Introduction to
International Centre of Insect Physiology and Ecology

Human resource and Instrumentation in environmental monitoring

Subramanian Sevgan and Xavier Cheseto

ssubramania@icipe.org, xcheseto@icipe.org

icipe

- **African Center of Excellence in Africa**
  for research and capacity building for insect science and its application
- **intergovernmental organization**
  charter signed by 13 countries worldwide
- **>571 staff (>30 nationalities)** and several contracted workers
- **200 graduate students** annually
- **>300 partners**

FAO Reference Centre for Vectors and Vector-borne Animal Diseases

STOCKHOLM CONVENTION

A Stockholm Convention Regional Centre

WHO-AFRO Partner for Vector Management

World Organisation for Animal Health
Founded as OIE

Collaborating Centre for Bee Health in Africa

Organisation with a unique history: > 50 years


T.R. Odhiambo


H.R. Herren

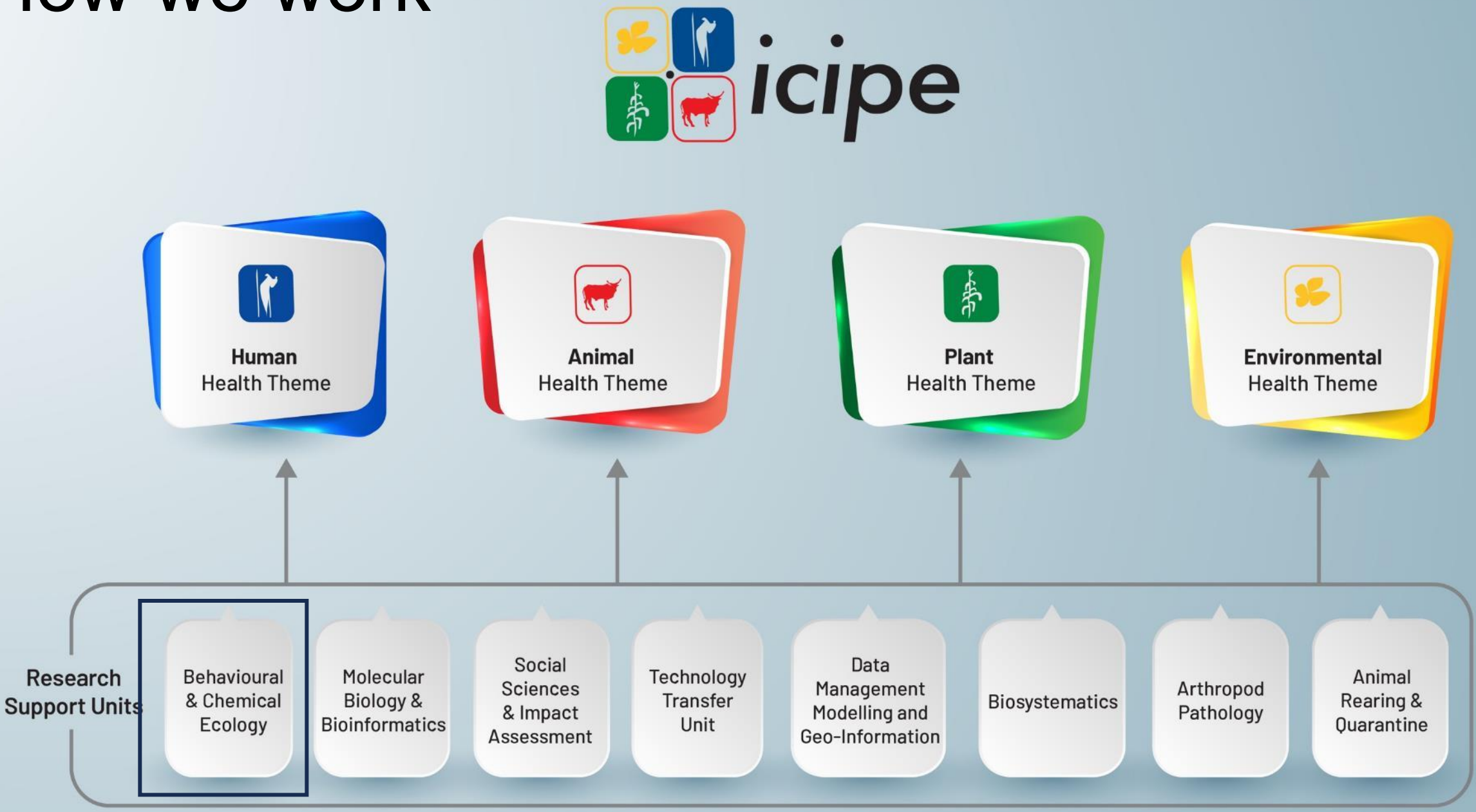

C. Borgemeister


S. Kelemu


A. Tenkouano

icipe

How we work


icipe
Human Health Theme
Animal Health Theme
Plant Health Theme
Environmental Health Theme
Research Support Units
Behavioural & Chemical Ecology
Molecular Biology & Bioinformatics
Social Sciences & Impact Assessment
Technology Transfer Unit
Data Management Modelling and Geo-Information
Biosystematics
Arthropod Pathology
Animal Rearing & Quarantine

Behaviour and Chemical Ecology Unit

Focus

- ❑ Understand chemical interactions between pests, crops and their environment
- ❑ Identification, formulation and evaluation of pheromones, kairomones, allomones and hormones mediating insect/arthropod behaviour.
- ❑ Development of environmentally-sound methods to reduce or suppress target pest populations and increase beneficial insects
- ❑ Analyse and characterise insect-based products (honey, nutritional profiling of edible insects and their products)
- ❑ Testing of chemical residues in the environment (e.g. Analysis of Pesticide residues and other contaminants)

Human Resource

Dr Merid Getahun Negash
-Senior Scientist and Acting Head, Behaviour and Chemical Ecology Unit

-**livestock-pathogens-vectors interaction at the interface of chemistry, neurobiology, behavior.**

Dr Xavier Cheseto
-Research Scientist

-**focus on Chemical Ecology, Organic chemistry and synthesis, food chemistry (esp. Edible Insect products**

Dr Cynthia Mudalungu
-Post doctoral Fellow

-**focus on extraction and** characterisation of new bioactive compounds

Dr David Tchouassi
-Senior Scientist

- Chemical ecology of malaria and arboviral disease vectors and disease transmission

Dr Amanuel Tamiru
-Senior Scientist

-**focus on plant signaling and insect-plant interactions, Chemical ecology of cropping systems**

Dr John Bwire
-Post doctoral Consultant

-**Natural Product Chemistry, Bioprospecting and product development**

Prof Baldwyn Torto
Former Head, Behaviour and Chemical Ecology Unit and currently Emeritus Scientist

-**Organic Chemistry**
-Chemical Ecology of disease vectors and crop pests

Instrumentation

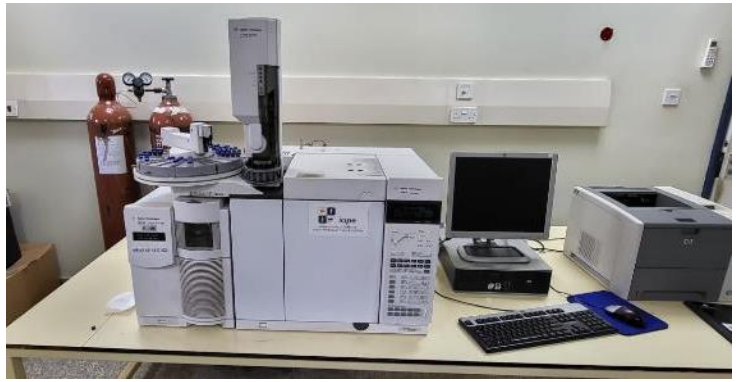
❖ **Volatile Entrainment Unit**
Dynamic ambient air sample collection

Portable Volatile collection equipment

❖ **Gas chromatography (GC-FID and GC-ECD with thermal desorption)**

Screening for matrix interferences before GC-MS analysis

Instrumentation



Gas chromatography-mass spectrometry (GC-MS)

Target analysis:
GC-amenable

a) pesticides e.g., Organochlorines DDT, chlordane, mirex, toxaphene etc
b) Industrial Chemicals e.g., PCBs, HBB, PeCB, PBDEs, SCCPs etc
c) By-products e.g., Dioxins, furans, screening only
d) Others: Dicofol, PCNs, HCBD

Note: *great for ppm and ppb levels*

LC-Qtof-MS

LC-Orbitrap-MS

Liquid Chromatography – Mass spectrometry

-Industrial Chemicals : PBDEs, HBCD, PFAS group, PFOS, PFOA PCP etc.
-LC- amenable untargeted

Instrumentation

Liquid chromatography-tandem mass spectrometry (LC-MS/MS)

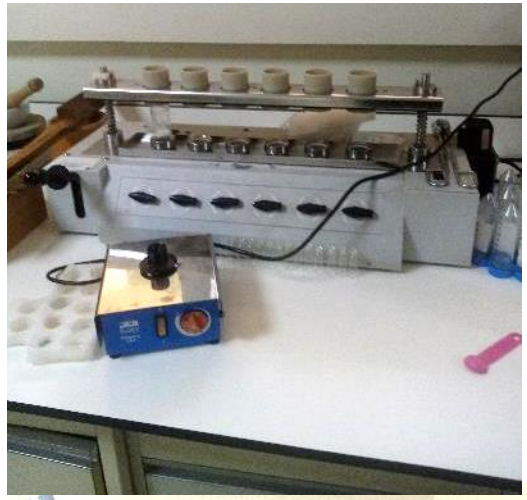
Target analysis:
Quantification of LC-amenable pesticides

Inductively coupled plasma mass spectrometry (ICP-MS)

ICP-MS for heavy metals and other elemental analysis

Instrumentation

Nutritional analysis



GC-EAD and GC-SSR

- Can reveal biological effects of POP exposure at the sensory level in insects, offering valuable data for:

- Ecological risk assessments
- Sublethal exposure studies
- Sensory toxicology
- Environmental monitoring beyond chemical quantification

Some other recent high-impact publications and discoveries

PNAS INAUGURAL ARTICLE | ECOLOGY OPEN ACCESS

Nanosilica supplementation in tomato increases oviposition on stems and caterpillar mortality in the tomato pinworm

Kokou R. Fiaboe, Fathiya M. Khamis, Xavier Cheseto, Abdullahi A. Yusuf, and Baldwyn Torto

Affiliations are included on p. 9.

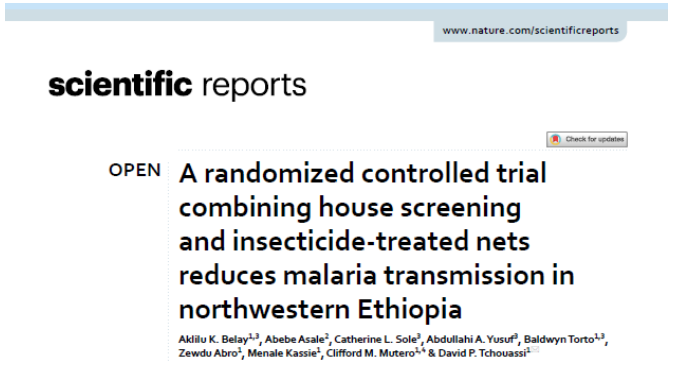
This contribution is part of the special series of Inaugural Articles by members of the National Academy of Sciences elected in 2023.
Contributed by Baldwyn Torto; received December 31, 2024; accepted February 25, 2025; reviewed by Lynn M. Riddiford and Bruce E. Tabashnik

nature sustainability ARTICLES https://doi.org/10.1038/s41893-022-00852-5

OPEN

Wrap-and-plant technology to manage sustainably potato cyst nematodes in East Africa

Juliet Ochola, Laura Cortada, Onesmus Mwaura, Meklit Tariku, Shawn A. Christensen, Margaret Ng'ang'a, Ahmed Hassanali, Tahira Pirzada, Saad Khan, Lokendra Pal, Reny Mathew, Dick Guenther, Eric Davis, Tim Sit, Danny Coyne, Charles Opperman and Baldwyn Torto



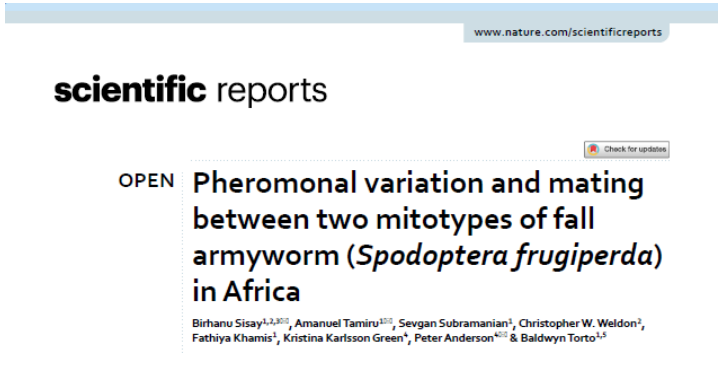
www.nature.com/scientificreports

scientific reports

OPEN

A randomized controlled trial combining house screening and insecticide-treated nets reduces malaria transmission in northwestern Ethiopia

Aklilu K. Belay, Abebe Asale, Catherine L. Sole, Abdullahi A. Yusuf, Baldwyn Torto, Zewdu Abro, Menale Kassie, Clifford M. Mutero & David P. Tchouassi



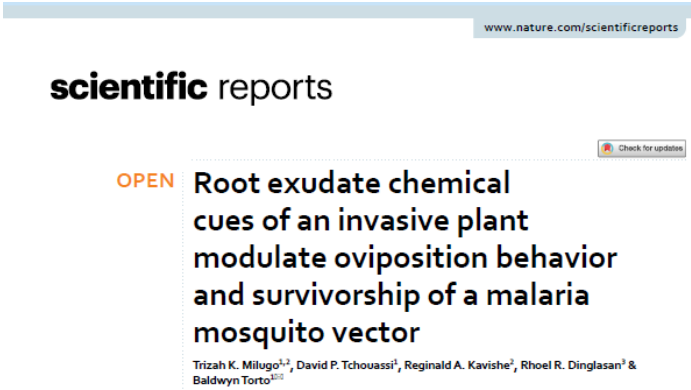
www.nature.com/scientificreports

scientific reports

OPEN

Pheromonal variation and mating between two mitotypes of fall armyworm (*Spodoptera frugiperda*) in Africa

Birhanu Sisay, Amanuel Tamiru, Sevgan Subramanian, Christopher W. Weldon, Fathiya Khamis, Kristina Karlsson Green, Peter Anderson & Baldwyn Torto



www.nature.com/scientificreports

scientific reports

OPEN

Root exudate chemical cues of an invasive plant modulate oviposition behavior and survivorship of a malaria mosquito vector

Trizah K. Milugo, David P. Tchouassi, Reginald A. Kavishe, Rhoel R. Dinglasan & Baldwyn Torto

Publications on Pesticide residue assessments

Contents lists available at ScienceDirect

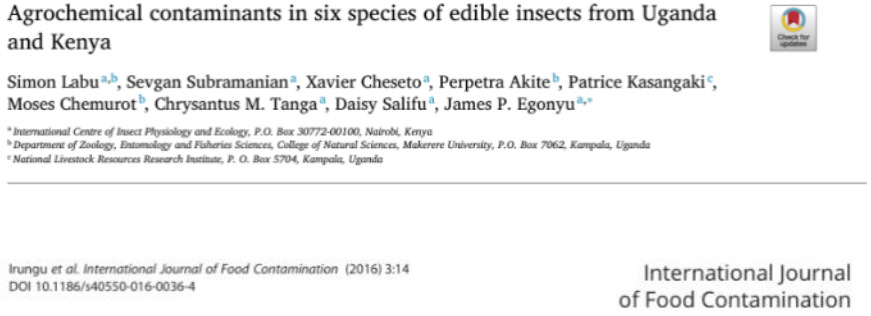
Current Research in Insect Science

journal homepage: www.elsevier.com/locate/cris

Agrochemical contaminants in six species of edible insects from Uganda and Kenya

Simon Labu[a,b], Sevgan Subramanian[a], Xavier Cheseto[a], Perpetra Akite[b], Patrice Kasangaki[c], Moses Chemurot[b], Chrysantus M. Tanga[a], Daisy Salifu[a], James P. Egonyu[a,*]

[a] International Centre of Insect Physiology and Ecology, P.O. Box 30772-00100, Nairobi, Kenya
[b] Department of Zoology, Entomology and Fisheries Sciences, College of Natural Sciences, Makerere University, P.O. Box 7062, Kampala, Uganda
[c] National Livestock Resources Research Institute, P. O. Box 5704, Kampala, Uganda



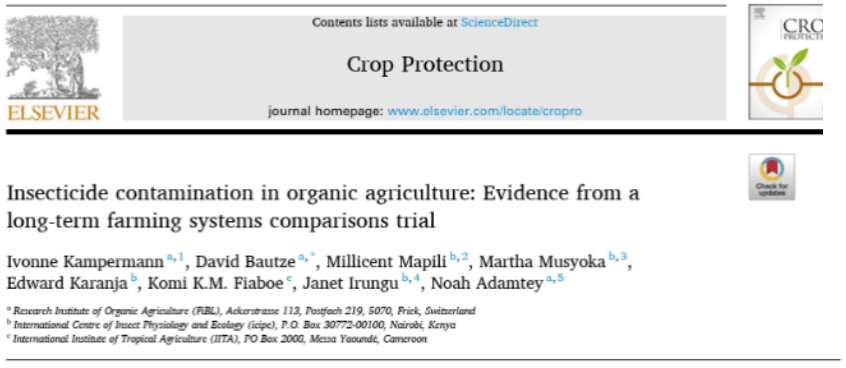
Irungu et al. International Journal of Food Contamination (2016) 3:14
DOI 10.1186/s40550-016-0036-4

International Journal of Food Contamination

DATA ARTICLE Open Access

Determination of pesticide residues in honey: a preliminary study from two of Africa's largest honey producers

Janet Irungu*, Suresh Raina and Baldwyn Torto



Crop Protection 177 (2024) 106529

Contents lists available at ScienceDirect

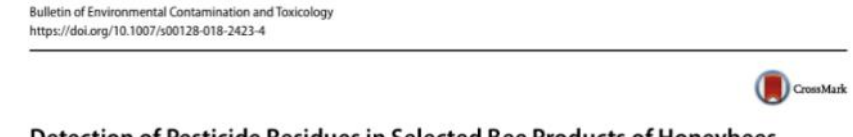
Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Insecticide contamination in organic agriculture: Evidence from a long-term farming systems comparisons trial

Ivonne Kampermann[a,1], David Bautze[a,*], Millicent Mapili[b,2], Martha Musyoka[b,3], Edward Karanja[b], Komi K.M. Fiaboe[c], Janet Irungu[b,4], Noah Adamtey[a,5]

[a] Research Institute of Organic Agriculture (FiBL), Ackerstrasse 113, Postfach 219, 5070, Frick, Switzerland
[b] International Centre of Insect Physiology and Ecology (icipe), P.O. Box 30772-00100, Nairobi, Kenya
[c] International Institute of Tropical Agriculture (IITA), PO Box 2008, Messa Yaounde, Cameroon

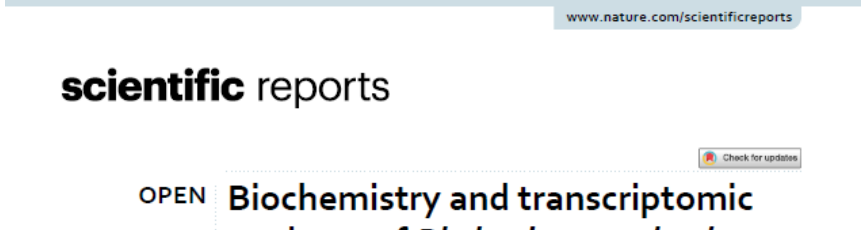


Bulletin of Environmental Contamination and Toxicology
https://doi.org/10.1007/s00128-018-2423-4

Detection of Pesticide Residues in Selected Bee Products of Honeybees (*Apis mellifera* L.) Colonies in a Preliminary Study from Seychelles Archipelago

Elliud Muli[1,2] · Joseph Kilonzo[1] · Norman Dogley[3] · Gerald Monthy[3] · Justus Kurgat[1] · Janet Irungu[1] · Suresh Raina[1]

Received: 3 November 2017 / Accepted: 17 August 2018

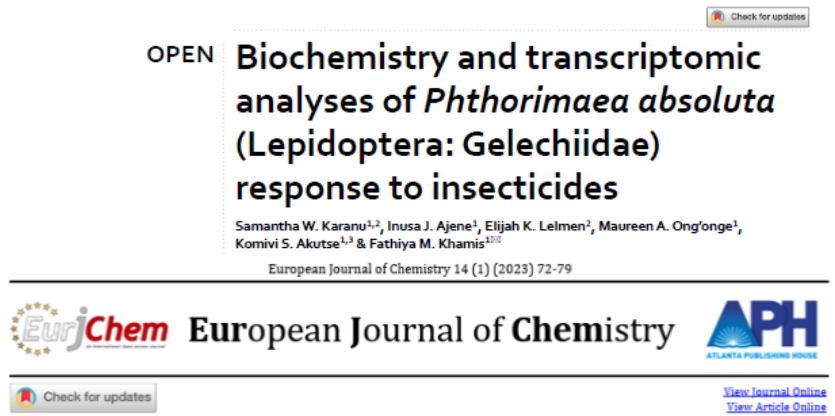


www.nature.com/scientificreports

scientific reports

OPEN Biochemistry and transcriptomic analyses of *Phthorimaea absoluta* (Lepidoptera: Gelechiidae) response to insecticides

Samantha W. Karanu[1,2], Inusa J. Ajene[1], Elijah K. Lelmen[2], Maureen A. Ong'onge[1], Komivi S. Akutse[1,3] & Fathiya M. Khamis[1]



European Journal of Chemistry 14 (1) (2023) 72-79

EurjChem European Journal of Chemistry

Check for updates

View Journal Online
View Article Online

GC/EI-MS and UV-Vis analysis of pesticide residues in cultivated *Catha edulis* Forsk (Khat) from selected farms in Meru County, Kenya

Albert Morang'a Oyugi [1], John Onyango Adongo [1,*], Cynthia Muhavi Mudalungu [2] and Joshua Kiprotich Kibet [1]

[1] Department of Chemistry, Faculty of Science, Egerton University, P.O. Box 536, Nakuru, 20115, Kenya
[2] International Centre of Insect Physiology and Ecology, P.O. Box 30772, Nairobi, 00100, Kenya

* Corresponding author at: Department of Chemistry, Faculty of Science, Egerton University, P.O. Box 536, Nakuru, 20115, Kenya.
e-mail: jadongo@egerton.ac.ke (J.O. Adongo).

Journal of Environmental & Analytical Toxicology

Mulati et al., J Environ Anal Toxicol 2016, 6:4
DOI: 10.4172/2161-0525.1000377

Research Article Open Access

Evaluation of Neonicotinoid Residues in Hive Products from Selected Counties in Kenya

Protus Mulati[1*], Esther Kitur[1], Catherine Taracha[1], Justus Kurgat[2], Suresh Raina[2] and Janet Irungu[2]

[1] Department of Environmental Sciences, Kenyatta University, PO Box 43844, Nairobi, Kenya
[2] International Center of Insect Physiology and Ecology (ICIPE), PO Box 30772, 00100, Nairobi, Kenya

Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.6, No.8, 2016

www.iiste.org

Analysis of Honey Bee Hive Products as a Model for Monitoring Pesticide Usage in Agroecosystems

Janet Irungu* Ayuka T. Fombong Justus Kurgat Protus Mulati Juliette Ongus Kiatoko Nkoba Suresh Raina

International Centre of Insect Physiology and Ecology (*icipe*), African Reference Laboratory for Bee Health, P.O. Box 30772-00100, Nairobi, Kenya

- **Our focus has been largely on monitoring for our specific research needs.**
- **We look forward to extend our collaboration and seek support in optimizing sampling and analysis protocols for GMP**

icipe

Accreditation Status and Conclusion

Complies with Good Laboratory Practice (GLP) guidelines and adheres to EU standards for pesticide quantification

With the current instrumentation and skilled personnel

- ❑ Well-positioned to support implementation of UNEP Global Monitoring Plan (GMP), WHO protocols for human biomonitoring, and USEPA/EU standards for the screening and quantification of POPs.
- ❑ Targeted benchmarking and capacity-building will further enhance readiness and compliance

Donor Acknowledgement

icipe

Thank you

International Centre of Insect Physiology and Ecology

P.O. Box 30772-00100, Nairobi, Kenya
Tel: +254 (20) 8632000
E-mail: icipe@icipe.org
Website: www.icipe.org

Support *icipe*: www.icipe.org/support-icipe

facebook.com/icipe.insects/icipe

twitter.com/icipe

linkedin.com/company/icipe