Peer Community In Infections

Large and complete datasets, and modelling reveal the major determinants of physiological and behavioral insecticide resistance of malaria vectors

Thierry DE MEEÛS *based on peer reviews by* ***Haoues Alout*** *and 1 anonymous reviewer*

Paul Taconet, Dieudonné Diloma Soma, Barnabas Zogo, Karine Mouline, Frédéric Simard, Alphonsine Amanan Koffi, Roch Kounbobr Dabiré, Cédric Pennetier, Nicolas Moiroux (2023) Physiological and behavioural resistance of malaria vectors in rural West-Africa : a data mining study to address their fine-scale spatiotemporal heterogeneity, drivers, and predictability. bioRxiv, ver. 4, peer-reviewed and recommended by Peer Community in Infections. https://doi.org/10.1101/2022.08.20.504631

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Parasites represent the most diverse and adaptable ecological group of the biosphere (Timm & Clauson, 1988; De Meeûs et al., 1998; Poulin & Morand, 2000; De Meeûs & Renaud, 2002). The human species is known to considerably alter biodiversity, though it hosts, and thus sustains the maintenance of a spectacular diversity of parasites (179 species for eukaryotic species only) (De Meeûs et al., 2009). Among these, the five species of malaria agents (genus *Plasmodium*) remain a major public health issue around the world. *Plasmodium falciparum* is the most prevalent and lethal of these (Liu et al., 2010). With a pick of up to 2 million deaths due to malaria in 2004, deaths decreased to around 1 million in 2010 (Murray et al., 2012), to reach 619,000 in 2021, most of which in sub-Saharan Africa, and 79% of which were among children aged under 5 years (World Health Organization, 2022).

As stressed by Taconet et al. (2023), reduction in malaria deaths is attributable to control measures, in particular against its vectors (mosquitoes of the genus *Anopheles*). Nevertheless, the success of vector control is hampered by several factors (biological, environmental and socio-economic), and in particular by the great propensity of targeted mosquitoes to evolve physiological or behavioral avoidance of anti-vectorial measures.

In their paper Taconet et al. (2023) aims at understanding what are the main factors that determine the evolution of insecticide resistance in several malaria vectors, in relation to the biological determinisms of behavioral resistance and how fast such evolutions take place. To tackle these objectives, authors collected an impressive amount of data in two rural areas of West Africa. With appropriate modeling, Taconet et al. discovered, among many other results, a predominant role of public health measures, as compared to agricultural practices, in the evolution of physiological resistance. They also found that mosquito foraging activities are mostly explained by host availability and climate, with a poor, if any, association with genetic markers of physiological resistance to insecticides. These findings represent an important contribution to the field and should help at designing more efficient control strategies against malaria.

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Reviews

Evaluation round #2

Reviewed by anonymous reviewer 1, 22 January 2024

I went through the revision made by the authors and I am happy with it.
I recommend the mentioned preprint.

Best

Reviewed by Haoues Alout, 19 January 2024

The authors have responded to all comments and made the changes in thier manuscript accordingly that enhanced the clarity and the quality of the revised version. I recommend this revised manuscript for publication.

Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.1101/2022.08.20.504631
Version of the preprint: 2

Authors' reply, 22 December 2023

Download author's reply
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Decision by Thierry DE MEEÛS, posted 13 November 2023, validated 14 November 2023

Revision needed

Dear Dr Taconnet
"I have received two reviews for your preprint and you will see that, despite the two referees recognize the good quality of your manuscript, they adise that you revise your article following their recommendations. I generally agree with their comments. In your revised manuscript, please make sure to correct all typos, as I could find some, in particular in the title where "adress" should write address".
In your rebuttal letter, do not forget to mention all revisiosn undertaken and all answer to each referees' comments
Thank you for your submission
Yours Sincerely
Thierry de Meeûs

Reviewed by anonymous reviewer 1, 11 November 2023

This is a very nice piece of work that demonstrate the intensity and spatio-temporal heterogeneity of physiological and behavioural resistance in malaria vectors, at the scale of a rural health district over the study period.
However, there are few things to clarify for guiding the readers. These are as follow:
1) What motivated the use of weather data collected "a month" preceding mosquito collection as we know mosquito takes ~14 days between eggs to adults?

2) As you explored the association between the weather data (within a 2 km buffer) and the mosquito exophagic behaviour, how far were the indoor and outdoor position to each other?

3) How reliable are you on your human behavioural data?

Have you considered that may be possible biases in these behavioural data because the head of the house will not stay/sleeping in the same house as the >18 years olds people, and will not know when that person is sleeping or not under bed-nets. Additionally, the time given will be approx.

4) Since you consider the rainfall during collection as binomial (presence/absence). Was there any collection when it was raining? Please advise how this was done - in the manuscript.

5) Authors should revise the line 359, as "R2 Î\0.02, 0.13\" is considered twice but first "very weak" and then "weak". Should also revise the closing brackets on lines 359 - 360 then 366 – 367

6) Revise line 377 to remove the second "were" after "used". Then, on page 15, second line, make space between the dote and "For" then on the third line should the "th" be "the" instead?

7) In addition, it increased when luminosity got relatively higher indoors compared to outdoors." Is that correct? If yes, how do you explain the fact that luminosity get higher indoor than outdoor while outdoor you have the sunlight?

8) Should remove the closing bracket on line 571 and please revise the line 576, word may be missing "... in fine ..."

9) Should consider revising the sentence from line 609 to 612; "Second, the exophily.. were substantially higher than those, overall, historically ..." and subsequently your discussion on the following lines as checking on some of your references - the (Sanou et al., 2021) - you cited indicates outdoor biting of 54% which is > 41% you found here.

10) Authors should also bear in mind when interpreting the results that human behaviour is somehow affected by the weather condition too. Thus, the time spend indoor probably higher when temperature is cooler outside houses thus affecting the perceptions on exophagic behaviour at that time of collection. Thinking about, An. funestus biting outdoor for example. In addition, did you check for correlation between % indoor temperature and human behaviour that my affect mosquito behaviour as well? Please provide some insight on that.

11) Please revise the lines 683 - 684 where the word "data" may be missing after "...resistance..."

12) The first sentence of the conclusion is confusing, as in the paragraph (lines 482 - 4885) it is stated that exophagic behaviour was not associated with the time since LLIN distribution within the time frame of the current study. Please revise accordingly.

Reviewed by Haoues Alout, 03 November 2023

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