



**FROM THE CHAIR,
icipe GOVERNING COUNCIL**

2

Prof. Kym Anderson



**THOUGHT LEADERSHIP COLUMN
BY THE DIRECTOR GENERAL**

3

A DECADE OF INSECT SCIENCE

Dr Segenet Kelemu

8

NEWSMAKERS

8

INSTITUTIONAL NEWS

10

RESEARCH HIGHLIGHTS

11

**MORE YOUNG
ENTREPRENEURS IN SILK
AND HONEY (MOYESH)
PROJECT**

11

**BIOINNOVATE AFRICA
PROGRAMME**

12

**REGIONAL SCHOLARSHIP
AND INNOVATION FUND**

13

**CAPACITY BUILDING
AND INSTITUTIONAL
DEVELOPMENT**

14

**SELECTED ARTICLES OF
RECENTLY PUBLISHED**

15

SCENES

16

**STAFF
NEWS**

17

**RECENTLY
FUNDED**

icipe BY NUMBERS (All figures are from Nov 2013 – Nov 2023)

16

Sustainable Development Goals (SDGs) to which *icipe* is contributing

2,300

black soldier fly-based enterprises in Africa

25,000

media mentions

13

patented products and three licenced biopesticides that are being commercialised

1,737

peer-reviewed journal articles, and 124 other noteworthy publications

>150

public goods that are being widely used in more than >40 countries in Africa and elsewhere

261

awards and recognitions (16 to the Centre; 160 to staff and 85 to scholars)

>300

scientists and innovators and >100 organisations in 8 eastern Africa countries in the BioInnovate Africa Programme network

350,000

push-pull farmers in 18 African countries

66

new donors and >300 partners



Prof. Kym Anderson
Chair, *icipe* Governing Council

Dear Friends and Colleagues,

We are very pleased to present this newsletter, which covers the period from July to December 2023.

The focal point of this publication is the [Thought Leadership Column](#), in which the Director General, Dr Segenet Kelemu, reflects on her past 10 years as the leader of *icipe*. In a decade marked by turmoil, including heightened insect menaces, geopolitics and the COVID-19 pandemic, *icipe* has held a firm belief in the concurrent, enormous development opportunities in Africa. Against this background, Dr Kelemu's leadership style has aimed to inspire and challenge the Centre's teams and partners to set grander visions. Major shifts during her tenure include: fortifying the *icipe* 4Hs thematic approach, thus placing the Centre ahead of the curve in the global move towards One Health; introducing new scientific niches, research areas and programmes; evolving *icipe* into a well-managed and highly productive Centre that thrives on a culture of transparency, equity (including gender) and accountability; solidifying the Centre as a worthwhile investment and partner; and reinforcing the indispensable role of insect science in the regional and global determination to re-imagine the present and re-think the future.

The rest of this newsletter consists of our regular sections including [Research Highlights](#), where we present recent progress, new initiatives and many contributions to high-profile research and development fora.

The [Selected Recent Publications](#) section provides a snapshot of the world-class knowledge generated at *icipe*, while in the [Capacity Building and Institutional Development](#) section we report on milestones and showcase the recognised excellence of our scholars.

Several sections, among them [Institutional News](#), [Newsmakers](#) and [Recently Funded](#), provide round-ups of news of events, visitors, collaborations and partnerships; awards and recognitions; and new investments in our Centre.

Highlights from the [BioInnovate Africa Programme](#) include the completion of a gender integration strategy, support to countries to domesticate the Eastern Africa Bioeconomy Strategy, and several videos where project partners talk about their innovation journeys.

Under the section on the [Regional Scholarship and Innovation Fund](#), we spotlight the reciprocal relationship with Ghana and Côte d'Ivoire, grants to set PhD graduates on their research careers, and emerging agri-based innovations.

We hope that you enjoy these and the many more stories in this newsletter.

All members of the Governing Council of *icipe* join me in thanking Dr Kelemu for her enormous and untiring contributions to the growth and development of the Centre over the past decade.

The entire *icipe* family thanks you for your partnership in 2023, and wishes you a joyful holiday season and a prosperous 2024.



Dr Segenet Kelemu
Director General, *icipe*

A DECADE OF INSECT SCIENCE



When I took over the helm of *icipe* in November 2013, I joined a rhythm of harmony and evolution set by my predecessors. Together with my team, we have transformed *icipe* through a vigilant approach that has secured the Centre's rich history and legacy while rectifying several past challenges.

icipe is ahead of the curve in the global move towards One Health, nature-based approaches that have at their heart balanced and optimised benefits for people, animals, and the environment.

It has been my honour to lead *icipe* over the past 10 years. I have aimed to challenge and inspire the Centre's teams and partners to set grander visions, grounded in the belief that, with good science, we can harness the wonderful potential of insects while tackling their negative impacts.

Over the past decade, insect-related menaces have heightened across the continent, not least due to the arrival of several invasive species. These new threats pile on to existing challenges, including a plethora of crop pests, as well as vectors that transmit human and animal diseases. These hazards are compounded by escalating factors such as climate change, poor soils, variations in land use and landscapes, and rising urbanisation.

As a result of these and broader circumstances, there are new urgencies to transform the food system, to provide a fast-rising population with healthy, adequate, safe, nutritious food, without harming the Earth; tackle Africa's disproportionate burden of vector-borne diseases, as well as emerging and re-emerging viruses, through integrated health systems; improve livestock health and productivity, while addressing their polarised role in greenhouse gas emissions and environmental degradation; generate novel income and job opportunities, especially for women, youth and vulnerable sections of society; protect and exploit the biodiversity of beneficial insects; and build cleaner, healthier and more resilient environments. **At *icipe*, we have held the firm belief that alongside these obstacles, the opportunities for development in Africa are enormous and the continent is well poised to exploit them.**

Our response to these imperatives has been multifaceted. In summary, we have:

- Fortified the *icipe* 4Hs thematic approach that integrates Human Health, Animal Health, Plant Health and Environmental Health, including:
 - Upgraded and modernised the Centre's research infrastructure; strengthened the research support units and created new ones like data management, modelling and geo-information, technology transfer and social science and impact assessment.
 - Introduced new scientific niches, research areas and programmes and cross cutting research components, which have contributed to future proofing of *icipe*. Examples: insects for food, feed and other uses; microbiome research, including arthropod symbiosis; soil health extending to soil microbiota, and soil dwelling pests such as plant-parasitic nematodes; climate change; insect and biodiversity protection; and the management of the Regional Scholarship and Innovation Fund <https://www.rsif-paset.org/>, and Bioinnovate Africa Programme <https://bioinnovate-africa.org/>.
 - Instituted engendered pathways for inclusive development, dissemination and commercialisation of technologies and innovations; boosted communication and policy support; heightened the nurturing of scientific capacity, talent, research and innovation excellence.
 - Launched two *icipe* Vision and Strategies (2013 – 2020; and 2021 – 2025), and developed Theme specific research strategies, which serve as blueprints for clear action.
- Evolved into a well-managed and highly productive Centre that thrives on a culture of transparency, equity (including gender) and accountability.
- Raised *icipe*'s regional and global eminence, status as a worthwhile investment and partner.
- Reinforced the indispensable role of insect science, and that of *icipe* in the regional and global determination to re-imagine the present and re-think the future.

MANAGEMENT AND LEADERSHIP

Financial and technical governance

We have made major adjustments in the financial, human resources, technical and administration systems. These changes include amendments to existing policies and procedures, and creation of new ones as necessary; checks and balances in procurement; evaluations and review of risks through an internal audit unit; and cost control measures to ensure that the Centre breaks even every year. We have also built-up financial reserves and established a currency revaluation reserve as a line item in the financial statements, to lower risk in view of currency fluctuations. Additionally, we have improved indirect cost recovery, while curtailing inefficiencies, thus providing high value for money. Computerised

business systems have been enhanced through an integrated Enterprise Resource Planning (ERP) system. Furthermore, we have developed a protected web-based portal for document repository, to promote effective communication, proper management and timely distribution of, and access to, important records and governance documents.

Resource mobilisation

icipe has established strong relations with a wide array of governmental and non-governmental donors, demonstrated by the impressive spectrum of organisations currently investing in the Centre. Since 2014, we have welcomed 66 new donors, among them 10 African governments and

16 foundations; and Australia, Germany, Norway and Ethiopia as new core donors.

Insects for Life

In 2020, the *icipe* family was humbled and grateful that against the global turmoil arising from the COVID-19 pandemic, we were able to celebrate the Centre's 50th anniversary, with a range of activities throughout the year, culminating in a highly successful hybrid event on 20 November 2020. This official commemoration was important as it provided a much-needed beacon of hope to our partners, stakeholders and varied publics, and an occasion for *icipe* to re-dedicate itself to the mission of transforming lives with insect science.

Science in the time of a pandemic

The COVID-19 pandemic was a time for us at *icipe* to remind ourselves of our place as workers in the frontline of poverty alleviation. And based on this consciousness, our response to the pandemic was purposeful; envisioned to safeguard our staff and their families, as well as our visitors, while minimising disruptions on commitments to stakeholders, including development partners, donors, collaborators and beneficiaries. *icipe* remained fully open and operational, with the staff being physically present every working day. This was possible because of the prompt development and implementation of protocols, and the vaccination of staff in collaboration with government authorities.

Building and maintaining partnerships

Partnerships are a crucial part of *icipe*'s strategy. We have used a delicate balance of tact and diplomacy, which has led to stronger, sustainable, strategic alliances. Currently, *icipe* has over 300 partners in Africa and around the world including universities, government institutions, national and international research organisations, community based organisations, non-governmental organisations (NGOs), United Nations agencies, think tanks, private sector actors and media outlets.

Expanding *icipe*'s presence in Africa

Over the past 10 years, *icipe* has heightened its regional presence significantly. Currently, the Centre has activities in 41 African countries, with new initiatives in west, central and southern Africa. We have invigorated the Ethiopia and Uganda country offices and opened a new office in Benin.

Scientific publications

Over the past 10 years, *icipe* has greatly improved its publications record. Between November 2013 and October 2023, *icipe* published 1,737 peer-reviewed journal articles, which received 37,785 citations, and more than 4.2 million full text views. A total of 1,062 articles were in journals

with an impact factor of 2 and above, and approximately 77% were published in either open access or open access model journals. The Centre published 124 books, book chapters and conference proceedings; and 849 non-refereed publications including project reports, manuals, brochures, posters and policy briefs.

Communication, publicity and visibility

Over the past 10 years, *icipe* has strongly embraced communication as a vital component of the Centre's R&D mission. A Unit on Communications has been set up; we have vitalized internal communication, as well as external communication at corporate, programme and project levels. A new dynamism has been introduced, incorporating multi-platforms and diverse approaches in a synergistic, creative and impactful manner. Professional media monitoring shows that between 2013 – (October) 2023, close to 5,000 news items on *icipe* were published or broadcast in local, regional and international media. Most of this coverage is available online, with many of the items reproduced, on average, by five additional outlets. As such, *icipe* has garnered about 25,000 media mentions. The *icipe* Youtube channel has more than 120 videos; the Centre has amassed 1.6 million impressions on X (Twitter); a reach of 1.3 million people on Facebook; and 2.28 million Website page views.

Awards and recognitions

Over the past 10 years, 261 accolades have been conferred: 16 to the Centre; 160 to staff and 85 to scholars. Notable among these honours are: the 2020 Food Planet Prize, recognising *icipe*'s pioneering R&D activities on edible insects; the 2021 Falling Walls Breakthrough of the Year, Life Science, for the discovery of *Microsporidia MB* in mosquitoes; inclusion of several *icipe* researchers in the "World Ranking of Top 2% Scientists" list (created by Stanford University, USA), in 2022 and 2023. I am personally thankful for numerous awards accorded to me by various organisations. Also, the Centre's leadership has delivered

invited keynote speeches, addresses and presentations at many high-level fora across the world, including a presentation by the Director General at the 59th Nobel Conference, on 3 October 2023.

Maintaining a highly motivated team

Upon commencement of my leadership of *icipe*, we embarked on a process of strategic recruitment to fill in gaps, reinforce existing teams, and improve capacity and skills and function alignment. *icipe* currently has a staff of 571. We have boosted our staff's leadership, technical and management skills, remuneration and welfare, and aimed to create institutional pride, confidence and teamwork. Significantly, we have advanced gender equity and equality in our workforce and across R&D activities and partnerships, to contribute to better outcomes for both women and men. In July 2022, I authored an invited article in *Nature Human Behaviour* journal on "Achieving workplace equity", which describes how I have used my role as the CEO of *icipe* to create a more equitable workplace for all. (<https://rdcu.be/cUlo5>)

Infrastructure upgrade

In general, *icipe* has modern research facilities and well-equipped laboratories. Noteworthy examples include the Africa Reference Laboratory for Bee Health and the Martin Lüscher Emerging Infectious Diseases Laboratory. We have refurbished and modernised the R&D complex and re-equipped various laboratories, insectaries and screenhouses. Also, we have renovated the *icipe* Thomas Odhiambo Campus located in Mbita Point, on the shores of Lake Victoria; and field stations in Muhaka, coastal Kenya, and Nguruman, Kajiado, Rift Valley. We undertook the greening of *icipe*, consisting of renewable energy, energy saving, innovative strategies to harvest and use water, and environmental conservation measures to reduce the Centre's carbon footprint, while also creating a thriving, eco-friendly landscape that has numerous flora, insects and bird species.

SELECTED RESEARCH AND DEVELOPMENT ACHIEVEMENTS

Malaria control

- Groundbreaking discovery of a microbe in *Anopheles* mosquitoes, which blocks transmission of *Plasmodium*, the malaria parasite, from the insects to people. This microbe, which we named *Microsporidia MB*, is passed on from female mosquitoes to their offspring at high rates and that it does not kill or cause obvious harm to the mosquito host. *Microsporidia MB* is also transmitted sexually between mosquitoes. This knowledge has paved way to investigate a viable dissemination strategy to increase the spread of *Microsporidia MB* among mosquito populations, which will lead to a transformative malaria

transmission blocking intervention.

- Knowledge on the biological and ecological adaptation of mosquitoes, providing evidence for decision-making on residual and outdoor malaria control interventions; socio-economic value, and recommendations for optimum integrated vector management (IVM) approaches for mosquitoes and malaria.
- Insights on the floral dimension of mosquitoes, including seminal research on the adverse connection between *Parthenium hysterophorus* (a highly destructive invasive plant), and mosquitoes, and the possibility of using compounds from the plant's roots to bait pregnant mosquitoes.

Neglected tropical diseases (NTDs)

- Leishmaniasis (transmitted by sand flies): new knowledge on vector diversity, species characterisation and identification; parasite biology and disease epidemiology; expanding geographical distribution; and support to the Kenyan government to respond to a leishmaniasis outbreak.
- Tungiasis (commonly known as jiggers), a skin disease caused by the female sand flea, *Tunga penetrans*: developed an efficient and economical PCR-based kit to identify the fly's larvae; a simple, affordable thermography technology to detect tungiasis-associated inflammation; a novel two-level classification of

tungiasis severity; knowledge on the interactions between parasite and hosts and disease burden including morbidity and severe inflammation.

- A One Health initiative, as a model for the simultaneous control of insect vectors of diseases that affect people and animals, and the testing of a “healthy home” concept.

New and re-emerging viruses

- Primary focus on viruses of yellow fever, Rift Valley fever and dengue fever, with new knowledge on the complex interface of host–pathogen–environment, vector abundance, vector–pathogen interactions, vector competency, transmission and disease risk.
- Support to the Kenya government to respond to a yellow fever outbreak in two counties in the country.
- Detection of a previously unknown phlebovirus and implication of sand flies in its circulation; first records of various zoonotic pathogens in Kenya, and their interaction with livestock and wildlife.

Integrated tsetse fly management

- Scale-up, mass production, distribution and marketing of the tsetse fly repellent collar technology across eastern Africa, in collaboration with private sector partners, farmers, pastoralists, community owned resource persons (CORPs) and local governments.
- Socio-economic assessments of the technologies, and farmers’ willingness to pay.
- Bolstering the efficacy of *icipe* technologies, for example through the discovery of zebra odours that could increase the effectiveness of the tsetse fly management collars technology and NGU traps.
- Modelling studies to update tsetse fly and animal trypanosomosis risk maps in East Africa.
- Identification of predictive biomarkers of African animal trypanosomosis in livestock, which can be used to develop a non-invasive, rapid, affordable, accessible efficient and easy-to-use tool to diagnose the disease.
- New generation tsetse fly management strategies, including small sticky panels made of cloth and insecticide-treated netting that improve trapping of *Glossina fuscipes fuscipes*, the species that transmit human African trypanosomosis.
- Knowledge on sensory neurons and odorant receptors in the tsetse fly antennae; and the insect’s vision ecology.
- Understanding of trypanosomes including swimming patterns and how this motility can be modulated to develop disease control tools.
- Characterisation of trypanosome induced semio-chemicals, responses of tsetse flies to the compounds; and identification and formulation of novel attractants that target blood-fed, infected tsetse flies.

Non-tsetse transmitted trypanosomosis

- New research on disease vectors of camel, a vital animal in arid and semi-arid lands in Africa, mainly focussing on camel trypanosomosis (surra).
- Identification of trypanosome species that are involved in surra transmission; biting fly species that are potential vectors of the pathogens; and insights on the fly biology, behaviour and ecology, providing leads for their management.
- Integrated surra vectors management technologies, including a repellent that is disseminated through a ‘camel collar’ that pastoralists use to keep track of their animals; and an attractant employed in an odour-baited trap. Both are dispensed from a nano polymer beads dispenser that maintains stability and slow release of the compounds.

Tick and tick-borne diseases

- Developed a fungus-based bioacaricide (Mazao Tickoff), and for the first time in Africa, we prepared and published a randomised efficacy protocol for the testing, registration and use of bioacaricides. We used this protocol to conduct a large-scale efficacy trial of Mazao Tickoff along the Kenyan coast.
- In Kenya, Mazao Tickoff is being commercialised with Real IPM Biobest, and an application for its registration has been submitted to Kenya Veterinary Medicines Directorate.
- Diversity of ticks and tick-borne pathogens extensively described in Kenya and Ethiopia.

Push-pull technology

- Development of a climate-smart push-pull.
- Introduction of the integration of farmer preferred vegetables into the push-pull system.
- A new initiative to harness the vegetable integrated push-pull and black soldier fly farming into a One Health package that will contribute to a resilient, circular, and regenerative food system, and create novel income generation and job creation opportunities especially for women and the youth, in eastern Africa.
- Scaling-up the push-pull technology through target-specific dissemination and impact pathways, as well as improved availability and affordability of *Desmodium* seeds.
- Increasing push-pull adopters to 350,000 and extending the technology to 18 countries in Africa.
- Push-pull integrated into the agriculture strategy of Ethiopia.
- New evidence on the resilience, sustainability and adaptability of the climate-smart pull-pull technology, its impact on soil conditioning, rhizosphere microbiome, plant-soil feedbacks and on maize phytochemistry.
- Insights on the push-pull technology and return on investments, economic benefits, women empowerment and nutrition, technology adoption and

policy recommendations. The vegetable integrated push-pull system is a profitable option for farmers, with a high net present value and benefit cost ratio (27:1).

Fall armyworm management

- In 2017, the *icipe* push-pull technology, became the first documented, readily available technology that could efficiently manage the fall armyworm in an environmentally friendly and cost-effective manner. We have published findings on the scientific mechanisms by which the technology conquers the pest.
- With support of development partners, government and regulatory authorities, as well as private sector actors in East Africa, several *icipe* biopesticides have been registered: Achieve OD (ICIPE 78), in Kenya; Mazao Achieve (ICIPE 78); and Mazao Detain (ICIPE 7), in Tanzania and Uganda.
- Found native parasitoid species (namely *Telenomus remus*, *Trichogramma chilonis* and *Cotesia icipe*), that are widely distributed in Africa, mass produced and released them in fall armyworm hotspots.
- Supported community-based monitoring and early warning, trapping using sex pheromones, as well as the training of numerous stakeholders.
- Actively participated in major global and regional initiatives on fall armyworm management.

Fruit tree IPM

- Participatory and inclusive upscaling of the fruit fly IPM packages in eastern Africa (Kenya, Ethiopia and Tanzania), and in Southern Africa (Malawi, Mozambique, Zambia and Zimbabwe), with a special focus on women and youth along the mango value chain. Strategy includes: strengthen and combine expertise with national agricultural research and extension systems; learning sites; gender-inclusive capacity building; generate best practices and evidence-based policy recommendations.
- Revitalised momentum for fruit cultivation in Africa, while postharvest protocols have enabled reaccess of fruit from Africa to export markets.
- New knowledge on fruit flies, resolution of the identity of *Bactrocera dorsalis*, an invasive fruit fly that was first recorded in the continent in 2003, enabling the adaptation of control tools developed for the species complex from regions where the pest has been in existence for a longer period; identification of hostmarking pheromones of fruit flies; insights on gut microbiome of fruit flies; and novel primers to identify endosymbionts in African fruit flies.
- Novel knowledge on citrus fruit pests and diseases including the African Citrus Trioza (*Trioza erythrae*) and the false codling moth (*Thaumetotobia leucotreta*); the invasive Asian Citrus Psyllid (*Diaphorina citri*); *Candidatus Liberibacter asiaticus* (Las), the causative agent of the

Asian greening disease, Huanglongbing (HLB).

Locust control

- In 2020, East Africa experienced the worst desert locust outbreak in decades.
- *icipe* obtained 2,500 records of desert locust nymphs, applied machine learning techniques and combined environmental variables in predicting the potential breeding areas of desert locusts in East Africa.
- Demonstrated that large areas of Kenya, north-western and north-eastern Uganda, middle and central regions of South Sudan have the highest potential in providing conducive breeding for the pests.
- Such specific knowledge of locust breeding sites enables better action and lower cost in the implementation of preventive measures to control future locust outbreaks.

Tackling invasive species

- Developed with partners, a regional strategy to tackle invasive species; and strengthened in-house capacity to design models for early warning and prediction of invasion, surveillance and control of invasive species.

Integrated pest and pollinator management (IPPM)

- Defined ways to enhance interactions between the two components for healthier agricultural landscapes and improved food security.
- Established key pests of avocado and curcubits; developed biopesticides for curcubits pests; assessed compatibility of biopesticides and IPPM; revealed the usefulness of flower strips in pollination; and determined pollination deficit in smallholder avocado farms.
- Case for prioritising pollination dependent crops.

Coffee IPM

- In collaboration with the French Agricultural Research Centre for International Development (CIRAD), developed niche models and generated risk maps to predict the distribution of coffee pests.
- Implementation of IPM best practices in Uganda, towards a triple certification scheme (organic, fair trade and geographical indication) of coffee.

Vegetable IPM

- Management of *Phthorimaea (Tuta) absoluta*, including knowledge on the bioecology, host range and distribution, as well as association with indigenous natural enemies; and invasion pathway using microsatellite markers and prediction maps of its spread in Africa. Supported by capacity building of farmers and other stakeholders. Assembled, validated and implemented an eco-

friendly management toolbox for *P. absoluta*. Developed a biopesticide from strains of *M. anisopliae* (ICIPE 20), currently being commercialised by Real IPM Biobest. Introduced a natural enemy, *Doligochenidea gelichiidivoris* from Peru (the native home of the pest) and released it in Africa.

- Generated knowledge and conducted capacity building of farmers and agricultural officers, and socio-economic assessment to develop and scale-out IPM packages for thrips and tospoviruses, white flies, leafminers, and pests of indigenous vegetables.

Nematode research

- New knowledge on nematodes, including chemical ecology insights on interactions that lead to infection by root-knot nematodes.
- Capacity building of scholars, universities, farmers, technical and government agencies, private sector partners; alongside awareness creation to integrate nematology into the academic and agricultural landscapes.
- Leadership role in the management of potato cyst nematode (PCN), an invasive quarantine pest that was first reported in Kenya in 2014.
- In collaboration with IITA, development of a banana fibre paper for the management of potato cyst nematodes, and other soil dwelling pests.
- A series of studies that are strengthening the basis for microbiome soil health assessments.
- Research on free-living nematodes, parasitic nematodes of pests and slugs.

Bee research

- Bee research based on four major pillars: bee health, pollination, nutrition of bees, and microbiome research, thus rectifying the absence of systematic procedures and capacity in Africa to monitor, analyse and safeguard bees.
- Advanced knowledge on colony collapse disorder (CCD), and the resilience of honey bees in Africa; other bee health risk factors, and mitigating strategies in the continent and globally.
- Characterising the gut microbiota of the African honey bee and stingless bees, the 'friendly bacteria' that aid insect nutrition and defence against pathogens, laying a foundation for microbe-based strategies for bee health management.
- Studies on pollinator–nectar–microbe interactions; pollination efficiency of stingless bee species; and ways to closing the pollination deficiency.
- Developed a plant-based biofumigant and repellent for bee pests and diseases known as Apicure, which is effective in killing *Varroa* mites and in repelling small hive beetles in bee colonies.

Stingless bees domestication

- Pioneering meliponiculture, the domestication of stingless bees in Africa, to create income generation opportunities

for communities while conserving and regenerating this mighty resource.

- Building knowledge on stingless bees' diversity in Africa; and linkages among the quality characteristics of their honey, and factors such as the bee species, ecosystems and processing methods.

Beekeeping and policy

- Sustainable and modern beekeeping for: ecological protection of mangrove forests on Zanzibar island; alternative livelihoods for food and income security, in the Indian Ocean island nations and in Zanzibar; diversified livelihoods and incomes of pastoral and agropastoral communities in Kenya and Ethiopia; and in the arid and semi-arid lands in Kenya.
- Draft National Honey Standard in Mauritius; support for regulations on organic honey certification in Ethiopia; quality production and fair trade of honey; support for the preparation of a directive by the Ministry of Agriculture, Ethiopia, on honey bee resources development and protection; model to integrate beekeeping and other agricultural products, drive formal trade and export and maximise economic benefits across the value chain and economy in Ethiopia.
- Designation of *icipe* as a Collaborating Centre for Bee Health in Africa by the World Organisation for Animal Health.

Biodiversity conservation

- Ethnobotanical knowledge, diversity and geographical distribution of plant species for malaria control; database that includes ca. 65,000 unique insect specimen records, and their positional and temporal data, and preliminary identifications; and the first inventory of insects in a peri-urban landscape. Awareness creation of insect diversity through a social media campaign and targeted events.

Silk farming

- Supporting African entrepreneurs to find a niche locally, and in the global market, which has traditionally been dominated by Asian countries.
- Identifying the best silkworm species for various African regions; basic science to establish high-quality silkworm egg grainages and rearing methods; introducing novel and unique silk products.
- For example, in Ethiopia, we have selected the Eri silkworm due to its suitability to the country's weather conditions, its hardiness, disease tolerance and year-round production cycles, among other factors. We also helped develop the silk farming strategy for Ethiopia

YESH and MOYESH

- The highly successful Young Entrepreneurs in Silk and Honey (YESH) and More Young Entrepreneurs in Silk and Honey (MOYESH) projects, being

implemented in Ethiopia by *icipe*, the Mastercard Foundation and other partners, stand out as a model for holistic and inclusive job creation for youth and women in Africa, and as potential hubs for One Health and circular economies.

Insects for Food, Feed and Other Uses (INSEFF) programme

- Indisputable global leadership in translating the reality of insects as a transformative force in reshaping our food system into a more sustainable and vibrant circular economy. Recognised through the award of the Curt Bergfors Food Planet Prize in 2020.
- Optimised protocols and substrates for cost-effective, sustainable mass-rearing, harvesting and postharvest techniques of edible insects.
- Characterising of the nutritive profiles of several edible insects, demonstrating the nutritional superiority of their products, for human consumption; creating a blueprint for using insects in food-to-food biofortification.
- Enabling use of insects as alternative, more affordable, nutritious protein options for animal feed, thus increasing productivity of livestock, fish and poultry. Demonstrated that insect-based feeds increase the wealth of beneficial bacteria in the gut of poultry, thus promoting the overall health and growth of the birds.
- Effective recycling of organic wastes into high-value organic fertilisers that improve soil health and crop productivity, and help to control pests.
- Extensive awareness creation, with a media reach of over 3 billion people; and partnerships with over 200 organisations in more than 60 countries around the world.
- Support for policies and national standards for the edible insect farming sector in eastern Africa.
- Capacity building, with over 57,000 people trained and 1,400 insect-based enterprises set up.

Data Management, Modelling and Geo-Information (DMMG) Unit

Established in 2019, the Unit has:

- Developed and implemented the *icipe*

Data Research Management and Archiving Policy, and aligned to it, the Centre's data infrastructure.

- Strengthened the analytical skills of *icipe* teams and partners. Currently, the Unit has a team of 53 members. It is also responding to an increasing number of requests from across Africa and the globe, to boost capabilities, share experience and create awareness.
- Developed a research niche to conceptualise and establish next generation decision-making tools, models, analytics and approaches for the management of crop pests and disease vectors, and the sustainable use and conservation of beneficial insects. This includes contribution to the management of the desert locust crisis in East Africa.
- Supported *icipe*'s 'One Health' vision and resource mobilisation goals, by reinforcing the alignment of the institution's scientific data infrastructure and practice to universal standards such as the FAIR (findable, accessible, interoperable, reusable) principles of data management, while also showcasing elements of open data, open science and reproducible science.

Capacity building

Over the past 10 years, *icipe* has aimed to transform the capacity development efforts from functional training to high quality mentoring, stronger embedment especially towards One Health skills development, intensified efforts to enhance geographical representation; and gender equity. A total of 97% of the postgraduate scholars hosted by the Centre represent 24 African nationalities, while the remaining 3% are from 8 non-African countries. Within the PhD programmes, 42% of the scholars are Kenyans, 56% from the rest of Africa, and 2% from outside the continent. A total of 79% the MSc scholars were Kenyans, 17% from the rest of Africa, and 4% from outside the continent. The *icipe* postgraduate scholars are enrolled at 39 African universities and 23 non-African universities.

BioInnovate Africa Programme

Supported by Swedish International Development Cooperation Agency

(Sida) and managed by *icipe* since 2016, BioInnovate Africa Programme is one of the largest regional bioscience research and innovation-driven initiatives in the continent. BioInnovate has partnerships with over 1,000 scientists and innovators in 200 organisations in eight countries: Burundi, Ethiopia, Democratic Republic of the Congo (DRC), Kenya, Rwanda, South Sudan, Tanzania and Uganda. A total of 25 innovation projects have been supported, with 17 products successfully tested, validated and launched in the market. Moreover, BioInnovate Africa helped to develop the eastern Africa Bioeconomy Strategy, the only such plan of its kind in Africa, and the second globally, after the European Union. The Programme offers valuable lessons in tackling key constraints in innovation systems, and is highly regarded across Africa, and indeed in the world, as a leader in mainstreaming biosciences as a sustainable pathway for development.

Regional Scholarship and Innovation Fund (RSIF)

Managed by *icipe* since 2018, has become one of the largest academic and research networks for nurturing the continent's talent and leadership in applied sciences, engineering and technology, which are priority areas of socio-economic transformation. Nine African governments have committed investments in RSIF, together with the World Bank, the Government of Korea, Carnegie Corporation of New York and several private sector partners. RSIF has a network of 15 African Host Universities and 29 international partner institutes. A total of 291 RSIF PhD scholarships have been awarded. RSIF scholars had published a total of 144 peer reviewed papers and grantees had published 22 papers. Overall, RSIF funding has resulted in the publication of 166 research papers in international refereed journals. Additionally, a total of 32 research and innovation grants have been awarded; and through a special agreement, 12 research and innovation grants have been provided to faculty and researchers in Mozambique.

I am deeply gratified that, after a decade at the helm of *icipe*, my administration leaves a much stronger Centre; one that has a track record and reputation for high quality science and impact on socio-economic transformation; is on a growth trajectory; and has a capable, well motivated team.

icipe continues to demonstrate that creativity and innovation in insect and arthropod related science can provide nature-based, inclusive solutions for millions of people in Africa, and promote food security, better health and sustainable

livelihoods in the face of emerging crises, for example climate change.

Indeed, scientific research remains an indispensable cog in development. But there is an urgent need in Africa for an adequate, well trained and empowered human resource, effective institutions of research, implementation and governance. Thus, the imperative for adequate global, regional and national financial investments. This will liberate researchers to focus on their core calling and mandate – the pursuit of scientific discovery and innovation.



I know that our vision has succeeded because of a network of donors, collaborators, colleagues, policymakers, students and communities. We synergize resources and expertise, dreams and aspirations, to translate broader global visions into locally acceptable, affordable, environmentally friendly and effective technologies. I express my heartfelt gratitude to them.

icipe was a semi finalist in the Future Global Food System Seeding Challenge, competing for USD 100,000 in growth grants for the innovative development of plant extract-based biopesticides and their on-farm applications for sustainable crop production that benefit both humans and the environment.

[Read More](#)

Kym Anderson, Chair, *icipe* Governing Council, is the 2022 recipient of the Crawford Fund Medal (Australia), for: "his contribution to the development of economics in the overlapping fields of international trade and political economy, with a strong focus on agriculture and products of importance to developing economies; and his contribution through leadership roles including with ACIAR, the World Trade Organization, the World Bank, the International Food Policy Research Institute and *icipe*".

[Read More](#)

Ted Turlings, Chair, Programme Committee of the *icipe* Governing Council, has received the 2023 Swiss Science Prize Marcel Benoist (also known as the 'Swiss Nobel Prize') "for his remarkable contributions to the fields of chemical ecology and plant-insect interactions".

[Read More](#)

Segenet Kelemu, Director General & CEO, *icipe*, has been elected Fellow of the International Society of Plant Pathology.

Baldwyn Torto, Head Behavioural and Chemical Ecology Unit (BCEU), was a plenary speaker at the International Society of Chemical Ecology (ISCE-2023), held in Bangalore, India from 23 – 27 July 2023.

Beatrice Nganso, Scientist, Environmental Health Theme, is a 2023 COLOSS Panuwan Chantawannakul awardee, for a proposal titled: "A survey of managed honeybee colony losses in two sub-Saharan African countries".

Robert Jackson, a visiting scientist at *icipe*, has been awarded an honorary membership to the International Society of Arachnology.

Sunday Ekesi, Head Capacity Building and Integrated Sciences, has been elected to Sigma Xi, the world's largest interdisciplinary scientific society that includes more than 200 Nobel Laureates, and whose membership is only by election.

Seven *icipe* scientists are in the "World Ranking of Top 2% Scientists" (2023) list released by Elsevier. They are Sunday Ekesi, Zeyaur Khan, Menale Kassie, Tanga Mbi, Tadele Tefera, Dan Masiga and Baldwyn Torto. [Link](#)

STAFF

Julia Muita (Kenya, MSc) – was ranked first for her poster titled "The Role of *Stomoxys* spp. in animal trypanosomosis transmission dynamics" at the 36th General Conference of the International Scientific Council for Trypanosomiasis Research and Control (ISCTRC), held in Mombasa, Kenya from 18 – 22 September 2023.

James Kisaakye (Uganda, PhD) received a travel grant, and was a runner-up for his poster titled "Fungal endophytes suppress *Radopholus similis* infection of banana (*Musa* spp.) through enhanced expression of defense-related genes", at the 53rd Annual Meeting of the Organization of Nematologists of Tropical America (ONTA), held in Cairo, Egypt from the 24 – 29 September 2023.

Rodrigue Kokou Fiaboe (Togo, PhD), was awarded a travel grant to attend the ISCE-2023.

Emmanuel Peter (Nigeria, PhD) received the AGRO Education Awards for student travel, to attend the American Chemical Society (ACS) fall meeting in San Francisco, USA, from 13 – 17 August 2023.

Bashiru Adams (Ghana, PhD) AGRO Education Awards for Student Travel (April 2023) to attend the ACS fall meeting.

Rehemah Gwoklyalya (Uganda, PhD) was awarded a Mawazo Fellowship, which supports African women PhD students with on-demand training, mentorship and access to funding for research, conference travel, research translation and cross-sector collaborations.

Joseph Oundo (Kenya, PhD) was awarded a travel grant to attend the 29th Conference of the World Association for the Advancement of Veterinary Parasitology in Chennai, India, from 20 – 24 August 2023.

Samuel Jeff Otieno (Kenya, MSc) received the student recognition (2021/2022 academic year) under the Research and Publication Category, Faculty of Agriculture, University of Nairobi, Kenya.

SCHOLARS

JOURNAL APPOINTMENTS

Prof. Torto has been appointed Member, Editorial Committee of the journal Annual Review of Entomology.

INSTITUTIONAL NEWS

The Norwegian Agency for Development Cooperation ([Norad](#)), has signed an agreement with *icipe*, to provide the institution with annual core funding. The core support by Norad to *icipe* is in line with Norway's commitment to strengthen food security in sub-Saharan Africa. Within this vision, Norad intends to boost research that contributes to increased local climate-resilient food production; increased local value creation and incomes for food producers; reduced malnutrition and undernutrition; and reduced hunger crises.

[Read More](#)

icipe Director General, Dr Segenet Kelemu, delivered a lecture on innovations in insect science at the 59th Nobel conference, titled "Insects: Little Body, Big Impact." The speakers discussed the disproportionately massive effects insects have on various aspects of the human experience and the environment (in comparison to their body size).

[Read More](#)

BMZ/GIZ to provide core funding to *icipe*

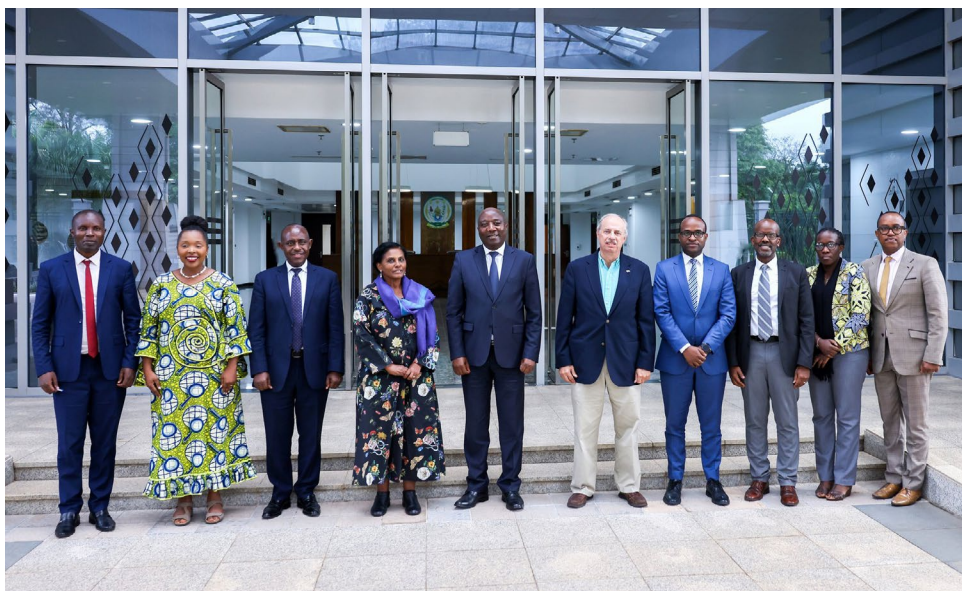
On behalf of the German Federal Ministry for Economic Cooperation and Development ([BMZ](#)), the Deutsche Gesellschaft für Internationale Zusammenarbeit ([GIZ](#)) has signed an agreement with the *icipe* to provide the institution with annual core funding for the period 2023 – 2025. The agreement, which is commissioned by BMZ and administered through the Fund International Agricultural Research (FIA) of GIZ, builds on more than two decades of partnership between Germany and *icipe*.

[Read More](#)



Dr Abdou Tenkouano, a national of Burkina Faso, has been appointed as the new Director General of *icipe*, starting from 1 January 2024. He becomes the fifth leader of the Centre, taking over from Dr Segenet Kelemu, who has held the helm since November 2013.

[Read More](#)



Dr Kelemu (4th left) was among members of the Rwanda National Council for Science and Technology (NCST), who attended the 8th Annual Council meeting held in Kigali, Rwanda, in October 2023, who are pictured here with the Prime Minister of Rwanda, Dr Édouard Ngirente (centre).



The *icipe* Governing Council held its annual meeting in Nairobi, Kenya, between 30 October – 1 November 2023. Pictured while addressing *icipe* staff (l-r) Prof Kym Anderson (Chair), Prof. Faith Osier, Prof. Ingrid Öborn, Dr Morven McLean, Amb. Dr Amina Mohamed, Dr Ylva Hillbur, Dr Ignace Gatere and Dr Michel Eddi.

EMERITUS FELLOWSHIPS

Segenet Kelemu (Ethiopia), Director General & CEO

The Emeritus Fellowship was granted to Dr Kelemu, by the Governing Council for her past and continuing innovative and steadfast science leadership, and capacity building, and for her contribution to the advancement of bioscience and sustainable food systems in Africa and abroad, as well as being an inspiring champion of African women in science and for her contribution to increased global visibility of scientific research and the recognition of *icipe* as a scientific centre of excellence in insect science and its applications.

Zeyaur Khan (India), Principal Scientist

The Emeritus Fellowship was granted to Prof. Khan, by the Governing Council for his past and continuing contribution to the understanding of the complex mechanisms mediating insect-plant and plant-plant chemical interactions in smallholder production systems of sub-Saharan Africa and using this knowledge to develop an integrated climate-smart pest and weed management of push-pull farming system, and for his contribution to capacity building and mentoring the next generation of African scientists.

Baldwyn Torto (Ghana), Principal Scientist

The Emeritus Fellowship was granted to Prof. Torto, by the Governing Council for his past and continuing outstanding contributions to the advancement of chemical ecology and its use in the development of practical tools for integrated management of plant pests, and vectors of animal and human pathogens of economic importance and promoting interdisciplinary science and increasing scientific competency of *icipe*, and capacity building and mentoring of the next generation of African scientists.



Mass Youth Employment in Apiculture Programme

Over the past eight years, the Mastercard Foundation, *icipe*, and several partners have implemented two major initiatives in Ethiopia, which have provided a model to harness the enormous potential of honey and silk value chains in providing novel jobs for young people. The approach also demonstrates an entry point for holistic and inclusive development, and the creation of circular economies.

The two partners have now signed a new five-year agreement that will scale-up these achievements, incorporating an even wider consortium of partners and aiming for a more ambitious target of empowering 1 million unemployed youth in Ethiopia. Dubbed Mass Youth Employment in Apiculture Programme (MaYEA) in Ethiopia, the new initiative will provide tailored skill development programmes, improved technologies and access for their diverse products to markets, in beekeeping and allied value chains. About 80% of the opportunities will go to disadvantaged, rural and peri-urban young women, with an additional 10% targeting people with disabilities and refugees.

ARSO-*icipe* collaboration

icipe has signed a memorandum of understanding with the African Organisation for Standardisation (ARSO), to provide general overview of cooperation in the development of continental standards and guidelines for edible insects-based products. The Centre will also facilitate capacity building and awareness creation, as well as support for policy and regulatory harmonisation in the sector. From 3 – 5 October 2023, *icipe* and ARSO organised training on African Standards and Certification Schemes for Insects for Food, Feeds and Derived Products, which was attended by 31 participants from Botswana, Burkina Faso, Cameroon, Congo Brazzaville, Kenya, Madagascar, Niger, Nigeria, Tanzania, Uganda, Zambia and Zimbabwe. As part of the ARSO-*icipe* partnership on capacity building, 100 women from 31 counties in Kenya attended a five-day black soldier fly farming training, conducted in collaboration with MaMa Doing Good, a programme by the country's First Lady. Two draft African standards have been developed: inventory of edible insects for human consumption and insects for animal feeds in Africa; and insect value-added products – procedures, hygiene, quality, safety, environmental concerns, and standards for commercialisation.

Global participation

Over the past several months, *icipe* researchers have participated in several high-profile events. Selected fora include: the Crawford Fund Annual Conference, themed Global Food Security in a Riskier World, with a presentation on Food Loss and Waste in Circular Economy; the Global Symposium on Sustainable Fall Armyworm Management, organised by the Food and Agriculture Organization of the United Nations (FAO), to facilitate worldwide dissemination of results and lessons learnt to improve the global response against fall armyworm and other invasive plant pests and diseases; meeting of the Controlling and progressively Minimizing the Burden of Animal Trypanosomiasis (COMBAT) Project, organized by the French Agricultural Research Centre for International Development (CIRAD) and FAO; conference on Breaking barriers: Advancing the One Health Agenda with a Focus on Environment meeting in Berlin, Germany; and the 'One Health and Agroecology Workshop', with a presentation on 'Experiences in One Health from Plant Health Perspective - Agroecological innovations from the Global Action for Fall Armyworm Control held in Nassau, Bahamas during the Caribbean week of Agriculture.

Horticultural workshop

Between 13 and 17 November 2023, the annual workshop of the Horticultural Association of Kenya (HAK), was hosted at the *icipe* Thomas Odhiambo Campus, under the theme of 'More, healthier and safer food', in appreciation of the rising global need for food that is produced without adverse impact on natural resources, and is devoid of contamination by pathogens or chemicals; as well as the access, intake and uptake of sufficient amounts of nutritious food by all people. The forum brought together 60 participants including academics, researchers, practitioners, scholars and farmers. They observed first-hand the field and laboratory research on *icipe*'s innovative one health activities, such as the integration of vegetables and edible insect farming into the Centre's highly successful push-pull technology. *icipe* researchers also participated in the training of young scholars and practitioners, to strengthen their scientific and technical skills, and in the training for farmers on basic skills in pest identification and integrated pest management.

Fruit tree pests

icipe has launched a new project to scale-up the Centre's IPM technologies for the management of fruit tree pests, including fruit flies, false codling moths, citrus psyllids, and the most recent devastating invader, the white mango scale. The BMZ-funded initiative will provide demand-driven interventions that are agroecological and gender-inclusive, with a multi-stakeholder approach with policymakers will be central to technology transfer and adoption. It will be implemented in Ethiopia, Tanzania, Zanzibar and Kenya.

Data science

icipe continues to solidify its place as a data science hub. Latest accomplishments include developing an early warning digital advisory service in Rwanda, in partnership with the Alliance of Bioversity International and CIAT, government entities and the private sector. In September 2023, the service enabled farmers to receive and act on advisories with guidance on best management strategies for the fall armyworm and *Striga* weed infestations and climate stress.

The Data Management Modelling and Geoinformation Unit also participated in several fora, including the Optica Sensing Congress in Munich, Germany with a keynote on the "Use of spectroscopy for assessing crop productivity and health of agro-ecological systems in Africa"; convened a workshop on 'Locust outbreaks and new technologies to improve monitoring, forecasting and control', co-organized by the German Aerospace Centre in cooperation with the German Federal Ministry of Education and Research (BMBF); and co-hosted the 11th International Association for landscape Ecology World Congress (IALE 2023), and a variety of presentations on various landscape modelling frameworks in relation to insects.

Visit our popular
'Insect of the Week'
series

icipe beekeeping activities in Ethiopia are featured in an impact story on the second phase of the Enhanced Integrated Framework (EIF), which comes to an end in 2024. To strengthen the growing honey sector in Ethiopia, the EIF supported a project implemented by *icipe*, which trained close to 20,000 beekeepers (over 6,000 women and nearly 18,000 youth) in honey harvesting, grading, packaging, storage and marketing, and were provided with modern equipment. Standardisation of honey production and better packaging has increased earnings to a total of USD 1.3 million, while complementary honey products such as beeswax and royal jelly, pollen and propolis generated an additional USD 400,000+ during the same period. To improve the quality and quantity of honey, 440,000 bee forage seedlings were planted around apiaries by 58 beekeepers' enterprises, with almost USD 80,000 generated from the sale of seedlings.

IN NUMBERS

- 115,053 (70% of them women) **young people recruited**, trained and provided with business starter kits for beekeeping and sericulture.
- 25,066 **direct jobs created** through input and service provider small enterprises.
- 648,014 indirect **jobs created for young people**.
- 1,457 **tonnes of honey** and 222 **tonnes of silk** produced and sold, generating ETB 414 million.
- 2,000 **honey villages** established through the Government of Ethiopia's Yelemat Tirufat development campaign, which focuses on nutritional opulence, inspired by the MOYESH project.
- 60,000 frame hives to be produced for beekeeping farmers by the Government of the Oromia Region, based on the **MOYESH project business model**.

Silk movement in Ethiopia

Over the past seven years, *icipe* has contributed to the revival of silk production in Ethiopia, through the YESH and MOYESH projects. The Centre has used its extensive experience, amassed over the past three decades of extensive research and development sericulture farming activities across diverse

agroecological regions in Africa. In Ethiopia, we have introduced the rearing of Eri silkworm due to its suitability to the country's weather conditions, its hardiness, disease tolerance and year-round production cycles, among other factors. Eri silk is unique; it is a staple fibre, which, unlike other silks has a continuous filament. It is very strong, durable and elastic and hardy for

processing. It is also darker and heavier than other silks and blends well with wools and cotton. The fabric produced from Eri silk is coarse, fine and dense. We are taking advantage of Ethiopia's comparative advantage in traditional craftsmanship in weaving and design, use of natural dyes on cotton, to create distinct, globally appealing fabrics.

L-R: MOYESH sericulture youth partners from the Southern Nations, Nationalities, and Peoples' Region (SNNPR), Ethiopia: Camero Ketema from Birhan silkworm farming enterprise in Mirab Abaya district displays an eri cocoons in the rearing room; Nazret Murte with boiled cocoons, washed, cleaned cocoons ready for drying. Serawit Berhe and Lidya Gezahegn from Fikir Silkworm Farming Enterprise in Ugayehu village, Mirab Abaya district, display silk yarns, after spinning, ready for sale. The two enterprises were established in 2020 through the YESH project, and have continued operations through the MOYESH project. Jointly, they have produced about two tonnes of silk cocoons, and they are major sources of eri silkworm eggs for the MOYESH project.



BIOINNOVATE AFRICA PROGRAMME

Enhancing gender integration in BioInnovate Africa:

BioInnovate Africa has developed a five-year gender strategy (2023-2028) and Action Plan (2023-2024) for systematic integration of a gender responsive innovation agenda. The strategic objectives include: enhancing the internal culture, capacity for design, planning, implementation, and reporting; and improving the ability to address gender issues in their projects.

Read More

Carbon farming in East Africa: BioInnovate Africa and the University of Bonn, Germany, are collaborating to research the economics of carbon sequestration in African agriculture. The research seeks to explore the opportunities and challenges of involving smallholder farmers in East Africa in emerging agricultural carbon markets to contribute to climate change mitigation through the adoption of sustainable land management practices, referred to as carbon farming. This type of farming involves increasing carbon sequestration in soils and plants while reducing or avoiding greenhouse gas (GHG) emissions in agricultural production. Carbon farming is linked to important policy efforts such as the development and expansion of a

sustainable bioeconomy. The research addresses the pressing global challenge of achieving the net-zero CO₂ emissions by 2050 as aligned with the Paris Agreement on Climate Change, by unlocking the potential of natural climate solutions in the pursuit of net-zero emissions.

Domesticating EA Bioeconomy Strategy: *icipe*, through BioInnovate Africa, is collaborating with the East African Science and Technology Commission (EASTECO) and other partners to implement the East African Regional Bioeconomy Strategy. As part of this process, BioInnovate Africa, EASTECO, the Stockholm Environment Institute (SEI) – Africa Centre, in collaboration with the Ministry of National Education and Scientific Research, Republic of Burundi through the National Commission for Science, Technology and Innovation (NCSTI) held a high-level, national policy dialogue on bioeconomy on 17 October 2023 in Burundi.

Coming soon: A publication that will chronicle the evolution of the BioInnovate Africa Programme as a boundary organisation for a bioeconomy in Africa.

Video podcast: How do biosciences unlock big ideas to tackle big problems? We feature two BioInnovate Africa supported projects, one that is combining rural and urban organic waste and beneficial soil micro-organisms to generate high-quality fertiliser; and another that is harnessing banana waste to control soil dwelling pests, thus increasing productivity of tuber crops.



IN FOCUS: GHANA AND RSIF

- In 2020, the Government of Ghana contributed USD 2 million to RSIF. Ghana is the current vice-chair of PASET.
- There are 22 RSIF doctoral scholars (5 of them women) from Ghana registered in seven RSIF African Host Universities (AHUs).
- 1 Ghanaian RSIF PhD scholar has completed studies on the application of smart internet of things (IoT) technologies in agriculture. He was registered at University of Gaston Berger, Senegal, with sandwich placement at Worcester Polytechnic Institute (WPI), USA.
- 18 peer-reviewed journal articles have been published by scholars from Ghana.
- University of Ghana (School of Agriculture), is an RSIF AHU in the Food Security and Agribusiness thematic area.
- 29 RSIF funded PhD scholars (11 of them women), from 10 countries are registered at the University of Ghana, in the PhD programme on Applied Agricultural and Policy / Agribusiness.
- 7 RSIF funded research and innovation projects are under implementation in Ghana.

3 research and innovation grants have been awarded to University of Ghana; and 1 research grant to an RSIF alumni at University of Mines and Technology, Tarkwa. Projects include: (i) Building Resilient Agribusiness Practitioners through Design Thinking Approach; (ii) Innovating Out of the Urban Street Food Safety Challenges; (iii) Robust and Affordable Smart Agri-IoT Technology; (iv) Institutional framework to enhance the Agri-innovation ecosystem within the University of Ghana (IFEA-Eco).

3 projects in agri-based digital innovation implemented in Ghana, supported by the European Union through the ACP Innovation Fund of the Organization of African, Caribbean and Pacific States (OACPS): (i) Digital Tools to Drive Market Access and Manage Ag-Value Chains, led by Esoko Ltd.; (ii) Scaling AgroCenta Platform and Adoption for Effective Market Linkages in Ghana, led by AgroCenta Ltd. and (iii) Enhancing farmers' uptake of digital technologies through empirical research, innovation and policy intervention, led by CSIR-STEPRI.

IN FOCUS: CÔTE D'IVOIRE AND RSIF

- In 2019, the Government of Côte d'Ivoire contributed USD 1 million to RSIF.
- There are 11 RSIF PhD scholars (3 of them women) from Côte d'Ivoire registered in four RSIF African host universities (AHUs).
- Université Félix Houphouët-Boigny (UFHB), Côte d'Ivoire, is an RSIF AHU in the Climate Change thematic area.
- 22 RSIF funded PhD scholars (8 of them women) from 10 countries are registered in the PhD programme in Climate Change and Biodiversity at the Africa Center of Excellence for Climate Change Biodiversity and Sustainable Agriculture (CCBAD) at UFHB, Côte d'Ivoire.

- 1 RSIF PhD scholar has completed his studies at UFHB with sandwich placement at Korea Institution of Science and Technology (KIST). Other UFHB registered scholars have their research placement at the Natural Resources Institute (NRI), University of Greenwich, United Kingdom; University Mohammed VI Polytechnic, Morocco; ILRI, Kenya or IRD, France.
- 19 peer-reviewed journal articles have been published by RSIF students registered at UFHB.
- 3 peer-reviewed journal articles have been published by scholars from Côte d'Ivoire.
- An RSIF funded project in sustainable and innovative production of yams by post-harvest pest control is under implementation in Côte d'Ivoire. Two biopesticides for yam fungi have been approved and registered. One of the RSIF funded Ivorian PhD students associated with this project was awarded the L'Oréal-UNESCO Women in Science 2022 award for her work on biopesticides to protect yam crops.

JUNIOR INVESTIGATIVE RESEARCH AWARD

Five research grants have been awarded to RSIF PhD graduates. The awardees are: David Oluwasegun Afolayan (Nigeria) and Richard Koech (Kenya), who were both registered at the African University of Science and Technology (AUST), Nigeria. David will conduct research on additive-assisted fabrication of efficient and stable perovskite solar cells. Richard will aim to characterize cleaved baryte surface-interfaces and computational study of interactions of baryte ore-based middling particles for enhanced mineral liberation and recovery.

Jean Nepomuscene Hakizimana (Rwanda), who was registered at Sokoine University of Agriculture, Tanzania, will conduct research to leverage pathogen genomics for an improved domestic pig health and production by mapping African swine fever virus transmission dynamics at the wildlife-livestock interface in Tanzania. Noel Gahamanyi (Rwanda), who was registered at the University of Rwanda, will research the prevalence, antimicrobial susceptibility profiles, and genotypes of thermophilic *Campylobacter* species from humans and animals in selected regions of Rwanda. Emmanuel Effah (Ghana), who was registered at the Gaston Berger University (UGB), will conduct research on robust and affordable smart Agri-IoT technology.

AgriDI INNOVATIONS

Since its inception in February 2021, the Accelerating Inclusive Green Growth through Agri-based Digital Innovation in West Africa (AgriDI) project, has helped to develop six digital innovations, which are being tested for their ability to provide tangible solutions for farmers and agribusinesses in crop and livestock production, as well as links to markets, in several west African countries. AgriDI is one of 12 Innovation Fund projects financed by

the European Union through the ACP Innovation Fund of the Organization of African, Caribbean and Pacific States (OACPS). The initiative is anchored in the innovation subcomponent of the Regional Scholarship and Innovation Fund (RSIF) implemented by an *icipe*-led consortium in Benin, Burkina Faso, Côte d'Ivoire, Ghana, and Nigeria. At *icipe*, AgriDI is, an initiative of the Partnership for skills in Applied Sciences, Engineering and Technology (PASET).

[Read More](#)


Milestone for ARPPIS, Class of 2022

Eleven *icipe* African Regional Postgraduate Programme in Insect Science PhD scholars (ARPPIS, Class of 2022), recently presented their PhD research proposals, a major milestone that enabled them to obtain vital input from the Centre's researchers. The topics include: Designing complex systems analogies: a novel computational approach to optimize integrated pest management delivery; Impact of digital advisory services on the use of sustainable land management practices and maize productivity in Uganda; Adoption and impact of sustainable agricultural practices: the role of mass campaigns and digital tools; Integrative approach for management of the alien invasive, *Drosophilla Suzukii* in Kenya; The socioeconomics and adoption patterns of the push-pull technology in the management of pests among smallholder farmers across East Africa; Modulation of *Glossina pallidipes* olfaction due to infection and feeding; Xenosurveillance of zoonotic diseases: use of environmental DNA and mosquito vectors as surveillance tools for tick-borne pathogens in livestock Kenya; Exploring antimicrobial potentials of black soldier fly (*Hermetia illucens*) larvae as novel therapeutic agents; Spatial and spatio-temporal modeling of insecticide resistance phenotypes in malaria vectors in Africa; arbovirus surveillance in syndromic, non-syndromic livestock and associated rodents in select pastoral arid to semi-arid zones in Kenya: Exploring zoonotic disease transmission potential; Novel approaches to automate data extraction and build a common data model for disease vector occurrence bionomics and insecticide resistance in Africa.

Nematology capacity building

icipe, International Institute of Tropical Agriculture (IITA) and Ghent University (Ugent), Belgium, have conducted their annual joint nematology training, which includes the Kenya Track Option for students enrolled on the Ugent's Master of Science in Agro- and Environmental Nematology Programme. Starting in November, five students from India, Indonesia, The Philippines, Uganda and South Africa, participated in a one-month industrial training in Kenya. They also took part in a one-week Tropical Pest and Disease Course, which has been expanded to include seven students from Moi University, Kenya. Through the course, the students visited smallholder and commercial farms in various agroecological zones in Kenya, to discuss with the farmers, the nematode menace, within the context of agronomic practices and plant protection strategies of major pest and disease challenges. The students also serve as trainers of the Basic Crash Course in Nematology (BCCN), through which 18 participants from Benin, Burundi, Ethiopia, Kenya, Nigeria, Rwanda and South Africa will gain knowledge in nematology techniques.

icipe GOVERNING COUNCIL STUDENT AWARDS WINNERS

BEST PUBLISHED SCIENCE PAPER

**Winner**

Komi Mensah Agboka (PhD, Togo)

Paper: Agboka K.M., Tonnang Z.E.H., Abdel-Rahman E.M., Kimathi E., Mutanga O., Odindi J., Niassy S., Mohamed S. A. and Ekesi S. (2022) A systematic methodological approach to estimate the impacts of a classical biological control agent's dispersal at landscape: application to fruit fly *Bactrocera dorsalis* and its endoparasitoid *Fopius arisanus*. *Biological Control*, 105053. <https://doi.org/10.1016/j.biocontrol.2022.105053> (Impact factor, IF 4.2)

**First Runner Up**

Rehema Gwokyalya (PhD, Uganda)

Paper: Gwokyalya R., Weldon W. C., Herren K.J., Gichuhi J., Makhulu E.E., Ndlela S. and Mohamed A.M. (2023). Friend or Foe: Symbiotic Bacteria in *Bactrocera dorsalis*–Parasitoid Associations. *Biology*, 12(2), 274; <https://doi.org/10.3390/biology12020274>. (IF 4.2)

**Second Runner Up**

Emmanuel Peter (PhD, Nigeria)

Paper: Peter E., Tamiru A., Subramanian S., Dubois T., Kelemu S., Kruger K., Torto B. and Yusuf A. (2023). Companion crops alter olfactory responses of the fall armyworm (*Spodoptera frugiperda*) and its larval endoparasitoid (*Cotesia icipe*). *Chem. Biol. Technol. Agric.* 10:61. <https://doi.org/10.1186/s40538-023-00415-6> (IF 6.6)

BEST SCIENCE POSTER

**Winner**

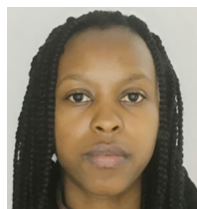
Abneel Matharu (PhD, Kenya)

Poster title: Efficacy of Pyriproxyfen in control of off-host stages of *Tunga penetrans*
Supervisor: Ulrike Fillinger

**First Runner Up**

Emmanuel Peter (PhD, Nigeria)

Poster title: Fall armyworm larval parasitoid, *Coccygidium luteum*, exploits cues from companion plants to locate its host.
Supervisors: Amanuel Tamiru, Baldwyn Torto and Subramanian Sevgan

**Second Runner Up**

Anne Wairimu (MSc., Kenya)

Poster title: Investigation of a *Microsporidia MB* protective phenotype against entomopathogenic fungi in the malaria vector, *Anopheles arabiensis*
Supervisor: Jeremy Herren

Insect-based indicator

icipe has developed a high-resolution, insect-based indicator to assess overall biodiversity status and environmental health of landscapes in Africa. The tool is based on big data from satellites, as well as information collected by citizens using a smartphone application. Findings show that wetlands, gallery forests and protected areas in Kenya and South Africa are important biodiversity hotspot areas that should be safeguarded. The diversity of indicator species, such as stingless bees, butterflies and dragonflies, is higher in protected areas across various climate zones in Africa. [Paper link](#)

Crimean-Congo haemorrhagic fever virus

The zoonotic Crimean-Congo haemorrhagic fever virus, which causes a fatal disease in people, is re-emerging globally. Certain tick species are considered vectors and reservoirs of the virus, while diverse animals are suspected to be amplifiers. A recent study by *icipe* suggests active, unnoticed circulation of the virus within the Kenyan Rift Valley, and the involvement of livestock, rodents and people in its circulation. So far, rodents and shrews have been largely neglected in the surveillance of the disease, despite their potential risk in its zoonotic transmission. [Paper link](#)

Agroforestry in push-pull

icipe continues to upscale, intensify and diversify the push-pull technology, for maximum benefits in smallholder farming systems. Most recently, the Centre has commenced integration of farmer-preferred vegetables into the technology. Additional studies show the potential of agroforestry as a potential component in the push-pull technology. This aspect is desirable to farmers, as it will help augment fodder and firewood supply, and fruits for dietary diversity. Ongoing studies are exploring push-pull plot design and manipulation of trophic interactions that will allow incorporation of agroforestry. Also, the current research contributes evidence that agroecological practices should prioritize farmer-preferred practices. It also highlights policy gaps in the integration of promising agricultural technologies such as push-pull technology into government agendas. [Paper link](#)

Insect-based feeds for aquaculture

Drawing on lessons from *icipe*'s experience, we have published a study that outlines the deliberate efforts that are needed to create a conducive environment in the insects for feed and

the transformation of the aquaculture sector in Kenya. Our report also outlines how to coordinate and articulate the roles and responsibilities among devolved and national governments, and donors and financial institutions, through public-private partnerships. These strategies will ensure optimal allocation of financial, human and infrastructure resources. Collaborative research is needed to design and construct climate-smart culture systems; rear new fish species; develop and scale-up insect-based fish feeds. Our study also indicates the innovative practices and market linkages that are needed to create employment opportunities for youth and women, and resilient livelihoods, through insect-based feeds for the aquaculture industry in Kenya. [Paper link](#)

Parasitoid probiotics

Parasitoids have shown potential as biocontrol agents of the devastating fruit fly, *Bactrocera dorsalis*. This function is influenced by several factors, including host-associated symbiotic bacteria, and how they interact with natural enemies within ecosystems, and hence the outcome of biological pest management regimes. We have assessed the effect that three common gut bacteria in *B. dorsalis*, have on biological control using parasitoid wasps. We found that some gut bacteria increase parasitoid emergence, their size and the fecundity of their offspring. Thus, some bacteria can be used as probiotics in the mass rearing of parasitoids to boost the biological control of the fruit fly. [Paper link](#)

Case for pollination dependent crops

Econometric results from a recent *icipe* study provides evidence for more investment in pollination dependent crops, as an integral approach to nutrition security in Africa. The research finds that such crops have higher micronutrient content per unit weight, and vitamin A production, compared to pollination independent crops. The findings demonstrate that increasing the cultivation of pollination dependent crops, relative to pollination independent crops, will help to reduce nutrient deficiencies, while also increasing crop income without compromising macronutrients production. [Paper link](#)

History of arboviruses

icipe researchers have published a book chapter that reviews the history of research into arboviruses that are endemic to Kenya. The chapter discusses mosquito- and tick-borne viruses, and

also mentions other viruses such as Ebola, which have similar symptoms to arboviruses identified in the course of surveillance in East Africa. History of Arbovirology: Memories from the Field [Chapter link](#)

Stingless bees propolis

Propolis is a hive product made by bees from wax and plant resins, which makes it rich in phytochemicals such as flavonoids and phenolics. Propolis is a known source of natural antioxidants too due to the presence of polyphenols. The chemical composition of propolis from stingless bees is affected by several factors including vegetation type and species. Our research demonstrates that propolis from Kenyan stingless bees has varying amounts of phytochemicals, which is dependent on the species and their floral resources preference. Our study confirms that the propolis from stingless bee species in Kenya is a good source of exogenous natural antioxidants. [Paper link](#)

Endophytes, plant growth and protection

We have identified three endophytic fungi isolates: *Trichoderma asperellum* M2RT4, *T. harzianum* F2R41, and *Hypocrea lixii* F3ST1, which improve maize plant defense against the fall armyworm, *Spodoptera frugiperda*. The endophytes also promote plant growth, possibly due to the increased uptake of nutrients. Thus, they hold the potential for the development of biopesticides as part of a sustainable IPM for the pest and as plant growth promoters. Further studies will investigate the underlying mechanisms by which the endophytes affect *S. frugiperda*, along with the validation of the findings under field conditions. [Paper link](#)

Sand flies, Leishmania and leishmaniasis

icipe has published a study that advances knowledge on sand fly diversity and distribution; occurrence of Leishmania DNA within sand flies; and blood-meal sources of sand flies, in Laisamis, northern Kenya, a poorly investigated leishmaniasis hotspot. The findings include the first report of *Phlebotomus alexandri* sand flies, alongside three other species that vectors leishmaniasis: *Ph. orientalis*, *Ph. saevus* and *Ph. martini*. These insights suggest complex transmission dynamics of leishmaniasis, and the need for more research to establish the pre-disposing factors to the anthropophilic nature of these sand flies, the alternative ecologies of *Ph. martini*, and the role of *Ph. alexandri* in the transmission of Leishmania parasites. [Paper link](#)



Ms Wambui Chege, Director, Agrifood Systems and Climate, Mastercard Foundation visited *icipe* in August 2023. She had a chance to sample stingless bees products. With her is Kiatoko Nkoba, Senior Scientist, *icipe*.

We were pleased to welcome a team from the Embassy of Sweden in Nairobi, Kenya

They include:

- Annika Otterstedt, Head of Section for Kenya Development Cooperation
- Cecilia Kleimert, Programme Specialist, Somalia section,
- Elena Sahlin, Regional Innovative Financing Specialist
- Joan Karanja
- Ulrika Åkesson, Regional Team Environment for Africa
- Lisa Andersson
- Amra Turcinhodzic, First Secretary
- Katrin Aidnell, Environment and Climate Change Specialist.



On 6 October 2023, Dr Etienne Coyette, European Union Commission, visited *icipe*. He is pictured with Subramanian Sevgan, Head, *icipe* Environmental Health Theme, in a discussion about the Centre's insect biodiversity conservation activities.



A delegation from the Rwanda Agriculture and Animal Resources Board, and the International Potato Centre (CIP) visited *icipe*, specifically to familiarise themselves with ongoing nematology research.



A team from journalists network, a German non-profit association representing a range of German media outlets visited *icipe*, conducted an interview with the DG, Dr Kelemu, and visited several *icipe* facilities.



A delegation of the Italian Agency for Development Cooperation pictured with *icipe* Director General during a visit to explore collaboration opportunities.

NEW APPOINTMENTS



**Dr Merid Negash Getahun
(Ethiopia)**

Interim Head, Behavioural and Chemical Ecology Unit (BCEU), to provide research and programmatic leadership to the BCEU



Dr Fathiya Khamis (Kenya)
Head, Arthropod Pathology Unit (APU)



**Dr Shaphan Yong Chia
(Cameroon)**

Research Scientist, Insects for Food, Feed and Other uses (INSEFF)



**Dr Menaga
Meenakshisundaram**

Postdoctoral Fellow, Aquaculture Nutrition, Insects for Food, Feed and Other Uses (INSEFF) Programme of the Environmental Health Theme



Bethlehem Melese
Senior Research Officer I (Senior Gender Expert) MOYESH project



Dr Elizabeth Ng'ang'a (Kenya)
Head of Communications, Director General's Office



**Benson Odhiambo Alex
(Kenya)**
Business Support Officer II (Guest Centre Supervisor)



Mary Majani (Kenya)
Senior Business Support Officer I (Project Support Officer), Regional Coordination Unit of the Regional Scholarship and Innovation Fund (RSIF)



**David Chandago Mwadzaya
(Kenya)**
Senior Business Support Officer I (Project Support Officer), Data Management Modeling and Geo-Information (DMMG) Unit



Joyce Kamau (Kenya)
Senior Business Support Officer I, Project Accounting Unit

Over the past several months, over 70 additional positions have been filled or regularised in the following categories:

Research and development

Junior staff assistants, research assistants and research officers.

Business support

Junior support assistants, business support assistants, business support officers and senior support officers.

Support services

Support assistants and support officers.

For complete details on recent staff appointments

[Read More](#)



Donor: Norwegian Agency for Development Cooperation (Norad)

Title: Core programme support
icipe staff: Dr Segenet Kelemu

Donor: Mastercard Foundation

Title: Mass Youth Employment in Apiculture (MaYEA) project
Collaborators: Organization for Rehabilitation and Development in Amhara (ORDA) Ethiopia; International Institute of Rural Reconstruction (IIRR); Bees for Development Ethiopia; Population, Health and Environment Ethiopia Consortium; Movement for Ecological Learning and Community Action – Ethiopia; SOS -Sahel Ethiopia; Ministry of Agriculture, Ethiopia; Ministry of Labour and Skills, Ethiopia; Ministry of Trade and Regional Integration, Ethiopia; Private sector companies and farmers cooperatives' Unions

Donor: BMZ through Rheinische Friederich-Wilhelms-Universität Bonn (ZEF)

Title: Program of Accompanying Research for Agricultural Innovation (PARI)
icipe staff: Julius Ecuru, Manager, Research Innovation Coordination Units; and Menale Kassie, Head Social Science and Impact Assessment Unit.

Donor: Feed the Future Innovation Lab for Current and Emerging Threats to Crops, Pennsylvania State University

Project title: Crop damage and yield losses due to insect pests under changes in climatic conditions

icipe staff: Samira Mohamed, Sunday Ekesi, Menale Kassie, Holger Kirscht, Michael Kidoido, Elfatih Abdel-Rahman, Fathiya Khamis, Thomas Dubois, Shepard Ndlela, Saliou Niassy, Elfatih Abdel-Rahman, Henri Tonnang, Thomas Dubois, Bonoukpoè Mawuko Sokame, Abdelmutalab Gesmalla, Beatrice Muriithi

Donor: International Food Policy Research Institute (IFPRI)

Project title: Impact evaluation of the adoption of integrated pest management technologies among maize producers in Uganda: Interventions
icipe staff: Kelvin Mulungu, Menale Kassie
Collaborators: The International Potato Center (CIP)

Donor: NIH – Harnessing Data Science for Health Discovery and Innovation in Africa (DS-I Africa): Research Education Program (UE5 Clinical Trial Not Allowed) - RFA-RM-22-022

Title: Eneza Data Science: Enhancing Data Science Capability and Tools for Health in East Africa (1UE5TW012539-01)
icipe staff: Daniel Masiga, Caleb Kibet, Kennedy Senagi
Co-PIs: Amina Abubakar, Professor and Director, Institute for Human Development, and Anthony Ngugi, Associate Professor, Epidemiology & Population Health; Department of Pathology, Aga Khan University, Kenya.
Collaborators: USIU-Africa, Kenya; Department of Biochemistry, Pwani University, Kenya; Michigan integrated Center for Health Analytics and Medical Prediction, and Center for Global Health Equity, University of Michigan, USA

Donor: One CGIAR Secretariat led by International Maize and Wheat Improvement Center (CIMMYT) - Plant Health Initiative

Project title: Development, testing and scaling of maize and vegetable IPM in Eastern Africa

icipe staff: Thomas Dubois
Collaborators: Real IPM Biobest; and National Agricultural Research Organization, Uganda

Donor: BMZ/GIZ project funding for International Agricultural Research Centers

Project title: Demand-driven interventions for implementing agroecologically-based and climate resilient IPM technologies to enhance fruit production and nutrition among smallholder farmers in East Africa
icipe staff: Samira Mohamed, Sunday Ekesi, Menale Kassie, Holger Kirscht, Michael Kidoido, Elfatih Abdel-Rahman, Fathiya Khamis, Thomas Dubois, Shepard Ndlela, Saliou Niassy

Collaborators: Ministry of Agriculture, Plant Health Clinic, Ethiopia; Tanzania Agricultural Research Institute (TARI); Zanzibar Agricultural Research Institute (ZARI); ARC-Tropical and Subtropical Crops, Nelspruit, South Africa

Donor: DFG-African-German Scientific Exchange in the Field of Sustainable Intensification of Agriculture, Stage 2 “Initiation of International Collaboration” programme

Project title: Agricultural pests under changing landscapes and climates: opportunities and costs to mitigate crop damage through managing biodiversity in Southern Africa (PestClim)

icipe staff: Sunday Ekesi
Collaborators: University of Technology, Germany; Stellenbosch University, South Africa; University of the Free State, South Africa; and Botswana International University of Science and Technology and IFPRI

icipe gratefully acknowledges the financial support of the following organisations and agencies

Core donors

- Swiss Agency for Development and Cooperation (SDC), Switzerland
- Swedish International Development Cooperation Agency (Sida), Sweden
- Australian Centre for International Agricultural Research (ACIAR), Australia
- Norwegian Agency for Development Cooperation
- Ministry of Education, State Department of University Education and Research, Kenya
- Government of the Federal Democratic Republic of Ethiopia

Restricted project donors

- African Academy of Sciences
- African Technology Policies Studies Network
- African Union
- Australian Centre for international Agricultural Research (ACIAR)
- Bayer: Science for a Better Life
- Bertha Foundation
- Bill & Melinda Gates Foundation
- BioInnovate Africa Programme
- Biotechnology and Biological Sciences Research Council (BBSRC)
- Biotechnology and Biological Sciences Research Council, UK, through Rothamsted Research, UK
- Biovision Africa Trust
- Biovision Foundation for Ecological Development, Switzerland
- British Council- Newton Fund Institutional Links
- Chalmers University of Technology
- Cambridge Africa ALBORADA Research Fund
- Canadian Executive Service Organization (CESO)
- Carnegie Corporation of New York
- Children's Investment Fund Foundation (CIFF)
- Code for Science & Society (CS&S)
- Cordaid
- Cultivate Africa's Future (CultiAF) through International Development Research Centre (IDRC)/Australian Centre for International Agricultural Research (ACIAR)
- Danish International Development Agency (DANIDA)
- Desert Locust Control Organization of Eastern Africa (DLCO-EA)
- Deutsches Zentrum für Luft- und Raumfahrt - German Aerospace Center (DLR)
- ETH Zürich
- Ethiopian Catholic Church Social Development Commission Branch Office of Meki (ECC-SDCBOM)
- European Union
- Food and Agriculture Organization of the United Nations (FAO)
- French Agricultural Research Centre for International Development (CIRAD)
- Future Leaders – African Independent Research (FLAIR)
- German Academic Exchange Service (DAAD)
- Federal Ministry for Economic Cooperation and Development (BMZ)
- German Aerospace Centre
- German Research Foundation (DFG)
- Government of Nigeria (Under investors of RSIF)
- Global Challenges Research Fund (GCRF)
- IKEA Foundation
- iMC Worldwide
- Impaxio GMBH
- Innovate UK
- InsectiPro Ltd
- Institute of Research for Development (IRD)
- International Atomic Energy Agency (IAEA)
- International Centre for Agricultural Research in The Dry Areas (ICARDA)
- International Development Research Centre (IDRC)
- International Food Policy Research Institute (IFPRI)
- International Fund for Agricultural Development (IFAD)
- IPM Innovation Lab (Feed The Future Innovation Lab for Integrated Pest Management) of Virginia Tech, USA
- James Hutton Institute
- JRS Biodiversity Foundation
- Keele University, UK
- Kenya Education Network (KENET)
- LEAP-Agri (A long-term EU-Africa research and innovation partnership on food and nutrition security and sustainable agriculture)
- Leibniz Centre for Agricultural Landscape Research, ("ZALF") with funding from European Space Agency
- Mastercard Foundation
- Max Planck Institutes, Germany
- Medical Research Council
- Ministry for Primary Industries (MPI), New Zealand
- Mozilla Foundation, USA
- National Geographic Society
- National Research Fund (NRF), Kenya
- Netherlands Organisation for Scientific Research (NWO)
- Norwegian Agency for Development Cooperation (Norad)
- Norwegian Refugee Council
- Novo Nordisk Foundation, Denmark Through Impact Designs
- One CGIAR Secretariat through CIMMYT and ILRI
- Open Philanthropy
- Participatory Ecological Land Use Management (PELUM), Kenya
- Penn State University, USA
- Remote Sensing Solutions (RSS) GmbH, Germany
- Research Institute of Organic Agriculture (FiBL)
- Rockefeller Foundation
- Scottish Funding Council
- Swedish International Development Cooperation Agency (Sida)
- Swedish University of Agricultural Sciences (SLU)
- Swiss Agency for Development and Cooperation (SDC)
- Swiss National Science Foundation (SNSF)
- The Curt Bergfors Foundation Food Planet Prize
- The Royal Society, UK
- The Stichting IKEA Foundation through Biovision Foundation for Ecological Development
- TWAS, The World Academy of Sciences through Organization for Women in Science for the Developing World (OWSD)
- United Nations Environment Programme (UNEP)
- United Nations Office for Project Services (UNOPS)
- United States Agency for International Development (USAID)
- United States Agency for International Development-Partnerships for Enhanced Engagement in Research (USAID-PEER) Science
- United States Department of Agriculture (USDA)
- United States National Academy of Sciences (NAS)
- United States National Institutes of Health (NIH)
- United States National Science Foundation (NSF)
- University of Bern, Switzerland
- University of Cambridge, UK
- University of Eastern Finland
- University of Glasgow, Scotland
- University of Leeds, UK
- USAID – United States Agency for International Development
- Wageningen University, The Netherlands
- Wellcome Trust, UK
- World Federation of Scientists
- WorldFish
- World Health Organization (WHO)
- World Trade Organization (WTO) – Enhanced Integrated Framework (EIF)

Investors in the Regional Scholarship and Innovation Fund

- Government of Benin
- Government of Burkina Faso
- Government of Côte d'Ivoire
- Government of Ghana
- Government of Kenya
- Government of Mozambique
- Government of Rwanda
- Government of Senegal
- Government of South Korea
- World Bank Group
- ACP Innovation Fund of the European Union through the Organisation of African, Caribbean and Pacific States (OACPS)

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

