Four PhD positions to work on Fall armyworm (FAW) under the Plant Health Theme at the International Centre of Insect Physiology and Ecology (icipe), Kenya

General Background
Fall armyworm (FAW) has recently invaded Africa, causing devastating losses to maize, the main staple and cash crop for millions of smallholder farmers in much of Africa, and the preferred host for the pest. The rapid spread and the potential to cause 100% loss in a wide range of crops especially cereals such as maize, rice, pasture, sorghum, millet pose a great and unprecedented threat to food security, incomes and livelihoods in the country. Extensive damage caused by FAW and lack of effective management strategies, has resulted in pesticide-based emergency responses in many affected countries at an astronomical cost, most of which has not only proved ineffective (Stokstad, 2017) but also with serious negative environmental impacts. The inefficacy of pesticides to manage FAW could be due to its ability to develop resistance to synthetic pesticides. Hence sustainable and environmentally friendly pests’ management strategies need to be urgently developed to guide farmers on sustainable FAW management.

icipe is offering four PhD positions, one working on development of microbial biopesticide, one working on a chemical ecology -based biological control approach, one working on plant-based biorationals for management of Fall armyworm and the last working on factors influencing the ability of maize to compensate for damage by FAW.

Project 1: Development and testing of microbial biopesticides for the management of Fall armyworm in East Africa

Fall armyworm is an invasive pest to Kenya where it was first reported in early 2017 on a maize crop. It is native to North and South America and known to cause 100% loss in wide range of cereals and vegetables, hence a serious threat to food security, incomes and livelihoods in Kenya. Synthetic pesticides were adopted as an emergency response with cost and negative environmental impacts. As an alternative to pesticides, we intend to test and develop entomopathogenic nematodes and endophytic fungal-based biopesticides which have been found effective against pests, including lepidopteran defoliators, such as Fall armyworm. Different formulations and isolates of these biopesticides will be researched to target FAW eggs, larvae, pupae and adults both through endophytic colonization of maize and innovative foliar and soil drench applications. The compatibility of these fungal and nematode-based biopesticides with various FAW-Integrated Pest Management options will be assessed to formulate a sustainable management strategy for the pest in East Africa.

Applicant requirements specific for project 1: The successful applicant will hold an excellent master’s degree with both coursework and research in Crop protection/Entomology with specialization in insect pathology or in Applied Microbiology with specialization in insect pathology. Knowledge in Chemical ecology and nematology will be an asset.

Work place
The PhD position is based at icipe’s Duduville Campus, Kenya but with field work in key maize production regions in Kenya.

Project 2: Designing a chemical ecology-based biological control approach for the invasive Fall armyworm in Africa

Fall armyworm (FAW), Spodoptera frugiperda, an economically important pest that attacks maize and other graminaceous crops throughout much of its native tropical and sub-tropical America has recently invaded Africa. It is now found devastating cereal crops, principally maize, in over 40 countries in Africa and is expected to further spread in the continent, with devastating consequences. Control of FAW in its native places is effected by use of genetically modified maize and pesticides, approaches that are not available and accessible to smallholder farmers in Africa, respectively. For sustainable management of such an invasive pest in such diverse cropping systems as found in Africa use of natural enemies holds promise. Our previous studies discovered that there exists smart maize germplasm that repel and recruit both egg and larval parasitoids following pest
oviposition. The proposed project will thus establish natural enemy abundance, diversity and activity in maize-based agro-ecologies in East Africa and identify the candidate species for mass production and augmentative release; elucidate the chemical ecology of tritrophic interactions involving maize-FAW-natural enemy interactions and identify the ecological factors determining recruitment and activity of the key natural enemies. Additionally, it will identify maize varieties with the smart trait to enhance activity of natural enemies early on before pest eggs hatch to cause damage to the maize. This will provide a sustainable method for management of FAW in Africa.

**Applicant requirements specific for project 2:** The successful applicant will hold an excellent master’s degree with both coursework and research in a relevant field, Entomology, Crop Protection or Plant Sciences, with experience in Chemical Ecology procedures or Chemistry. Field experience in maize systems.

**Work place**
The PhD position is based at icipe’s Thomas Odhiambo Campus at Mbifa, Homa Bay County, South Nyanza, Kenya but with field work Kenya, eastern Uganda and Tanzania.

**Project 3: Validation of indigenous-knowledge and plant-based biorationals for management of Fall armyworm**

The Fall armyworm (FAW), *Spodoptera frugiperda*, is a key invasive pest in Africa (Goergen et al., 2016), affecting millions of hectares of maize, sorghum and pasture grasses (FAO, 2018). The pest can feed on over 80 plant species. In a situation of panic, broad-spectrum pesticides remain the primary control strategy (Prasanna et al., 2018). However, recent evidence on effectiveness of climate-adapted push-pull and intercropping in reducing Fall armyworm (Midega et al., 2018; Hailu et al., 2018) indicates the importance of plant-based volatiles for FAW management. Furthermore, FAW affected farmers in Sub-Saharan Africa report effectiveness of indigenous practice such as use of plant extracts, ash and soaps. These findings need to be validated and further elucidate and exploit the chemistry of bioactive plants against Lepidopteran insects to develop environmentally safer biorational pesticides for the effective control of Fall armyworm. Systematic assessment of indigenous practices for FAW management is critical to confidently upscale them for FAW management.

**Applicant requirements specific for project 3:** The successful applicant will hold an excellent master’s degree with both coursework and research in crop protection, entomology or a related fields. Previous experience on conducting field experiments and lab bioassays, botanical pesticides and their characterisation might be helpful. A good knowledge about design of field experiments and lab bioassay, statistical analysis will be of help in the project.

**Project 4: Understanding the key factors influencing the ability of maize to compensate for damage by fall armyworm at different crop phenological stages**

The Fall armyworm (FAW), *Spodoptera frugiperda* is a key invasive pest in Africa that inflicts severe foliar damage to cereal crops such as maize and sorghum in the vegetative stage and less frequently damages the tassel and ears at reproductive stage. However, reduction in grain yields due to fall armyworm is influenced by several factors such as intensity of foliar damage, crop phenology when FAW infestation occurs, ability of cultivars/hybrids to compensate for foliar damage and good agricultural practices adopted by the farmers and other soil fertility related factors. It is critical to establish a relationship between these factors and the ultimate grain yield loss incurred to establish appropriate economic thresholds for FAW management in Africa. Further economic thresholds to guide implementation of economically viable pest management interventions in Africa, depends on other variables such as value of maize produced, cost and effectiveness of the management interventions. This study will focus on understanding the diverse factor influencing the grain yield loss due to FAW, assess the ability of maize to compensate for
damage due to FAW and establish economic thresholds for initiation of FAW management interventions in east Africa.

**Applicant requirements specific for project 4:** The successful applicant will hold an excellent master's degree with both coursework and research in crop protection, entomology or a related fields. Previous experience with conducting field experiments and lab bioassays, economic threshold assessment of pest and disease might be helpful. A good knowledge about design of field-, Screenhouse- and lab experiments, data modelling and multivariate analysis will be of help in the project.

**Eligibility**

- A Bachelor’s degree with a minimum pass of second-class, upper division.
- The Master’s degree must have been completed less than six years ago at the time of application.
- The applicant must be a national of Kenya, Rwanda, Ethiopia, Tanzania, Uganda.
- Qualified female candidates and candidates from less privileged regions or groups as well as candidates with disabilities are especially encouraged to apply.
- A good command of the English language (written & spoken).
- Completed application form and accompanying supporting documents submitted online.

Completed application form and accompanying supporting documents must be submitted latest by 4th December 2019.

**Applications**


**Timeline**

- **Closing date for applications** by 4th December 2019.
- **Successful candidates will be notified by 16th December 2019**
- 3-year doctoral training by research: start: Jan 2020, end: Dec 2022

Please note: Successful candidates will develop a full proposal and register with a University after they commence their PhD programme at icipe.