

ICIPE visit at BMI – January 13-16th, 2020

Presentations and statements abstract

Opening statements

Prof. Yaron Oz, Rector, Tel-Aviv University

Prof. Itai Sened, Head, the Boris Mints Institute; Founding Head, School of Social and Policy Studies, Tel-Aviv University

Dr. Segenet Kelemu, Director General, *icipe*

Mrs. Joelle Aflalo, Co-Chair, Matanel Foundation

Tel-Aviv University and the Boris Mints Institute are allocating substantial research resources to the issue of sustainable development, which is crucial for humanity and the planet. Many life forms have disappeared, there is an exponential growth of the human population, and we are facing the first human-induced climate change. 100,000 species of animals are lost per year, the environment is changing and thus uncertainty is rising. There are tools that suggest technology-based solutions for issues such as food security, renewable energy resources and waste management. In order to save the globe right now - Academia, decision makers and businesses need to come together to fight the challenges.

Insects should be the starting point in the path of achieving food security. An example of such a step forward could be the cycle in which worms eat waste, and then fed to various farming animals, therefore reducing the waste and progressing within the framework of sustainable development. People need to think differently, and the only way to achieve the UN's Sustainable Development Goals (SDGs) is to create inter-disciplinary and multinational projects.

Insects, animals, that are often unnoticed in the food chain, can be used for various purposes, such as oil extraction for various purposes, food additives and protein consumption by humans. *Icipe*, with some of its' projects and the new technology, aims to bring insects to good use for all human beings. Another point of traction of how to achieve the SDGs is educational farming, in order to help farmers develop practical long-term sustainable tools and best practices.

Research presentations, TAU

Dr. Neta Dorchin, School of Zoology and Chief Curator of Entomology, the Steinhardt Museum of Natural History

Israel enjoys a high level of biodiversity and has a variety of different ecosystems, despite its small size. The Steinhardt Museum of Natural History at TAU is a unique institution which studies, curates and explores these ecosystems and the various organisms who inhabit these ecosystems. The museum's staff is comprised of collection managers and expert



taxonomists, who focus on taxonomic and systematic research, as well as field work in nature reserves. The Museum publishes books and policy recommendations in its fields of research.

Museum researchers conducted the first project of weed biocontrol in Israel. This biocontrol study is completely safe, as the insects cannot feed on anything but the parasite plant. The museum also engages in other research projects: Identification of pests and invasive species, Identification for ecological studies, Ecological surveys in focal nature reserves for Israel's Nature and Parks Authority, as well as raising awareness of endangered habitats and species. The pictures below illustrate the fieldwork conducted by the Entomology section of the museum:

Dr. Gideon Pizanti, Hymenoptera Collection Manager, the Steinhardt Museum of Natural History

It is very important to define an ecological profile of crop pollinators in order to conserve the biodiversity of bees, and further research is required. The Hymenoptera collection's work focuses on how the bee fauna changes along a natural agricultural gradient. It samples bees in natural and agricultural habitats, as well as sampling various areas and environments, using active and passive collection. Some results of the studies include the conclusion that wild pollinators contribute to crop pollination according to their life history traits, that natural habitats being close to the pollinators do not guarantee efficient crop pollination and that wild pollinators sometimes prefer man made agricultural habitats as well as others.

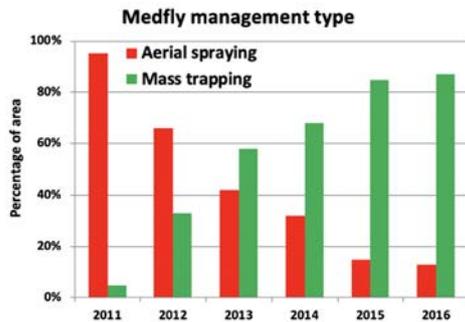
Dr. Malkie Spodek, Hemiptera Collection Manager, the Steinhardt Museum of Natural History

The Museum accounts for a very big National and international collection of specimens in the Hemiptera collection. With the work of this particular section of the museum, first sightings of certain insects in Israel were recorded. The massive hopper collection is used to determine a vector of plant diseases (a certain type of bacteria). The Museum collaborates with the Food and Agricultural Organizations of the UN and PPS. Currently, Dr. Spodek is working on a classical biological control program with the cotton mealybug and a parasitoid wasp in pepper crops under net house conditions in the Arava valley. With time, the goal of this project is to use wasps as a means of biocontrol in various agricultural products (herbs, tomatoes, etc.), both in Israel and abroad. Another project involves weed scientists, trying to develop a protocol of controlling a stranglevine weed in date orchards, using integrated weed management.

Dr. Opher Mendelsohn, Department of Public Policy

In the framework of Public Policy and invasive insect species, a crop protection pyramid is used to determine appropriate strategies. It was previously believed that this pyramid was simply a triangle, which included the host and the pathogen at the bottom and the environment at the top. However, the case is actually different, as at the top of the pyramid there is a place for the human factor of production. A tool available to help farmers achieve sustainable development is the Integrated Pest Management (IPM), which is not just technology, it is a concept. It consists of three main steps: control, surveillance, avoidance.

Ever since the AW IPM project started - there was a big reduction in the number of spray pesticides, since farmers are switching to mass trapping. The regional IPM project has a major objective, which is to improve agricultural culture and farmers' trust, so it will be easier for them to adapt for new technologies. Data management proceeds online, in order to keep a live track of what happens throughout the village. People gradually transfer to mass trapping and use aerial spraying, an increase in compliance levels was noticed as well, both can be seen in the diagrams below:



Basic compliance – compulsory project requirement:
 High compliance – close work with regional advisory



In 4 years, the area covered by the project increased 1.5 times. One of the studies analyzed the effect of difference in compliance levels (basic and high) on the results of farming. The study proved that all farming parameters improved when higher compliance level were observed. It is a social process that improved adoption of IPM, the technique of implementation of which is a system approach and collective action. There was a gradual transition towards technology adoption, starting with influential early adopters.

Mr. Gilad Ben Zvi, Manager, the Entomological Laboratory for Applied Ecology, The Steinhardt Museum of Natural History

The Entomological Laboratory for Applied Ecology deals with various issues, using arthropods as bio-indicators, due to their big diversification as well as the largest biomass. The lab focuses on several issues, such as monitoring the impact and restoration following ecological disasters; assessing the impact of agricultural practices on biodiversity and the identification and assessment of endangered species. The lab has helped to monitor and eradicate the little fire ant, as well as compile the Israeli black book of invasive invertebrates. Insects and arthropods are a uniquely effective tool to monitor the preservation of our natural resources, hence the importance of the lab's work.

Engineers Without Borders, Tel-Aviv University Chapter

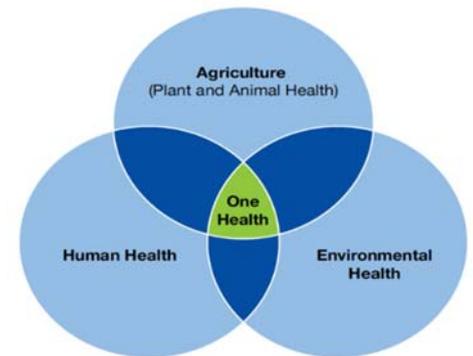
The TAU chapter of Engineers Without Borders believes in solving social and environmental problems with engineering tools. In their past work, they were dealing with fluoride contamination in the groundwater, alongside water scarcity in Tanzania. They decided that the most cost-effective solution would be to harvest the rainwater before it gets into the ground. Stopping contamination in the groundwater level is not an option, therefore the water needs to be collected in prior. They have built 6 systems on top of schools in Tanzania, focusing on engaging the entire community to the project and making the project self-maintained. Not only have they built the systems, but they have also taught the locals how to work on their own.

At the moment, the project is looking for new solutions for households or community centers, considering the option of using a dialysis system as a water filter. This project is of crucial importance, as water infrastructure is not only significant on its own, but is also co-dependent with agriculture and health, therefore finding a multi applicable solution would help the world.

icipe Researchers, presentations

Dr. Sunday Ekesi, Director of Research and Partnerships at *icipe*

icipe is an intergovernmental Center of Excellence for research and capacity building in insect science and its application. The center deals with environment change, decomposers and pollinators, alongside other fields. The center has 300 partners and 14 interdisciplinary units. The primary function of the institute can be seen in the diagram here.



One of the technologies created by the center is the Push-Pull technology: intercropping maize with legume desmodium and a border row of Napier. This technology controls the fall armyworm invasion. In the area of animal health, *icipe* created a repellent and mass traps for the Tsetse fly, a vicious disease carrier. In the spectrum of human health, the center highly deals with Malaria, emerging infectious diseases, alongside neglected tropical diseases. In order to achieve a systematic prevention of diseases, *icipe* focuses on understanding the behavioral ecology of all life stages of mosquitos. There was a discovery of host plant odors for malaria vector. Improved plant based lures are helpful for monitoring disease vectors.

Dr. Robert Skilton, Head of the Capacity Building and Institutional Development Program, *icipe*

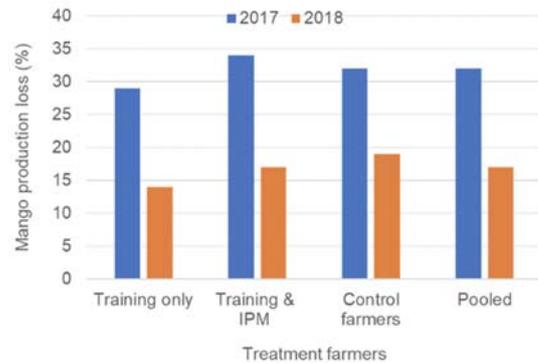
icipe offers a lot of space for Capacity Building and Institutional Development, as well as professional development and educational opportunities. Institutional development is achieved by nurturing and strengthening African research, promoting innovation. MSc and PhD programs at *icipe*, alongside a PhD program focused on improving personal research skills by providing specific training. Extreme poverty fell worldwide but rose in Sub Saharan Africa, due to a very high level of population growth, urbanization without industrialization and a genuinely low skilled population compared to the world average.

The solution to this challenge lies in creating highly trained scientists, professionals and innovators, along with promoting overall equality, which *icipe* does by fostering innovation. Below are the educational programs offered by *icipe*:

<p style="text-align: center;">PhD <i>African Regional Postgraduate Programme in Insect Science (ARPPIS)</i></p>	<ul style="list-style-type: none"> • Nationality: sub-Saharan Africa • Scholarships + <i>icipe</i> project funds • New cohort starts in ~Oct each year • Students with <i>icipe</i> for entire programme • Co-supervision & registration: African universities
<p style="text-align: center;">PhD and MSc <i>Dissertation Research Internship Programme (DRIP)</i></p>	<ul style="list-style-type: none"> • Any nationality • Supported by <i>icipe</i> projects • Students with <i>icipe</i> for part or all of their research programme • Start at any time • Co-supervision & registration: universities in any country

Dr. Menale Kassie, Head of Social Science and Impact Assessment Unit, *icipe*

Upscaling has proven that IPM technologies and Pest surveillance are efficient tools for managing fruit flies and Fall armyworm in Kenya. *Icipe* focuses on capacity building and assessing the impact of training and fruit fly IPM technologies. It is crucial to understand the challenges and opportunities these technologies bring to mango production. The pest surveillance project has significant benefits, such as monitoring and dissemination of FAW infestation data to partners. Nudge intervention is necessary to enhance representative pest data collection and farmer participation. The Social Science and Impact Assessment Unit at *icipe* is responsible for major research themes & impact pathways. *Icipe* has produced numerous impact papers, as well as trained 374 farmers and 15 extension officers. An online surveillance platform was developed, alongside a pest surveillance mobile app, on both of which FAW data is available to users in real time. So far, there were three waves of mango data from 57 villages. Empirical papers were produced and the overall adoption of IPM has increased, followed by a reduction in mango production loss.



Dr. Segenet Kelemu, Director General, *icipe*

Insect science can be crucial for promotion of sustainable development and environment. The vast majority of insects are beneficial in the ecosystem, affecting other damaging pests and their position in the food chain can never be overlooked. They act as really

important indicators for environmental health. There are around 5,000 insect species that are deadly, transmitting diseases and devastating crops; however, it is possible to utilize the beneficial attributes of insects to counter-affect the deadly ones. The insects' beneficial effects also have a significant commercial potential. Such effects can be applied and are important to crops such as grasses, maize and more. *Icipe* has recently developed a system which is easy and cheap for farmers to utilize and adapt, in order to control socio-parasitic wheat: Push-pull technology - intercrop maize crops with *Desmodium* (legume). The system has already been adapted in nine African Countries, due to its' significant reduction of labor.

Icipe is also contributing to the elimination of Malaria, which is still a big problem in the world. It is vital to remember that probably way more soldiers died more from Malaria/Yellow fever than from bullets. The world has moved to start combating Malaria, which still exists and is a major problem, disproportionately common in Africa. A lot of progress has been made in order to control the vector of Malaria, however invasive alien plants are contributing to Malaria now, causing significant reduces in agricultural yield, livestock productivity, bee productivity, and human health. Certain plants contribute to mosquito pools, so eradicating these plants will reduce malaria. Vertically transmitted fungus reduces the transmission of Malaria between mosquitos, as the symbiont has a strong malaria transmission blocking phenotype, which is one of the functional ways of biocontrol.

It is possible to start extracting protein from insects, however the planet is addicted to meat. There is an increase in global meat consumption to a rate of 43kg per capita annually. Furthermore, an enormous amount of freshwater used to produce livestock. The consumption of insect protein would reduce our carbon footprint drastically. Many insect-based proteins contain a lot of vital micronutrients and many people globally consume insects for protein, some even as delicacies.

Insects (such as locusts and grasshoppers) can also produce different oils, which are good for nutrition, as well as skincare. There is a need for new business models - fulfilling the demand without harming the environment. Insect-treated compost performs the same as the commercial fertilizer (by combining the two in equal proportion - getting even higher yield). Think out of the box solutions are needed instead of focusing on materialistic goods. Unfortunately, from a public policy standpoint, the question still remains: how to implement these solutions into mass-production which will promote the sustainability of the planet?