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The impact of treated eave ribbons in reducing malaria transmission: a mathematical modelling perspective

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Background

Main malaria vectors; *An. funestus* and *An. arabiensis*

An. funestus

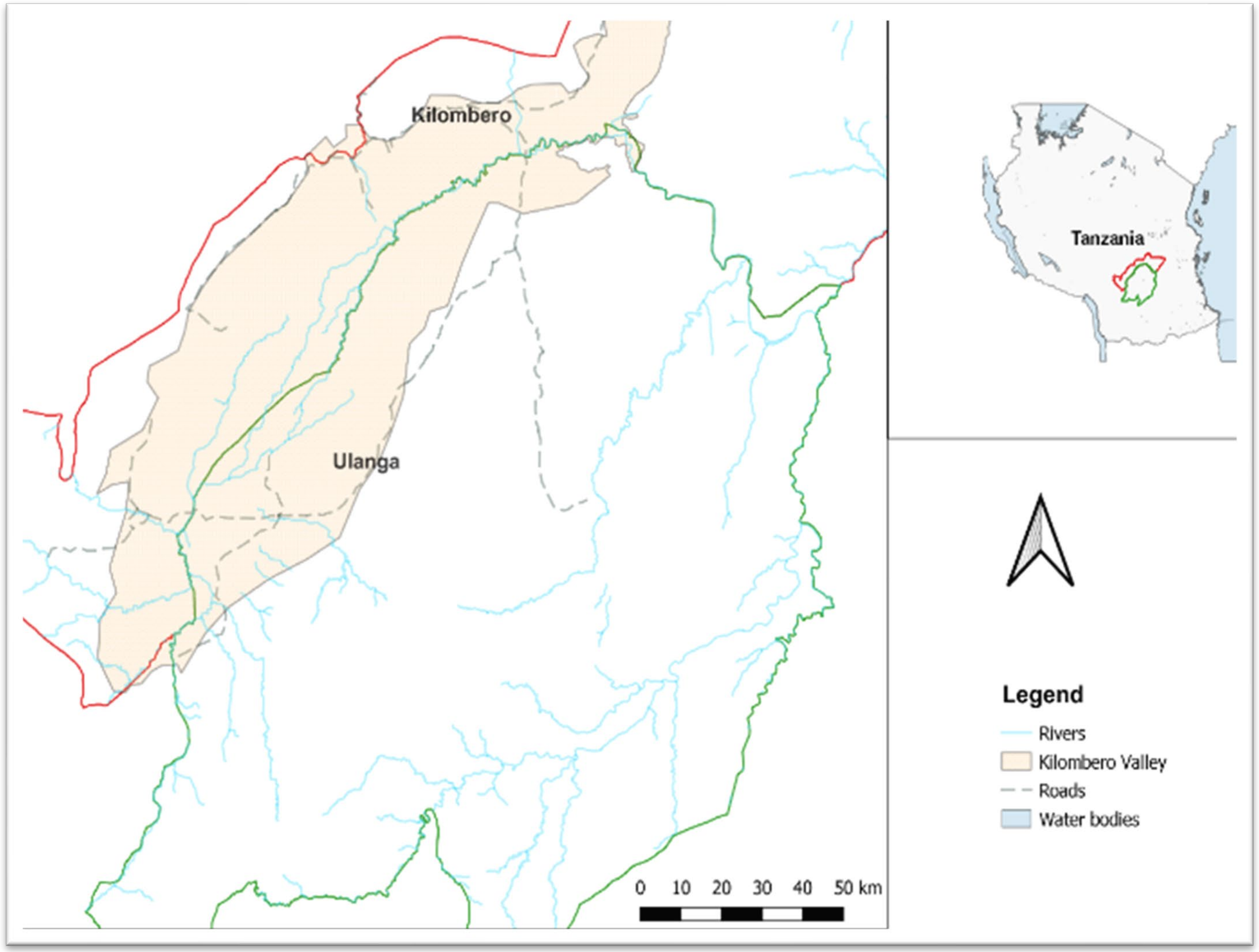
- Anthropophilic; Endophilic

An. arabiensis

- Zoophilic; exophilic

Challenges

- Resistance to insecticides
- Outdoor & early hours biting



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Supplementary tools are needed

Eave ribbons

- Treated with spatial repellent
- Repel mosquitoes
- Kills mosquitoes

- Provide protection indoor and outdoor in peri domestic areas

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Overall aims

- Assessing the impact eave ribbon + ITNs on transmissions mediated by *An. funestus* and *An. arabiensis.*

- Impact of the interventions on combined transmissions mediated by *An. arabiensis* and *An. funestus*.

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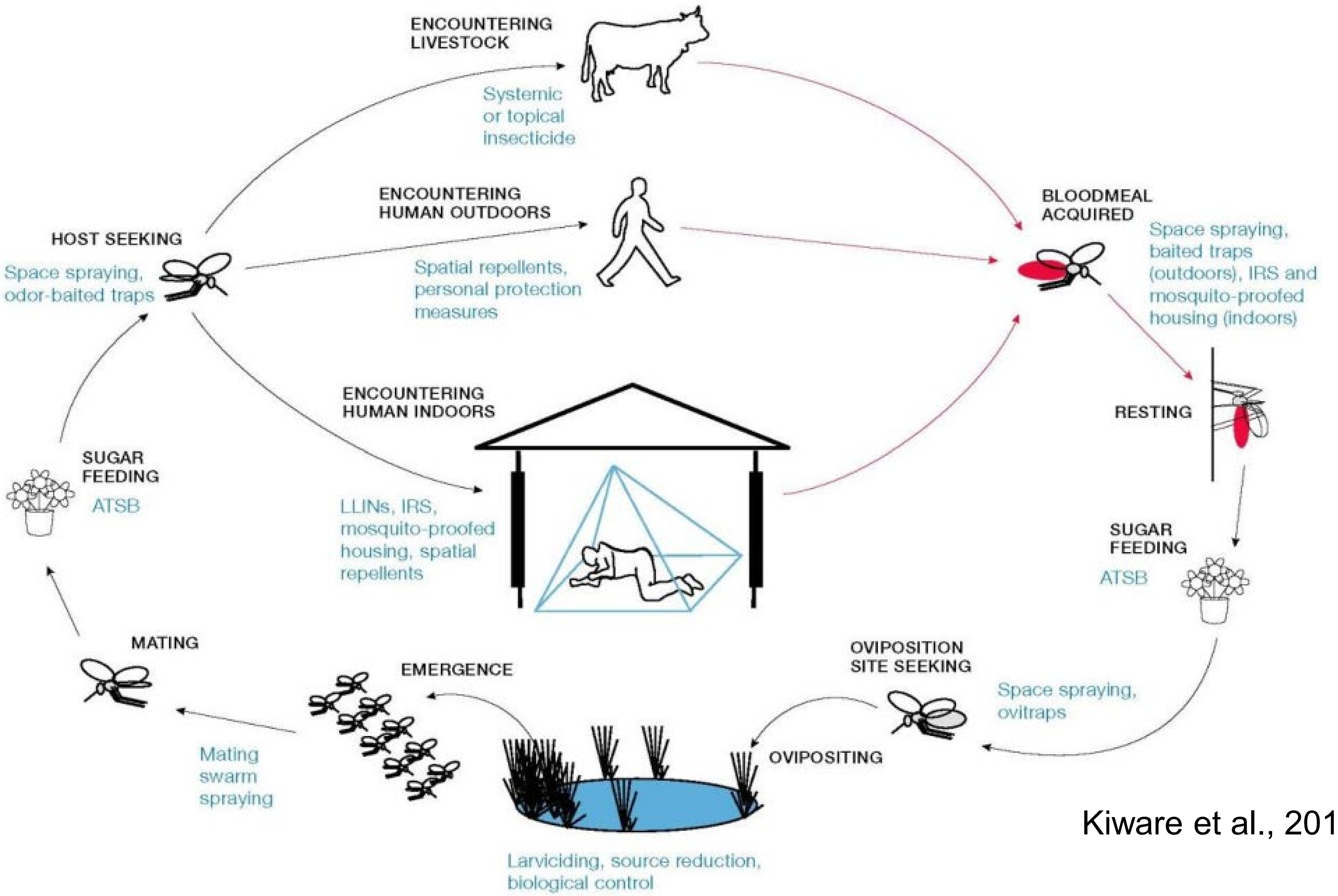
	Anopheles arabiensis	*Anopheles funestus s.l*
Total number of mosquitoes collected by CDC Light Trap (Jan 2015 to Jan 2016)	20135	4759
Total number of trap nights	1152	1152
Biting rate per night	17.48	4.13
Relative efficiency (CDC-LT) relative to HLC (Derived from Okumu et al 2008)	0.3	0.68
Corrected biting rate	58.26	6.08
Total number of mosquitoes analysed for *Plasmodium falciparum* circumsporozoite protein (CSP)	20135	4759
Total number of sporozoite positive mosquitoes	4	25
Sporozoite rate	0.0002	0.0053
Annual EIR (Adjusted)**	**4.22**	**11.65**
% EIR Contribution (Adjusted)**	**26.61%**	**73.39%**
Annual EIR (not adjusted)	**1.27**	**7.92**
% EIR Contribution (not adjusted)	**13.79%**	**86.21%**

Kaindoa *et al*. (2017)

Methods

- VCOM was adapted and extended

- It describes mosquito life and feeding cycle



Kiware et al., 2017

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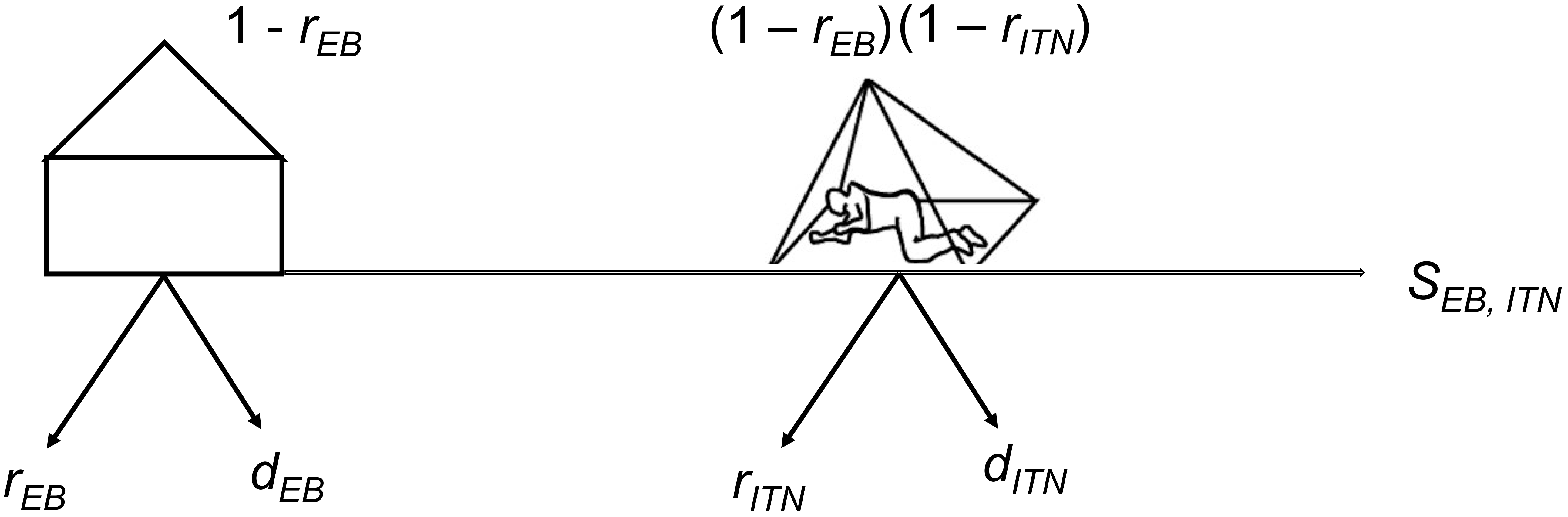

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Methods

1. Extraction of parameters

- Focused on studies conducted in Kilombero valley
- Other parameters were drawn from other studies conducted elsewhere

RESEARCH Open Access

Eave ribbons treated with the spatial repellent, transfluthrin, can effectively protect against indoor-biting and outdoor-biting malaria mosquitoes

Arnold S. Mmbando[1*], Halfan Ngowo[1], Alex Limwagu[1], Masoud Kilalangongono[1], Khamis Kifungo[1] and Fredros O. Okumu[1,2,3]

RESEARCH Open Access

Eave ribbons treated with transfluthrin can protect both users and non-users against malaria vectors

Emmanuel P. Mwanga[1*], Arnold S. Mmbando[1], Paul C. Mrosso[1], Caleb Stica[1], Salum A. Mapua[1], Marceline F. Finda[1,2], Khamis Kifungo[1], Andrew Kafwenji[1], April C. Monroe[1,4,5,6], Sheila B. Ogoma[1], Halfan S. Ngowo[1,2] and Fredros O. Okumu[1,2,3]

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Methods

2. Simulating the impact of eave ribbon for the transmission mediated by *An. funestus* and *An. arabiensis* separately

- Different coverages (0% - 100%) when combined with 80% ITNs (baseline usage)
- Outcome measure was entomological inoculation rate (EIR)
- EIR – number of infectious bites per person per time
- EIR < 1, considered the point for malaria interruption

3. Simulating the impacts of the interventions for the combined transmission by *An. funestus* and *An. arabiensis*

- EIR as output measure

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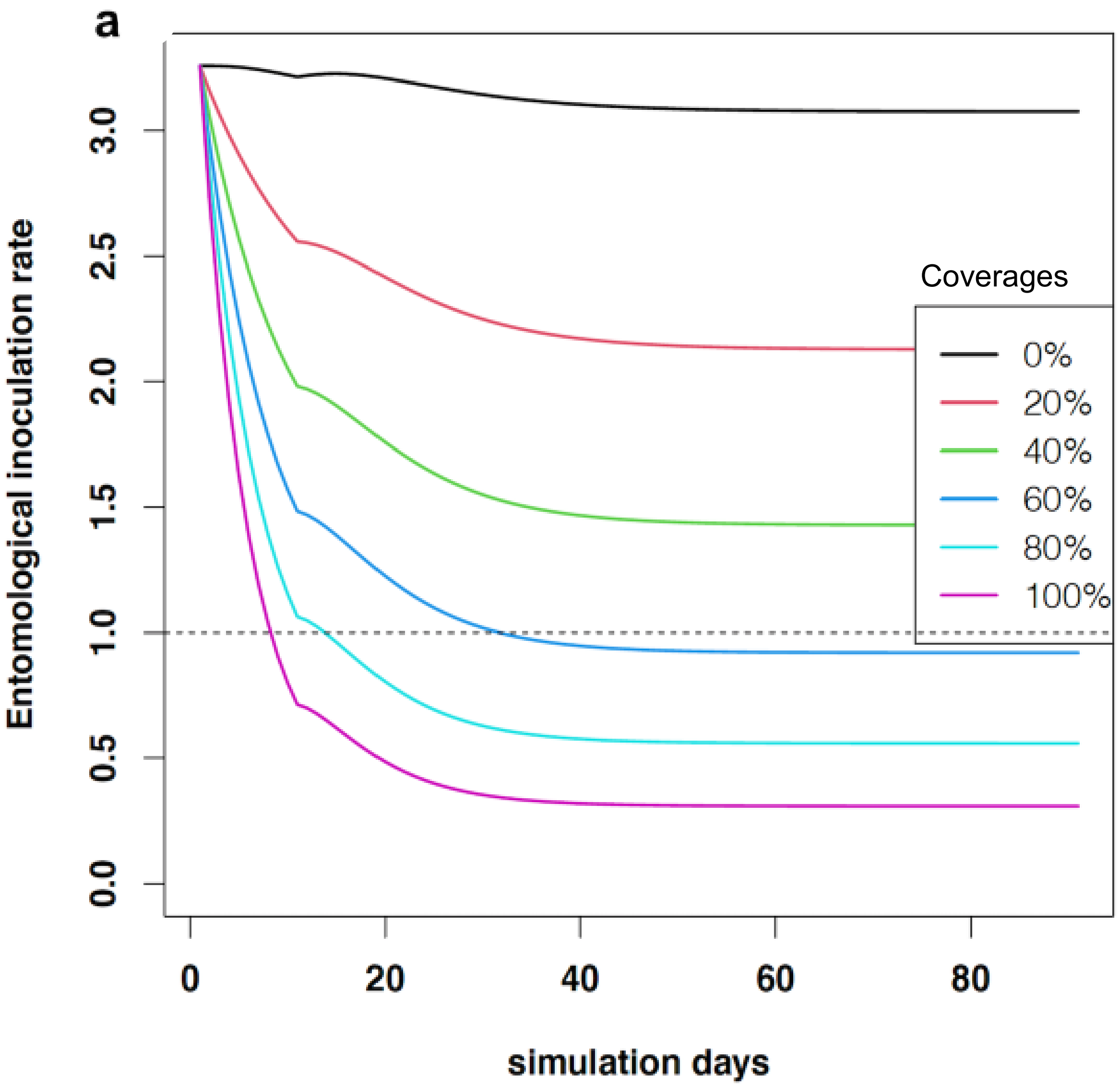
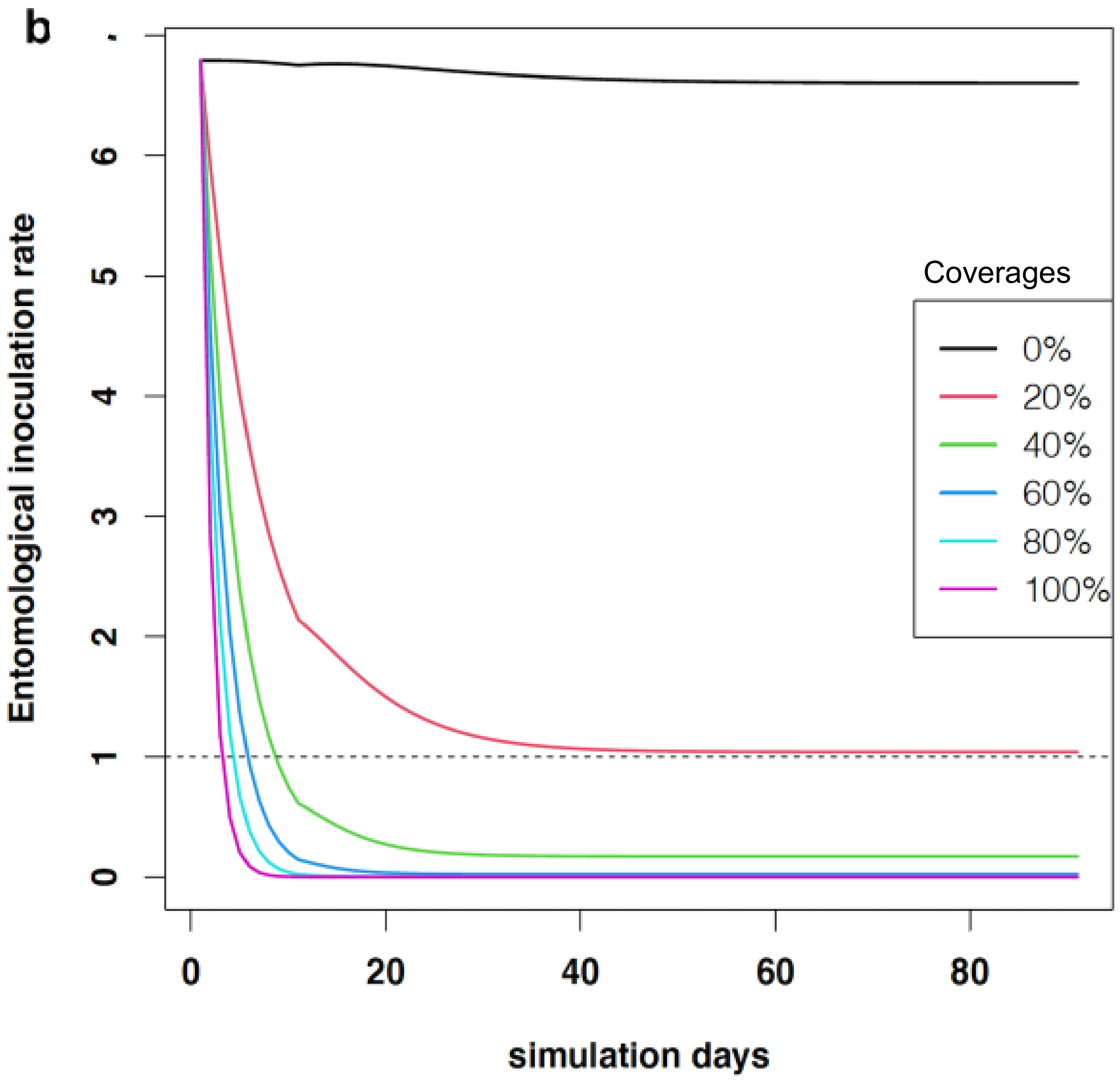
Results

Impact of combining eave ribbons & ITNs

An. arabiensis



An. funestus



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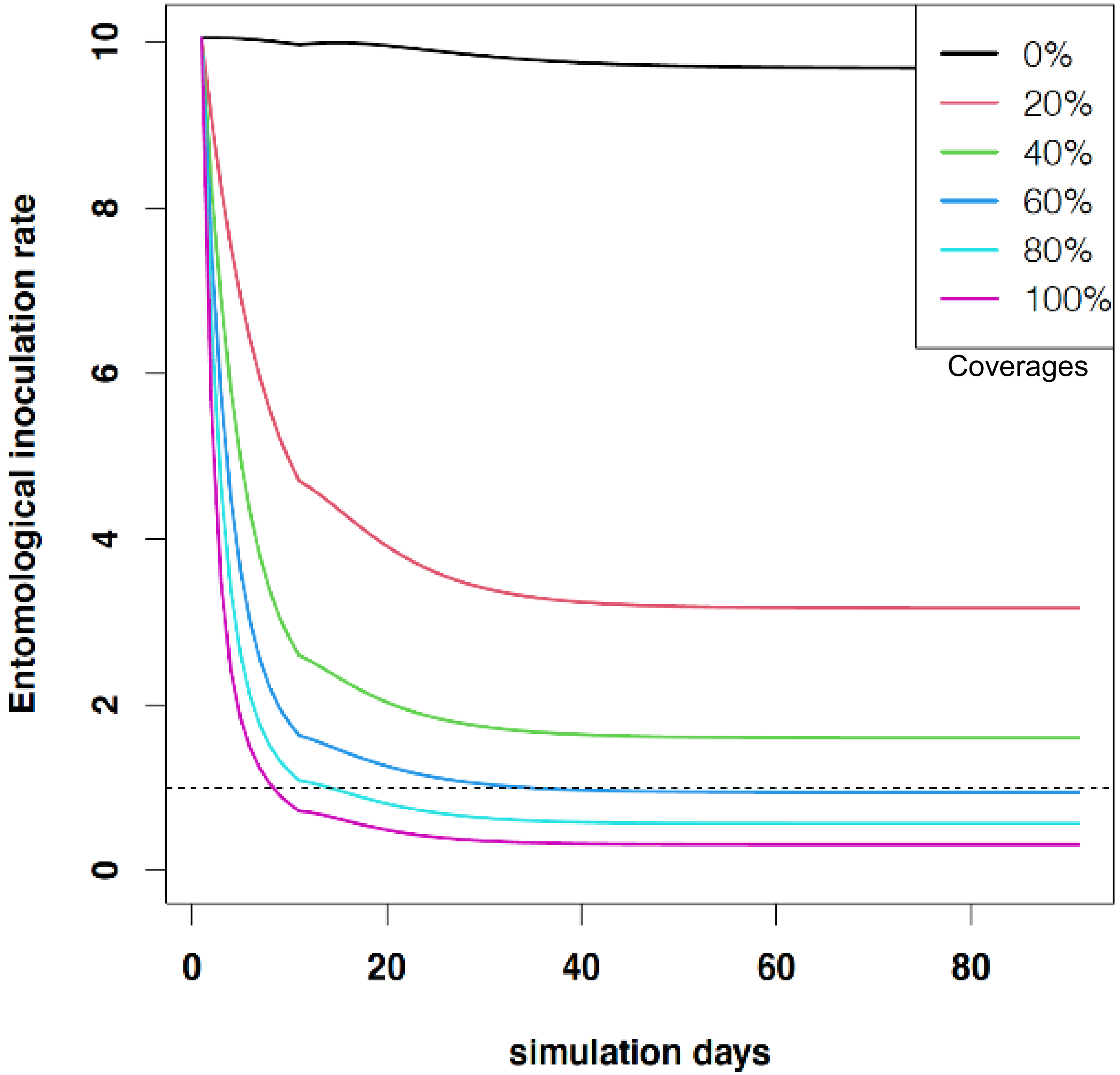
Results

Impact of eave ribbons + ITNs on the combined transmissions



High coverage level (~60%) needed to reduce EIR to below 1

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Conclusion

- New tools are needed to complement ITNs for successful malaria control.
- For *An. funestus,* eave ribbon and ITNs is the best combination
- For the combined transmission, higher coverage of the interventions are required though in reality is difficult to achieve.

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Others

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- Outdoor Mosquito Control team

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