



MESSAGE FROM THE CHAIR, *icipe* GOVERNING COUNCIL

2 Dr Lukas Bertschinger



THOUGHT LEADERSHIP COLUMN

Insects and climate change

3 Dr Segenet Kelemu



INSTITUTIONAL NEWS

- Fruit Fly Protein Bait Facility launched 6
- Sida innovation workshop 8
- Visit by Dr Yves Guinand, Senior Thematic Adviser, SDC 9
- Sida's Research Council visit 10
- DfID livelihood adviser visit 11
- NACOSTI registration 12
- Bioinnovate Africa first open call 13
- Prof. Bill Hansson elected Associate Fellow of AAS 13

6



NEW FUNDING

- Malaria and irrigation 14
- Safe technologies for thrip control 14
- Bee gut microbiota 15
- Schistosomiasis research 15

14

RECENTLY PUBLISHED

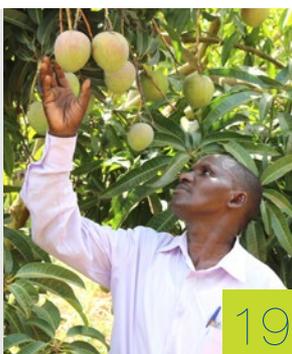
- Fruit fly disinfestation 16
- Ticks and pathogens diversity 17
- Bean weevil acoustics 18
- Rearing queens 18



17

RESEARCH HIGHLIGHTS

- IBCARP fruit fly IPM progress 19
- Gender and agricultural technologies 20
- icipe* in Ethiopia 21



19



STAFF NEWS

New appointments and retirements

22

icipe BY NUMBERS

48
Peer review journal articles (Jan – Mar 2017)



40,000
Current fruit fly IPM farmers



150,000
Current push-pull farmers



126
Ongoing postgraduate students





Dr Lukas Bertschinger,
Chair, *icipe* Governing Council

We sincerely hope you will find this publication that includes news on a range of institutional activities, recent publications, research highlights and staff updates, informative.

Dear Friends and Colleagues of *icipe*,

This *e-bulletin* provides an overview of the Centre's very intense and diverse activities in the first quarter of 2017.

Some of the highlights include the marking of a major milestone: the launch of a Fruit Fly Protein Bait Facility in Kenya, by *icipe*, Kenya Biologics Ltd and partners, to commercially produce Fruitfly Mania™, a highly effective product developed through the Centre's research. Fruitfly Mania™ will now be accessible to around 600,000 farmers across East Africa, and alongside *icipe*'s other fruity fly integrated pest management (IPM) packages, the bait will contribute to better health of people, animals and the environment, and increase global competitiveness of fruits from Africa.

We are pleased to inform you that, with the support of our donors, we continue to expand our research portfolio, and in this bulletin we focus on two new research projects: a study to investigate how irrigation will affect the goals of the Kenya Malaria Strategy, and an initiative to develop novel technologies for the control of bean flower thrips in cowpea and other legumes, as an alternative to insecticides.

On donor relations, between January and March 2017, the Centre was honoured to welcome representatives of the Research Council of the Swedish International Development Cooperation (Sida), and Mr. Duncan Barker, Livelihoods Adviser, Agriculture Research Team, Department for International Development. *icipe* also hosted the Capacity to Innovate international workshop organised by Sida, to deliberate on innovation management in research institutions.

In March 2017, *icipe* received a Certificate of Registration jointly endorsed by the Cabinet Secretary, Ministry of Education, Science and Technology, and the Director General, National Commission for Science, Technology and Innovation (NACOSTI), Kenya.

This is a momentous occurrence for the Centre, which underscores our adherence to regulation and quality in science, technology and innovation sector, as well as contribution to socioeconomic development in Kenya.

On that note, we recognise the expansion of *icipe* activities in Ethiopia, including upscaling of the geographical scope and focus of research and development activities, and reinforcing of the Office's capacity.

The Director General's Thought Leadership column is a reflection on the issue of insects and climate change, noting predicted profound alterations, existing knowledge gaps and *icipe*'s contribution so far towards developing practical, local level adaptation strategies for communities.

We sincerely hope you will find this publication that includes news on a range of institutional activities, recent publications, research highlights and staff updates, informative.

Dr Lukas Bertschinger,
Chair, *icipe* Governing Council

INSECTS AND CLIMATE CHANGE



Dr Segenet Kelemu
Director General, icipe

icipe has generated significant knowledge with regard to insects and climate change in Africa, contributing to practical, local level adaptation and management strategies for communities.

When many people think of animals in relation to climate change, endangered species like the polar bear often come to mind. Yet, in fact, the vast majority of species affected by climate change are insects.

Due to their cold-blooded nature, insects must live in areas with temperatures that are suitable for their biological processes, for instance development, reproduction and survival. Therefore, climate change will profoundly impact insects, including their physiology (how they live and reproduce), their behaviour and physical features, as well as relationships with other species (like host plants and natural enemies). As a result, immense shifts are predicted in population dynamics, abundance and geographical spread of insects. In turn, these alterations will have positive and negative outcomes for people, livestock and crops, in terms of vulnerability to insect-transmitted diseases, and availability of essential services provided by insects such as pollination and pest regulation.

Research to understand how insects will respond to climate change is still in its infancy, and various gaps exist. For instance, while a variety of bioclimatic models have been developed towards determining likely changes among insect species due to climate change, many such systems focus on broad geographic scales, either continental or global, thereby limiting their translation into practical, local level management options for communities. There is also lack of adequate information on pest biology, outbreak frequencies, ecological, behavioural, physiological and life history responses of insects to climate change, especially in Africa.

In the recent past, *icipe* has generated

significant knowledge with regard to insects and climate change in Africa. A considerable amount of the Centre's research has been conducted within the Climate Change Impacts on Ecosystem Services and Food Security in Eastern Africa (CHIESA) project implemented by *icipe*, the Ministry for Foreign Affairs of Finland, and various partners from 2011 – 2015.

Specifically, CHIESA researchers aimed to understand how current and projected climate change scenarios will affect key pests and diseases, as well as beneficial insects, of four important crops: maize, crucifers, avocado and coffee, around Taita Hills (Kenya), Mount Kilimanjaro (Tanzania) and Jimma Highlands (Ethiopia). The pests investigated were maize stemborers (*Busseola fusca* and *Chilo partellus*); the diamondback moth (DBM), which damages crucifers; and fruit flies (specifically *Bactrocera dorsalis*), the false codling moth (*Thaumatotibia leucotreta*), and thrips, *Heliothrips haemorrhoidalis*, in relation to avocado. The coffee pests studied include the variegated coffee bug, *Antestiopsis thunbergii*, and the coffee white stemborer, *Monochamus leuconotus*.

Towards producing microclimatic information specific to the study areas, the researchers used a combination of approaches, including automatic weather stations installed in strategic locations at different altitudes in the three regions, and hundreds of data loggers situated in farmers' fields. Laboratory studies were conducted to produce life-tables of key pests and natural enemies, and additional factors likely to influence the pest dynamics, such as farming practices and soil factors, were also investigated and correlated with environmental data.

CHIESA researchers established that due to rising temperatures, higher altitude areas will become more suitable for the pests listed above, and as a result their damage on crops will increase significantly. However, the studies showed that although temperature is a major factor, other climatic elements (e.g. rainfall), responses of natural enemies to climate change, soil status and issues related to human activity, for instance environmental degradation, are also playing a role.

Based on these findings, the researchers have provided a range of recommendations to minimise the predicted risks. Suitable natural enemies for the control of stemborers have been identified and are being studied for possible releases in higher altitude areas. Guided by knowledge on their efficacy and tolerance to temperature, natural enemies are being released to control *B. dorsalis* releases at different altitudes. To sustain pollination efficiency of the honey bee, *Apis mellifera*, the researchers propose conservation of flowering plants and maintaining of beehives in avocado orchards. Since the efficiency of *Cotesia vestalis*, a wasp that controls DBM naturally in the lower altitudes is expected to improve in higher altitudes, the wasp can therefore be used in biological control in the latter regions. Wild crucifers provide alternative refuge for DBM in the high altitudes, and they need to be conserved as a way of naturally controlling the pest. To reduce coffee pest and disease impact in present and future climatic conditions, the researchers recommend prevention of deforestation, promotion of tree planting in coffee farms to provide shade, dissemination of existing good coffee agronomic practices, use of risk analysis tools, such as distribution maps and prediction models and biological control of pests and diseases.

The findings of the CHIESA project are currently being validated and disseminated through the Adaptation for Ecosystem Resilience in Africa (AFERIA), a two-year project that commenced in 2016, to be implemented by *icipe* and the Ministry for Foreign Affairs of Finland and various partners.



Avocado is an important source of income for many households in Africa. Climate change could worsen insect damage on the crop, and affect efficiency of honey bee pollinators. *icipe* research has produced knowledge on reducing such impacts.

Beyond the CHIESA project, *icipe* has also conducted a variety of studies, for instance to address the growing need for knowledge on the influence and mutualistic interactions between flowering plants and pollinators (including insects) due to climate change. Ongoing analysis of insects and wild fruits around the Taita Hills by the Centre's Biosystematic Unit, complemented by long term meteorological data obtained through the CHIESA project, is expected to reveal the continued presence or absence of plants, shifts in fruiting periods, insect phenology and the guild of insect species associated with the fruits.

Globally, remote sensing has significantly advanced our understanding of climate systems, including the dynamics and impacts of climate change, by enabling assessments that would not be possible through climate models and conventional observations. The *icipe* Geoinformatics Unit is using remote sensing to improve generation of pest distribution maps. For instance, using geospatial tools, the researchers have collected data on four key pests of bee diseases in key beekeeping regions of Kenya, resulting in projections of increased honeybee pest risk by 2055 based on current climate and projected climate change scenarios. Although bioclimatic data was most

relevant in the results, remote sensing enabled the researchers to incorporate vegetation seasonality variables, thereby improving pest mapping by over 20%. The Unit has also developed a new remote sensing-based methodology to map flowering plants in Africa, and used it to produce the world's first floral map. Long-term data on flowering patterns in a given landscape helps to understand, among other factors, the climate and ecological stresses that trigger pest and diseases in bee colonies. This information can also be used in evaluating pollination effects and the quantity and quality of beekeeping products.

One of the consequences of climate change is unpredictable weather patterns, leading to severe droughts, as is the case currently in eastern Africa, especially the horn of Africa. This scenario is changing dynamics between insects, people and livestock, especially in the arid and semi-arid regions. For instance, left with no choice, herders are encroaching on wildlife conservancies and protected areas, increasing their chances of coming into contact with disease vectors like tsetse, and contracting zoonotic diseases like trypanosomiasis. As reported elsewhere in this bulletin, research conducted by the *icipe* Martin Luscher Emerging Infectious



icipe and partners have developed a climate-smart push-pull, to ensure that continued efficiency of the technology, in view of climate change.

Diseases Laboratory showed that in the Shimba Hills National Reserve, one of Kenya's high biodiversity areas facing considerable human encroachment, has produced breakthrough knowledge on previously unidentified tick-pathogen relationships and a unique tick diversity, which could contribute to morbidity of human and livestock in the region. The Centre continues its research in this area to understand, design strategies and make recommendations to minimise such risks.

icipe is also investigating the connection between climate change induced wildlife declines with population dynamics and biting patterns of mosquitoes. Studies by the Behavioural and Chemical Ecology Unit show that huge losses of wildlife have an impact on risk parameters (e.g abundance and diversity) of mosquitoes. This knowledge is useful in developing predictive models of zoonotic diseases emergence in people.

As the impacts of climate change intensify, research and development partners need to re-assess the performance of existing strategies, for instance in controlling crop pests. In accordance, over the past five years, *icipe* has developed a climate-

smart version of its highly innovative and successful push-pull technology (<http://www.icipe.org/research/plant-health/push-pull-ipm-technology>), which addresses the five key constraints of cereal-livestock mixed production systems in Africa – insect pests (stemborers), the parasitic weed *Striga* (and other weeds), poor soil fertility, soil moisture management, while also fulfilling the need for high quality animal feed. A recent assessment study established that the climate-smart push-pull technology is enabling farmers living in some of the East African regions most severely affected by climate change to stabilise their cereal-livestock mixed production systems, while also increasing yields by 2.5 times, and in addition, integrate dairy farming into their production systems, despite challenges posed by climate of change.

Indeed, this is *icipe's* overall goal: to continue to support communities to not only adapt, but to thrive, regardless of the impact of climate change especially in relation to insects. Towards this goal, we intend to continue working with partners to generate knowledge, to enable the design of practical, local level technologies and strategies.

FRUIT FLY PROTEIN BAIT FACILITY LAUNCHED



Fruit fly Mania™, alongside icipe's other fruity fly integrated pest management packages, will contribute to better health of people, crops, animals and the environment, and increase global competitiveness of fruits and vegetables from Africa.

icipe, Kenya Biologics Ltd and partners have launched a Fruit Fly Protein Bait facility, located in Makuyu, Murang'a County, Kenya, to commercially produce Fruitfly Mania™, a protein bait developed through the Centre's fruit fly integrated pest management (IPM) research.

Protein is an important part of the diet of adult female fruit flies. Therefore, globally, specifically identified proteins are used in bait sprays laced with an appropriate toxicant, as a way of killing female fruit flies in a manner that is not harmful to people, crop, animals and the environment. Yet, although there is high demand for protein

food baits in Africa, currently there is no local producer of the products. This means that protein baits have to be imported and retailed at exorbitant prices, which makes them unaffordable to smallholder growers.

icipe research has shown that an extract from waste brewer's yeast, an industrial by-product from East Africa Breweries Ltd, is capable of controlling fruit flies to levels comparable to commercially available protein baits in the African market. The Centre has used this extract to develop Fruitfly Mania™, which has been tested in farmers' fields across Africa and found to be effective leading to its registration



(L-r): Dr Sunday Ekesi, icipe Interim Director of Research and Partnerships and Head, African Fruit Fly Programme; Dr Segenet Kelemu, icipe Director General and CEO; Dr. Wolfgang Kasten, Head of the ITAAC project, GIZ, Germany and Mr Chris Kolenberg, Managing Director, Kenya Biologics Ltd, pictured during the launch with Fruitfly Mania™.

by relevant authorities in Kenya. The goal now is to make Fruitfly Mania™ accessible to as many fruit growers as possible in the continent.

Fruitfly Mania™ will retail at 70% less the cost of other commercially available products. The Fruit Fly Protein Bait Facility has a production capacity of 2,000 litres per day, enough to meet the local demand of over 229,000 households whose

livelihoods depend on mango production in Kenya. An additional 400,000 mango growers will benefit from Fruitfly Mania™, once the product is registered across East Africa (to include Uganda and Tanzania).

Technical and financial support for the Fruit Fly Protein Bait Facility has been provided by: Elephant Vert; German Federal Ministry for Economic Cooperation and Development/ Deutsche Gesellschaft für Internationale

Zusammenarbeit GmbH (BMZ/GIZ); Biovision Foundation for Ecological Development, Switzerland; European Union; UK Aid from the UK Government; Swiss Agency for Development and Cooperation (SDC); Swedish International Development Cooperation Agency (Sida); Food and Agriculture Organization of the United Nations (FAO); International Atomic Energy Agency (IAEA) and Government of Kenya.



Ribbon cutting ceremony (l-r): Ms Jasmin Fraatz, Manager Energy Portfolio, GIZ Kenya, representing Mr Hendrik Linneweber, Country Director, GIZ Kenya; Dr Segenet Kelemu, *icipe* Director General and CEO; Dr Sunday Ekesi, *icipe* Interim Director of Research and Partnerships and Head, African Fruit Fly Programme; Dr Wolfgang Kasten, Head of the ITAAC project, GIZ, Germany and Dr Eliud Kireger, Director General, Kenya Agricultural and Livestock Research Organisation.



(L-r): Dr Wolfgang Kasten, Head of the ITAAC project, GIZ, Germany and Ms Jasmin Fraatz, Manager Energy Portfolio, GIZ Kenya, representing Mr Hendrik Linneweber, Country Director, GIZ Kenya pictured after unveiling the plaque of the Fruit Fly Protein Bait Facility. The German Federal Ministry for Economic Cooperation and Development (BMZ), and GIZ through the Innovation Transfer into Agriculture – Adaptation to Climate Change (ITAACC) project has provided support for the facility. A complete list of technical and financial support partners is available under the Notes to Editors section of this story.



Invited guests during the launch of the Fruit Fly Protein Bait Facility, including technical and financial support partners, collaborators from research institutions and farmers, government representatives and members of the press.

SIDA INNOVATION WORKSHOP



icipe researchers made presentations on formal aspects of Research to Store innovation processes, and presented a range of examples through displays and a tour of the Centre's laboratory facilities.

Between 27 and 30 March 2017, *icipe* hosted an international workshop on innovation management in research institutions.

Titled Capacity to Innovate, the forum was organised by the Swedish International Development Cooperation Agency (Sida). The event commenced with opening remarks by Ms Lena Ingelstam, Head of Department of Partnership and Innovation, Sida, and *icipe* Director General, Dr Segenet Kelemu.

Presentations were made regarding innovation at participating organisations including: Addis Ababa University and Armauer Hansen Research Institute, Ethiopia; La Universidad Mayor de San Simón and La Universidad Mayor de San Andrés, Bolivia; University of Dar es Salaam, Muhimbili University of Health and Allied Sciences, Ardhi University and the Tanzania Commission for Science and Technology, Tanzania; Makerere University, Uganda National Council for Science and Technology and Uganda Industrial Research Institute; the Eduardo Mondlane University and the National Research Africa Oil Works Fund, Mozambique; University of Rwanda and National Commission of Science and Technology, Rwanda; and *icipe*.

The workshop also included sessions on national, regional and organisational

innovation systems and the role of university innovation managers; the contribution of universities in the innovation system, as well as a deliberation on the meaning of Innovation Capacity.

icipe researchers made presentations on formal aspects of Research to Store innovation processes, and presented a range of examples through displays and a tour of the Centre's laboratory facilities. Further discussions on examples of successful innovation initiatives were provided by the Bioinnovate Africa Programme, which is based at *icipe*.

Discussions on funding of innovation and innovation ecosystems were guided by presenters from: Chalmers University of Technology and KTH Global Development Hub, and Sida, Sweden; Grand Challenges Africa; and Innovation Transfer into Agriculture – Adaptation to Climate Change (ITAACC) project of GIZ.

Issues related to national innovation systems were pondered through a presentation on innovation and policy by the Africalics Secretariat and innovation research results from Bolivia.

The participants also reflected on multi helix clusters, based on talks on innovation systems and clusters in the context of Mozambique, and experiences from a new cluster programme in Tanzania.

VISIT BY DR YVES GUINAND, SENIOR THEMATIC ADVISER, SDC



▲ Dr Guinand (second right), pictured with *icipe* team (l-r): Mr Moses Ndotono, Laboratories Manager; Dr Sunday Ekesi, Interim Director of Research and Partnerships, and Head, Africa Fruit Fly Programme and Timothy King'ori, Facilities and Assessts Manager; in front of a carport on which solar photovoltaic (PV) modules have been fixed as part of the SDC-funded Greening of *icipe* initiative.

During this period, Dr Yves Guinand, Senior Thematic Advisor, Rural Development, Swiss Agency for Development and Cooperation (SDC), visited *icipe*.

Dr Guinand's programme included meetings with *icipe* Director General, Dr Segenet Kelemu, and Dr Sunday Ekesi, Interim Director of Research and Partnerships and Head, African Fruit Fly Programme, who presented an overview of the Centre's research and development programmes and projects.

He also received a briefing from Dr Robert Skilton, *icipe* Head of Capacity building and Institutional Development, on the Unit's activities composed of: postgraduate and postdoctoral training; nurturing and strengthening of African research and development organisations and institutions, and dissemination of technologies to national agricultural and health research and extension systems.

icipe researchers made presentations on a variety of ongoing projects. A talk by Dr Ivan Rwomushana titled: From research to store – *icipe* experience with Fruitfly Mania™, outlined the Centre's journey from developing basic knowledge to the launch of a facility in Kenya to commercially manufacture Fruit fly Mania™ for fruit flies.

The Centre's microbiome research to explore the potential of endosymbionts in making insects more resistant to pathogens and to prevent the transmission of diseases, was also a key focus. Dr Jeremy Herren spoke about the Spirovector project supported by the R. Geigy Foundation, the Swiss National Science Foundation (Switzerland), and the Wellcome Trust (UK), which aims to develop better understanding of diverse insect endosymbioses and to explore their potential use to control insect vector-borne diseases. Dr Juan Paredes highlighted *icipe*'s initiative, with support from the Swiss National Science Foundation, to assess the connection between honeybee gut microbiota and the overall health of the insect.

Further, Dr Guinand received an update on the Greening of *icipe*, a US\$ 2.5 million initiative funded by SDC, with the goal of reducing the Centre's carbon footprint and making its environment more eco-friendly. He also visited various components of the project, consisting of solar PV plants, water saving measures and extensive planting trees and other flowering plants.

Dr Guinand's visit concluded with a tour of various *icipe* facilities, including the Martin Lüscher Emerging Infectious Diseases (ML-EID) Laboratory.

SIDA's RESEARCH COUNCIL VISIT



Group photo of Sida's Research Council with *icipe* staff.



(l-r:) Dr Sunday Ekesi, *icipe* Interim Director of Research and Partnerships and Head, African Fruit Fly Programme, chats with Sida's Research Council members, Prof. Margareta Bergendahl Norell and Prof. Per-Olof Östergren.



Council members view silk products produced through *icipe* research.



Prof. Baldwyn Torto, Head, Behavioural and Chemical Ecology Unit, discusses ongoing research with the guests.

In January 2017, the Research Council of the Swedish International Development Cooperation (Sida), and key Sida staff members visited *icipe* as part of a mission to East Africa.

Sida's Research Council is an external body for advice and overarching quality assurance of Sida's research support portfolio. Recurrently, the Council has visited countries and regions where Sida supports research capacity building and research of relevance for development. Sida is a core funder, and a long-time partner of *icipe*.

The current Council, which was appointed in early 2016, includes: Thomas Rosswall (Chair); Margareta Bergendahl Norell; Francesca Chiodi; Anders Olofsgård; Kerstin

Sahlin; Maria Stern; Per-Olof Östergren, Elsa Håstad and AnnaMaria Oltorp, Head of the Research Cooperation Unit, Sida. During their visit to *icipe*, the Council was accompanied by Sida representatives including: Karin A i; Hannah Akuffo; Renée Ankarfjärd; Petra Attfors Burcher; Philip Chiverton; Lisa Román; Staffan Smedby and Barni Noor from the Swedish Embassy in Nairobi.

The day's programme consisted of discussions on *icipe*'s research and development activities including: outputs in terms of knowledge, strategies, technologies and products; socioeconomic impact; and an overview of the Centre's strategic direction. The visitors also toured an exhibition prepared by various *icipe* projects, demonstrating these aspects.

DFID LIVELIHOOD ADVISER VISIT



▲ Mr. Barker, pictured with *icipe* team (l-r): Ms Anna Njui, Grants, Partnerships and Projects Manager; Dr Segenet Kelemu, Director General; Mr Gatigwa Kimana, Director, Finance and Administration and Dr Sunday Ekesi, Interim Director of Research and Partnerships and Head, African Fruit Fly Programme

On 1 February 2017, Mr. Duncan Barker, Livelihoods Adviser, Agriculture Research Team, Department for International Development (DfID) visited *icipe* for discussions on the UK government funded research, development and capacity building activities at the Centre. He also toured *icipe* research facilities.

Through core funding to *icipe* by UK Aid, and DfID's contribution to the Association of International Research and Development Centers for Agriculture (AIRCA) 2016 – 2020, *icipe* will be supported to

implement research and development, commercialisation and availability of biopesticides as alternative to chemical pesticides for crops and animal pests. The projects being implemented include: management of key pests of vegetables in Kenya and Tanzania; integrated tick control for livestock in pastoralist households in Kenya, Tanzania, Burkina Faso and Cameroon; and upscaling of the *icipe* push-pull technology (<http://www.push-pull.net>) based on new knowledge on mycotoxin control and carbon sequestration for climate change mitigation in six countries in eastern and southern Africa.



Mr. Barker observes laboratory experiments in one of *icipe*'s insects for food and feed research laboratories.



Dr Merid Getahun (left) explains ongoing research on camel surra to Mr Barker (centre), as Dr David Tchouassi (right) looks on.

NACOSTI REGISTRATION



Dr Jacinta Kapiyo (left), Director of Higher Education, State Department of University Education, Ministry of Education, Kenya, presents the Certification of Registration to *icipe* Interim Director of Research and Partnerships and Head, African Fruit Fly Programme, Dr Sunday Ekesi (centre), as Prof. James Kahindi, Professor of Microbiology at Pwani University, Kenya, and Member, *icipe* Governing Council, looks on.



(l-r) Ms Caroline Oyula, *icipe* Chief Legal Officer, Dr Ekesi and Ms Annah Njui, the Centre's Grants, Partnerships and Projects Manager, pose with the Certificate of Registration.



Dr Kapiyo (left) and Dr Moses Rugutt (right), Director General, NACOSTI, address guests during the presentation ceremony.



icipe has been granted a Certificate of Registration, jointly endorsed by the Cabinet Secretary, Ministry of Education, Science and Technology, and the Director General, National Commission for Science, Technology and Innovation (NACOSTI), Kenya.

The certification signifies *icipe*'s compliance with the Science, Technology and Innovation Act (No. 28 of 2013), which,

in part, mandates NACOSTI to regulate and assure quality in the science, technology and innovation sector.

This milestone is significant as, in effect, it recognises *icipe*'s contribution to research, development and capacity building, leading to the development of technologies and strategies for socioeconomic transformation of communities across Kenya, and indeed Africa.

BIOINNOVATE AFRICA FIRST OPEN CALL

Applicants must demonstrate a strong and realistic practical linkage between their biological based research idea or technology to business.

The Bioresources Innovations Network for Eastern Africa Development (BioInnovate Africa) Programme has announced a three-year grant fund totalling US\$ 5 million to enable collaboration between scientists, researchers, innovators and entrepreneurs in eastern Africa to turn innovative ideas and technologies based on biological sciences into viable businesses.

Currently operational in Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda, with the support of the Swedish International Development Cooperation Agency (Sida), BioInnovate Africa Programme is based at the *icipe* Dudaiville Campus, Nairobi.

The Programme is inviting concept notes from teams resident in the six eastern African countries mentioned above, under two thematic areas. The first theme is for innovations focused on adding value to agricultural produce and related raw

plant and animal materials. The second encompasses innovations with potential to convert biological waste and crop or plant residues from agricultural processes, to mitigate climate change and support environmental sustainability.

Applicants should be formally affiliated with universities, public research organisations or private firms. They must demonstrate a strong and realistic practical linkage between their biological based research idea or technology to business. Applications should also articulate the potential of the idea or technology and how or whether smallholder farming communities and agricultural and biological processing firms in eastern Africa are likely to benefit.

Details are available at:

www.bioinnovate-africa.org

Submission deadline: Tuesday 30 May 2017, no later than 23:59 hours.

PROF. BILL HANSSON ELECTED ASSOCIATE FELLOW OF AAS

Prof. Dr Bill Hansson, Vice Chair, *icipe* Governing Council, has been elected Associate Fellow of the African Academy of Sciences (AAS). Headquartered in Nairobi, Kenya, AAS is the premier pan-African institution for recognition of excellence and promotion of science, technology and innovation for sustainable development in Africa. The AAS associate fellowships are awarded to individuals who, though not nationals of African countries, have contributed to the development of science on the continent. Prof. Hansson is a Swedish researcher based at the Max Planck Institute for Chemical Ecology, Jena, Germany, and

at the Max Planck headquarters in Munich, Germany. For the past eight years, he has been part of the leadership of the Swedish Linnaeus project Insect Chemical Ecology, Ethology and Evolution. During his career, he has also worked at universities and research institutions in Germany, Sweden, Japan, Kenya, the United Kingdom and the United States. Indeed, Prof. Hansson has had a strong connection with *icipe* since the early 1990s, when he worked at the Centre on locust and stemborer chemical communication. In addition, he has been a member of the *icipe* Governing Council since 2006, and served as its chair 2014 – 2016.



Prof. Dr Bill Hansson
Vice Chair, *icipe* Governing Council

MALARIA AND IRRIGATION



As is the case with many sub-Saharan Africa countries, Kenya is currently embarking on a number of large irrigation projects, as a way of reducing over-reliance on rainfed agriculture. However, while irrigation can improve food security, the approach also causes considerable land use changes with negative implications for malaria and other mosquito-borne diseases.

icipe has recently commenced a study to investigate how irrigation will affect the goals of the Kenya Malaria Strategy. The research will be conducted in Busia County, western Kenya, where the Kenyan government is establishing an irrigation project expected to cover 4000 hectares.

The *icipe* study is unique as it provides the opportunity to investigate in collaboration

with the Kenya National Irrigation Board, the mosquito and malaria status quo pre-irrigation, and to assess the changes as the irrigation scheme progresses.

The Centre aims to generate reliable information to enable policymakers and stakeholders to allocate resources and adopt strategies to alleviate health risks in an integrated 'One Health' approach towards malaria elimination.

The research is being conducted through a Wellcome Trust Postdoctoral Training Fellowship in Public Health and Tropical Medicine awarded to Dr Oscar Mbare, who will be mentored by scientists from *icipe*, the London School of Hygiene and Tropical Medicine, and from Durham University, United Kingdom.

SAFE TECHNOLOGIES FOR THRIP CONTROL



icipe, Keele University and Harper Adams University (both in the United Kingdom), have received funding from UK Aid through the Global Challenges Research Fund (GCRF) project, to develop novel technologies for the control of bean flower thrips in cowpea and other legumes, as an alternative to insecticides.

Across SSA, cowpea, *Vigna unguiculata*, is a major crop that is cultivated by an estimated 38 million growers, besides being the only source of protein for over 200 million people who cannot afford meat, fish or milk products. Indeed, close to 94% (5.2 million tonnes) of the annual global production of cowpea is harvested in Africa.

However, the bean flower thrips (*Megalurothrips sjostedti*), a key pest of legumes, threaten the production of cowpea in the continent, causing yield losses of 20-100%. In an attempt to control the pest, many smallholder farmers over-rely on chemical insecticides, compromising the safety of the yield due to high levels of pesticide residues.

Previous research by *icipe*, Keele University and Plant Research International, The Netherlands, identified special chemicals (pheromones) released by male bean flower thrips, which can attract males and female species of the pest. Field assessments indicated that these pheromones can enhance the ability of traps to capture thrips by over 130%.

Such behaviour modifying pheromones can be integrated with other thrips management options, such as biopesticides. For instance, the pheromones can be combined with other plant based attractants to draw thrips away from the crop to a focal point where the pests are then infected with insect pathogenic fungi. *icipe* and partners will develop this innovative thrips management strategy, commonly referred to as autodissemination, lure and infect or spot-spray, primarily for cowpeas, and other similar crops in Kenya. The researchers intend to build capacity for thrips research and provide opportunities for postdoctoral training for African researchers and facilitate scientific exchanges between Kenya and the UK.

BEE GUT MICROBIOTA



Significant declines in bee populations over the last two decades have raised concerns in Europe and North America. While such a phenomenon has not yet been reported in Africa, devastating bee pathogens such as mites and viruses are being increasingly found in the continent. As a result, bee health is now a priority of national governments, development agencies as well as farmers and beekeepers.

icipe, Kenya Agricultural and Livestock Research Organization (KARLO) and the University of Liverpool, UK, have received a grant from the Newton Fund to develop microbe-based strategies for improved bee health. The research will involve characterising the gut microbiota of African honey bees, the 'friendly bacteria' that aid insect defence against pathogens. Overall,

these studies will contribute towards food security in Kenya by reinforcing bee pollination services, and also enhance rural incomes by bolstering the quality and quantity of bee derived products.

In addition, the research is envisioned to elevate *icipe*'s ongoing bee gut microbiota studies to world-class status, connecting it to European and USA networks. Further, this research project will contribute to the understanding of the causes of global bee population declines and develop a potential bee health diagnoses technique based of bee gut microbiota characterisation.

A panel library of bee gut microbiota will also be established, forming an invaluable tool for future *icipe* research and for the scientific community.

SCHISTOSOMIASIS RESEARCH

icipe, Kenya Medical Research Institute (KEMRI), Egerton University, Kenya, the University of Aachen and the Helmholtz Centre for Environmental Research, Leipzig, both in Germany, have received a research grant from the German Research Foundation (DFG), to conduct studies on Schistosomiasis, a neglected tropical disease.

Caused by blood flukes (trematode worms) of the genus *Schistosoma*, this acute and chronic parasitic ailment is transmitted through contaminated fresh water (lakes and ponds, rivers, dams) inhabited by snails carrying the parasite. Larvae from the snails, once in contact with an individual, penetrate the skin and then develop into

adult schistosomes that live in the blood vessels for years. The females continue to release eggs, some of which are passed out of the body in the faeces or urine thereby continuing the parasite's lifecycle. Others become trapped in body tissues, leading to immune reactions and progressive damage to organs.

Schistosomiasis disables more than it kills, resulting in significant economic and health impacts. In children, the disease can cause anaemia, stunting and a reduced ability to learn, although the effects are usually reversible with treatment.

Estimates show that at least 258 million people in 52 endemic countries required preventive treatment in 2014 alone. Around 90% of those most vulnerable to Schistosomiasis live in Africa, with the disease being overly prevalent in communities without access to safe drinking water and adequate sanitation.

In Kenya, control of Schistosomiasis involves largescale treatment of population groups at risk, provision of safe water, improved sanitation, hygiene education and snail control. This latter aspect is an important component in the fight against Schistosomiasis, and a clear understanding of the snails' ecology is required to predict its distribution and vectorial capacity.

Therefore, the research by *icipe* and partners, which will be conducted in western Kenya, will have two thrusts. The first is investigations of the effect of freshwater pollution (specifically the direct and indirect effects of pesticide pollution) on the distribution and vector competence of *Schistosoma* host snails in freshwater streams. The second research aspect will be an assessment of exposure of water and biota to pesticides and other pollutants to investigate the exposure of host snails as well as of competitors to pesticides and other potentially toxic chemicals.

Schistosomiasis disables more than it kills, resulting in significant economic and health impacts.

FRUIT FLY DISINFESTATION

icipe research has provided sufficient evidence to allow plant protection organisations and trading partners to open market access previously blocked due to the presence of fruit fly species *Bactrocera dorsalis*.

A study by *icipe* has demonstrated a postharvest fruit fly disinfestation treatment that is non-damaging to mangoes and is also more cost effective for exporters of the fruit.

Specifically, the research, which was conducted by Shepard Ndlela, a PhD scholar at the Centre, evaluated disinfestation of the highly destructive *Bactrocera dorsalis* fruit flies in apple mango, the most widely grown and exported mango variety in East Africa.

Fruit flies are quarantine pests, and their presence in many African countries restricts the export of produce from the continent to European markets. To ensure quarantine security, many importing countries require very specific postharvest disinfestation treatments of fruits to get rid of fruit flies. Currently, the internationally adopted fruit fly disinfestation protocol is intended to achieve Probit 9, a treatment standard that results in 99.9968% mortality of fruit flies.

One postharvest disinfestation treatment method for mango is by immersing the fruit in hot water at stipulated temperatures and durations. The *icipe* study showed that dipping mango in water at 46.1°C for 81.47 minutes is sufficient to disinfest mango of *B. dorsalis*, and achieve Probit 9. These findings fall within the European Union quarantine security treatment level,

which recommends 65 to 90 minutes at 46°C, depending on the shape and size of the fruits. However, the *icipe* research also showed that a shorter exposure time of 68 minutes at 46.1°C causes 99.99% mortality of fruit flies in the most heat-tolerant immature stage (third instar) of the pest.

The results provide parameters and opportunities for private sector companies interested in establishing a postharvest treatment plant for disinfesting fruits off fruit flies. *icipe* has already been contacted by Kibwezi Agro Ltd, a major, Kenya-based mango exporter, to assist in establishing a postharvest treatment facility, guided by the scientific information generated in this publication. It is important to note that these findings should be applied to other mango varieties with caution. *icipe* will continue to develop protocols based on different fruit fly species present on widely exported mango varieties.

Shepard is registered at the University of Nairobi, Kenya. This study was supported by a grant from the German Federal Ministry for Economic Cooperation and Development (BMZ) to the *icipe* African Fruit Fly Programme, and a student fellowship to Shepard by the German Academic Exchange Service (DAAD) through the African Regional Postgraduate Programme in Insect Science.

TICKS AND PATHOGENS DIVERSITY

The research has produced breakthrough knowledge towards addressing gaps on the diversity of ticks and the pathogens they transmit, in areas of intensified human-livestock wildlife interactions.

Ticks are key vectors of emerging infectious zoonotic pathogens in Africa. However, there is limited understanding of the diversity of ticks and the pathogens they transmit, especially in areas of intensified human-livestock-wildlife interactions, a scenario that often constrains development of effective disease prevention and control strategies.

Research by Micky Mwamuye, a Dissertation Research Internship Programme (DRIP) MSc fellow, has produced breakthrough knowledge towards addressing these gaps. The study, conducted in Shimba Hills National Reserve, one of Kenya's high biodiversity areas facing considerable human encroachment, demonstrates previously unidentified tick-pathogen relationships as well as a unique tick diversity, which may contribute to livestock, and possibly human, morbidity in the region.

Notably, the research makes the first molecular detection of *Anaplasma phagocytophilum*, a zoonotic bacteria, in *Rhipicephalus maculatus* ticks. The study also reports, for the first time,

Ehrlichia chaffeensis, a zoonotic pathogen transmitted by *Amblyomma americanum*, and *Coxiella sp.*, *Rickettsia africae* and *Theileria velifera* parasites in *Amblyomma eburneum* ticks.

The researchers therefore recommend routine surveillance in areas similar to the Shimba Hills National Reserve, to clarify disease transmission dynamics and identify novel potential pathogens, as a critical step towards better tick-borne disease diagnosis, prevention and control measures. The results also form an important basis for conservation efforts to minimise the impact of human activities in high wildlife diversity areas, to combat emergence of zoonotic diseases.

Micky was registered at the University of Nairobi, Kenya, and is now a lecturer at Pwani University, at the Kenyan coast. This research was funded through the *icipe* special innovative idea project grant and was conducted in collaboration with the Kenya Wildlife Service.

Paper link: <http://www.sciencedirect.com/science/article/pii/S1877959X16301406>

BEAN WEEVIL ACOUSTICS



Every year, in sub-Saharan Africa (SSA), significant volumes of food (estimated to amount to the caloric needs of 48 million people) are lost after harvest.

One of the challenges in the quest towards postharvest losses reduction is the difficulty in detecting the presence of insect pests that damage food in storage.

A study by Anastasia Njoroge, an *icipe* DRIP PhD scholar, has contributed knowledge towards exploiting the sounds made by insects to develop early warning systems to control storage pests.

The research investigated the acoustics characteristics of the bean weevil, *Acanthoscelides obtectus*, a major legume pest. Because of the cryptic nature of its larvae, which spend most of their developmental stage inside bean seeds, this pest is largely imperceptible, until when the larvae emerge as adults.

The findings of this study indicate that the sounds produced by the bean weevil larvae and adults have different temporal patterns.

Therefore, the larvae acoustic signals can be exploited for early detection of pest, permitting timely intervention.

The research was conducted in partnership with the University of Kassel, Germany, and United States Department of Agriculture, Agricultural Research Service (USDA-ARS), Center for Medical, Agricultural, and Veterinary Entomology, and the University of Florida, both in Gainesville, Florida, USA.

The study was funded by the Federal Ministry for Economic Cooperation and Development (BMZ)/ the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, through the RELOAD Project.

Paper link: <http://www.bioone.org/doi/full/10.1653/024.100.0116>



REARING QUEENS

In a bee colony, the quality of the queen has a profound impact on honey production, disease prevalence and pollination ability of bees.

As such, queen rearing is an essential part of beekeeping as a way of producing bees with desirable qualities and improving productivity. The process should be guided by a thorough understanding of bee biology, which, though well researched across the world, is understudied for African bee races.

To address existing gaps, *icipe* has recently conducted a study in Kenya on

the effect that the age of grafted larvae and supplemental feeding in rearing colonies, has on reared queens of the African honey bee, *Apis mellifera scutellata*.

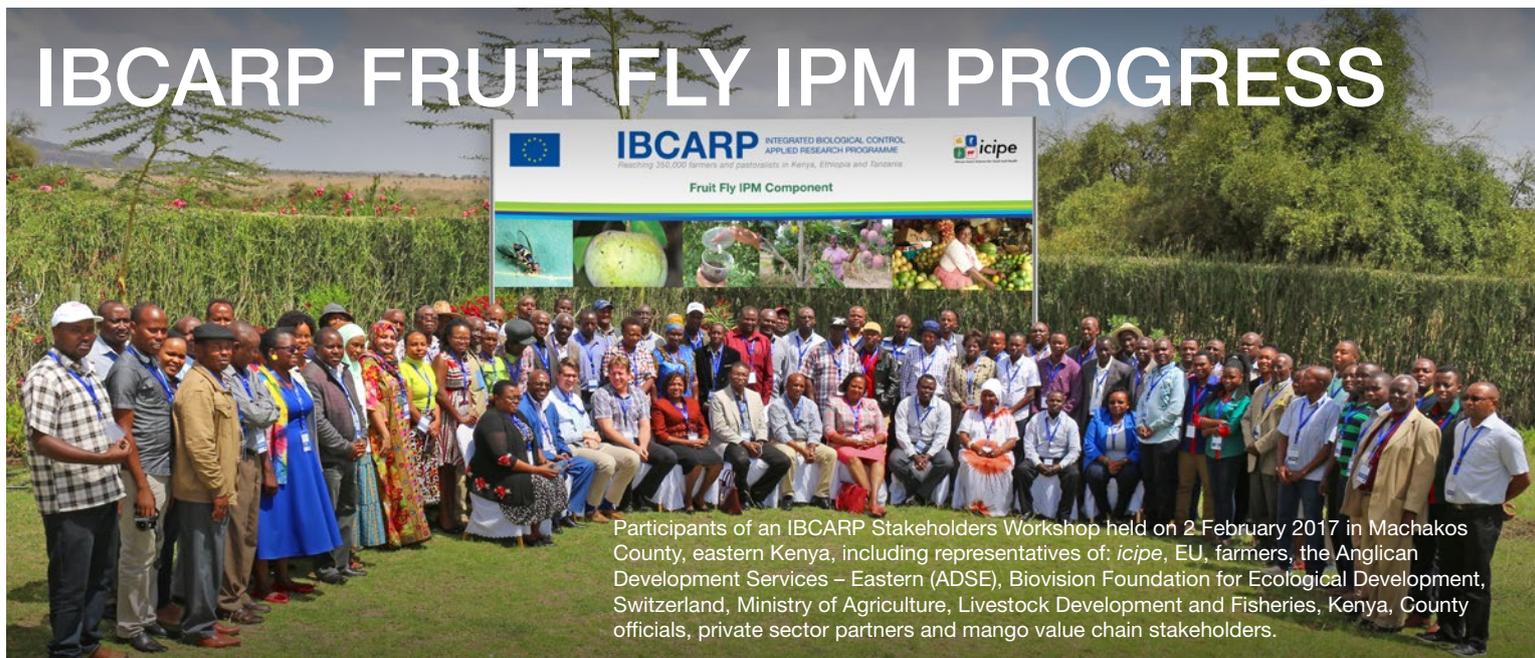
In a recently published paper, the researchers report that, in consistence with studies conducted on bees in America and Europe, younger bee larvae of *A. mellifera scutellata* are most suitable for queen rearing. In addition, supplemental feeding enhances the quality of reared queens. No significant differences were observed in egg laying between queens produced through natural mating and those that had been artificially inseminated.

This study is important as it is the first of its kind in the region. In addition, the findings are useful in selecting the best breeds of honey bee subspecies in East Africa, and towards improving queen rearing methods.

The research was conducted by Loise Kawira Njeru, an MSc student within the *icipe* Bee Health project, with funding from the European Union (EU) and the International Fund for Agricultural Development (IFAD).

Paper link: <http://www.tandfonline.com/doi/full/10.1080/00218839.2017.1307714>

IBCARP FRUIT FLY IPM PROGRESS



Participants of an IBCARP Stakeholders Workshop held on 2 February 2017 in Machakos County, eastern Kenya, including representatives of: *icipe*, EU, farmers, the Anglican Development Services – Eastern (ADSE), Biovision Foundation for Ecological Development, Switzerland, Ministry of Agriculture, Livestock Development and Fisheries, Kenya, County officials, private sector partners and mango value chain stakeholders.

Close to 40,000 fruit growers across Africa are now using *icipe*'s integrated pest management packages for the control of fruit flies.

Of these farmers, 8,000 have gained access to the strategies over the past two years through the Integrated Biological Control Applied Research Program (IBCARP), an initiative aimed at supporting the adoption of *icipe* technologies and strategies for improved cereal, horticulture and livestock productivity by an estimated 350,000 additional farmers and pastoralists in Kenya, Ethiopia and Tanzania.

IBCARP is funded by the European Union (EU) through a Euro 12 million grant with additional funds from *icipe*'s core funding provided by UK Aid from the UK Government, Swedish International Development Cooperation Agency (Sida), the Swiss Agency for Development and Cooperation (SDC), Federal Ministry for Economic Cooperation and Development (BMZ), Germany, and the Kenyan

Government, as well as support from other sources.

The *icipe* fruit fly IPM package includes: use of fungi-derived biopesticides; baiting and male annihilation techniques; biological control with parasitoids; cultural control through field sanitation; minimal use of pesticide in localised bait stations of spot spray, and proper postharvest treatment to provide and assure quarantine security.

The packages are aimed towards reducing yield losses and the huge expenditure incurred by farmers to purchase chemical pesticides. They are also intended to mitigate the health and environmental risks associated with the use (and misuse) of such chemicals. Overall, the IPM strategies should increase the market competitiveness of fruits from sub-Saharan Africa (SSA) and, as a result, elevate the income and livelihoods of people involved in the value chain.

A recent socioeconomic impact

assessment of the project shows that the use of two to three *icipe* fruit fly IPM components increased the net income of smallholder growers by 22-48% relative to the control, and insecticide use and mango rejection were reduced by 46% and 55%, respectively.

The IPM packages have been developed by *icipe* in collaboration with partners from Africa, Asia, Europe and USA. The Centre's fruit fly IPM activities commenced close to two decades ago, their basis laid through basic knowledge to develop a comprehensive management package, with support from the International Fund for Agricultural Development (IFAD).

Since then, funding has been obtained from: the German Federal Ministry for Economic Cooperation and Development (BEAF), implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ); Biovision Foundation for Ecological Development, Switzerland; the Food and Agriculture Organization (FAO) of the United Nations; the International Atomic Energy Agency (IAEA); the UK Department for International Development (DFID); the United States Agency for International Development (USAID); the United States Department of Agriculture, Foreign Agriculture Service (USDA-FAS) in coordination with USDA Animal and Plant Health Inspection Service (USDA-APHIS) and the EU; and *icipe* core donors UK Aid from the UK Government, Sida, SDC, BMZ, and the Kenyan Government.



Mr Steve Wathome, Programme Manager, Agriculture and Rural Development, EU Delegation to Kenya, addressing workshop participants.



Mr Peter Kilonzo Ngovi, a mango farmer from Machakos and one of the beneficiaries of IBCARP project, inspects his healthy crop, a result of the *icipe* fruit fly IPM technologies.

GENDER AND AGRICULTURAL TECHNOLOGIES



Participants of the Structural Transformation of African Agricultural and Rural Spaces: Gender and Adoption of Agricultural Technologies in East Africa workshop organised by *icipe* and PEP on 17 March 2017.

icipe and the Partnership for Economic Policy (PEP) (<https://www.pep-net.org/>), working within the Structural Transformation of African Agriculture and Rural Spaces (PEP-STAARS) (<https://www.pep-net.org/staars>) initiative, are contributing critical knowledge to understand factors that affect adoption of agricultural technologies in sub-Saharan Africa (SSA).

Although agricultural technologies could increase crop productivity, contribute to food security and strengthen incomes for many people, there is low adoption and mixed results of such approaches. Further, since women contribute more than 65% of agricultural production in the region, gender equality in production systems can pivot the translation of SSA's agricultural socioeconomic transformation potential into a reality. However, women have fewer opportunities and access to productive agricultural resources, including technologies. Also, many agricultural technologies are gender biased in design and implementation, leading to their low adoption by women farmers.

Overall, factors that affect adoption of agricultural technologies in SSA are generally not studied in a systematic way, and associated research methodologies are not robust enough.

At a workshop held on 17 March 2017, *icipe* and PEP presented findings obtained through four research projects: Three of the studies were conducted by the *icipe* Social Science and Impact Assessment Unit, including: *Does adoption of push-pull technology induce productivity growth and aggregate poverty reduction? A case study in western Kenya*; *Does gender matter in adoption of sustainable agricultural technologies?* and *A case of push-pull technology in Kenya?; Women's empowerment in agriculture and household productivity: Evidence from rural maize farmer households in western Kenya* (which was co-funded by the PEP-STAARS initiative). The fourth study, conducted by a PEP-STAARS fellow based at the University of Nairobi, Kenya, focused on the adoption and dis-adoption of improved maize varieties in Tanzania.

The forum re-emphasised and demonstrated the importance of technology adoption and gender equity in agriculture, and existing challenges. Stronger methodological rigour, theory and application to policy, and capacity building of young economists, were also highlighted, to realise Africa's strong potential in research leadership. Requirements were also identified for clear articulation of gender, as well as the

mainstreaming of gender in agriculture as a research priority. Importantly, the forum observed a disconnect between research and policy, noting the crucial need to translate research results into strong policy statements. A gap was also flagged between researchers and the private sector, as a key player in developing and disseminating appropriate technologies for farmers.

This research was conducted with financial support from the Government of Canada through the International Development Research Centre (IDRC), and by UK Aid from the UK Government, and the European Union-funded Integrated Biological Control Applied Research Program (IBCARP) through *icipe*.

PEP also receives core funding from UK Aid and IDRC. Other partners of the STAARS consortium include the African Development Bank (AfDB), the African Economic Research Consortium (AERC), the CGIAR Research Program on Policies, Institutions and Markets (PIM), Cornell University, USA, and the World Bank.

icipe IN ETHIOPIA



icipe is strengthening its presence in Ethiopia, a strategy that includes upscaling the geographical scope and focus of R&D activities.

On 27 February 2017, the *icipe* Ethiopia Office organised a seminar to present findings regarding the economic benefits of using a holistic 4Hs (Human Health, Animal Health, Plant Health and Environmental Health) approach in the Centre's research and development (R&D) activities.

A case study of *icipe*'s work in Oromia Region, Ethiopia, demonstrates that, on average, the implementation of just one 4H intervention increases a household's net annual income by 49%, relative to baseline scenario. However, when a combination of 4H components are applied, household net annual income can go up by an additional 126%, compared to a single intervention.

The advantages of multiple interventions are higher when assessed from a baseline scenario, with a 237% net income average increase observed. The *icipe* interventions can also raise the price of farm land, by as much as 100% when a single intervention is used. The research, which was conducted by the *icipe* Social Science and Impact Assessment (SSIA) Unit, was funded by Biovision Foundation for Ecological Development, Switzerland.

The seminar, led by Dr Menale Kassie, Head, SSIA, which was attended by

40 participants consisting of scientists and researchers from *icipe* and several international research institutions, is part of the Centre's ongoing efforts to strengthen its presence in Ethiopia, a strategy that includes upscaling the geographical scope and focus of R&D activities, and bolstering linkages with government, private sector and development agencies in the country. Ongoing initiatives are: integrated vector management for malaria; commercial beekeeping and scaling up push-pull technology funded by Biovision Foundation for Ecological Development, Switzerland; Integrated Biological Control Applied Research Program (IBCARP), funded by the European Union to support the adoption of the Centre's technologies and strategies for improved cereal, horticulture and livestock productivity; the MasterCard Foundation-funded Young Entrepreneurs in Honey and Silk (YESH) project; maize, rice, chickpea integrated pest management (IPM) project funded by USAID Feed the Future through Virginia Tech University, USA.

icipe has also been reinforcing the capacity of the Ethiopia Office, which now has 44 staff members (16 of them based in field sites across the country) 44 including graduate students four postgraduate students.

APPOINTMENTS



Dr Michael Lattorff joined *icipe* in February 2017 as Head of Environmental Health Theme. Previously, he held positions as Assistant Professor in Molecular Ecology and as Professor of Animal Physiology at Martin-Luther-University Halle-Wittenberg, Germany. For more than a decade, he conducted research on the genetics,

physiology and ecology of bees with a special interest in host-pathogen-interactions. He uses techniques like genomics, transcriptomics and other molecular methods to infer behavioural and physiological adaptations in pollinator insects with respect to bee health and diseases. Dr Lattorff is also interested in determining effects of bee products on bee health due to antioxidant and antimicrobial activities.



Dr Christopher Mutungi has been appointed a Postdoctoral Fellow in Postharvest Technology, to conduct research on acoustic early warning systems for control of insect and rodent pests in grain stores. Prior to his appointment, he was a consultant at *icipe*, focusing on the development, testing and dissemination of

hermetic storage technologies. A Food Technologist, Christopher holds a PhD in Food Engineering from Technische Universität, Dresden, Germany. He has over 10 years of experience in research, training and technology transfer, in postharvest value chains of cereals, legumes and root and tuber crops. He is also competent in working with farmers, extension staff and private sector partners, and has a passion for capacity building, with a good track record of mentoring students in food and feed processing, preservation and storage.



Dr Janet Irungu has been appointed the new Head, *icipe* Bioprospecting Programme. Having joined *icipe* in 2013, Janet has since then been a scientist in the Bee Health project, where her research has focused on conducting analysis on pesticide residues in food and their effect on pollinators and human health. She has also been developing alternative sustainable natural strategies by exploiting semio-chemical based pest management techniques to control African honey bee pests. In addition, Janet has been working on identifying and characterising natural products, plants of medicinal value and related quality control processes.

Janet received postgraduate training in the USA, including a PhD in Bio-analytical Chemistry from the University of Kansas; a BSc in Chemistry and Biology from Park University, Missouri, as well



Ms Shira Bayigga Mukiibi has been appointed Business Development Manager of the *icipe*-based Bioinnovate Africa Programme, a regional initiative supported by the Swedish International Development Cooperation Agency (Sida). Prior to joining Bioinnovate Africa, Ms Mukiibi was Manager of the Renewable Energy

Business Incubator (REBi), at the College of Engineering, Design Art and Technology, Makerere University Kampala. She was previously a Start-up Manager Solar Assembly Plant at African Village Ltd, Entebbe, Uganda. Overall, Ms Mukiibi has around 12 years of work experience in the private sector in the areas of clean energy technologies, operations management and business incubation. She holds an MBA from Nanyang Technological University, Singapore, and a BSc in Civil Engineering from Makerere University, Uganda.



Mr Arnold Mwanzu has joined *icipe* as Information Resource Centre Coordinator. Previously, he was a Senior Librarian, Digital Repository and Head of Archives at the United States International University (USIU) Library and Information Centre. He has also served as the Librarian/ ICT Manager, Regina Pacis University College.

Mr Mwanzu holds an MA in Library and Information Science (MLIS) from Kenyatta University, Kenya; an MSc in Organizational Development from USIU, and a Management Information Systems certification (Lib@web Programme) from University of Antwerp, Belgium. He also holds a BA in Information Science from Kenyatta University.

as pharmacy training from University of Missouri Kansas City. In addition, she is also a certified public accountant (CPA), from the Strathmore School of Professional Studies in Kenya.

Prior to joining *icipe* in 2013, Janet worked at Sigma-Aldrich Biotech headquarters in St. Louis, Missouri, USA as a senior analytical research and development scientist, where she was involved in developing new products for research and biotech, generating application data to support marketing of new biotech products, evaluation of new technologies for business development, coordinating projects with project managers and team leaders to ensure successful completion of clients' projects, and led problem-solving initiatives in support of high-value products.

Her research interests include using various analytical techniques to address pressing needs in environmental, plant, human and animal science in support of new product development that can improve livelihoods and quality of lives.

RETIREMENTS



Dr Rajinder Kumar Saini, previously Head of the Animal Health Theme, retired from *icipe* on 10 January 2017 after 40 years of service to the Centre.

A specialist in insect behaviour and chemical ecology, Dr Saini's research at *icipe* has generally been on the development of tools and strategies for shortening the

life span of vectors of diseases, especially tsetse flies – vectors of trypanosomiasis through development of traps and odour baits.

Recently, his work has focused on the prevention or suppression of the interaction between the insects carrying the pathogen and their vertebrate hosts, through identification of repellents that are involved in differential attraction of vertebrate hosts /non hosts and on identification of synthetic repellents.

In his early career, he was instrumental in the identification of the oviposition aggregation pheromone of the gregarious desert locust *Schistocerca gregaria* and the larviposition pheromones of *Glossina* species.

Dr Saini's current projects also involve working closely with the private sector for technology development, validation and optimisation for large scale dissemination. These initiatives are

designed and implemented with active community participation and involvement of national systems/government ministries and non governmental organisations (NGOs).

During the course of his career, Dr Saini has developed, coordinated and provided technical leadership to several large research and development projects (from US\$ 1 – 5 million) at *icipe* funded by a variety of donors. Most recently, he coordinated the tsetse repellents and the camel health components of the European Union-funded Integrated Biological Control and Applied Research Project (IBCARP).

Dr Saini is a member of the African Union's International Scientific Council for Trypanosomiasis Research and Control (ISCTRC) and is also a member of the Food and Agricultural Organization of the United Nations (FAO) steering committee for the Programme Against African Trypanosomiasis (PAAT). In addition, he serves on the expert panel for trypanosomiasis for the World Health Organization (WHO). He published extensively, and also has two patents to his credit.

He holds an MSc from the University of Nairobi, Kenya, and a PhD from the University of Wales, United Kingdom. He undertook postdoctoral research at the United States Department of Agriculture – Agricultural Research Services (USDA-ARS) insect attractants and basic biology research laboratories in Gainesville, Florida USA.



Prof. Suresh Raina has retired from *icipe* where he most recently served as the Team Leader, Environmental Health, and Programme Leader, Beneficial and Commercial Insects.

Prof. Raina joined *icipe* in June 1990 as a research scientist, with a grant from the World Bank to develop a biological control

strategy for grasshoppers in the Sahel. Since 1994, with support from the International Fund for Agricultural Development (IFAD), he has led the initiation and advancement of the *icipe* Commercial Insects Programme, which is aimed at improving the livelihood of communities across Africa through science-led sericulture and modern apiculture enterprises.

He has also overseen the African Reference Laboratory for Bee Health, a partnership between *icipe* and the African Union Inter-African Bureau for Animal Resources (AU-IBAR), which provides a focal point for cutting-edge research towards improved bee health and pollination services, with the ultimate aim of enhancing

the livelihoods of beekeepers and farmers across Africa, through improved honey products and crop productivity.

A native of Nagpur, India, Prof. Raina has close to 50 years of experience in designing and implementing livelihood related programmes bringing together insects and the environment. He earned an MSc in entomology and cytogenetics at Nagpur University and a PhD in insect neuroendocrinology from the same university, co-supervised by the Agriculture Canada Research Station, Saskatoon. Through a fellowship from Rotary International, Illinois, USA, and the International Development Research Centre (IDRC), Canada, he undertook postdoctoral training between 1977 and 1980 at the Agriculture Canada Research Station, Saskatoon. He returned to Nagpur University with a grant from IDRC and the Universities Grant Commission (UGC), India, to establish a centre of sericulture and biological pest management. He was awarded a research professorship in 1988 by IDRC Canada, endorsed by Nagpur University. Through a United States Department of Agriculture (USDA) grant, he identified and introduced a biological control agent to eradicate citrus blackfly in orange orchards, an endeavour that won him a certificate of appreciation from USDA in 1990.

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Core donors

- Aid for Africa, USA
- Federal Ministry for Economic Cooperation and Development (BMZ), Germany
- Ministry of Higher Education, Science and Technology, Kenya
- Swiss Agency for Development and Cooperation (SDC), Switzerland
- Swedish International Development Cooperation Agency (Sida)
- UK Aid, Government of the United Kingdom

Restricted project donors

- ACDI/VOCA Agribusiness Systems International (ASI) Kenya
- African Union
- African Women in Agricultural Research and Development (AWARD)
- AIRD (French Inter-institution Agency for Research and Development)
- Australian Centre for International Agricultural Research (ACIAR)
- Biotechnology and Biological Sciences Research Council, UK, through Rothamsted Research, UK
- Biovision Africa Trust
- Biovision Foundation for Ecological Development, Switzerland
- Canadian Government through International Development Research Centre (IDRC)
- CIRAD – Agricultural Research for Development, France
- Consortium for National Health Research (CNHR), Kenya
- Cultivate Africa's Future (CultiAF) through International Development Research Centre (IDRC)/Australian Centre for International Agricultural Research (ACIAR)
- European Union
- Food and Agriculture Organization of the United Nations (FAO)
- German Academic Exchange Service (DAAD)
- German Research Foundation (DFG)
- Global Environment Facility (GEF)/United Nations Environment Programme (UNEP)
- Grand Challenges Canada (GCC)
- Humidtropics CGIAR Research Programme (CRP) led by International Institute of Tropical Agriculture (IITA)
- International Atomic Energy Agency (IAEA)
- International Centre for Genetic Engineering and Biotechnology (ICGEB)
- International Fund for Agricultural Development (IFAD)
- IRD, Institut de Recherche pour le Développement, France
- Liechtenstein Development Service (LED), Principality of Liechtenstein
- McKnight Foundation, USA
- Ministry for Foreign Affairs of Finland
- National Commission for Science, Technology and Innovation (NACOSTI), Kenya
- Netherlands Organisation for Scientific Research (NWO)
- Newton Fund
- R. Geigy Foundation, Switzerland
- Research Institute of Organic Agriculture (FiBL), Switzerland
- Russell IPM Ltd, UK
- Swiss National Science Foundation (SNSF)
- SWITCH Africa Green
- The MasterCard Foundation, Canada
- The Volkswagen Foundation, Germany
- United Nations Environmental Programme (UNEP)
- USAID—United States Agency for International Development's IPM Innovation Lab (Feed The Future Innovation Lab for Integrated Pest Management) of Virginia Tech, USA
- United States Agency for International Development Partnerships for Enhanced Engagement in Research (USAID-PEER) Science program with funding from National Academy of Sciences (NAS)
- United States Department of Agriculture (USDA)
- United States National Institutes of Health (NIH)
- United States National Science Foundation (NSF)
- Wellcome Trust, UK
- World Federation of Scientists through the ICSC-World Laboratory
- World Health Organization
- World Trade Organization (WTO) – Enhanced Integrated Framework (EIF)

In realising its mission, *icipe* also benefits from extensive partnerships with research partners (including universities and research institutes in Africa and beyond), private sector partners, and communities across Africa.

For more information on these and other topics, please visit our

Website: <http://www.icipe.org> or contact us through our

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