of *Anopheles funestus* during Indoor spraying in Northern Ghana.

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Introduction

- Malaria remains a major public health problem in Africa, with *An. funestus* as one of the principal vectors aside *An. gambiae* complex (Sachs and Malaney, 2002).
- In the control of malaria, indoor residual spraying (IRS) is an existing front-line measure for vector control (WHO, 2013) and has been implemented in some sites in northern Ghana where the inhabitants mostly engage in farming and other agricultural activities.
- *An. funestus* is highly amenable to insecticides than *An. gambiae*. However, resistance to insecticides used in the spraying programmes occurs as a result of selection pressure and this threatens successful malaria control and eradication efforts in various countries (Chaccour *et al*., 2013)

Objectives

The effect of IRS on *Anopheles funestus* is poorly understood, hence, this study was aimed at investigating;

- The species diversity of *An. funestus* group in IRS and Non-IRS study areas.
- The sporozoites rates and Entomological Inoculation Rates (EIR) of *An. funestus* in IRS and Non-IRS study areas.
- Insecticide resistance status of *Anopheles funestus* in the study areas.

Methods

- The study was carried out in three districts of Northern Ghana; Tolon and Savelugu Districts (IRS areas) which have been under IRS for five and seven years respectively and Tamale District (Non-IRS area) as a control site where no IRS has been implemented.

Figure 1: Pyrethrum Spray Collection
Source: protocols.io

Figure 2: Human Landing Catch (HLC)
Source: protocols.io

- Collection of mosquitoes.

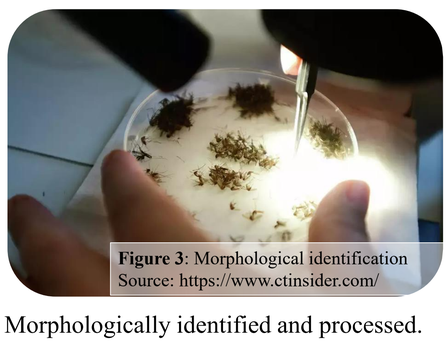


Figure 3: Morphological identification
Source: https://www.ctinsider.com/

- Morphologically identified and processed.
- Genomic DNA was extracted from the legs and wings using CTAB method.

Figure 4: PCR
Source: https://tark-solutions.com/

- Molecular sibling species and *kdr* genes identification using PCR

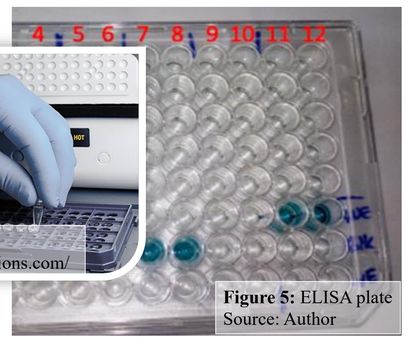


Figure 5: ELISA plate
Source: Author

- Detection of *Plasmodium falciparum* sporozoites in the heads and thoracis using qualitative sandwich ELISA method.

Results and Discussion

A total of 688 adult females morphologically identified as *An. funestus* mosquitoes were caught in the IRS and Non-IRS study areas in the years 2010, 2013, 2014 and 2015 (Figure 6), with the yearly collections from the study areas illustrated in Figure 7.

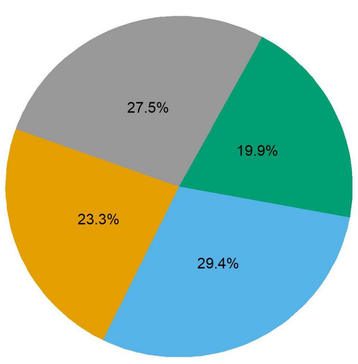


Figure 6: Percentage composition of *An. funestus*

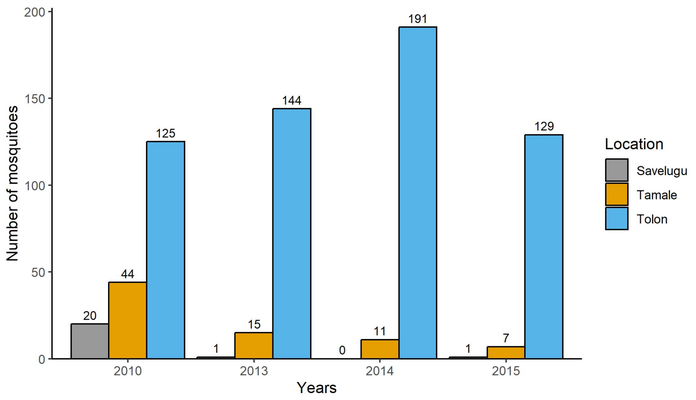


Figure 7: Yearly trends of *An. funestus*

- Mosquito samples were randomly selected for species diversity and all identified species were *An. funestus s.s* based on their DNA band size which is a fragment of 505 base pairs (Figure 8)

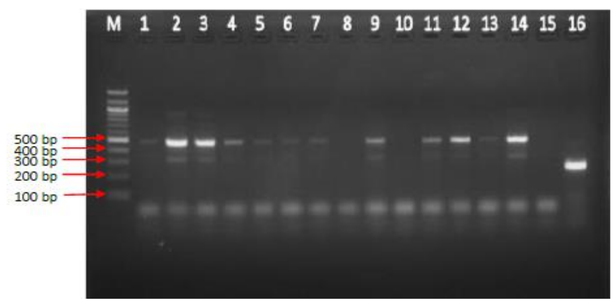


Figure 8: 2% agarose gel electrophoregram of PCR amplified rDNA sequences of *An. funestus s.s*

- Out of the 596 *An. funestus* mosquitoes tested for the presence of *P. falciparum* circumsporozoite protein (P*f*CSP), 504 and 22 were collected from the Tolon and the Savelugu Districts, respectively while 70 were collected from the Tamale District.

- Entomological Inoculation Rate (EIR), calculated using the positive samples, was used to determine the level of malaria transmission (Figure 9)

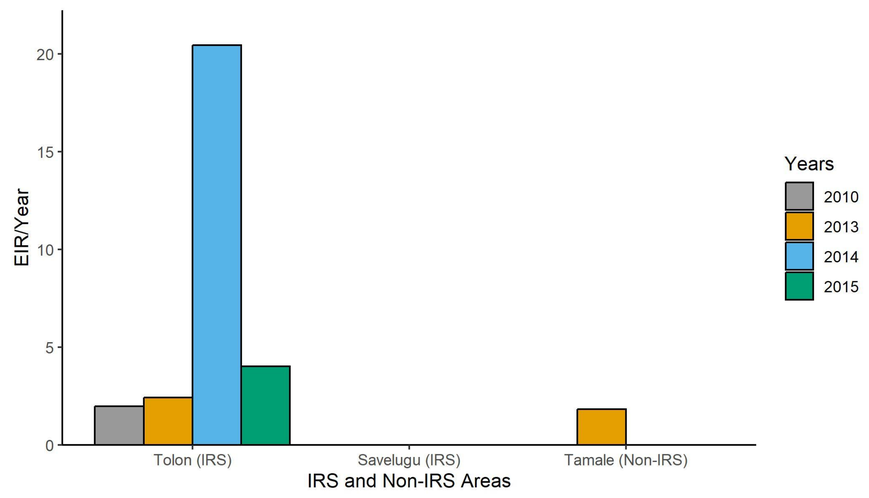
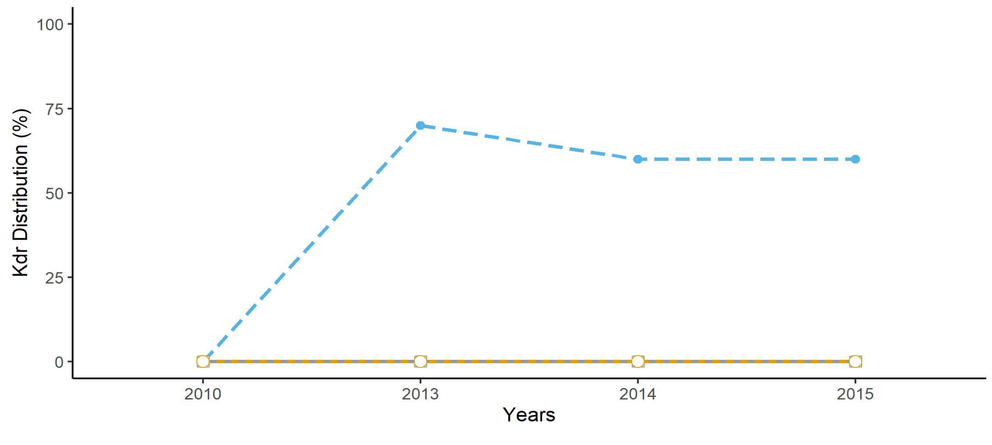


Figure 9: Yearly trends in Entomological Inoculation rates (EIR) in IRS and Non-IRS areas.

- A total of 70 adult An. funestus s.s were analysed to determine their kdr status. Molecular analysis showed that 27 (38.57%) of the mosquitoes which were examined possessed the resistant gene (*kdr*) and was present only in samples from Tolon districts (Figure 10).



Conclusion

The results of this research demonstrated:

- That *An. funestus s.s*. was the only member of the group present in both IRS and Non-IRS areas.
- The increasing importance of *An. funestus s.*s. in the transmission of malaria in Tolon and Tamale districts.
- That the high vector densities and sporozoite rate *An. funestus s.s* in Tolon may be as result of an irrigation scheme in the area.
- Malaria transmission was high in 2014 after the withdrawal of IRS in Tolon.

Acknowledgements

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References

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