Project Number	PhD Project Title	Project Summary	Location of project	Qualifications and experience required
1	Development of biorationals as a component of Integrated Pest Management (IPM) strategy for suppression of *Tuta absoluta*	Agriculture is a vital tool for sustainable development in Africa. Specifically, the horticultural sub-sector generates jobs, with vegetable production providing market opportunities for smallholder growers. Tomato, besides being both a subsistence and cash crop, is highly nutritious and provide good amounts of minerals, antioxidants and vitamins. Despite the socio-economic importance of this crop, it is constrained by numerous biotic and abiotic factors, and ranking high among the former are arthropod pests, a problem that was further compounded by the recent invasion by *Tuta absoluta*. The pest causes yield losses of up to 100%, jeopardizing the livelihoods of millions of growers. The PhD project is designed to address constraints due to *T. absoluta* through assembling, validation and dissemination of management strategies in an Integrated Pest Management (IPM) approach to suppress the pest in East-Africa and beyond.	icipe, Nairobi, Kenya	MSc in organic chemistry
2	Understanding the chemical ecology underpinning Fall Armyworm resistance mechanisms in maize-based intercropping systems	The rapid spread and subsequent yield loss due to Fall Armyworm (FAW), *Spodoptera frugiperda*, calls for an urgent need for the development and deployment of sustainable pest management options suitable for majority of smallholder maize farmers in sub-Saharan Africa (>90% of the area). Most smallholder maize farmers in the region traditionally use cultural control such as intercropping. Increasing plant diversity has been shown to reduce pest population, enhance natural enemy and reduced crop loss (Letoumeau et al. 2011). Mixed cropping systems such as 'climate-adapted push-pull' and other cereal-legume intercropping have been shown to provide a significant reduction against FAW incidence and damage levels (Midega et al. 2018; Hailu et al. 2018). However, the scientific basis underpinning resistance mechanisms of different cropping systems to FAW in Africa have not been widely studied. The PhD project will investigate the chemical ecology of FAW resistance mechanisms underpinning maize-based intercropping systems and examine herbivore-crop-natural enemy interactions. The study will enable a better understanding of the role of diversified cropping systems in reducing the incidence and damage of FAW infestation and enhancing the pest's natural enemies and explore potential of different cropping systems for wider FAW agroecology-based management.	icipe, Nairobi, Kenya; icipe, Mbita, Kenya; and Keele University (UK)	BSc in biology, agriculture, biochemistry or chemistry. MSc in entomology, biochemistry or chemistry Previous experience in insect chemical ecology techniques/research would be an added advantage.
3	Modelling the efficacy and spread of biological control options to optimize use and deployment of environmentally friendly pest	This PhD project is a continuation of *icipe*'s research for development initiatives that aims to increase smallholder farmer productivity by efficient use and application of environmentally friendly pest management strategies such as biopesticides. This will be achieved by using existing information/data (from previous projects) and those developed by further experimentation in this project on efficacy, spread and interaction dynamics of biological control agents, including effective biopesticides and improved application strategies (autodissemination) for management of invasive pest such as fruit flies (*Bactrocera dorsalis*),	icipe, Nairobi, Kenya	MSc in Computer Science, Physics, Statistics, Mathematics or related discipline. Good skills in programming languages such as R, Java and Eclipse platform. A strong foundation in quantitative analysis, experience and in developing and

	management strategies	*Thrips* (*Frankliniella occidentalis*) and more recently Fall armyworm (*Spodoptera frugiperda*) that have been developed. This PhD project will focus on developing spatial and temporal growth and interaction dynamics models to understand, both inter- and intra-specific interactions among fungal isolates and their insect hosts and environment. These models will further be used to predict potential impacts of climate change on use and application of selected entomopathogenic fungal-based biopesticides to control the above target insect pests.		using dynamics models. Some knowledge in biological processes will be an advantage. Must also have a proven track record of R&D relating to growth and spatial analysis models and demonstrated ability to publish in high quality peer-reviewed scientific journals. Outstanding oral and written communication skills.
4	Modelling the dispersal, outbreak patterns and crop association of Fall Armyworm in Africa for its effective management	Fall Armyworm (FAW), *Spodoptera frugiperda*, is a crop pest of the Western Hemisphere that has recently become widespread in Africa and recently introduced into Asia. The expansion of FAW to staple crops in Africa such as maize and sorghum is negatively impacting on the livelihoods and wellbeing of millions of smallholders. The pest is migratory in North America, while it is considered resident in Brazil as it is expected in Africa. However, efforts to understand the dispersal and outbreak patterns of FAW in Africa and even in Brazil are lacking. The Food and Agriculture Organization (FAO) in partnership with *icipe,* CABI, the Desert Locust Control Organisation for Eastern Africa (DLCO-EA) and the International Institute of Tropical Agriculture (IITA) have developed and implemented mobile applications for scouting and monitoring of FAW (FAW Monitoring and Early Warning System (FAMEWS)). This PhD project will focus on exploiting information obtained from tools deployed across Africa, and understand the ecology of FAW in Africa, model the data to predict the spread pattern of FAW and carry out scenario analysis for prioritizing pest control options though specific, tailored and targeted integrated pest management (IPM) measure. Spatial model for FAW's key host plants will be developed to overlay with the seasonality of crops for better understanding of outbreak patterns for better preparedness to manage the pest. The study will further guide in establishing mechanisms for early detection and anticipated interventions against other invasive crops pests in Africa, from lessons learnt with FAW.	icipe, Nairobi, Kenya	MSc in statistics, Computer Science, Physics, Mathematics or related discipline with good skill in programming languages such as R, Java and Eclipse platform. Strong foundation in quantitative analysis, experience in developing and using dynamics models. Knowledge of biological processes would be an advantage. Proven track record of R&D relating to growth and spatial analysis models and demonstrated ability to publish in high quality peer-reviewed scientific journals. Good oral and written communication skills.
5	The role of the microbial symbionts in mediating the tri-trophic interaction between the host plant, host insect and parasitoids in invasive fruit fly species	This PhD project will investigate the tri-trophic interaction between fruit flies, microbiomes and parasitoids. Initially, the link between microbiome members and fruit fly host plants will be investigated. Subsequently, this project will characterize members of microbiome in key native fruit flies (*Ceratitis coyra* and *C. rosa*), invasive fruit flies (*Bactrocera dorsalis*) and their associated native parasitoids (*Psyllia cosyrae*) and introduced parasitoids (*Fopius arisanus* and *Diachasmimorpha longicaudata*). Furthermore, the project will assess how various members of the microbiome affect the efficiency of parasitisation of fruit flies by their respective parasitoid species and whether specific microbes confer any immunity to the fruit flies against the parasitoid. In addition, we will characterize endosymbionts and investigate these for their	icipe, Nairobi, Kenya	MSc in molecular biology or related field. Demonstrated capacity to conduct independent scientific research in one or more of the following fields: molecular biology, bioinformatics, entomology and microbiology. Good communication (written and verbal) and IT skills.

		capacity to manipulate host reproduction. The ultimate aim of this project is to develop / improve pest control strategies based on microbial symbionts.		
6	An evaluation of potential risk of yellow fever virus re-emergence in parts of Kenya: the bionomics of key mosquito vectors and virus prevalence	Despite the availability of an effective human vaccine, yellow fever (YF) still poses a significant public health threat. This is exemplified by recent outbreaks in Uganda, Ethiopia, DRC, Congo and Angola with resulting high human mortality. Our understanding of the ecology of the vectors involved remains poor, yet this knowledge is important in risk assessment to inform cost-effective vaccination efforts. Concerns have been raised about the risk of urban YF in East Africa although the last outbreak of YF (1992-95) in Kenya in the Rift Valley, was largely sylvatic. The critical question is how the vector ecology compares in this area and an urban area where there has been increased incidences of *Aedes*-borne viral diseases (e.g. dengue) which shares a niche with YF. The PhD project will assess the ecology and vectorial capacity of key vectors of YF in Kenya in selected vulnerable sites in Coast and North Rift Kenya, and also establish evidence of virus activity in the human population. Information obtained will be used to establish proxy variables for large scale projection of the vectors ecology and to forecast potential outbreaks across Africa. Findings will inform prioritization of vaccination and integrated vector management plans for YF in these areas.	icipe, Nairobi, Kenya	MSc in biological sciences. Knowledge or exposure in entomology (field and lab), virology, microbiology or immunology