<table>
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<th>Title</th>
<th>ECOVEG: Manipulating the Soil Ecosystem for Improved Management of soil-Borne Pathogens in Smallholder ‘greenhouse’ Tomato Production in Kenya</th>
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Dr. Vitalis Wafula Wekesa  
Department of Applied and Technical Biology  
Technical University of Kenya (TUK) |
| Purpose | To utilize an interdisciplinary research approach to develop improved and inexpensive strategies combining natural plant chemical defenses and fertilizer to suppress root-knot nematodes and bacterial wilt in greenhouse tomato production in Kenya |
| Project summary | The goal of this project is develop improved and inexpensive strategies for suppressing root-knot nematodes (RKN) and bacterial wilt in smallholder high-tunnel (‘greenhouse’) tomato farming in Kenya. Firstly, we will use previous knowledge to identify three greenhouse tomato farmers within Kirinyaga county in Central Kenya. We will establish the farmers’ practices especially on the use of both organic and inorganic fertilizers. Together with the farmers, we will establish the dynamics of RKNs and bacterial wilt for a period of three months and how this relates to crop productivity. To achieve this, firstly, soil samples will be collected within the greenhouse in areas with poor and healthy plant growth and evaluated in the laboratory. At the same time, the allelochemicals produced by these soil samples will also be screened. Secondly, we will evaluate the impact of fertilizer type and application rates on the RKN and bacterial wilt populations on tomato under a controlled environment. Varying fertilizer applications will give a direct |
measure of how much supports or suppresses the RKN and bacterial wilt populations. The associated allelochemicals will also be determined. Thirdly, we will elucidate the mechanisms underlying nematode-plant interactions using assay systems developed at icipe coupled with chemical analyses of volatiles by chromatographic techniques. We will compare nematode responses to tomato plants treated with different fertilizer rates with untreated ones as well as with plants inoculated with a bacterial wilt strain. Various treatment combinations will guide us to establish the chemical signals produced by the plant that render it susceptible to pathogen infection. Fourthly, we will test all findings with the farmers and develop a simple inexpensive control method for RKNs and bacterial wilt based on successful fertilizer and tomato variety combinations and chemical mechanisms evaluated. Finally, we will conduct a training workshop to disseminate the results to greenhouse tomato farmers and stakeholders. This project will seamlessly integrate research, outreach, and extension with personnel from the university, national and international agricultural research centers. Growing healthy greenhouse tomato will increase productivity in Kenya and progressively in other African countries which is essential for food security and improved livelihoods. With the institution of this permanent collaborative program on tomato health, longer term consequences will undoubtedly involve further understanding of other plant parasitic nematodes and mechanisms of resistance based on farm practices, and eventually their interactions with potential hosts. In addition, results and methodology from this proposal will be broadly disseminated which will serve as a long-term platform for future training of more postgraduate students in Africa on RKN and bacterial wilt management.

| Country and specific location | Kenya: Kirinyaga County, Central Kenya |
| Participating institutions | International Centre of Insect Physiology and Ecology (icipe) |
| Horticulture Research Institute (HRI), Kenya Agricultural and Livestock Research Organization (KARLO) |
| Technical University of Kenya (TUK) |
| Start date | 1st September, 2015 |
| End date | 31st August, 2017 |
| Budget | USD 59,683 |
Lucy Kananu Murungi is a crop protection expert in the Department of Horticulture at the Jomo Kenyatta University of Agriculture and Technology (JKUAT). Her role in the department includes, but not limited to, capacity building and research. Dr. Murungi who holds a BSc, MSc and PhD in Horticulture from JKUAT has specialized on the ecological interactions between plants and pests found below- and above ground. She is currently a postdoctoral research fellow at the International Centre of Insect Physiology and Ecology (icipe) where she is evaluating allelochemicals involved in the interactions between high value vegetables and root-knot nematodes. Dr Murungi is a principal investigator and a collaborator in various vegetable integrated pest management projects both locally and internationally. She has published scientific articles in peer-reviewed journals and is supervising more than seven postgraduate students working on various crop pests. Recently, she was awarded the first prize for demonstrating progressive laboratory research of the 2013-2015 fellows at the end of her fellowship program with the African Women in Agricultural Research and Development (AWARD). Dr Murungi belongs to six professional associations one of them being the Horticultural Association of Kenya where she is serving in the executive board as the vice-secretary. She is working closely with various stakeholders in order to apply scientific knowledge to develop simple and affordable tools to solve pest problems at the smallholder farmer level and improve food security.

Selected Publications

Coffea arabica L. at different constant temperatures. Journal of Pest Science (under review)


On-going and Previously Funded Projects

- “The enemy below-ground:” Elucidating the semiochemical basis for root-knot nematode infestations in high-value vegetable small holder farming systems in East Africa. Funded by the Department for International Development (DFID). **USD 180,000. Principal Investigator.**
- Diversifying food systems: Horticultural innovations and learning for improved nutrition and livelihood in East Africa (HORTINLEA). Grant supported by "GlobE - Global Food Security" National Research Strategy BioEconomy 2030 in collaboration with the Leibniz University, Hannover; sub-project 2. **Euro 50,000. Coordinator**
- Investigation of allelochemicals in high-value leafy vegetables that confer their susceptibility to root-knot nematodes (*Meloidogyne* spp.). Grant supported by the National Council for Science and Technology (NCST), Kenya. **USD 9,697. Principal investigator.**
- Pesticidal effects of aerial plant extracts of African nightshades on the tomato spider mite (Acari: Tetranychidae). Grant supported by The International Foundation for Science. **USD 6,000. Principal investigator**
- Investigation of pesticidal compounds from trichome exudates in *Solanum sarrachoides* Sendtner. Grant supported by the German Academic Exchange Service and icipe. **USD 4000. Principal investigator**
- Biological performance, response and population dynamics of *Tetranychus evansi* Baker and Pritchard, as influenced by different African nightshade (*Solanum* spp.) species. Grant supported by the German Academic Exchange Service and JKUAT. **USD 9500. Principal investigator.**