THE ECOLOGICAL ROLE OF MOSQUITO LARVAE IN AQUATIC ENVIRONMENTS

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Assessing the community role and trophic interactions of Anopheles gambiae larvae in the Volta Region of Ghana

The *Anopheles gambiae* mosquito complex, which consists of eight species, is the prevalent malaria vector in Sub-Saharan Africa[1]. While we have a reasonable understanding of predation rates, resource availability, and competition among aquatic invertebrate[2-7], we lack a comprehensive appreciation of the larval ecology of *An. gambiae*, including their trophic role, diets, and population dynamics. My research aims to address this gap, crucial in integrating aquatic habitat management with vector control programs[8].

With the advance of DNA technologies such as metabarcoding, we can now identify prey to a species level by examining the stomach contents of aquatic predators. When using these insights with network analyses, it is possible to quantify direct and indirect ecological interactions in the environment[9]. I will take advantage of these techniques for my research which aims to assess the trophic interactions of *An. gambiae* larvae in water bodies within two agricultural communities in Ghana.

I will collect mosquito larvae with a dipper and a larger subset of invertebrates with an aquatic net (with a mesh size of 250 µm). Each specimen's gut contents will be analyzed using DNA barcoding and this data will be used to gain an understanding of the larval niche and ultimately *An. gambiae*'s role within the aquatic community. I will examine network interaction metrics such as connectance (the number of realized connections between species relative to what is available), degree (the number of interaction partners), betweenness (the importance of a species as a connector between different groups), and closeness (how central a focal species is in the community) to aid in niche construction. Temperature, pH, dissolved oxygen, salinity, and conductivity of the target water bodies will also be measured while sampling, as these factors affect the occurrence and abundance of larvae by influencing the breeding behaviours of mosquitoes[10].

In addition, I plan to study how different species of mosquito larvae compete for key resources. In the laboratory, the densities of local-caught larval populations of *An. gambiae* and other mosquito species will be manipulated to help determine the strongest competitor. While maintaining optimal rearing conditions by measuring the physio-chemical properties of the water daily, I will examine four indicators of overall growth and survival (the mean time to pupation, percentage of larvae that did not reach the adult stage, sex ratio, and mean female wing length) and therefore infer competitive strength among species. These data will provide important insights into predicting whether another mosquito species would dominate if the number of *An. gambiae* is reduced in the habitat.

An. gambiae are relatively small, constituting about half to one-third the mass of many Aedes mosquito species[12]. Foraging theory indicates that small, mobile insects of low profitability, do not form a preferred food source to predators unless they are massively clustered[13]. Though many species feed on mosquitos, these animals also feed on other small organisms that typically co-occur with *An. gambiae*[14]. For these reasons, I do not foresee that *An. gambiae* larvae will be a key food source for any predator in the aquatic environments in Ghana or that they will have a central role in local trophic systems.

If this is proven to be true, it will provide evidence that malaria-intervention methods that aim to suppress or reduce *An. gambiae* mosquitoes will not have detrimental consequences for the larger community.

THIS RESEARCH IS PART OF A LARGER EFFORT BY TARGET MALARIA IN GHANA TO UNDERSTAND THE ROLE OF THE *AN. GAMBIAE* MOSQUITO IN THE BROADER ECOSYSTEM.

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