DOES EXPOSURE TO PESTICIDE IN FARMLANDS BOOST MOSQUITO POPULATIONS?

By Akbar Ganatra, Wageningen University
January 23, 2024

Globally, mosquito-borne diseases (MBDs) make for about 17% of the total burden of infectious diseases. Africa, especially its sub-Saharan countries, continues to be a global hotspot in this regard, with the risk of MBDs set to increase in the continent as climate change expands mosquito habitats. It is against this context that FoSTA-Health is setting up field experiments, which will help improve our understanding of land-use as a contributing factor to incidence of mosquitoes.

Images by zefe wu from Pixabay (right) and Syed Ali on Unsplash (left)

Studies suggest that pesticides can alter community compositions of macroinvertebrates in favour of disease carrying organisms. With a rise in use of pesticides in agricultural settings, as well as the overlap of pesticide compounds used for both disease control and crop protection, vectors such as mosquitos could be encountering pesticides from early stages of their lifecycles, such as larvae. Subsequently, they develop resistance to these compounds faster, also due to their shorter generation time than many of their competitors and predators. Thus, we hypothesize that pesticide usage trends and changes with the changing crop type or land use could affect the macroinvertebrate community to favour an ever increasingly resistant mosquito population.

FoSTA-Health will test these conclusions through field experiments in Mkushi and Chibombo districts in Zambia's Central Province. The effort is guided by the following research questions:

- *How does the change in landscape from natural to maize to soya affect the presence and abundance of mosquito populations, as well as their natural predators and competitors?*
- *How does pesticide usage (against crop pests, against mosquitoes and ticks) affect the incidence and abundance of mosquitos and their associated predators and competitors?*
- *How does the presence of pesticides/pesticide residues in water affect mosquito oviposition (egg-laying) behaviour?*

Based on GIS data and ground truthing, we have concluded that the research area is under three kinds of land cover: cropland, diverse cropland, and woodland. Within these landcover types, farms were under one of the three cropping patterns- maize, maize with vegetables, or soy. Covering all possible combinations of land cover and farm type, we will be setting up experiments at 81 sites each in Mkushi and Chibombo.

The experiments essentially involve:

- setting up mosquito traps in order to assess the incidence of mosquitoes in these different kinds of land uses. This includes the CDC Light trap, which targets Anopheles mosquitoes as well as the BG Sentinel II trap, which targets the Aedes and Culex varieties.
- recording 'bioacoustics,' i.e. sounds emitted by mosquito predators such as bats and birds, using special microphones
- analysing the soil for pesticide content. This will help examine the correlation between pesticide levels and mosquito population

As of now (January 2024), we are finalizing site selection. To this end, we have conducted a survey among 400 farmers across the two districts and collected data regarding their land which will help ascertain their feasibility as test sites. Based on the data collected, we will soon finalize the sites. Besides, a research protocol has been developed, which will guide project colleagues as they set up the equipment, record the readings, collect soil samples, and analyse the data.

Through scoping work carried out over the past eight months, we have learnt that mosquito population in the area thins out drastically during the dry season (May to mid-November), and therefore mosquito collection is only possible between mid-November and April, when it rains.

At this point, we are looking forward to setting up the field experiments, with the aim to complete it by February. The results will be fairly representative of most of Zambia, as landscape, soil and climatic conditions do not vary much across the southern African country.