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icipe BY NUMBERS

2020

icipe 50th Anniversary (jubilee year).

1,394

Farmers, young entrepreneurs, policymakers and trained through the Insects for Food and Feed programme.

29

Peer reviewed journal publications published between October and December 2019.

2

Calls for grants open through the *icipe*-managed Regional Scholarship and Innovation Fund (<https://www.rsif-paset.org/calls/icbp-grants/>).

400

Individuals including researchers, scholars and private sector partners working directly with the *icipe* managed Bioinnovate Africa Programme (<https://bioinnovate-africa.org/>).



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

“The activities in this e-bulletin embody *icipe*'s ideal of scientific excellence: the balance between world class knowledge, and real, transformative solutions for developmental challenges.

Dear Friends and Colleagues,

I am most delighted to, once again, assume the position of Chair of *icipe* Governing Council. I would like to express my strong commitment to serve this unique and outstanding institution.

And in that spirit, I am honoured to welcome you to the final *icipe* e-bulletin for 2019, which presents the Centre's activities for October – December. We are gratified to close the year on a strong note, and I would like to single out two milestones achieved during the past three months.

First, is the completion of the Integrated Biological Control Applied Research Program (IBCARP), an initiative launched in 2015 to enhance adoption of the Centre's technologies and strategies for improved cereal, horticulture and livestock productivity in Kenya, Ethiopia and Tanzania. Supported by the European Union with additional funds from *icipe* core funds and other sources, IBCARP has generated extensive outcomes, impacting end-users and scientific knowledge, as shown in the [Research Highlights](#) section of this publication.

Second, is the commencement of the MOre Young Entrepreneurs in Silk and Honey (MOYESH) project, a partnership between *icipe* and the MasterCard Foundation and the Ethiopia Jobs Creation Commission. This five-year scheme aims to see 100,000 young men and women in Ethiopia secure dignified and fulfilling work along honey and silk value chains. As discussed in [From our Partners](#) section, authored by the Mastercard Foundation, the MOYESH project will strengthen the partnership between Mastercard Foundation and *icipe*, which started in 2016, to harness the youth as one of Africa's greatest resources.

Indeed, *icipe* is committed to the realisation of the potential of the youth as a demographic dividend for Africa. And the Centre's approaches and outcomes towards this goal are expounded in the Director General's [Thought Leadership Column](#).

Our regular columns, [Recently Published](#) and [Recently Funded](#) further demonstrate how, with support from our partners and collaborators, we are responding to emerging developmental issues and the aspirations of the African continent. At the same time, *icipe* is truly part of the global community, as evidenced in the [Newsmakers](#) and [Scene](#) sections of this e-bulletin.

Through our management of the BioInnovate Africa Programme (<https://bioinnovate-africa.org/>), one of Africa's largest regional innovation-driven science initiative, and the Regional Scholarship and Innovation Fund (<https://www.rsif-paset.org/>), we continue to build Africa's capacity of innovation.

The activities in this e-bulletin embody *icipe*'s ideal of scientific excellence: the balance between world class knowledge, and real, transformative solutions for developmental challenges. These elements have been at the core of *icipe* since the Centre's founding close to 50 years ago. And we enter our jubilee year, in 2020, with humility, hope and dedication to the same spirit.

We wish you happy holidays.

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



Dr Segenet Kelemu
Director General, *icipe*

Africa's youth as a demographic dividend

“*icipe* is committed to contributing to realising the potential of the youth as a demographic dividend for Africa.

One of *icipe*'s strengths is constant alertness to the changing developmental needs arising from emerging issues in Africa. Currently, the Centre recognises the urgent need to create productive employment for young people. Africa has the youngest population in the world, with more than 400 million people aged between 15 to 35 years. This “youth bulge” will become a demographic loss if the status quo is maintained. For example, while the young people make up 40 percent of the continent's workforce, they also comprise 60 percent of the unemployed. And that is not taking into account the “poor working youth”, that is, young people in vulnerable employment and those who are under-employed in informal sectors; or unpaid working youth, majority of them women. *icipe* is committed to contributing to realising the potential of the youth as a demographic dividend for Africa. The selected examples below demonstrate the Centre's approaches and outcomes towards the goal of harnessing the youth, as Africa's most valuable resource.

Dignified jobs



The dignity of any unemployed or under-employed person is compromised due to personal frustration, as well as the risk of marginalisation and social exclusion. In contrast, dignified jobs enable people to exploit the most valuable asset that they hold – their labour – leading to meaningful livelihoods, enhanced social status and, overall, healthy economies. One factor that may contribute to such opportunities, especially for the youth in Africa, is the transition from informal to formal economies. This policy driven process should be supported by efforts to increase skills and

specialisation, and endeavours to tap into the entrepreneurial potential of young people. Indeed, this is the vision of the MOre Young Entrepreneurs in Silk and Honey (MOYESH) project, a recently launched collaborative initiative between *icipe*, Mastercard Foundation and the Ethiopia Jobs Creation Commission. The MOYESH project aims to see 100,000 young men and women in Ethiopia secure dignified and fulfilling work along honey and silk value chains over the next five-years. The venture builds on *icipe*'s extensive experience in leading successful modern beekeeping and sericulture enterprises across Africa, including development and marketing of related innovative high quality products. MOYESH will capitalise on significant progress made through the Young Entrepreneurs in Silk and Honey (YESH), a project implemented in Ethiopia by *icipe* and the Mastercard Foundation between 2016 and 2019.

Agriculture and the youth



Agriculture has immense potential to create employment opportunities for young people, turning rural areas into sites of possibility and transformation, while also curbing urban migration and its associated challenges. However, agriculture continues to be perceived as an option for the older generation; the least educated; few young people consider farming a profitable or desirable opportunity. But, *icipe* technologies and strategies are successfully attracting young people to agriculture. For example 30% of all farmers using the Centre's Push-Pull technology are aged below 35 years. Push-Pull controls the main constraints of cereal production: *Striga*, stem borers and fall armyworm infestations, while also

“All *icipe*'s research activities are designed to to promote equality of opportunity and outcomes for women and men.

providing quality fodder and improving soil health. Young Push-Pull farmers include Peace Nakato, a 25 year old primary school teacher from eastern Uganda who has realised her passion for farming, while also rescuing her family's piece of land that was on the verge of being abandoned due to the various menace mentioned above. In addition to impressive cereal harvests, she also uses the technology as a platform to rear pigs, dairy cows and goats. *icipe*'s fruit fly integrated pest management strategies and technologies enhance the quality, quantity and marketability of yield. Access to the *icipe* IPM packages has provided a new lease on life for Joseph Wambua, a 31 year-old Kenyan and former urbanite. After an unsatisfactory stint as a computer programmer in Kenya's capital, Nairobi, Joseph relocated to Machakos County, a farming region in eastern Kenya, where he is using mango farming as a base for a thriving livelihood.

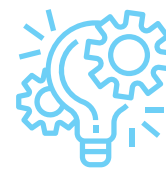
Unique partnerships



Against the din of the numerous odds stacked against them, it is easy to forget the amazing talent embodied in Africa's youth. Predominant narratives project young people as a passive demography. But *icipe* has had the privilege of welcoming the youth as a unique category of partners; ambitious, skilled, savvy, and apt in identifying solutions for socio-economic challenges. For example, our Insects for Food and Feed programme has linked us with Kimani Mungai, a 25-year-old Kenyan postgraduate degree holder from the UK, and an entrepreneur, focused on addressing the protein scarcity faced by farmers. Having started off selling brewer's yeast to dairy farmers to enhance milk yield, and to *icipe* for the manufacture of fruit fly bait, he has now co-founded a company specialising on black soldier fly farming for the feed industry. The entity is coordinating over 2000 farmers, collaborating with *icipe* to provide training and marketing, through a participatory out grower model and inclusive business approach. Meanwhile, in the heart of Kiambu County, Central Kenya, 24-year-old Talash Huijbers, who earned a degree from the Netherlands, has initiated a thriving

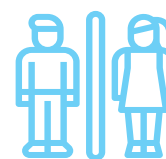
enterprise to rear BSF primarily for the fish industry with support from *icipe*.

Tech-driven initiatives



For long, the effective translation of knowledge, as well as transfer of technologies for impact has been a challenge for many research and development (R&D) organisations in Africa. The booming technology scene driven largely by mobile phones, has become an important platform for an R&D shift across Africa, for example by providing alternative dissemination pathways for knowledge and technologies. Capitalising on Africa's 'digital generation' – their technological ability and desire to lead socio-economic change – will create a win-win scenario for individuals and economies. For example, *icipe* has partnered with mHealth Kenya Ltd, a mobile phone based health solutions company, to develop and implement a cloud-based agrovet system known as LiMA to market and distribute the Centre's tsetse repellent collars. The result is an intergenerational effort that has mobilised community members across the spectrum, bolstering availability and accessibility of the tsetse repellent collars, creating mutual learning, income generation opportunities, big data and a platform to address other challenges like pest and disease surveillance.

Engendered approaches



Young women face substantial barriers to enter the labour market. Indeed, research shows that the chances of young women being unemployed are twice as high as those of young men. There is also evidence that technologies can effectively benefit women if designed and delivered with a gender lens. Therefore, all *icipe*'s research activities are designed to to promote equality of opportunity and outcomes for women and men. As a prerequisite, we continue to make extensive efforts to engender the research and development impact pathways of technology development and adoption; capacity development; and policy influence.

NEWSMAKERS *icipe* Governing Council Student Awards Winners

Best published science paper

Winner

Olabimpe Yewande Olaide (Nigeria)



Registered at: University of Pretoria, South Africa

Paper: Zebra skin odor repels the savannah tsetse fly, *Glossina pallidipes* (Diptera:Glossinidae). PLOS Neglected Tropical Diseases 13(6), e0007460. <https://doi.org/10.1371/journal.pntd.0007460> IF 4.487

Mentors: Baldwyn Torto and Dan Masiga (*icipe*); Rajinder Saini; Abdullahi Ahmed Yusuf and Christian W.W. Pirk (University of Pretoria)

Financial support: Integrated Biological Control Applied Research Programme (IBCARP – Tsetse Repellent component) funded mainly by the European Union to *icipe*.

First runner up

Bernard Steve Soh Baleba (Cameroon)



Registered at: University of Pretoria, South Africa

Mentors: Merid Getahun, Baldwyn Torto, Dan Masiga, Chris W. Weldon (University of Pretoria)

Paper: Egg-laying decisions based on olfactory cues enhance offspring fitness in *Stomoxys calcitrans* L. (Diptera: Muscidae). Scientific Reports 9, Article number 3850.

<https://doi.org/10.1038/s41598-019-40479-9> IF 4.525

Financial support: IBCARP Camel Component funded mainly by the European Union.

Second runner up

Hilaire Kpongbe (Benin)



Registered at: North-West University, South Africa.

Mentors: Baldwyn Torto, Fathiya Khamis, Johnnie Van Den Berg J., Tamò M.

Paper: Isopentyl butanoate: Aggregation pheromone of the brown spiny bug, *Clavigralla tomentosicollis*, (Hemiptera: Coreidae), and kairomone for the egg parasitoid *Gryon* sp. (Hymenoptera: Scelionidae). Journal of Chemical Ecology, PMID: 31209625 DOI: [10.1007/s10886-019-01081-5](https://doi.org/10.1007/s10886-019-01081-5) IF 3.151

Financial support: German Academic Exchange Service (DAAD) In-Region Postgraduate Scholarship.

Best science poster by an *icipe* scholar

Winner

Lilian Mbaisi, MSc scholar (Kenya)



Poster title: A novel microsporidian blocks *Plasmodium falciparum* transmission in *Anopheles arabiensis* mosquitoes
Supervisors: Enock Mararo, Joseph Oundo, Edward E. Makhulu Hellen Butungi and Jordan Jabara (*icipe*); Maria Vittoria Mancini and Steven P. Sinkins (MRC-University of Glasgow Centre for Virus Research, Glasgow, UK); Victor Mobegi, (Centre for

Biotechnology and Bioinformatics –CEBIB, University of Nairobi, Nairobi, Kenya); Jeremy K. Herren (*icipe* and MRC-University of Glasgow Centre for Virus Research, Glasgow, UK).

Financial support: Wellcome Trust, the Scottish Research Council, the Swiss National Science Foundation, the R. Geigy Foundation, the UK's Department for International Development (DFID).

First runner up

Pascal Osa Aigbedion-Atalor, PhD Scholar (Nigeria)



Poster title: Unravelling and ameliorating the impacts of *Tuta absoluta* (Meyrick) in East Africa: spread, socio-ecological impacts, and potential of a newly-imported parasitoid.
Supervisors: Martin P. Hill (Centre for Biological Control, Department of Zoology and Entomology, Rhodes University, South Africa); Myron P. Zalucki (School of Biological Sciences, The University of Queensland,

Australia); Ramasamy Srinivasan (World Vegetable Center, Taiwan); Sunday Ekesi and Samira Abuelgasim Mohamed (*icipe*).

Funding: German Federal Ministry for Economic Cooperation and Development (GIZ) through the World Vegetable Center, Taiwan, and Biovision Foundation, Switzerland, Tuta IPM project.

Second runner up

Iman Brema Hassaballa, PhD scholar (Sudan)



Poster title: Exploring sand fly plant feeding behaviour for development of nectar- based vector control strategies

Supervisors: David P. Tchouassi and Baldwyn Torto (*icipe*), Catherine L. Sole (University of Pretoria, South Africa).

Financial support: Combating Arthropod Pests for Better Health, Food and Resilience to Climate Change (CAP-Africa) project,

an initiative funded by the Norwegian Agency for Development Cooperation (Norad).

All the above are supported through *icipe* core funds, provided by: Swiss Agency for Development and Cooperation (SDC); Swedish International Development Cooperation Agency (Sida); UK Aid, from the government of the United Kingdom; the Ministry of Higher Education, Science and Technology, Kenya; and the Government of the Federal Democratic Republic of Ethiopia.

NEWSMAKERS



Gladys Mosomtai (Kenya), a PhD scholar in the *icipe* Geoinformation Unit, is one of newly announced class of the Next Einstein Forum (NEF), Ambassadors representing the third cohort of young science and technology champions from across Africa. The Ambassadors, one from each African country, will drive public engagement activities to promote science and technology education, research and innovation in their countries. <https://nef.org/2019/12/02/new-next-einstein-forum-ambassadors-to-drive-shift-in-perceptions-about-science-and-technology-in-africa-2/>



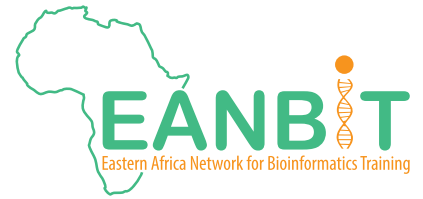
Ruth Kihika (Kenya), a PhD scholar in the Behavioural and Chemical Ecology Unit (BCEU) is among recipients of the 2019 Young Talents Sub-Saharan Africa Awards, of the L'Oréal-UNESCO For Women in Science programme. Her research project is on: Identifying gene targets that correlate with biochemical pathways responsible for plant resistance to parasites.



Bethelihem Mekonnen Bekele (Ethiopia), PhD scholar, Plant Health Theme, received the best presentation by a female student at the African Association of Insect Science 23rd Conference which was held in Abidjan, Côte d'Ivoire. Her presentation was titled: Trait-mediated avoidance behavior of fruit flies to semiochemicals of *Oecophylla longinoda* L. (Hymenoptera: Formicidae).



A review of nematode pests and their impact on food security in sub Saharan Africa, published jointly by *icipe* and the International Institute of Tropical Agriculture (IITA), was recognised as most outstanding publication during the IITA Board of Trustees annual awards held in November. Paper link: <https://www.ncbi.nlm.nih.gov/pubmed/29958072>



Eastern African Network for Bioinformatics Training (<http://eanbit.icipe.org/>) fellows awards

Martha Muthina Luka

Registered at: Pwani University and hosted at the KEMRI Wellcome Trust Research Program
Award: Runner-up for oral presentation
Presentation title: Molecular epidemiology of human rhinovirus from one-year surveillance among school-going children in rural coastal Kenya
Conference: ISCB-Africa – ASBCB Conference organised by the for Computational Biology on Bioinformatics, organised by the International Society for Computational Biology - African Society for Bioinformatics and Computational Biology in Kumasi, Ghana, 11 – 15 November 2019

Brian Bwanya Edward

Registered at: Pwani University but hosted at *icipe*.
Award: Best poster presentation
Poster title: Comparison of mitochondrial genetics of zoophilic and domestic *Aedes aegypti* strains in East Africa to strictly anthropophilic strains in other continents
Conference: ISCB- Africa ASBCB Conference on Bioinformatics in Kumasi, Ghana, November 11 - 15, 2019

Funded proposals: 1 Oct 2019 – 27 Nov 2019

Donor: African Academy of Sciences/DELTA Africa Community and Public Engagement (CPE) Seed Fund round on Gender Equity in Science

Project title: Dialogues in the wilderness: camels, science and the girl child.

icipe researcher: Joel Bargul

Collaborators: Laisamis Secondary School, Marsabit, Northern Kenya

Donor: Korea-World Bank Group Partnership Facility Second Grant Agreement

Project title: Africa Regional Scholarship and Innovation Fund for Applied Sciences, Engineering and Technology Project between *icipe* and International Development Association (acting as Administrator of Korea World Bank Group Facility Single-Donor Trust Fund for the Regional Initiative for Applied Sciences, Engineering and Technology in Africa).

icipe researchers: Segenet Kelemu, Sunday Ekesi, Gatigwa Kimana, Julius Ecuru and Robert Skilton

Collaborators:

Donor: Regional Grantee Agency for the World Bank's Regional Scholarship and Innovation Fund (RSIF) under the Partnership for Skills in Applied Sciences, Engineering and Technology (PASET)

Project title: First Africa education Centres of Excellence for development impact project subsidiary agreement between Republic of Ghana and *icipe* for financial support to implement the Africa Regional Scholarship and Innovation Fund.

icipe researcher: Moses Osiru and Senior Management

Collaborators:

Donor: United Nations Environment Programme (UNEP) Small Scale Funding Agreement

Project title: Sub-regional workshop to facilitate the strengthening of the decision-making capacity for the life-cycle management of chemicals in support of an increased number and improved quality of notifications for Final Regulatory Actions (FRAs) under the Rotterdam Convention for Rwanda, Ethiopia, Eritrea and Tanzania workshop.

icipe

Collaborators: The Stockholm Convention Regional Centre for Africa based in Nairobi, Kenya (SCRC-Kenya); and the Secretariat of the Basel, Rotterdam and Stockholm (BRS) Conventions

Donor: OX/BER (Oxford/Berlin) Research Partnership: Second Call for Seed Funding Proposals

Project title: A one health approach for controlling Tungiasis in Kenya.

icipe researcher: Ulrike Fillingner

Collaborators: Oxford University, UK; KEMRI-Wellcome Trust Programme Kilifi, Kenya; Charite Medical School, Berlin, Germany; and Free University Berlin, Germany

Donor: Cambridge-Africa ALBORADA Research Fund 2019

Project title: Arbovirus metagenomic surveillance in sand flies and ticks.

icipe researcher: David Tchouassi

Collaborators: Dr. Barbara Blacklaws, Department of Veterinary Medicine, University of Cambridge, UK.

Donor: FAO - Food and Agriculture Organization

Project title: Training and technical support for the NENA region on Fall Armyworm (FAW) natural enemies' preservation, production, release and assessment.

icipe researcher: Samira Mohamed

Donor: Cambridge-Africa ALBORADA Research Fund 2019

Project title: Common bean as a reservoir for viruses that infect bees and aphids –A study in Kenya.

icipe researcher: Francis Wamonje

Collaborators: Professor John Peter Carr, University of Cambridge

Donor: Bertha Foundation

Project title: Push-pull for enhanced resilience in the Kenyan arid and semi-arid lands-PERKAL.

icipe researchers: Saliou Niassy, Zeyaur Khan, Charles Midega, Jimmy Pittchar and Menale Kassie

Donor: Innovate UK/Agri-tech Catalyst round 8: agriculture and food systems innovation Competition for Funding/Crop Health and Protection Limited

Project title: Diagnostic tool for the identification and quantification of Potato Cyst Nematode (PCN).

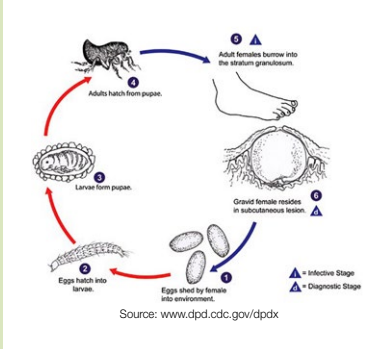
icipe researcher: Solveig Haukeland

Collaborators: Lead partner: CHAP, Crop Health and Protection UK; PES Technologies, UK



Fruit fly microbes

Currently, there is limited knowledge of the gut microbiome of fruit flies. However, available information suggests a wide range of insect-microbe interactions in nature. *icipe* continues to expand knowledge in this area, with a recently published study that has identified potential natural gut microbes and host transcriptional profiles that could be used to define and differentiate two fruit fly sibling species *Ceratitits quilicii* and *Ceratitits rosa sensu stricto*.



Tungiasis, neem and coconut

Tungiasis is a neglected tropical skin disease caused by the female sand flea (*Tunga penetrans*) – the insect burrows into the skin causing intense pain, itching and debilitation. In many cases, vulnerable people do not have effective and safe home treatment for the disease. An *icipe* study has demonstrated that a traditionally used and readily available mixture of neem and coconut oil is a non-harmful, easy to use method to manage early diagnosed cases of tungiasis, while also breaking transmission of the disease. Further studies are necessary to understand this strategy fully. <https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0007822>



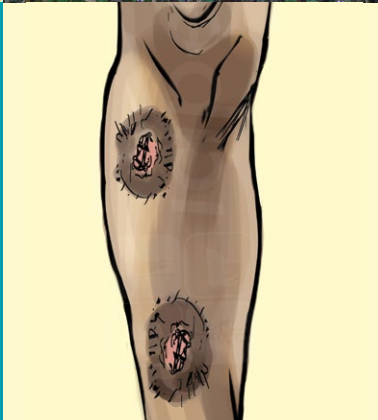
Balanced conservation

Often, in conservation of natural resources like forests, striking the balance between environmental improvements, and socioeconomic benefits for adjacent communities is a challenge. *icipe*-led initiatives, which promote the domestication and commercialisation of medicinal plants and other resources that communities obtain from forests, have been shown to be an effective way of achieving such a balance. Policy support could help to upscale such approaches for more impactful conservation efforts. <https://www.tandfonline.com/eprint/SMYEUJYJ9SQHUKNFNGMT/full?target=10.1080/10549811.2019.1689145>



Pre-detecting Striga

icipe researchers have demonstrated the possibility of using remote sensing to pre-detect and model the invasive and highly destructive *Striga* before the weed causes damage. This approach is superior to the usual prediction of *Striga* infestation, which relies on flowering and, as such, does not provide the opportunity to pre-empt the destruction caused by the weed. <https://www.sciencedirect.com/science/article/pii/S0303243419305689>



Leishmaniasis knowledge

Cutaneous leishmaniasis is a disease that causes ulcers on exposed parts of the body, such as the face, arms and legs, leading to scarring and stigmatisation of affected people. Over one million cases reported worldwide annually. In Kenya, epidemics of the disease have recently been reported in various parts of the country. Although the sandy species *Phlebotomus (Larrousius) guggisbergi* are known vectors, there is limited knowledge of the factors that drive transmission cutaneous leishmaniasis. An *icipe* study has contributed new insights on the occurrence, distribution and host blood feeding preference of the vectors, while also identifying Leishmania species and infection rates in sandflies. This information could lead to improved control approaches. <https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0007712>



Honeybee co-existence

The introduction of honeybees into new continents can have both beneficial and harmful consequences, depending on the regional ecological context of the introduction. In some cases, invasive honeybees out-compete native species during foraging and rob their colonies. More importantly, they have potentially transmit diseases and pests. *icipe* has assessed the invasive potential of the dwarf honeybee, *Apis florea*, a highly mobile species native to Asia, introduced into Sudan, and which is spreading northward along the river Nile. the native *A. mellifera* The study found no indication of competitive displacement, suggesting that although.

The Integrated Biological Control Applied Research Program (IBCARP) was implemented by *icipe* and partners between 2015 – 2019, funded by the European Union through a Euro 12 million grant, with additional funds from *icipe*'s core funds and other sources. Below are the objectives and achievements of the four IBCARP components.

Tsetse repellent component

Objective: To ensure that the commercial availability of the technology, and to facilitate its integration into broad based agriculture development practices.

Accomplishments

- Registration of the *icipe* waterbuck repellent blend by the Kenya Pest Control Products Board.
- New effective and affordable dispensers evaluated and optimised, and 4,000 pieces produced through small scale artisanal facilities.
- A cloud-based agrovet system known as LiMA established in partnership with mHealth Kenya Ltd to market and distribute the repellent collars.
- A licensing agreement signed between *icipe* and Innova Biologicals Ltd for production and distribution of tsetse repellent collars in Kenya.
- Community Owned Resource Persons-CORPs, Kenya Tsetse and Trypanosomiasis Eradication Council staff and government Officials trained.
- Novel tsetse reinvasion barrier, based on artificial and natural barriers, developed to stop flies from reinvading tsetse-controlled areas
- A new repellent blend has been identified from Zebra body odour. Two repellent blends optimised against *G. f. fuscipes*, *G. pallidipes*, *G. brevipalpis*, and *G. austeni*. Blends currently being optimized against *G. morsitans morsitans* and *G. m. centralis* in Zambia.
- 4 peer reviewed journal articles; 11 conference papers presented
- 9 PhD and MSc students trained.

Fruit fly IPM

Objective: Upscaling of proven IPM technologies and classical biological measures to manage fruit flies.

- Local, commercial production of Fruitfly Mania™, a product developed through *icipe* research commenced, through a partnership between the Centre and Kenya Biologics Ltd,
- 43,825 mango growers reached through awareness building campaigns.
- Native natural enemies and exotic parasitoids fruit fly parasitoids introduced, mass produced and released in Kenya. Release permit obtained in Ethiopia.
- Alternative wild and cultivated host fruit species for fruit flies identified.
- New female biased fruit fly attractants discovered.
- Parameters for postharvest treatment developed.
- Scientific mechanisms underpinning biopesticide efficacy resolved.
- Host marking pheromones, which enables certain species to deposit a chemical (pheromone) to indicate fruits where they have already laid eggs, thereby pre-empting repeated egg-laying on the same fruit, identified.
- Capacity building of extension officers, lead farmers, community extension service providers.
- 7 peer reviewed publications published, and 13 conference presentations made.
- 5 PhD and MSc students trained.

Camel surra

Objective: develop low cost, low environmental impact control technologies for camel disease vectors.

- Four major species of biting flies potential vectors of surra associated with camels identified: *Hippobosca camelina*, *Pangonia ruppellii*, *Tabanus spp.* *Stomoxys calcitrans*.
- *T. evansi*, *T. vivax* and *T. congolense* noted as the main pathogens of camels.
- Components of an integrated surra diseases and vector management (ISVM) identified and is being piloted in Northern Kenya.
- Nectar feeding habits of male biting flies identified and exploited for bait technology. Six plant-based odours being tested.
- A simple visual test for identifying infected camels using a non-invasive urine test developed.
- Novel repellents and their mimics developed from plant sources.
- 4 peer reviewed journal articles published and 3 conference papers presented.
- 2 PhD students trained.

Climate-resilient push-pull

Objective: adapt and scale up climate resilient Push-Pull technology to key agro-climatic conditions and farmer practices in eastern Africa.

- *Brachiaria* cultivars that are effective for stemborer control, drought, pests and disease resistance identified.
- Better adapted *Desmodium* spp. evaluated and validated for pest, disease and drought tolerance; chemistry of pest and weed control established.
- Trained 136,691 new farmers (63,314 males and 73,377 females), resulting in adoption of the climate-smart push-pull by 137,778 (60,076 males, 77,702 female) farmers.
- More than 8.3 million farmers indirectly reached in sub-Saharan Africa through secondary channels, e.g. mass media.
- Push-Pull introduced in 18 African countries: Malawi, Zambia, Rwanda, Zimbabwe, Burkina Faso, Senegal, Burundi, Ghana, Benin and Togo. Initial contacts made in Mali, Mozambique, Togo, Benin, Cameroon, Guinea, Niger and Congo.
- Climate smart Push-Pull technology showed increase in yields by between 2.5 and 3.8 t/ha.
- Partnered with six private seed companies, two agricultural research institutes to produce *Desmodium* seeds.
- Role of Push-Pull in management of maize mycotoxins and ear rots evaluated, and activity against *Aspergillus* soil fungi population and diversity elucidated.
- Effectiveness of climate-adapted Push-Pull in the management of the fall armyworm evaluated and validated.
- Field trials of smart maize cultivars conducted to investigate larval parasitism levels mediated by 'early warning' defense induction under real field conditions.
- 50 peer-reviewed articles, three book chapters published and 17 conference papers presented.
- 3 PhD students trained.

Strengthening African Host Universities

In its role as the Regional Coordination Unit (RCU) of RSIF, *icipe* has commenced a process to strengthen the capacity of RSIF African Host Universities (AHU). Ultimately, improved capabilities of AHUs will enable the institutions – which are competitively selected based on their expertise in RSIF priority thematic areas – to effectively partner in the programme, while boosting their overall and long term ability to undertake training, research and innovation. The efforts started with a detailed exercise held in October aimed at obtaining insight on current capacities of AHUs. Further activities include a series of workshops to enable AHUs develop strategies to address identified gaps.

Grants open

In October 2019, PASET-RSIF opened two grants calls. RSIF Research Awards are awarded competitively to faculty who are engaged in PhD training in PASET-RSIF African Host Universities (AHUs). The funds enable faculty members to advance their research and to support their PhD students generate exceptional research results with potential for commercialisation. The eligible applicants are (i) Outstanding faculty from RSIF AHUs participating as teachers and mentors in the PhD programme and (ii) International partners as collaborators. The deadline for submission of proposals is **January 6, 2020**.



The RSIF Cooperability grants encourage public-private partnerships and support commercialisation of innovative research outputs. Researchers from AHUs are expected to create partnerships with private sector and international partners who have experience in innovation development and commercialization of knowledge. Eligible applicants are researchers and faculty in the AHUs who are involved with RSIF, together with partners from private sector companies and international partners with experience in innovation development and commercialisation of knowledge. The deadline for submission of proposals is **January 20, 2020**.

New partners



To expand its network, and as a result the quality and diversity of PhD training, *icipe* and its AHUs have signed Memoranda of Understanding (MoU) with two universities in the USA: Worcester Polytechnic Institute, Worcester, Massachusetts, and the College of Agriculture and Life Sciences (CALs), Virginia Tech. The main areas of cooperation with these institutions include training of PhD scholars and postdoctoral fellows; promoting joint academic programmes; exchange of faculty professors and researchers; facilitating joint research and innovation projects in priority development areas; and development or strengthening of models for commercialising research and innovation in different selected thematic areas.



Improving institutional environments for research and innovation in Africa

The goal of BioInnovate Africa is to strengthen institutional capacity for bioscience research and innovation in eastern Africa. The Programme enables scientists, business executives and government officers to collaboratively invent and bring to the market biological based solutions. This is in line with regional priorities aimed at using science, technology and innovation for socio-economic transformation, as also highlighted in the Science Technology and Innovation Strategy for Africa (STISA) 2024, the African Union Agenda 2063 and the United Nation Sustainable Development Goals 2030 (SDGs). To achieve its goal, BioInnovate Africa, is assisting to create enabling institutional environment, including national policies, that foster research and innovation-led growth in the region.

Deliberation sessions on innovation

In November, BioInnovate Africa held two key sessions to deliberate challenges and progress towards the institution of a bioeconomy in Africa.

The first event was a high-level policy seminar, held in Bujumbura, Burundi, on the role of the public sector in building innovation ecosystems for a sustainable economy. Jointly organised with the University of Burundi and the Burundian Ministry of Scientific Research and Innovation, the main recommendation of the seminar was the need for enhanced collaboration between universities, industry and government and for greater regional engagement.

The second forum was a workshop on Innovation in the Development Context of Eastern Africa, held in Zanzibar, Tanzania, to identify and address bottlenecks to innovation in the region. The forum brought together project leaders of 20 initiatives currently being funded by the Programme, and a variety of experts, to map out strategies

for strengthening innovation ecosystems for moving biological based ideas and inventions to market. Key outcomes of the workshop include: collaborative partnerships strengthened among project team members; consensus on matrices for measuring the development outcomes of innovations supported through BioInnovate Africa; and agreements models for managing intellectual property and revenue sharing for innovative products being developed through the programme.

Regional bioeconomy strategy

At the policy level, BioInnovate Africa is contributing to the development of a regional innovation-driven bioeconomy strategy for eastern Africa. The strategy aims to develop bioeconomies based on national and regional needs, and link local innovative sustainable bio-based goods and services to regional and global value chains. The first draft of the strategy is currently under review.

Increasing women involvement in bio-entrepreneurship and bioinnovation

A key focus of BioInnovate Africa is to increase women's involvement in bio-entrepreneurship and bioinnovation in eastern Africa. This goal is achieved primarily through the BioInnovate Africa Women Scientists Fellowship, an initiative that provides opportunities for early and mid-career women scientists to work with and learn from the Programme's diverse bioeconomy projects and networks in the region. In October 2019, BioInnovate Africa selected the second cohort comprising 13 fellows for period October 2019 to September 2020. The fellows work with mentors in the different project implementing partner organisations supported by the programme, outside their country, for four to six months. During this period, fellows gain experience and establish networks to advance their skills, innovation capacity and overall career progression.



Dr Ignace Gatare, Principal, College of Science and Technology, University of Rwanda, and member of BioInnovate Africa Programme Advisory Committee, gives a keynote address on the development context of innovation in eastern Africa, at a workshop held by the Programme in Zanzibar, Tanzania.

Dr Théodomir Rishirumhirwa, Agrobiotech Burundi Director General, gives a keynote address on the role of universities, public sector science-based institutions and private businesses in fostering the growth of bio-based enterprises, at the BioInnovate Africa high-level policy seminar held in Bujumbura, Burundi.



ARPPIS Class of 2019

In October 2019, 4 postgraduate students joined *icipe* through the African Regional Postgraduate Programme in Insect Science (ARPPIS), with support from German Academic Exchange Service (DAAD). The scholars will be hosted within various projects being implemented by the Centre.



Fedinand Ong'wen (Kenya)

Research project title: Cattle-targeted interventions for control of arthropod vectors of malaria and other diseases of humans and livestock

Funding: Biovision Foundation, Switzerland

Supervisors: Ulrike Fillinger and Mike Okal (*icipe*)



Sahadatou Mama Sambo (Benin)

Research project title: Biovision Foundation, Switzerland

Funding: Classical biological control of *Tuta absoluta* (Meyrick) in East Africa

Supervisors: Samira A. Mohamed and Shepard Ndlela



Aklilu Belay (Ethiopia)

Research project title: Deployment of improved vector sampling and diagnostic tools to facilitate characterization of residual malaria in selected areas of Ethiopia

Funding: Combating Arthropod Pests for Better Health, Food and Resilience to Climate Change (CAP-Africa) project, funded by the Norwegian Agency for Development Cooperation (Norad).

Supervisors: David P. Tchouassi and Clifford Mutero (*icipe*)



Kavengi Kitonga (Kenya)

Research project title: An assessment of cost-effectiveness, economic and nutrition effects and potential adoption of the integrated tsetse and ticks control management technologies in Kenya and Ethiopia.

Funding: BMZ-funded large-scale project

Supervisor: Menale Kassie (*icipe*)



Alemayehu Konde Koira
Country Head, Ethiopia
Mastercard Foundation

Young Africa Works

Mastercard Foundation's strategy for the youth

Africa is quickly becoming home to the world's workforce, with 375 million young people expected to enter the job market by 2030. With the right skills, this population will not only improve their lives and those of their communities, but also contribute to Africa's global competitiveness.

Young Africa Works is the Mastercard Foundation's strategy to enable 30 million young people across Africa, 70 percent of them young women, to access dignified and fulfilling work by 2030. The focus of Young Africa Works is threefold: enabling entrepreneurs and small businesses expand through access to financial services; improving the quality of education and vocational training to support youth to acquire the skills they need; and, leveraging technology to connect employers and job seekers. The Mastercard Foundation will co-create strategies with governments, the private sector, entrepreneurs, educators, and young people to implement its Young Africa Works strategy in 10 African countries.

In Ethiopia, Young Africa Works will facilitate 10 million young people to access dignified and fulfilling work by 2030. Young Africa Works in Ethiopia will leverage the momentum created by the government's policy and regulatory reforms to encourage the development of the private sector and attract foreign investment. Job creation is a national priority for Ethiopia. With the right investments in skills, financial services, networks, and markets, young entrepreneurs can create employment for themselves and for others. Working in partnership with the Jobs Creation Commission (JCC), Young Africa Works in Ethiopia will focus on four key sectors identified by the government: Agriculture, Manufacturing, Tourism and Services, and Digital Economy and Information Communication Technology.



MOYESH

In alignment to this vision, in October 2019, Mastercard Foundation, in partnership with *icipe* and the Ethiopia Jobs Creation Commission (JCC), launched the More Young Entrepreneurs in Silk and Honey (MOYESH) project, a five-year initiative that aims to see 100,000 young men and women in Ethiopia secure dignified and fulfilling work along honey and silk value chains.

Beekeeping and silk production has the potential for a wide range of economic opportunities for unemployed youth in Ethiopia. Local demand for honey is high, and honey and beeswax export markets are on the rise. Demand for Ethiopian silk yarn is 100 tons per year, and is expected to grow with the emergence of textile industrial parks in the country. But production remains low, at only at 10 tons per year.

MOYESH will stimulate the development of value chains for beekeeping, silk farming, and high value complementary activities such as horticulture. Young people will be equipped with the necessary skills, including soft skills, and an enabling business environment will be created through, for example, access to finance and markets. The MOYESH project will impact on the entire value chain from input suppliers to primary producers (honey and cocoon suppliers), aggregators, to processing and packaging to enhance market access. aims to secure dignified and fulfilling direct employment and income for 100,000 unemployed youth (60% women) in 4 regions of Ethiopia; Amhara; Oromia; Southern Nations, Nationalities, and Peoples (SNNP); and Tigray.

The MOYESH project will strengthen the partnership between Mastercard Foundation and *icipe* between 2016 and 2019. The YESH project spawned jobs for 12,500 young men and women in the country through honey and silk enterprises. The initiative also established functional marketplaces for honey and beeswax, and served as a platform for *icipe* to lead the development of a National Sericulture Development Strategy, at the request of the Ministry of Agriculture of the Federal Democratic Republic of Ethiopia.



Above
Youth beekeepers: (l-r) Eskeziaw Mogne, Tsehaynesh Neber, Birhan Alehegn and Dires from East and West Gojjam, Ethiopia.



Left
Youth silkworm growers: (l-r) Aynalem Choke, Mitiku Denbel and Samrawit Chernet in Cahno Mille, Gamo Zone, Ethiopia.

MOYESH is also positioned within *icipe*'s vision of science-led strategies towards holistic and inclusive socio-economic transformation across Africa. The project will capitalise on *icipe*'s extensive experience over the past 50 years in collaboration with national and international partners, which has generated extensive knowledge and built capacity for modern beekeeping and sericulture leading to the development and marketing of innovative high-quality products. Additionally, *icipe* research encompasses the often overlooked, but vital role of bees in boosting agricultural productivity through pollination of crop and wild plants and the provision of essential ecosystem services.

Silk is white gold

Mintiwab Mukulo: 35 years old, Southern Nations, Nationalities, and Peoples' Region.

Education: secondary school.

Former occupation and source of income: housewife and mother of four; relied on her husband for financial support.

Project: Young Entrepreneurs in Silk and Honey (YESH), sericulture farming.

Outcomes: financial independence including building her own savings kitty; contribution to household well being; supporting her husband to start a goat trading business; with other women, starting a small silk weaving and dyeing enterprise that now has 30 members.

“Sericulture farming was a tough learning curve, but not I did not consider quitting even for one second. I am now an inspiration to my neighbours. Through my own experience and that of others involved in the YESH project, I have come to understand that as women, we have power in our own hands. We just need a helping hand to translate this power into a mighty reality.”

Vision: pioneer a silk processing industry in her village to create transformation employment opportunities for many members of the community.



Mintiwab Mukulo

Through Mastercard Foundation's partnership with organisations like *icipe*, we have learnt that Young entrepreneurs can be the engines of economic growth. The challenge is that they often do not have access to sufficient financial resources or products and services to be sustainable, or to grow and expand. The testimonials below bear witness to this.

The unlikely beekeeper

Wude Ayimro: Amhara Regional State.

Education: 10th grade.

Former occupation and source of income: Unemployed for two years; survived through casual jobs, for example domestic work; dreamt of starting a business but was unable to obtain loans either through formal or informal channels.

Area: YESH, beekeeping.

Outcomes: skills in proper business and finance management, and entrepreneurialship; modern beekeeping, processing and packing of products; widening network and visibility through participation in international and national honey symposiums and festivals.



Wude Ayimro

“Initially my father was not happy about me starting a beekeeping business, an occupation he believed to belong to men because it requires hard work, and courage to work even at night. Ironically, most of my family members were traditionally engaged in beekeeping which meant I was already had exposure in the activity, ineffect a dormant asset. Through YESH, support from my family and my husband I have developed confidence as a beekeeper.”

Vision: “Nothing will hold me back. Infact, I the challenges inspire me to try even harder to improve my own life and those of my family.”

Nairobi, Kenya

Participants of a scientific writing paper training workshop for African Regional Postgraduate Programme in Insect Science (ARPPIS) and Dissertation Research Internship Programme (DRIP) scholars, conducted by the African Population and Health Research Center (APHRC).



Germany

Ms Christina Lubotzki (Advisor, Advisory Service on Agricultural Research for Development of the German Federal Ministry for Economic Cooperation and Development (BMZ) visited *icipe* to assess the progress of the 'Integrated pest and pollinators management (IPPM) to enhance productivity of avocado and cucurbits among smallholder growers in East Africa' project.

Nairobi, Kenya

The Stockholm Environment Institute (SEI) Board led by its Chair, Kerstin Nilblaus (centre), Vice-Chair Andreas Carlgren (second right) and Ingrid Peterson (third left), and accompanied by SEI Africa Centre Communications officer Emmanuel Ngui (right) and SEI Africa Centre Research fellow Romanus Opiyo (left), paid a courtesy visit to *icipe*, on 18 October 2019, which was coordinated by BioInnovate Africa. SEI Africa Centre is an implementing partner organization of BioInnovate Africa's project that is developing an innovation-led bioeconomy strategy for eastern Africa. The visiting team held a briefing session with *icipe* Director General, Dr Segenet Kelemu and toured various research and innovation activities at the Centre.



Brussels, Belgium

Prof. Pauly Alain (Scientist, Royal Belgian Institute of Natural Sciences), during a visit to understand progress of *icipe* research on stingless bee species to support taxonomic aspects.

Kenya, Uganda, United Kingdom and Germany

Review and planning meeting of the Tungiasis Ecology project, funded by the German Research Foundation (DFG). Participants included Ulrike Fillingner (Senior Scientist and Principal Investigator), Ibrahim Kiche (Tungiasis Project Coordinator), Esther Chongwo (PhD student), Dr Lynne Elson (Research Fellow, KEMRI-Wellcome Trust), Prof Amina Abubakar (Senior Scientist, KEMRI-Wellcome Trust), Dr Juergen Kruecken (Senior Lecturer, Free University Berlin, Germany) and Dr Francis Mutebi (Post-doctoral Fellow, Makerere University, Uganda).



Norway

A delegation visiting Kenya on a Norway Agricultural Technology Study Tour, organised by Innovation Norway, visited the *icipe* Duduville Campus, Nairobi.



Benin, Kenya, Rwanda, South Africa, Tanzania, Uganda, Zimbabwe

Participants of the Basic Crash Course in Nematology (BCCN), organised by *icipe*, International Institute of Tropical Agriculture (IITA), and the International MSc in Agro- & Environmental Nematology, Ghent University, Belgium. In the front row are the MSc nematology students from Ghent University, Belgium, participating in the 'Kenya track' who assisted in teaching the course.

Switzerland

Dr. Katharina Jenny, Senior Thematic Advisor Rural Development, Swiss Agency for Development and Cooperation (SDC) visited *icipe* Duduville Campus, Nairobi.



Eritrea, Ethiopia, Lesotho, Mauritius, Rwanda, Switzerland, Tanzania, Tunisia

icipe, in its role as the Stockholm Convention Regional Centre, hosted a sub-regional workshop to strengthen the decision-making capacity for lifecycle management of chemicals under the Rotterdam Convention. About 30 participants represented ministries and respective administrative institutions of recipient countries that are responsible for the sound management of chemicals, the private sector responsible for production, use, import and export of pesticides and industrial chemicals, as well as civil society.

Benin, Cameroon, Ethiopia, Malawi, Mozambique

Independent Evaluation Committee (IEC) composed of experts during the selection of the second cohort of RSIF PhD scholars: Ana Maria da Graça Mondjana (second left), Vice-Rector for Academic Affairs and Assistant Professor, Eduardo Mondlane University, Mozambique; Dr Tesfa Tegegne Asfaw (third left), Director, ICT for Development Research Center and Assistant Professor of Computer Science, Bahir Dar Institute of Technology, Bahir Dar University, Ethiopia; Rose Kalizang'oma (fourth left), Chief Education Officer, Higher Education, Ministry of Education Science and Technology, Malawi; Dr Flora Chadare (fifth left), Researcher, Laboratory of Food Sciences, University of Abomey-Calavi, Benin; and Prof. Emmanuel Tanyi (sixth left), Dean of the Faculty of Engineering and Technology, University of Buea, Cameroon. They are pictured with Dr Robert Skilton (extreme left), Head, Capacity Building and Institutional Development, *icipe*; Dr Moses Osiru (second right), Manager, RCU-*icipe*; and Kristin Seljeflot (extreme right), Resource Mobilization Specialist – RCU-*icipe*.



Berlin, Germany

The Director General, Dr Segenet Kelemu, participated in the Falling Walls Conference a unique international platform for leaders from the worlds of science, business, politics, the arts and society. This year's conference was themed "Which are the next walls to fall?" and marked the 30th Anniversary of the fall of the Berlin Wall. The Director General delivered a keynote speech on breaking the wall of food scarcity using insects for food and feed.



Berlin, Germany

(l-r): Dr Sunday Ekesi, Director of Research and Partnerships; Dr Jeremy Herren, Scientist, Human Health Theme; Dr Merid Getahun, Scientist, Animal Health Theme, participated in the Berlin Science Week Campus which was part of the Falling Walls Conference. The event saw the most innovative and visionary institutions from German and across the world share their scientific breakthroughs. The team made presentations on *icipe's* research Insects for Food and Feed and Other Uses, malaria endosymbionts and camel diseases.

Addis Ababa, Ethiopia

icipe participated in the 2019 Grand Challenges Annual meeting. Launched by the Bill & Melinda Gates Foundation in 2014, Grand Challenges is a family of initiatives fostering innovation to solve key global health and development problems. The Director General, Dr Segenet Kelemu, was a keynote speaker in a series of Spotlight Talks – a collection of short, TED-like presentations that highlight areas of interest in global health and development.



Hyderabad, India

icipe was strongly represented at the XIX International Plant Protection Conference IPPC 2019 by: Behavioural and Chemical Ecology Unit team: Baldwyn Torto (Head), Amanuel Tamiru (Scientist), Ruth Kihika (PhD Scholar), Juliet Ochola (MSc Scholar) and Push- Pull IPM Technology team: Zeyaur Khan (Principal Scientist), Charles Midega (Senior Research Scientist) and Jimmy Pittchar (Social Scientist); and Solveig Haukeland, Nematology Research.

Abidjan, Côte d'Ivoire

Saliou Niassy, Head Transfert Technology Unit and Amanuel Tamiru, Scientist, Behavioural and Chemical Ecology Unit, pictured during the 23rd African Association of Insect Scientists (AAIS 2019) Conference.



Bujumbura, Burundi

Pictured during the 6th meeting of the BioInnovate Africa Programme Advisory Committee (PAC) members (l-r): Prof. Måns Nilsson Executive Director, Stockholm Environment Institute (SEI), Sweden; Prof. Ruth Oniang'o, Founder & Editor in Chief, African Journal of Food, Agriculture, Nutrition and Development (AJFAND); and Dr Yifru Tesfaye, Director, Private Sector Development, Ethiopia.

St. Louis, Missouri, USA

Caroline Kung'u, PhD Scholar, Behavioural and Chemical Ecology Unit, making a presentation during the Annual Meeting of the Entomological Society of America (ESA) – Entomology 2019.



Mbale, Uganda

The *icipe* Uganda Office and Food for the Hungry, held an agroecology workshop for staff and model farmers from six countries in East, Central and Southern Africa. The event spotlighted various technologies developed by *icipe* and demonstrations on the Push-Pull technology.

icipe Staff Awards

Employee of the Year



Rosalynn Murithi,
Resource Mobilisation Coordinator

Partner of the Year



Paul-Andre Calatayud, Visiting
Scientist, Institut de recherche pour de
développement (IRD).

Publication of the Year



Baleba, S.B.S., Torto, B., Masiga,
D., Weldon, C.W., & Getahun, M.
(2019) Egg-laying decisions based
on olfactory cues enhance offspring
fitness in *Stomoxys calcitrans* L.
(Diptera: Muscidae). *Scientific
Report* 9:3850 doi.org/10.1038/
s41598-019- 40479-94

Professional Staff of the Year



Menale Kassie, Head, Social Science
and Impact Assessment Unit.

Support Staff of the Year



Nelson Suchi, Clerk of Works

New appointments



Dr Henri Tonnang has joined *icipe* as the Head of Data Management, Modeling and Geomatics Unit. Dr. Tonnang holds a PhD in Applied Mathematics in Zoology from University of Nairobi, Kenya, as an *icipe* African Regional Postgraduate Programme in Insect Science (ARPPIS) scholar; an MSc in Electric and Electronic Engineering, an MSc in Physics, and a BSc in Physics, all from the University of Ibadan, Nigeria.

Prior to joining *icipe*, Henri was a Technology Transfer and Outreach Expert of the Technology for African Agriculture Transformation (TAAT), funded by the African Development Bank Group (AfDB) programme and implemented by International Institute of Tropical Agriculture (IITA)-Cotonou, Benin. He has also served as a Geospatial Agronomist (Climate Change Expert) at the International Maize and Wheat Improvement Centre (CIMMYT). In addition, Henri was previously a Senior Research Scientist-Modeler/Data Scientist at *icipe*, and a Postdoctoral Research Scientist at the International Potato Centre (CIP), Peru.

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Core donors

- Swiss Agency for Development and Cooperation (SDC), Switzerland
- Swedish International Development Cooperation Agency (Sida), Sweden
- UK Aid, Government of the United Kingdom
- Ministry of Higher Education, Science and Technology, Kenya
- Government of the Federal Democratic Republic of Ethiopia

Restricted project donors

- African Academy of Sciences
- African Union
- African Women in Agricultural Research and Development (AWARD)
- AIRD (French Inter-institution Agency for Research and Development)
- Bertha Foundation
- Bill & Melinda Gates Foundation
- Bioinnovate Africa Programme
- Biotechnology and Biological Sciences Research Council, UK, through Rothamsted Research, UK
- Bayer: Science For A Better Life
- Biovision Africa Trust
- Biovision Foundation for Ecological Development, Switzerland
- Cambridge-Africa ALBORADA Research Fund
- Canadian Government through International Development Research Centre (IDRC)
- Centre for International Migration and Development (CIM)
- CIRAD – Agricultural Research for Development, France
- Cultivate Africa's Future (CultiAF) through International Development Research Centre (IDRC)/Australian Centre for International Agricultural Research (ACIAR)
- Ethiopian Catholic Church Social Development Commission (ECC-SDCBOM)
- European Union
- Federal Ministry for Economic Cooperation and Development (BMZ), Germany
- Food and Agriculture Organization of the United Nations (FAO)
- Future Leaders – African Independent Research (FLAIR)
- German Academic Exchange Service (DAAD)
- Deutsche Forschungsgemeinschaft (DFG)
- Global Challenges Research Fund (GCRF)
- Global Environment Facility (GEF)/United Nations Environment Programme (UNEP)
- Government of Côte d'Ivoire
- Government of Ghana
- Government of Rwanda
- Government of South Korea
- Grand Challenges Canada (GCC)
- Innovate UK
- Innovative Vector Control Consortium (IVCC), through Wageningen University
- 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
- JRS Biodiversity Foundation, directly and through Royal Museum for Central Africa (RMCA)
- LEAP -Agri (A Long term EU-Africa research and Innovation Partnership on food and nutrition security and sustainable Agriculture)
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- Mastercard Foundation, Canada
- Max Planck Institute
- Medical Research Council, UK
- Ministry for Foreign Affairs of Finland
- Mozilla Foundation
- National Geographic Society
- National Research Fund, Kenya
- Netherlands Organisation for Scientific Research (NWO)
- Newton Fund
- Norwegian Agency for Development Cooperation (NORAD)
- R. Geigy Foundation, Switzerland
- Research Institute of Organic Agriculture (FiBL), Switzerland
- Rockefeller Foundation
- Russell IPM Ltd, UK
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- Swedish Research Council through the Kungliga Tekniska Högskolan (KTH)
- Swedish University of Agricultural Sciences (SLU)
- Swiss National Science Foundation (SNSF)
- SWITCH Africa Green
- 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)
- Volkswagen Foundation, Germany
- Wellcome
- World Academy of Sciences (TWAS)
- World Bank
- 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

Email address: icipe@icipe.org

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