

ARPPIS-DAAD 2022 PhD Projects

Project Number	PhD Project Title	Project Summary	Location of project	Qualifications and experience required
1	Eco-epidemiology of visceral leishmaniasis: The ecological and microbiome correlates of transmission in Kajiado County, Kenya	Visceral leishmaniasis (VL) caused by the obligate intracellular parasites <i>Leishmania donovani</i> or <i>L. infantum</i> is a life-threatening NTD, which is transmitted through the bites of <i>Leishmania</i> -infected female sand fly vectors. It is estimated that over 30,000 cases of VL occur annually worldwide, but only between 25% to 45% are reported to the World Health Organization (WHO). Most cases occur in East Africa. VL is one of the top parasitic diseases causing outbreaks with a fatality rate of 95% without treatment of more than 2 years. The focus of this PhD study is Kajiado County, which has recently emerged as a new transmission hotspot, with most patients reported in 2020 and 2021 aged 1-15 years. This in itself indicates the complexity of the Kajiado transmission setting. This PhD will investigate leishmaniasis epidemiological and ecological transmission determinants, harnessing accessible geospatial data, patient demographics, sandfly ecology, the genotypes of parasites and vectors. This data will be supplemented with new data on sand fly microbiomes, including the occurrence of microsporidia, recently implicated with malaria parasite transmission blocking in <i>Anopheles</i> mosquitoes and also found in sand flies, and their potential interaction with <i>Leishmania</i> transmission. Unlike Asia, where VL is targeted for elimination, in East Africa the WHO target is for <i>control</i> . Hence, understanding the key epidemiological drivers of disease transmission with spatial and temporal considerations can greatly enhance prevention and early case detection and management.	icipe, Nairobi, Kenya	<ul style="list-style-type: none"> - Candidates are expected to have completed an MSc in molecular biology or any other related field with a background in statistics and at least second-class degree (upper division) - Demonstrated capacity to conduct independent scientific research in one or more of the following fields: molecular biology, bioinformatics, entomology, and microbiology. - Well-developed IT skills.
2	Global change effects and biodiversity monitoring in Africa: Developing "big data" surveillance systems that incorporate eDNA-based insect	Knowledge on insect-biodiversity in socio-ecological systems provides important early warning information to decision makers on the conservation and land degradation status of these systems and their productivity. <i>icipe</i> has been engaged extensively in morphological surveys of insect communities to ascertain the productivity of agro-ecological systems (i.e., pollinator abundances that enhance yields). However, "traditional" surveillance methods are often non-standardized, tedious (inefficient) and can only represent localized sampling areas or single taxa. Data mining (existing species data) and environmental	icipe, Nairobi, Kenya	<ul style="list-style-type: none"> - MSc in biological sciences, preferably with experience in/knowledge of molecular biology, bioinformatics, GIS, and landscape modelling. - Some knowledge in biological processes will be an advantage. - She/He must demonstrate ability to publish in high quality peer-reviewed scientific journal and outstanding oral and written communication skills.

	biodiversity indices of agro-ecological landscapes	metrics will be combined with novel environmental DNA (eDNA) sequencing approaches to identify genetic material directly from environmental samples. Novel Earth observation metrics that better depict spatio-temporal systems dynamics will be probed as predictors. A data-driven artificial intelligence modelling framework will be optimized to predict insect diversity patterns associated with distinct geographies. The better understanding of biotic interactions can be used to understand global change effects and develop robust monitoring routines.		
3	Exploring the antimicrobial potential of gut microbiota from African edible insects as novel therapeutic agents	Several African edible insects are among the most efficient decomposers of organic wastes into high quality value-added nutrient-rich products for human food and animal feeds. They thrive on agro-industrial products, thus, they harbor a vast majority of important microbes, which hold promise as potential sources for new bioactive secondary metabolites against multi-drug resistant pathogens. So far, only one fungal strain from the gut of BSF larvae have been investigated for its chemical composition which were identified as γ -pyrone molecules and a diketopiperazine. Additionally, a review of the literature reveals that insects for feed and food are good source of antimicrobial compounds among other bioactivities (Mudalungu et al., 2021), yet underexplored. This project aims to identify bioactive small molecules derived from the gut microbiota of insects for feed, particularly black soldier fly (BSF) (<i>Hemertia illucens</i> L.) as antimicrobial and pesticidal agents for developing future pharmaceutical products and animal nutraceuticals.	icipe, Nairobi, Kenya	<ul style="list-style-type: none"> - BSc in Biochemistry/Microbiology/ Organic Chemistry - MSC in Biochemistry/Microbiology/ Organic Chemistry - Previous experience in analytical chemistry and natural products characterization research will be an added advantage.
4	Investigation of the entomologic and ecologic risk factors of malaria persistence in selected dryland ecosystems	Entomological risk factors for malaria in Kenya have largely been informed by studies in the highly endemic coastal and Lake regions. The transmission dynamics and how the disease is sustained remain poorly explored in dryland ecosystems yet prone to malaria outbreaks. The goal of this study is to gain deeper insights into aspects of vector biology that enable malaria persistence in selected dryland ecosystems. Specific aims are to: i) assess association in anopheline population structure with changes in malaria transmission profiles, ii) examine insecticide resistance profiles and associated mechanisms among selected vectors, iii) determine Microsporidia-MB infection in anophelines and correlate with plant feeding and Plasmodium infection prevalence. A suite of approaches including field ecology, laboratory	icipe, Nairobi, Kenya	<ul style="list-style-type: none"> - MSc in Medical Entomology or related Biological Sciences and with proven ability working on mosquito disease vectors. - Knowledge on mosquito morphological identification and insecticide resistance assays are added advantages

		analyses and behavioural experiments will be used. Findings of the study will inform current elimination strategies and also the development and deployment of novel vector-based interventions.		
5	Integrative approach for management of the alien invasive, <i>Drosophila suzukii</i> in Kenya	The recent detection of <i>Drosophila suzukii</i> in Kenya represent a major impediment to berries and stone fruit production in the country and Africa at large. Unlike other Drosophilids, <i>D. suzukii</i> attacks sound ripening fruits, rendering them unsuitable for human consumption and causing massive yield losses. <i>Drosophila suzukii</i> , being a novel pest in the region, information on its bioecology/management are quite scanty. Therefore, this study seeks to determine host range, distribution of the pest and the magnitude of berries losses caused. Furthermore, the study will develop a comprehensive inventory of indigenous natural enemies capable of forming a new association with the pest. Another aspect that the study will focus on, is establishing the invasion history/pathways and development of molecular markers for rapid identification of the pest. To identify a novel benign management approach, the use of African indigenous fruit flies host-marking pheromone as oviposition deterrent for <i>D. suzukii</i> will be explored.	icipe, Nairobi, Kenya	<ul style="list-style-type: none"> - Recent MSc graduate in Agricultural Entomology, with focus on molecular biology and or chemical ecology - BSc degree in Biological Sciences, with a minimum of 2nd Class Upper division degree or equivalent
6	Duration analysis of push-pull technology (PPT) adoption and impact on households' livelihoods in East Africa	Push-pull technology is a major innovation with high potential to increase food security and agricultural sustainability in East African smallholder farmers. The UPSCALE project aims at scaling up understanding and applicability of push-pull from individual fields to farm, landscape, and regional scales, and sustainably intensifying the cereal cropping system by integration with other crops and cultivation methods. This PhD project aims to conduct a duration analysis of push-pull technology adoption and assess the socioeconomic and governance impacts of upscaling push-pull from individual livelihoods to regional value chains and policy. The study will utilize household and community-level survey data of farmers of fields selected along gradients in push-pull amount and age, comparing the situations of vegetable integrated push-pull and non-push-pull farmers in the same landscapes to assess the agro-economic, social, health, and food security impacts, accounting for the time since implementation of push-pull practices in fields farmers by men, women, and youth. The data will be obtained from Kenya, Uganda, Tanzania, Rwanda, and Ethiopia.	icipe, Nairobi, Kenya	<ul style="list-style-type: none"> - MUST be a Ugandan citizen - MSc. degree in agricultural sciences; preferably agricultural economics - Knowledge in Econometrics related to adoption and impact analysis. - Strong knowledge of analytical software (STATA, SPSS, and R). - Published at least one manuscript in a peer-reviewed journal or presented a paper at an International Conferences - Strong experience in designing and programming survey instruments using an electronic data collection system is an added advantage
7	Towards the	The Fall armyworm (FAW), <i>Spodoptera frugiperda</i> , is an	icipe,	- BSc in computer science/data science/

	<p>development of sustainable near-real-time data-driven observatory and monitoring of the Fall armyworm (<i>Spodoptera frugiperda</i>) in sub-Saharan Africa</p>	<p>invasive crop pest considered a major threat to maize, sorghum, and millet production in sub-Saharan Africa (Day et al., 2017). Since its first detection in Africa in 2016, it has rapidly spread across Africa and other continents, causing extensive damage to most staple cereal crops and socioeconomic losses to millions of resource-poor smallholder African farmers. It is estimated that crops worth over USD 13 billion per annum are at risk of FAW damage throughout sub-Saharan Africa, thereby threatening millions of poor farmers (Niassy et al., 2021). Despite the rigorous work already conducted to reduce FAW prevalence, the population dynamics and invasion mechanisms of FAW in Africa are still poorly understood. The evolution and development of data science provide an opportunity to harness and integrate the vast spatially explicit and underutilized data gathered for decades to inform of the various FAW dynamics across the different regions in Africa. Improved understanding of adult FAW movements and dynamics of its different life stages could guide the release of natural enemies for specific life stages of the pest and determine other control strategies in specific locations and at a given crop stage. There is thus an urgent need to develop near-real-time models that provide predictive capacities to enhance localized and regional early warning and enable informed intervention and effective resource allocation to curb the spread and reduce the losses caused by FAW in Africa.</p>	<p>Nairobi, Kenya</p>	<p>mathematics/entomology/agriculture/environmental science</p> <ul style="list-style-type: none"> - MSC in computer science/data science/ mathematics/entomology/agriculture/environmental science - Basic/ advanced programming in R and /python - Previous experience in insect ecology, GIS, and remote sensing will be an added advantage
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