Kenyatta University

School of Pure and Applied Sciences

CONFERENCE ON BASIC AND APPLIED SCIENCES

Embracing Science & Technology for Resilience and Transformation

Date: 16TH – 18TH November, 2022
Time: 8.00 am – 5.00 pm
Venue: BSSC Rm 14

Zoom Link: Join Zoom Meeting

https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyOERERU4ybHBvVlovRkEyUT09

BOOK OF ABSTRACTS

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List of CBAS-Organizing Committee

Prof. Michael Gicheru	- Executive Dean SPAS
Dr. Susan Musembi	- Chairperson, Department of Biochemistry, Microbiology & Biotechnology
Dr. Evans Changamu	- Department of Chemistry
Dr. Rebecca Karanja	- Department of Plant Science
Dr. Joshua Mutiso	- Department of Zoological Sciences
Dr. Raphael Nyenge	- Department of Physics
Dr. Fredrick Tamooh	- Department of Zoological Science
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Prof. Hudson Nyambaka	- Department of Chemistry
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Dr. Caroline Wanjiru	- Zoological Sciences
Ms. Zipporah Mose	- Executive Dean's Office
Mr. Evans Kiara	- Executive Dean's Office

VICE CHANCELLOR'S SPEECH DURING THE OPENING OF THE CONFERENCE OF ON BASIC AND APPLIED SCIENCES ON 16TH NOVEMBER 2022

Our Chief Guest, Prof. Walter Oyawa, Director General
National Commission of Science Technology and Innovation (NACOSTI)
The CEO, National Research Fund (NRF), Prof Dickson Andala
Members of University management
Dean of schools
Other invited guests
Faculty members
Students
Ladies and gentlemen
Good morning!

It gives great pleasure and honor to witness this important event on Basic and Applied Sciences in Kenyatta University calendar organized through the School of Pure and Applied Sciences. We do appreciate that basic sciences is the foundation of many innovations which is key to development. It's worthwhile to mention that many of the courses in Kenyatta University have their root in sciences. Importantly, is the observation that many of the technological development the world enjoys today have their foundation in Science. The 2022 Kenyatta University Conference on Basic & Applied Sciences provides a platform for researchers, academia, leaders from governmental science agencies, public and private sector to share their findings and exchange ideas on how science & technology can be embraced for resilience and transformation of our societies.

The on-going COVID-19 pandemic has underscored the need for interdisciplinary collaboration, innovations and resilient systems that support knowledge creation and livelihoods that is paramount to development. It is noted that the aim of the conference is to offer platform for sharing knowledge, interactions and networking with the goal of fostering communities of practice that can drive science based solutions and strategies that can generate new lines of business, solve problems and promote spread of best practice among scholars and policy makers. It will also provide platform for presentation of research findings through exhibitions, posters, oral presentations and interactive thematic plenary sessions.

It is through scientific research and innovations that the world has witnessed technological advancements in many fields. You have all benefited from the research in area of science and technology, for example innovation in the area of internet and information technology. Today's conference takes blended mode

with colleagues from various parts of world like Europe, USA, Canada, South Africa, and different parts of Kenya are participating in the conference virtually while others will be participate in person here in Kenyatta University. We owe this to advancement in technology. We recently witnessed how COVID-19 was managed through innovation and research from medical engineers, clinical officers and biological scientists with precision and evidence-based recovery of patients. You also witnessed how biotechnology and immunology was put into practice in development of Covid -19 vaccine.

I am happy to note that the conference objective is well aligned to the University's mission "*To provide quality education and training, promote scholarship, service, innovations and creativity and inculcate moral values for sustainable individual and societal development***".**

I have noted with appreciation that some of the speakers in conferences are eminent scholars and heads of institutions who are leaders in different fields in science and technology. I am aware that you have taken time out of your busy schedules to prepare for this meeting. On behalf of Kenyatta University Management I would like to appreciate all of you. Let me take this opportunity to appreciate Director General Kenya Medical Research Institute (KEMRI), Prof. Samuel Kariuki, Director Institute of primate research, Dr. Peter Mwethera and Chief executive officer, National Research Fund (NRF), Prof. Dickson Andala, who are participating in this conference as presenters.

Our chief guest Prof. Walter Oyawa, the Director General National Council for Science and Technology and Innovation (NACOSTI), the Chairman of East African Science and Technology Commission (EASTECO), Kenyatta University is indebted to you for gracing this event as the Chief Guest. We do appreciate the role played by NACOSTI in regulating Science, Technology and innovation agenda in this country. I strongly believe your address will not only set the pace in this meeting but will also empower and encourage our scholars and researchers and assure them of government support on matters of science, technology and innovation. We are very grateful for your support.

Once again, welcome and I wish everyone three fruitful days of scholarly engagement.
It is now my honor to invite our chief guest, Prof. Walter Oyawa, Director General NACOSTI to give his address.

God Bless You.
Prof P. K. Wainaina, Vice Chancellor

DEANS SPEECH DURING THE OPENING OF 2022 CONFERENCE OF ON BASIC AND APPLIES SCIENCES ON 16TH NOVEMBER 2022

Our Chief Guest Prof. Walter Oyawa, Director General
National Commission of Science Technology and Innovation (NACOSTI)
Vice chancellor Kenyatta university, Prof Paul Wainaina, Represented by Prof Paul Okemo,
Deputy Vice chancellor administration
Deputy vice chancellor Academic
Members of University management present
CEO National research fund, Prof Dickson Andala
Dean of schools present
Other invited guests
Faculty members
Students
Ladies and gentlemen
Good morning!!

On behalf of the school of pure and applied sciences, the host to 2022 CBAS, let me take this opportunity to welcome you all to this important conference. This indeed is a happy moment for the school, when we come together and have discussion in what we believe in as school, as our name indicate we teach and practice science, ranging from biological to physical sciences.

Our chief Guest, this conference has elicited a lot interest among scholars, researchers and students from within and outside the country, over 85 abstracts have been reviewed for this conference. The conference adopt a blended mode enabling scholars and innovators to participate in the conference virtually and also in person. We have presentations from different parts of the globe like South Africa, Europe, USA, Canada, West Africa, in addition to the host country Kenya.

This three day event brings together researchers, academia, and leaders from governmental science agencies, public and private sector and industry to share their findings, to network and foster collaborations and exchange ideas on science & technology for resilience and transformational development. The conference will embrace oral presentations, Posters, Thematic plenary sessions, invited speeches and exhibitions.

Let me also mention that the authors of selected abstracts will invited to write full papers to be published

as conference proceeding in the Journal of Pure and Applied sciences (AJPAS), a biannual Journal published by Kenyatta University. Secondly, there will be poster competition and the best three posters will be identified and awarded.

At this juncture let me appreciate 2022 CBAS organizing committee lead by Dr Susan Musembi for working tirelessly since March 2022 to plan and organize for this conference. Secondly all the conference participant are appreciated for showing confidence in us.

Kenyatta University Management lead by the Vice chancellor, Prof Paul Wainaina has not only approved this conference, but also provided most of the resources used in planning and organizing this meeting, we are very grateful.

Our partners represented by Vision scientific, African Development Bank, Kenya Medical Research Institute and Kenyatta University Phytotheraputic center have supported us in realization of the objectives of this conference, you highly appreciated

It is now my Privilege and humble duty to invite the Deputy Vice Chancellor (academic) to give some remarks and invite the Vice chancellor to address the audience

Thank you and May God Bless all of us!! May God bless Kenyatta University!!

Prof. Michael Muita Gicheru
Executive Dean School of Pure and Applied Sciences

CHAIRPERSON, ORGANIZING COMMITTEE – CBAS 2022 SPEECH DURING THE OPENING OF 2022 CONFERENCE OF ON BASIC AND APPLIES SCIENCES ON 16TH NOVEMBER 2022

Vice Chancellor, Deputy Vice Chancellors, Management of Kenyatta University, Chief Guest Prof Walter Oyawa Director General NACOSTI, Members of Faculty, Distinguished guests, Invited speakers, Conference delegates, ladies and gentlemen,

Welcome to the beautiful campus of Kenyatta University!

On behalf of the Conference organizing committee, I am honored and delighted to welcome you to the 1st Conference on Basic and Applied Sciences organized hosted by Kenyatta University and the School of Pure & Applied Science

First, allow me to thank my Head of Department for nominating me for the membership of the School Conference Committee. I want to thank the Executive Dean Prof Gicheru for entrusting me the responsibility to chair the organization of this most important conference at a time when our world is increasingly dependent on science and technologies.

As chair I recognize the success of the conference depends ultimately on the many people who have worked with us in planning and organizing the technical program.

Vice Chancellor, Distinguished guests, Conference delegates, this team has worked tirelessly over the last couple of months was this idea was born to overcome many obstacles to achieve this and we appreciate them.

This event is the culmination of an enormous collective effort; conducting in-depth discussions on various proposals and views - and reach approaches and agreements that took into account the needs of all parties.

As you are aware, turning this optimism into solid results needed everyone's support and we acknowledge the support from Heads of Departments and various committees to reach our ultimate goal: which is this conference for the benefit of people everywhere.

We appreciate the support of African Development Bank Project Hosted by Kenyatta University, KEMRI, Wetlands International, Vision Scientific, RSIF Project that allowed many these young scientists presenting their work here to attend. We appreciate all speakers who have given their time to share their expertise and insights during the conference. Additionally, I would like to warmly thank all the authors

who, with their presentations and posters, will drive the exchange of scientific information that is so vital to the endurance of scientific conferences of this kind.

Distinguished Delegates our technical program is rich and varied with invited talks and discussions on Investing in basic and applied sciences, Science Education, Science Communication to how to move a science idea to a startup in our Sciencepreneurship session on Friday.

There are six parallel streams covering science and technology for climate adaptation and resilience, chemical science, coastal resources and blue economy, infectious and non-infectious disease and advanced material and nanoscience that wil provide numerous opportunities for networking and building collaborations.

I hope this event will be very successful; that we will all work in a spirit of consensus, teamwork, mutual understanding, and common approaches.

Thank you and I wish all a successful Conference!

Dr. Susan Musembi
Chairperson, Organizing Committee – CBAS 2022

Prof. Walter O. Oyawa PhD

Director General/ CEO of National Commission for Science, Technology and Innovation (NACOSTI)

Prof. Walter O. Oyawa, is currently, the Director General / CEO (NACOSTI), and also the Chairman of the East African Science and Technology Commission (EASTECO) under the East African Community. He is a member of several international and national Governing Boards of institutions/corporations that include; The International Science Council (ISC), the International centre for Genetic Engineering and Biotechnology (ICGEB) Board, the Joint UK-Kenya Oversight Board, and the National Research Fund (NRF), among others. He is a Professor of Civil Engineering, and a holder of PhD in Civil Engineering, and Executive MBA, amongst others. He is a Registered Professional Engineer, and Lead Expert on Environmental Management-NEMA. In addition to his current position as Director General / CEO (NACOSTI), Prof. Oyawa has served in various senior leadership and management positions including having been the first substantive Principal/CEO of Multimedia University College-Kenya, Deputy Commission Secretary/CEO (Administration & Finance) at the Commission for University Education, the first Ag. Principal of the pioneering College of Engineering and Technology (COETEC) at JKUAT, the first Director of SMARTEC-JKUAT (a research & Technology Centre for Sustainable Construction Materials), the Chairman of Management Board SMARTEC-JKUAT, and the Chairman of Civil, Construction and Environmental Engineering Dept.-JKUAT, among others. Prof. Oyawa is a holder of several other Certificates that include; Strategic Leadership Development Program, Corporate Governance for Directors, Project Management, and Financial Management.

He has vast experience in research/scholarly work, as evidenced by extensive publications and presentations in peer reviewed journals, and conferences. He has supervised a large number of PhD and Master's degree students. His core area of research embraces Sustainable Construction Materials and Technologies. He has undertaken extensive Resource Mobilization Projects and Proposals including being the pioneering Team Leader of the Pan African University initiative at JKUAT, and the Kenya Advanced Institute of Science, Technology and Innovation (KAIST) Project.

Prof. Dickson Andala

Prof. Dickson Andala, is currently the Chief Executive Officer of the National Research Fund (NRF). He is an Associate Professor of Materials / Inorganic Chemistry, Multimedia University of Kenya; PhD in Materials Chemistry from Binghamton University and Postdoctoral Fellowship Pennsylvania State University, USA. He is Lead Expert with NEMA; DOSH and CBRN and a reviewer of several local and international journals.

Prof. Andala has served in various senior leadership/management positions including having been the Director to the Kenya Nuclear Regulatory Authority (KNRA), African Materials Research Society (AMRS) boards, Executive Committee Member to Africa Crystallographic Association (AfCA); Chairman Chemistry Department, Multimedia University of Kenya. Membership to various Professional Associations including African Academies of Science (AAS), Kenya National Academy of Sciences (KNAS); Materials Research Society of Kenya, Kenya Chemical Society (KCS). He is endowed with vast experience in research/scholarly work, as evidenced by extensive publications in peer reviewed journals, several awards and research grants mobilization, keynote lectures and conference papers, and supervision of numerous postgraduate students. His research interests lie in the area of nanoscience and nanotechnology and its applications in remediation, sensors, catalysis.

Mary Mwangi

Mary Mwangi is a Lecturer and plant Biotechnology researcher at Kenyatta University, Kenya. Her job entails teaching and supervising students experiments in Fundamentals and applications of Biotechnology, Gene mapping, Forensic DNA analysis, Plant tissue culture and, Biosafety, Bioethics and Biosecurity. She is actively involved in initiatives to create awareness on the applications of Biotechnology in seeking practical solutions for poverty reduction, sustainable food security and wealth creation in Africa. These include participation in the Open Forum on Agricultural Biotechnology in Africa (OFAB) where she has served as a judge for the annual journalist awards. She is a facilitator for capacity building on effective Science Communication, focusing on biosafety, bioethics and biosecurity concerns in biotechnology. Currently, she is a collaborator in the Long-term EU-Africa Research and Innovation Partnership on Food and Nutrition Security and Sustainable Agriculture (LEAP-Agri) 2017 aimed at developing Climate Smart Banana (CLISMABAN) varieties with optimal market potential in Africa and Europe. In this project she is a co-promoter for the Kenyan initiative in participatory, gender,

responsive variety selection of improved cooking banana hybrids (NARITAs). Through this project she has established a tissue culture laboratory and experimental farm at Kenyatta University. Mary is actively involved in initiatives to promote participation of women in STEM. To this end she is a partner in one the projects funded by the Bill and Melinda Gates Foundation through the Kenyatta University, What works for Women's Economic Empowerment (WEE) Hub entitled: Improving Young Women's Work Readiness and Employability through Apprenticeship, Internship and Mentorship (AIMS). She is also a certified Applied Entrepreneurship Education Program (AEEP) trainer with an interest in mainstreaming entrepreneurship in STEM, specifically targeting start-ups by the youth for enhanced employability. In this respect she is a partner in DIFFERENTIATE and PARTICIPATE Plus projects funded by the British council Innovation for African Universities initiative (IAU). These projects explore a place-based approach to design and develop entrepreneurial capacity building across African research institutions by stimulating Entrepreneurial thinking among all stakeholders in Higher Education. She is a consultant and expert peer reviewer for the annual UNESCO L'Oréal Young Talent program for Women Scientists in Sub-Saharan Africa. Mary is a board member and Secretary General of the International network of Women Engineers and Scientists (INWES) and the Association of African Women in Science and Engineering (AWSE).

Dr. Peter Gichuhi Mwethera, PhD, MBS

BSc (Hons, Kenya); MPhil (Bristol, UK); PhD(Bristol, UK); Post Doc(North Carolina, USA); IVF (Leuven, Belgium)

An accomplished Researcher with a successful career history spanning over 30 years
with specific focus on Reproductive Health. Author of more than 45 publications including chapters in peer reviewed journals. Has been a member of several Boards including Pumwani Maternity Hospital Management Board (Biggest Maternity Hospital East and Southern Africa). Innovated and patented three medical products (UniPron, Smugel & Smuscan) to improve human sexual/reproductive health and improve child and maternal health. Recipient of several awards including, The
Newton Fund/Royal Academy of Engineering (UK)/KENIA (2020), Kenya Presidential Award (Kenya, 2019), The Africa Union innovation award (Brazzaville- 2013), Premier Tony Elumelu Entrepreneurship Award (TEEP, Nigeria, 2015,), Kenya Public Service Innovation Award (KICC, Kenya-2012) and National Commission for Science and Technology best Award (Kenya, 2012). Awarded research grants totaling over US $4 Million between the year 2001-2022 by the World Health Organization (WHO), CONRAD Organization, Anderson Cancer Centre Dept. of Molecular Genetics, University of Texas- USA, Newton Fund/Royal Academy of Engineering, (UK), Kenya National Innovation Award

(KENIA), National Research Fund (NRF, Kenya) and the Government of Kenya to carry out research in reproductive health. Supervises PhD, Masters and Undergraduate students. Currently, Dr. Mwethera is the Director at the Institute of Primate Research (IPR-NMK)-a premier Biomedical Primate center whose mandate is to improve human health by ethically utilizing non-human primates.

Professor J Catherine Ngila

Fmr. Ag.Executive Director, The African Academy of Sciences
Fellow of TWAS, AAS, & ASSAf
Visiting Professor, Analytical-Environmental Chemistry
University of Johannesburg and University of Nairobi
Email: jcngila2015@gmail.com

Prof Ngila is the immediate former Acting Executive Director of The African Academy of Sciences (AAS) where she provided leadership and strategic direction of The AAS's programmatic and operational management whose vision is to transforms lives in Africa through science.

Prof Ngila is a former Deputy Vice Chancellor of Riara University for Academic and Student Affairs (DVC-AA). She is also a former Deputy Director of the Institute of Oil and Gas (MIOG) under Kenya Pipeline Company, in charge of Training, Academic Programmes and Linkages. She has also worked at University of Johannesburg, University of KwaZulu Natal, University of Botswana and Kenyatta University.

Prof Ngila is a Fellow of the World Academy of Sciences; Fellow of the Africa Academy of Sciences (AAS); Member of Academy of Science of South Africa (ASSAf); Member of the AAS mentorship programmes; former Co-Chair for the 2021 Commonwealth Science Conference 22-26 Feb; Mentor for Mastercard Foundation; She is a member of various chemical societies and professional organizations.

Prof Ngila has won various Awards; 2021 L'Oréal-UNESCO For International Women in Science Awards for excellence in water research; 2017 African Union Kwame Nkrumah East Africa Regional Women Scientific Awards (January 2017); 2016 South Africa (SA) Distinguished Women in Science (WISA) Awards. She has received various Awards from SA National Research Foundation (NRF), Water Research Commission, and Council for Scientific for Industrial Research.

Prof Ngila's research work is on Analytical/ Environmental Chemistry and focuses on water quality/ pollution monitoring; modelling methods of water treatment based on nanotechnology; development of analytical methodologies for detecting chemical substances in water. She has over 460 publications comprising of 224 journal articles, 15 book chapters, 18 conference proceedings, 50 Keynote/Invited Lectures and 160 Conference abstracts. She is rated by South Africa NRF with a Researchgate Score of 39.86 and h-Index 33; Google Scholar h-Index of 37, i10-index 109, total citation of 4,174.

https://www.researchgate.net/profile/Jane_Ngila/

https://scholar.google.co.za/citations?user=NNc4NEYAAAAJ&hl=en

https://www.linkedin.com/in/catherine-ngila-68a620114

https://orcid.org/0000-0002-0121-4567

Professor Grace N. Njoroge

Deputy Commission Secretary

The Commission of University Education

Professor of Botany (Jomo Kenyatta University of Agriculture and Technology) and a senior educator with 36 years of work experience, fifteen of these being at organizational leadership level particularly in developing and overseeing implementation of corporate strategy, goals, policies and objectives in higher education in Kenya. Currently serving as the Deputy Commission Secretary (Accreditation), Commission for University Education where she has overseen through external quality assurance establishment of new Universities and academic programmes in Kenya as well as the East African Community since 2017.

She has spearheaded international study tours (United States of America, Netherlands, Germany, South Africa and Tanzania) that have provided valuable bedrock of knowledge for the establishment of specialized degree-awarding institutions in Kenya; specifically: National Defence University-Kenya, National Intelligence Research University College among others.

Prof. Njoroge is an accomplished researcher in applied Plant Taxonomy, sustainable utilization of natural resources, wealth creation, pollination biology and quality assurance in university education. Her research has led to about fifty peer reviewed papers including publications in Springer, Nature, three books and numerous conference papers.

She is passionate about relevant university education for national development and attainment of sustainable development goals.

Dr. Domitila Kyule-Muendo

Dr. Domitila Kyule-Muendo is a Senior Research Scientist working with Kenya Marine and Fisheries Research Institute (KMFRI). Currently, she is a Centre Director at KMFRI, Sagana incharge of coordinating and implementing research, administrative and financial activities and ensuring they are in tandem with the Institute's strategic plan, vision and mandate. She is trained in Senior Management and a Strategic Leadership from Kenya School of Government, Embu Campus. During her academic and research experience spanning over 10 years, she has collaborated in the development and execution of donor funded research projects at national, regional and international tiers including (ASARECA, KAPAP and NRF Projects).

Currently, she is a principal Investigator of donor funded projects including (CSAPP, STFC KCSAP Projects). She has a vast knowledge and experience in post-harvest technologies, value addition, safety in fish and fish products and in general aspects of Aquaculture and fisheries thematic areas. She has published over 10 books and book chapters, over 25 papers in peer reviewed journals and has innovated over thirteen fish products and an improved fish smoking kiln. She sits in Technical & Vocational Education & training (TVET) Curriculum development committee on occupational standards for aquaculture Technicians, a Technical member in the Review of food safety bill and Policy and also a member in the development of fish marketing Policy and blue economy strategy for Kenya. In Kenya Marine & Fisheries Research institute (KMFRI), she is a committee member in several task forces including (Monitoring and evaluation, Risk management and KMFRI Performance Management committee) among other tasks.

Dr. Bridget Mutuma

Dr. Bridget Mutuma is a Research Associate Fellow at the Department of Chemistry, University of Nairobi, Kenya. She is an ARISE fellow (2022). She has a BSc. degree in Analytical Chemistry from Kenyatta University, (Kenya, 2009), an MSc degree in Material Science and Engineering from Kangwon National University (South Korea, 2013) and a PhD in Chemistry from the University of Witwatersrand (South Africa, 2016). Dr Mutuma has extensive postdoctoral experience in nanomaterials, sensor technology and energy storage systems. Her research interest is on the development of core-shell nanostructures/ carbon-based nanomaterials and their application in gas sensors, solar cells, supercapacitors and

photocatalysis. In particular, she has pioneered research in the design and use of hollow carbons as gas sensing materials. Her current research entails the generation of core-shell nanostructures for the design of gas and electrochemical sensors. Her research findings have been published in over 30 peer-reviewed articles and presented in several national and international conferences. In the last few years, she has mentored and co-supervised BSc Honours, MSc and PhD students in the area of nanotechnology and materials chemistry. Dr Mutuma has been a member of the India-Brazil-South Africa (IBSA); Solar energy project, South African Chemical Society, and the American Chemical Society (ACS) and is a registered Professional Natural Scientist (Pr.Sci.Nat). Due to her research achievements, she has received several awards and fellowships; ACS PITTCON travel grant (USA, 2020), CNPq Visiting PhD Research Fellowship (Brazil, 2016), Penny Huddle Memorial Award (Witwatersrand University, 2015) and the Korean Government Scholarship Award (South Korea, 2010), among others.

Chip Kingsbury, PhD

Charles "Chip" Kingsbury and his wife, Chari, have lived and ministered in Kenya since 1980. From 1997 to 2021, Chip served on the faculty of Daystar University, for most of that time as the director of the Centre for Excellence in Teaching and Learning, the University's faculty development programme. His main job there was to help the faculty to be facilitators of transformation, not purveyors of information.

Chip is also the chair of the Association for Faculty Enrichment in Learning and Teaching (AFELT). This is an East Africa-wide body dedicated to helping all colleges and universities in the region to become world-class universities offering world-class transformative learning.

Chip holds a BA degree in History from William Jewell College, in Liberty, MO, graduating magna cum laude in 1979. He also graduated from Full Faith Church of Love Bible College, Shawnee, KS, with a diploma in Bible, the same year. He graduated from Wheaton College Graduate School, Wheaton, IL, in 1989 with an MA in Intercultural Studies. In 2003 he completed a PhD in Adult Education at Florida State University. His dissertation is, Barriers and Facilitators to Teaching for Critical Reflective Thought in Christian Higher Education in Anglophone Africa.

Chip's main academic passion is education for being over education just for knowing. Learning to teach so that learners become the people they want and need to be, making meaning of their learning, not just making sense; is what drives him in his work.

Chip and Chari are founders and co-directors of Ukarimu Ministries; a hospitality, mentoring, and counselling ministry.

Chip became a Kenyan citizen in 2020.

Chip is currently taking a 4-month woodworking course at Panesar's Furniture in Nairobi.

Chip and Chari have 3 adult children. Two of them are living in Kenya. One in the USA.

Professor Odireleng Martin Ntwaeaborwa

Prof. Odireleng Martin Ntwaeaborwa is a Professor of Physics and Deputy Dean for Research and Innovation at the University of the Witwatersrand. He PhD degree in Physics from the University of the Free State in 2006. He has served in many capacities with the South African Nanotechnology Initiative (SANi) including President in 2012 – 2016. He was the deputy dean of the Southern African Young Scientists Summer Programme in 2012 – 2015 that was co-organized by the South Africa government and the International Institute of Applied Systems Analysis (IIASA). Professor Ntwaeaborwa was the director of the Unesco-Twas Centre Excellence for the advancement of Science in developing countries. His research interests are surface science and powders and thin films of optoelectronics nanomaterials applied to solid state lighting, solar cells, phototherapy and gas sensing. He has published more than 2665 articles, 7 book chapters, 1 edited book, and more than 100 peer reviewed conference proceedings. Prof Ntwaeaborwa has supervised, to completion, 24 Doctoral and 20 Masters Students. He has given numerous invited talks at national and international conferences in different countries around the world. In recognition of his work, Professor Ntwaeaborwa received research excellence Awards from the University of the Free State in 2004 and 2010, and young investigator awards from the South African National Science and Technology Forum (NSTF) and the Thin Film Division of the American Vacuum Society (AVS) in 2009 and 2010 respectively.

Dr Miriam Mumbua Nyamai

Dr Miriam Nyamai is a stellar astronomer and an associate operation scientist at the South African Radio Observatory (SARAO). She completed her PhD in Astronomy at University of Cape Town in 2021. Throughout her studies, she has won different awards/prizes and scholarships. She loves working with students on research projects and doing observations with radio telescopes especially the MeerKAT radio telescope located in the Karoo in South Africa. Her research focuses on dying stars and radio transients. Using radio data, she investigates mechanisms of interaction between two stars that are orbiting each other, known as Cataclysmic Variables.

Lydia Roos

Lydia Roos is a research director at the Institut national de physique nucléaire et physique des particules (IN2P3) at CNRS (France). During her PhD in Marseilles she studied the properties of beauty mesons using data from the ALEPH experiment at the Large Electron-Positron collider (LEP) at CERN. In 1993 she joined a CNRS/IN2P3 laboratory in Grenoble and worked on the construction and operation of a silicon pixel detector for the DELPHI experiment at LEP. Since 1996 she works at the Laboratoire de physique nucléaire et de hautes énergies (LPNHE) in Paris. She studied matter-antimatter symmetry with the BABAR experiment at the Stanford Linear Accelerator Center (SLAC). During a four-year stay in Beijing devoted to fostering the Sino-French scientific collaboration, Lydia Roos led an associated international laboratory for elementary particle physics (FCPPL). At her return to Paris in 2008 she joined the ATLAS experiment at the Large Hadron Collider (LHC), where she was involved in the discovery of the Higgs boson and the measurement of its properties. She also contributed to searches for new particles. In 2018 she became a scientific director at IN2P3.

Source:
https://twiki.cern.ch/twiki/bin/view/AfricanStrategy/LydiaRoosBio

Eric Broyles

Eric Broyles is the Founder and CEO of Nanocan Therapeutics Corporation, Princeton, New Jersey, USA. Eric founded Nanocan in early 2020 when it was awarded the global license from Harvard University's Medical School to commercialize a breakthrough cancer innovation. Eric began his career as corporate attorney where he was an Associate at the Washington, DC office of Skadden, Arps, Slate, Meagher & Flom LLP. He was also a corporate counsel for AOL, Inc. and AOL Time Warner, Inc. where he served as Senior Counsel. He served as a judicial law clerk on the United States Court of Appeals for the Eleventh Circuit for Chief Judge of the Circuit the Honorable Joseph W. Hatchett. Eric is a 1995 graduate of the University of Virginia School of Law where he served as Business Editor of the Virginia Journal of Law & Politics and is a Summa cum laude graduate of the University of Cincinnati where he double majored in Marketing and Management and was Valedictorian of his graduating class.

Prof Martin O Onani

Prof Martin O Onani is a full professor of inorganic chemistry and nanomaterials at the University of the Western Cape (UWC), Cape Town South Africa. He supervises PhD and MSc students in both organometallic and nanochemistry applicable in the areas of catalysis, HIV/AIDS, tuberculosis, diabetes, and cancer in South Africa. He heads the Inorganic Chemistry division of the Chemistry Department at UWC and has been the head of Health and Safety for ten years. He is the designated chemist for the DSI/Mintek NIC Biolabels Platform which is tasked with the development of diagnostic and therapeutic nanotechnology-based systems. This is a South African national initiative in nanotechnology started over 15 years ago. Prof Onani is also a senior collaborator of University of Nairobi Ken001 project funded by IFS, Uppsala Sweden where they have graduated a PhD and two MSc students. Prof Onani has successfully supervised 9 PhD and 27 MSc students and is currently supervising 7 PhD and 7 MSc students. Prof Onani is currently serving as an adjunct professor of the Jaramogi Oginga Odinga University of Science and Technology and a long-time collaborator of world renown crystallographer, Prof Roger Lalancette of Rutgers, The State University of New Jersey, USA. He has served as a lecturer at both the Jomo Kenyatta University of Agriculture and Technology, Kenya and Walter Sisulu University of Technology and Science, South Africa. He holds B.EdSc (Hons) and MSc from Kenyatta University, Kenya and PhD from the then University of Natal, South Africa. He is a member of the South African Chemical Institute, African Academy of Sciences (FAAS), Fellow of the Royal Society of Chemistry (MRSC) and member of the Academy of Science of South Africa (ASSAf). Professor Onani has published well over 90 peer-reviewed articles and presented in over 85 international ranked conferences. He serves as advisory panel in many international conferences and is a reviewer for American Chemical society, Elsevier, RSC, MDPI and Wiley published journals. He is a panel member for various international conference organizers and advisory board member of Water Research Commission projects in South Africa.

Prof. Mary Gikungu

Prof. Mary Gikungu is a PhD holder in Natural Science and Mathematics at University of Bonn, Germany. She is currently working with National Museums of Kenya (NMK) as the Director, National Repository and Research. Prior to joining NMK, she worked with Jomo Kenyatta University of Agriculture and Technology (JKUAT) as an Associate Professor in Conservation Biology. She is a renowned Bee Specialist and a Conservation Biologist with wide experience in ecosystem services, climate change, environmental health and food security.

She has published over 55 papers in peer-reviewed journals and book chapters. Furthermore, she was a Lead Author (LA) in the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), Board member of Kibabii University Council, Mentor of African Women in Agricultural Research and Development (AWARD), Member of Biodiversity Advisory Panel of Africa Oil Kenya, Member of Biological Weapon Convention Task Force, Member of Global Systemic Pesticide Task Force and Vice-Chair of Research and Grant Management Committee of Kenya Climate Smart Agricultural Project

Prof Farai Nyabadza

Prof Farai Nyabadza is currently a Professor and Head of Department, at the University of Johannesburg. His Mathematical career started at the University of Zimbabwe and did his PhD at the University of Botswana, being the first doctoral student in the Mathematics department then. He is passionate about the Mathematical modelling and in particular modelling infectious diseases, crime, substance abuse and Systems thinking dynamics. He is a former President of the Southern Africa Mathematical Sciences Association and has held many positions in international bodies. He is an academic mentor (having supervised 51 MSc students and 9 doctoral students), a researcher, an author, a facilitator and a great speaker.

Dr. Patricia Mathabe

Dr Mathabe Holds a PhD in Plant Sciences from Montana State University the USA, a Master of Philosophy Degree in Biochemistry in the United Kingdom and a Bachelor of Technology Degree in Biotechnology from the Vaal University of Technology in South Africa. She holds various prestigious awards which include the FPrestigious Fulbright Scholarship, the Prestigious Nelson Mandela Scholarship, the Human Proteome Organization Young Investigator Award, amongst many others.

She has over 19 years of work experience in Research, Industry, Academia and Government Relations combined. Her specialties lie in Proteomics Research, Agricultural Research, Agribusiness Management, Farmer Development, Technology Diffusion and Crop Development.

In South Africa, she has worked and contributed immensely in the Government's Bio-Economy Strategy, where she spearheaded various Government initiatives which include the Farmer Development Bio-Innovation Initiative, the DryLand Rice Initiative, Crop Preservation and more. She has supervised and graduated Honors, Masters and PhD students in South Africa, United Kingdom and Kenya in the fields

of Biotechnology. Agriculture, Food Technology, Biochemistry and Agribusiness Management. She has published, presented in various international conferences and appeared as a guest speaker in various events.

She is currently based and lives with her family in the United Kingdom and is a Lecturer in the field of Agriculture.

INVITED SPEAKER ABSTRACTS

The Global Cancer Burden and Nanotechnology Therapy: Current Status and Future Perspectives

1. Eric C. Broyles, Esq. and Dr Paul Nguyen – Nanocan Therapeutics Corporation, USA
2. Dr George O. Orinda – Kenyatta University, Kenya

Overall, the burden of cancer incidence and mortality is rapidly growing worldwide. Low-and-middle-income countries shoulder most of the cancer burden. In 2020, an estimated 19.3 million new cancer cases and about 10 million cancer-related deaths occurred globally. The global cancer burden is expected to be 28.4 million cases in 2040, a 47% rise from 2020. In sub-Saharan Africa, for example, cancer incidence is projected to increase more than 92% by 2040. With the global growing burden, the need for advanced techniques and innovative strategies for cancer treatment with decreased systemic toxicities is clearly evident and urgent. Amongst the noble strategies under clinical evaluation with promising prognostic outcomes is nanotechnology therapy. Using nanotechnology, Nanocan Therapeutics Corporation has invented a product called Nanoparticle Encapsulated Smart Technology (NEST™) for combined radiotherapy-immunotherapy cancer treatment focused on 7 solid cancer indications with promising preclinical results. A phase I prostate cancer clinical trial is ongoing in the USA. Based on the findings of phase I clinical trial in USA, Nanocan Therapeutics Corporation in collaboration with Kenyatta University plans to extend phase II clinical trial to Kenya. This presentation provides insights into the current status and future perspectives of nanotechnology therapy for cancer treatment.

Facilitating Critical Reflective Thought In Our Own Lives As Academics

Charles Kingsbury, PhD

The theme of this conference, *Embracing Science & Technology for Resilience and Transformation* calls us to some serious critical reflection. Change, i.e., transformation, is often uncomfortable and something we resist. How do we embrace transformation as academics in ways which we will find edifying, exciting, and which enhance our sense of well-being? In my short presentation I will demonstrate transformative learning, help conference participants become comfortable with the concept and process, and challenge them to find at least two ways they can facilitate their own transformative learning in the next 1 to 2 weeks. I will begin by asking them a reflective question that will get them thinking about transformative learning experiences that they have experienced in their own lives. I will then share a personal example of transformative learning that changed me and my approach to learning and teaching. I will then very briefly explain the steps in facilitating transformational learning in their own lives and in the lives of their students. Finally, I will challenge them to create two specific plans for experiencing transformative

learning in their own lives in the next week or two. I'll ask each of them to find a fellows conference participant so they can pair up to hold each other accountable for these plans and to report the level of success they have had.

The Impact Of Climate Change On Pollination Service And Food Security

Prof. Mary Gikungu
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Pollinator populations have been declining worldwide. The key drivers of pollinator loss have been identified as habitat modification and fragmentation, use of agrochemicals, diseases, invasive species and climate change. Among these threats, climate change has been identified as one of the major threats to pollinators and consequent provision of pollination services. Climate change does not only affect the pollinator population but also their nesting habitats and food plants. Given that animal species have the ability to adapt to changing climate by moving out from unfavorable conditions to favorable areas, this movement causes decoupling of pollinators with their food sources including crops. In addition, climate change and its consequences such as prolonged drought may also affect the synchrony between plants and pollinators by altering chemical signals or specific scent produced by flowers to attract pollinators. It is now evidently clear that increase in temperature resulting to climate changes contributes to disruptions of plant-pollinator networks as well as plant phenology and reproduction. All these effects have serious implications on food security for both humans and animals as well as biodiversity conservation.
Key words: Pollinators, Pollination service, climate change, Food security

Particle physics with the ATLAS experiment at the LHC

Dr. Lydia ROOS
Laboratoire de physique nucléaire et des hautes énergies (IN2P3/LPNHE)
French National Centre for Scientific Research (CNRS)

The ATLAS experiment is the largest detector on the LHC (Large Hadron Collider) ring at CERN (Geneva, Switzerland). The ATLAS collaboration gathers 5900 members (including almost 2000 Master and PhD students) from 42 countries all around the world. Together with the CMS collaboration, it claims the discovery of the Higgs boson in 2012, for which Peter Higgs and François Englert were awarded the Nobel Prize in 2013. The ATLAS members all contribute to the construction and operation of the detector, to the data acquisition and analysis, should they be based at CERN or at their home institutes, and work together to understand the elementary particles and their interactions. Although the primary goal is fundamental science, the impact of this research on society is huge. The best-known example

is the World Wide Web, which was invented at CERN in the early 1990's. Detection technologies like silicon pixel detectors or muon tomography, originally developed for particle physics, have applications in medicine, space physics, environment, archeology, industrial controls. Simulation of particle interactions with living or inert matter with the GEANT4 toolkit is also widely used in these many fields. Particle physics experiments are also about Big Data: a distributed computing and storage model has been adopted, the so-called Worldwide LHC Computing Grid (W-LCG) with computing centres on five continents, and which now serves as a model for other computing-intensive scientific fields. Machine learning techniques, which are heavily used to process the complex data recorded by ATLAS, also find application in fields directly related to societal issues. Therefore, contributing to these developments is a fantastic opportunity for physics or ICT students to acquire skills that will be extremely beneficial for their future careers as scientists or engineers in the public or private sector.

The hemilabile P-N complexes: Synthesis, characterization, X-ray crystal structure and evaluation in Heck reactions

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The Heck coupling reaction, commonly known as olefination of aryl halides, is one of the most powerful tools for the formation of new C-C bonds in organic synthesis of olefinic compounds [1]. It features applications that range from the preparation of hydrocarbons and industrial production of pharmaceuticals, to advanced synthesis of natural products [2]. A major challenge in Heck reactions is to design new ligands which would effectively promote the conversion of aryl halides into Heck products by stabilizing the intermediate oxidation states.

Some new P-N complexes have been prepared before and investigated as catalysts for Heck reactions and Suzuki-Miyaura cross coupling reactions [3], and the complexes showed exceedingly high catalytic activities under mild reaction conditions. The advantages of these complexes include their ease of preparation, facile modification and convenience of handling [3].

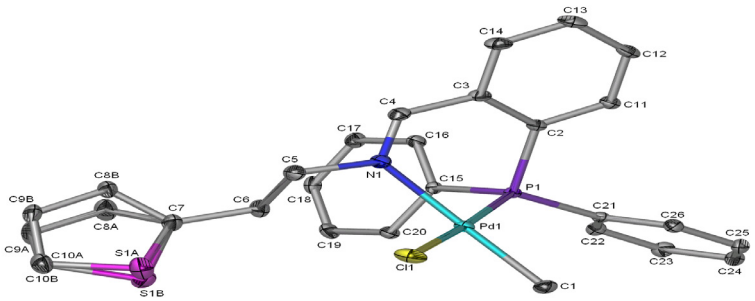

Fig. 1 Structure of the P-N palladium (II) complexes

In this work, we report the synthesis, characterization and molecular structure of novel P-N based palladium (II) complexes. The complexes will be evaluated as catalysts for Heck coupling reactions.

Perspective On The Use Of Nanotechnology For Environmental Sustainability

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Recently, there has been an immense increase in plastic waste generation worldwide owing to the COVID-19 crisis. Burning of plastic wastes in kilns and open landfills has augmented carbon emissions, further affecting climate change and many ecosystems. In coastal cities and marine environments, plastics readily degrade into microplastics, which can be ingested by marine organisms and affect their physiological functions. As such, plastic waste is a nuisance as it affects not only marine organisms but can also be transferred to the soil and, finally, to the human body, causing health and environmental-related issues. Therefore, dramatic actions in the application of science and technology could provide creative answers for a sustainable environment and resource management. Nanotechnology could be used to provide novel environmental solutions, where its adaptation for plastic waste management and recycling is a plausible approach. The main focus of this report is the use of nanotechnology for a sustainable environment and the challenges associated with applying it in basic sciences. This cutting-edge technology could produce innovative solutions for achieving a green economy while assisting in the growth of cost-effective energy systems and a skill-based society.

Women contributions to ground breaking discoveries and advancement of Science

Miriam M. Nyamai,

South African Radio Observatory

The word "Women in Science" has become a buzzword in recent years with movements encouraging more women to join the STEM fields. Throughout history, women have been involved in ground breaking and advancing humanity's science. This talk highlights some of the major discoveries made leading to both social and political changes. The number of women doing research in Science and technology still remains low. Therefore, past successes help to encourage and pave the way for young women to participate in advanced Science and Technology research today.

ZnO: The future materials for solid state lighting, photovoltaics, and gas sensing

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Zinc oxide (ZnO) is a remarkable, multifunctional semiconducting material with a direct, wide bandgap (Eg ~ 3.4 eV) and high exciton binding energy (60 meV). It has intrinsically high transparency over the whole visible range, and a resistivity that can be tuned from semi-insulating right through to semi-metallic by doping. Undoped ZnO has two characteristic emissions in the ultraviolet and visible regions related, respectively, to excitonic recombination and intrinsic defects. X-ray photoelectron spectroscopy (XPS) data demonstrated a correlation between the visible emission and intrinsic defects. Upon doping, both the excitonic and defect emissions can be suppressed because of non-radiative energy transfer from ZnO to dopant ions. ZnO, especially with particle sizes in the nanoscales, has a wide variety of applications in solid state lighting, solar cells and gas sensors. The fundamental properties of doped and undoped ZnO nanoparticles and their applications will be discussed.

Modernizing University Education offering by embracing technology enhanced teaching and learning

Prof. Grace N. Njoroge

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Universities as other organizations today are compelled to take advantage of growth, changes and opportunities in technology advancement so as to maximize on effectiveness and success. Consequently, digitization in universities has affected almost every sphere including teaching and learning, curriculum, institutional ICT and physical infrastructure, Human Resources Management, financial Management

as well as governance and research. This paper focuses on the importance of Technology Enhanced Learning (TEL), requirements for institutional infrastructure with special emphasis on Sciences as well as the need for enhanced internal & external quality assurance mechanisms. Challenges facing e-learning particularly in the face of increasing Massive Open Online Courses (MOOCs) are outlined with proposed approaches for improved digitization of university education.
Key words: Digitization of universities, e-learning, quality assurance, MOOCs

A) COASTAL RESOURCES AND BLUE ECONOMY

ORAL PRESENTATION ABSTRACTS

A forgotten "blue-chip" resource for economic and livelihood transformation: An overview of the mariculture impact and potential in Kenya

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Globally, aquatic products provide nearly 3.2 billion people with at least 20% of their animal protein intake. The current fish demand for human consumption is more than what is produced from capture fisheries and thus without significant remedies, food and nutritional security may be compromised. Food and especially protein insecurity in East Africa requires a sustainable and multi-faceted approach rather than dependency on freshwater systems where most of the aquaculture is currently practiced, wild fish capture, fish imports and terrestrial agriculture that depends on rain and other water sources that are impacted by climate change. To improve food security in east Africa there is need to utilize the expansive ocean space and estuarine areas that have over time remained idle for mariculture production. Consequently, there is need to enhance diversification of culture species that have previously been limited to mud crabs, prawns, milkfish. Marine tilapia and marine seaweeds. In the recent huge potential has been observed in the culture of market preferred finfish like rabbitfish and silver pompano in addition to farming of live feeds like artemia with more research and innovation required to close the gap to bring into production the more than 220 marine fish species for the food and ornamental industry. Further, to minimise costs associated to production of fish feeds, has led to production of black soldier fly larvae that feeds on domestic decomposable wastes reducing it to organic manure while the larvae become a protein source for the aquafeed industry. Overall contribution from mariculture is bound to change due to the paradigm shift by the government to invest in infrastructure for production of fingerlings for marine farmers giving a promise for the long forgotten blue chip thus promoting Blue Economy associated benefits.

Gillnet selectivity and its' effects on population structure of two key species in Lake Victoria (Kenya)

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Successful fisheries management requires estimation of gear selectivity for optimum exploitation of the resource. The aim was to document the effects of gillnet selectivity on population structure of two key species in Lake Victoria: *Lates niloticus* **(Nile perch) and** *Oreochromis niloticus* **(Nile tilapia) and come up with the most appropriate gillnet mesh sizes to be used in Lake Victoria for sustainable management of the fisheries. The study was conducted in the lake where predefined sampling areas were identified and sampled. Standard gillnetting methods were used in the sampling sites. A fleet of monofilament gillnets whose mesh size ranged from 1" to 8" at ½" intervals were set during the day for a period of not less than 3 hours, while a fleet of multifilament gillnets with mesh sizes ranging from 1" to 8" stretched mesh size at 1" intervals were set overnight in triplicates.The catch rates increased with an increase in mesh size and was significantly different between mesh sizes for** *Lates niloticus* **and** *Oreochromis niloticus* **($p < 0.001$). The mesh sizes 1" to 2" were very efficient in catching Nile perch, contributing about 86.8% of the catch. The 4" mesh size gillnet was most efficient in catching Nile tilapia, contributing about 83.7% of the catch. The models for gillnet selectivity showed that gillnets were optimally selective from mesh sizes 7" and 5" for Nile perch and Nile tilapia respectively. Nile perch and tilapia gillnet fishery is currently being overexploited due to rampant use of illegal and undersize gillnets. The future of Nile perch fishery is threatened by fishing pressure, thus, this study recommends shifting the minimum stretched mesh size for Nile perch to 7" and above and retention of the 5" mesh size for tilapia.**

Keywords: Lake Victoria, gillnet selectivity, *Lates niloticus*, *Oreochromis niloticus*, **population structure**

Assessment of Stock Status of Specific Grunts, Seabreams and Snappers Along the Kenyan Coast

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Haemulidae, Sparidae and Lutjanidae form a considerable part of both artisanal and industrial fisheries catches along the Kenyan Coast, hence impacting significantly on local economy, enhancing livelihoods,

providing food and nutrition to thousands of people. Despite these fish families being of importance, their fishery is less prioritized by the regulatory bodies due to existing little information based on scientific evaluation of fish stock status. This study therefore, was aimed to avail scientific based information of specifics of the above mentioned fish families to enhance effective management policy. Data was sourced from the Kenya Fisheries and Research Institute (KMFRI)'s Catch Assessment Survey (CAS) of between 2001 and 2021. The methodology involved estimation of species abundance and diversity, length weight relationship, length-based stock assessment and length-based Spawning Potential Ratio (LB-SPR) using TropFishR to evaluate spawning potential biomass and length based indicator (LBI) traffic light system stock assessment. The results showed that the three families comprised (59) species with a higher diversity index of above (2.3) in four counties except Lamu (1.2). There was a strong length-weight relationship with an r^2 = >0.9 where *Plectorhinchus gaterinus* **and** *Lutjanus lutjanus* **displayed a positive allometric growth whereas** *Plectorhinchus chubbi, Acanthopagrus berda* **and** *Lutjanus sanguineus* **reflected negative allometric growth. Fishery stocks of** *A. berda***, and** *L. lutjanus* **were suffering from overexploited (E>0.5)** *P. chubbi* **and** *L. sanguineus* **were underexploited (E<0.5) while** *P. gaterinus* **were stable (E≈ 0.5). Furthermore,** *P. gaterinus, A. berda* **and** *L. lutjanus* had an SPR of (19.29%), (2.16%), (13.05%) respectively which were far much below the reference point. The IUCN Red List status of the fish that were found in Kenya also showed that (51) were enlisted in the category of least concern (LC), (4) data deficient and (4) were not evaluated (NE). This study recommends conservation of mature individuals of the above species by introducing closed seasons especially during spawning periods as well as conservation of immatures through fishing gear regulation.

Marine capture fisheries and opportunities for blue economy growth

Gladys M. Okemwa
Kenya Marine and Fisheries Research Institute

The Blue Growth Initiative prioritizes promotion of investments and innovations in support of food security, poverty reduction, and the sustainable management of aquatic resources. Fish and fisheries are an important component in achieving Blue economy growth through supporting livelihoods as well as food security and nutrition. Kenya contains diverse coastal and marine ecosystems which host a wide variety of resources that are fished for consumption and trade including fish and invertebrates such as molluscs, shrimps, crabs, lobsters and sea cucumbers. Although the production from marine capture fisheries is low when compared to inland fisheries, the sector has promising potential to contribute to blue economy growth. The small-scale capture fisheries sector which concentrates in nearshore areas of the Kenya coast produces 80 percent of the annual fish production. However, the target resources are either optimally fished or threatened by overfishing due to overcapacity, use of destructive fishing gears, IUU fishing, pollution, high post-harvest losses, inadequate market access.

Despite these challenges, there are a number of opportunities to enhance sustainability and economic development through science-based interventions ranging from improving regulatory mechanisms, and investing in tools and strategies to address IUU fishing and destructive fishing practices. Implementing an Ecosystem Based Fisheries Management is fundamental to supporting blue growth as it helps to develop sustainable and equitable fishery management systems using the ecological and human interfaces. Efforts to harness untapped fisheries resources also provides a new direction for securing new investments through private sector involvement in research and innovation. This presentation provides an overview of the existing challenges, and elucidates the opportunities for the development of blue economy in marine capture fisheries using a case study approach.

Advancing Economic Opportunities for Women and Youth in the Blue Economy Sector; Contextual Analysis of Lake Victoria and Lake Turkana in Kenya

Julie Bwoga, Brenda Linda Achieng Ongiri, Donna Achieng

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The national agenda of Blue Economy growth highlights the importance of the country's marine and inland resources in providing employment, eradicating poverty, improving food and nutrition security, and ensuring sustainable livelihoods for Kenyans. Despite this huge potential, women and youth in particular are disadvantaged as their participation in the core functions within the value chains remain limited due to a myriad of constraints including; lack of access to capital, discriminatory cultural and social norms, and the labour-intensive nature of the sector. This study conducted along the shores of L. Victoria and L. Turkana between February and March 2021 aimed to provide a deeper analysis of the key opportunities and constraints for women and youth in the Blue Economy sector and to identify potential interventions in exploiting the strategic blue opportunities that exist within the purview of fisheries and aquaculture for dignified economic independence. Primary data was gathered from 557 respondents in the fish value chain of which 74% were youth < 35 years of age (37% females and 63% males). The data was collected using mixed methods comprising; a quantitative survey with primary actors in the fish value chain (fisherfolks, traders, and processors), Key Informant Interviews, and Focus Group Discussions. Monthly revenues earned by women fish traders averaged at Kshs. 79,000 per month compared to men traders whose mean income earnings were found to be Kshs. 151,000, almost double what women earned. These incomes statistically differed ($t(557) = .031$, $P < 0.05$). The low returns from fish sales was attributed to; high spoilage (77% women; 23% male traders); stiff competition (96% female; 4% males), particularly from fish imports, and lack of access to finance (98.5% female and 1.5% male traders). In addition, females despite playing a dominant role in post-harvest handling of fish reported low supplies since they do not have major control of production/fishing aspects. The key barriers to women and youth's involvement in the Blue Economy include; lack of access to credit facilities, lack of equipment,

post-harvest losses, gender disparities, and skewed representation in leadership. Opportunities available for women and youth include; cage culture, bait fishery, ornamental fish culture, Nile perch swim bladder sale, ice production, value addition and marketing, handicraft making, and local fishing gear fabrication. The study recommends training and capacity building in fish handling, improved technologies for value addition and marketing, and linkage to market and credit facilities.

Keywords: Opportunities, Challenges, Interventions, Women and Youth, Blue Economy

Impact of increasing the mesh size of the traditional basket trap on catch rate and size structure of target species in Kenya

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Background: Basket traps are among the most common gears used by artisanal fishers in Kenya. They are considered relatively sustainable with minimal damage to the habitats in which they are deployed. However, they have been observed to be unselective, capturing a high proportion of juvenile individuals. We therefore trialed the use of 3-inch mesh size basket traps in protecting key target species, by replacing the 2.5-inch basket traps for a period of 6 months. It was hypothesized that an increase in mesh size by 0.5 inches will increase the mean size of key target species, reduce the proportion of juveniles, and increase the catch rate of the basket traps.

Methods: The trial was conducted in Mkunguni Beach Management Unit (BMU) located in Msambweni sub-county of Kwale county. A participatory approach was employed to promote ownership and sustainability where consultations were held with basket trap fishers and the BMU Committee to co-design the basket trap trials. A total of 16 fishers (25% of all basket trap fishers) volunteered to participate in the trial and each fisher received one 3-inch mesh size basket trap.
Fish landings were monitored for 6 months from October 2019 to April 2020 through shore-based catch assessment for both 3- and 2.5- inch basket traps. Effort data were collected by recording the type and number of traps, crew size and fishing grounds. Catch surveys involved assessing all landed fish individuals and recording their total weight (kg), species' weight (g) and total length (cm). Total weight was measured to the nearest 0.5 kg using an electronic digital weighing scale. Species were identified using printed fish identification guides adopted from the FAO species identification guide. Individual weights were measured using an electronic balance to the nearest gram, while total lengths (TL) were measured to the nearest 0.1 cm using a fish-measuring board or tape measure. For small catches, all fish

were measured and for large catches (>10 kg) a random subsample of approximately 5kg of the catch was selected for measurement of individual weights and total lengths.
3- and 2.5- inch mesh basket traps were compared based on number of species caught, mean catch rate by weight (kg/fisher/trap) and number of individuals (individuals/fisher/trap), mean total length and weight of all species and dominant species and proportions of juveniles captured. Non-parametric Wilcoxon test was used to test for significant differences in catch rates and mean total length and weight of species.

Results: The 2.5-inch basket traps recorded greater number of species (87) compared to 3-inch traps that recorded 59 species indicating a 47.5% reduction in the number of species. Siganus sutor was the most abundant species landed from both 2.5- and 3-inch basket traps recording 69.5% and 78.3% respectively. S. sutor, L. mahsena, and L. borbonicus cumulatively contributed to 78.7% of the catch in 2.5- inch traps and 86.4% in 3-inch traps.

The mean catch rate was significantly greater ($p < 0.05$) for 3-inch basket traps (1.9 ± 1.9 kg/fisher/trap) compared to 2.5-inch basket traps (0.6 ± 0.8 kg/fisher/trap). This represented a 214.1% increase.
The mean total length and weight of all species was greater in 3- inch basket traps (28.6 ± 4.5 cm and 325.0 ± 191.2 g) than 2.5-inch basket traps (26.7 ± 5.3 cm and 279.8 ± 193.4 g) respectively. This represented a 7.1% and 16.2% increase in mean total length and weight respectively. However, both length and weight differences were not significant ($p > 0.05$). The mean total length and weight of dominant species were significantly higher in 3- inch traps compared to 2.5-inch traps ($p < 0.05$).
Overall, 19.1% of the target species captured by 3-inch basket traps were immature which was lower than the 25.4% captured by 2.5-inch basket traps representing a 24.8% reduction in immature individuals. The proportion of juveniles retained by 3-inch basket traps for S. sutor, L. mahsena and L. borbonicus were 20.4 %, 3.1% and 20.0% respectively compared to 2.5-inch basket traps which recorded 25.3 %, 17.7% and 47.7% of immature individuals respectively. This represented a reduction of 19.4%, 82.4% and 5.1% in immature individuals respectively.

Conclusion: The results from the trial highlighted that increasing the mesh size by half an inch has the potential to achieve ecological benefits by reducing the capture of immature individuals of target species and reducing the proportion of non-target species. It also realizes economic benefits by increasing the catch rate and consequently fishers' income. We recommend the use of 3- inch basket traps to achieve both ecological and economic benefits. Upscaling requires the use of locally available and cheap materials to make it more economically viable and operationally convenient.

Importance of coastal habitats in reducing exposure to coastal hazards in Kenya

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Coastal ecosystems such as mangroves, coral reefs, and seagrasses provide natural protection against flooding and erosion caused by coastal hazards. However, large-scale infrastructure developments at the coast e.g. ports, tourism growth and climate change impacts (e.g. sea level rise and more extreme weather events) are causing environmental changes including habitat loss. Studies conducted on Coastal vulnerability in Eastern Africa found that Kenya benefits most from its coastal ecosystems and hence is identified as the most vulnerable if it loses its coastal habitats. The Integrated Valuation for Ecosystem Services and Tradeoffs (InVEST) coastal vulnerability model was used to understand the implication of habitat loss to the provision of natural coastal protection services. Currently, only 16% of the country's coastline is at a higher level of exposure to coastal hazards but the loss of corals and mangroves could increase the proportion of the coastline at higher risk of exposure to 41%. Although coral reefs protect slightly more of the country's shoreline against coastal hazards, mangroves contribute the most in Lamu and Tana River counties. Tana River is the most exposed county with 71% of its shoreline showing higher exposure levels. However, the loss of habitats can increase four times the proportion of Kwale's coastlines at a higher level of exposure and more than double in Kilifi and Lamu County. This information is important to inform local communities of the wider importance of coastal habitats and guide management in prioritizing areas for conservation and monitoring habitat degradation.

Keywords: coastal habitats, coastal vulnerability, exposure, erosion and flooding

Opportunities for Big Data in Delivering Mangrove Restoration at Scale: Application of Global Mangrove Watch in Kenya

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Mangrove restoration is increasingly embraced as a key component of ecosystem conservation. When done right, successful restoration supports local communities, helps countries achieve conservation and carbon emission targets, and contributes to global climate change ambition. To inform the design of Wetlands International's mangrove restoration interventions in Kenya, we required earth observation data and information on restoration potential. Global Mangrove Watch data provided time-series working

maps of these areas with the assumption that recently converted areas are more restorable than those that were lost long ago. However, not all areas were restorable. To debunk these assumptions and develop an actionable map, we modified areas of loss, removing areas that had been converted to infrastructural development and areas that were converted to non-tidal open water either through erosion or inundation. This provided our base map of restorable areas. Data on the environmental and social constraints to restoration, such as freshwater regimes and demographics were also incorporated to provide a complete picture of the factors that drive restoration potential. Five classes of restoration potential were identified using an index of 1 to 10, where low scores indicate a low probability of restoration success and high scores indicate likely restoration success. Of the 7,419 ha of mangrove area lost in Kenya between 1996 and 2016, approximately 3,000 ha was considered suitable for restoration. Restoration could be achieved by addressing physical hydrological processes or enrichment planting which can help accelerate recovery rates in places where natural recruitment may be constrained. This, along with long-term monitoring and management of restoration sites, makes it possible to restore mangroves effectively.

Keywords: Mangrove, Restoration, Potential, Mapping, Success

Delivering the ocean climate actions: Building a blue carbon information base to facilitate and enhance the incorporation of blue carbon solutions into Kenya's climate commitments

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Blue carbon ecosystems (BCEs: mangroves, seagrass beds and salt marshes) are gaining important recognition in global climate policy dialogue as one of the most cost- effective nature-based solutions (NbS) to combat climate change impacts. This has led to strong emphasis on their integration into the Nationally Determined Contributions (NDCs) commitments of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement. However, one of the main barriers of integration of BCEs into climate change intervention strategies has been availability of adequate information due to methodological challenges. This report presents the progress and challenges of incorporating ocean climate solutions into Kenya's climate change commitments. The

study adopted a blue carbon readiness assessment approach to ascertain, enabling conditions, and data requirement as well as to build an information base to facilitate full integration of BCEs into Kenya's climate commitments in the Paris Agreement. At least 24 publications comprising reports and published articles on the status of Kenya's 'Blue Carbon Ecosystems (BCEs)' were reviewed and analyzed to determine trends in their status and conditions. Cover change analysis was conducted for the BCEs and combining with results from literature review. In addition, blue carbon dynamic projections over the next 30 years were made based on business as usual (BAU) and some management intervention scenarios. Furthermore, a synthesis of cost-benefit analysis of BC climate actions was conducted based on available information on their economic valuation. The results showed that BCEs in Kenya are declining; with the overall loss of cover at rates of 0.54% $year^{-1}$ and 0.26% $year^{-1}$ for mangroves and seagrasses, respectively. Projections of the trends in blue carbon ecosystems indicate that implementing some management interventions in the next 30 years could result in □48% reduction in carbon losses and carbon emission abatement potential amounting to 18.7 $MtCO_2e$ as well as benefit-cost ratios of 5.6:1 and 2.9:1, for mangroves and seagrass, respectively. However, further blue carbon assessments are required to achieve full integration of ocean climate solutions into Kenya's progressive NDCs.

Key words: blue carbon ecosystems, carbon stocks and emission projections, NDCs, Kenya.

Carbon Stocks and Stable Isotopic Signatures af Soil Organic Sources Across the Mangroves Of Kenya

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Mangroves are important carbon sinks and plays an important role in mitigating against climate change. However, the ecosystem carbon stocks in the mangroves of Kenya have not been studied comprehensively. Mangroves have been reported to captures more carbon than any forested ecosystem. The highest proportion of this carbon is stored in the soil component. However, this carbon risks being released into the atmosphere if mangroves are degraded. Measurement of soil carbon pool is critical for determining long-term changes in carbon stocks particularly in the face of climate change. This study quantified the carbon storage in mangrove soils through intensive sampling along the Kenyan coast (Mida, Dabaso, Mtwapa, Kibokoni-Kilifi creeks and Gazi and Vanga bays). Sediment cores (up to 100 cm) were taken in different mangroves species formations (Rhizophora mucronata, Avicennia marina, Ceriops tagal and Sonneratia alba). Thermo elemental analyzer–isotope ratio mass spectrometer (EA-

IRMS) system was used to determine organic carbon content (%OC). Overall, the (%OC) ranged from 0.15 to 13.11% with a mean of 3.99±0.24%. A consistent decrease in % organic carbon (%OC) with depth was observed within all mangrove species formations (Pearson correlation, $p < 0.01$). The carbon stock in mangrove soil ranged from 80.2 to 567.1 Mg C ha^{-1} with a mean of 207±110 Mg C ha^{-1}. $\delta^{13}C$ and $\delta^{15}N$ values remained relatively consistent throughout the soil depth profiles. Mangrove soil within Gazi bay recorded the highest carbon pool (299.4±60.0 Mg C ha^{-1}) while Mtwapa Creek recorded the lowest mean (156.0±31.4 Mg C ha^{-1}). Rhizophora mucronata formations recorded the highest soil carbon pool (262.1±36.7 Mg C ha^{-1}) while Sonneratia alba formations recorded the lowest mean (145.9±16.2 Mg C ha^{-1}). Considering mangroves in Kenya are estimated to cover 61,271 ha, this study estimates mangrove soil stores ~12.7 Mt of carbon, equivalent to 46.5 Mt of CO_2e. The results of this study strongly demonstrate the role of mangrove conservation on national carbon budgets and the need to incorporate them into Nationally defined Contributions.

Key words: Mangroves, Soil, Organic, Carbon, Isotopic signatures

Beyond Planting - Adoption of Community Based Ecological Mangrove Restoration for Sustainable Mangrove Forest Management in Lamu and Tana River, Kenya

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Globally, tree planting has been widely promoted to bring back lost forest areas. Kenya's Vision 2030 aims to increase forest cover by 10%. To achieve this objective, several campaigns in different parts of the country including the coastal region have been undertaken within the past two years. The latest is the Lamu mangrove planting launch spearheaded by the Kenya Forest Service, in collaboration with the local community, Wetlands International and other stakeholders in May 2022. The launch aimed to mobilise the planting of more than 250,000 mangroves by 2023. Mangrove loss in Lamu has mainly been attributed to over-exploitation, dating back to the early 1990s. Although cutting is currently restricted to those licensed, illegal cutting continues to exert pressure on Kenya's largest mangrove ecosystem. In an effort to address this challenge, restoration has been proposed. However, most restoration initiatives largely involve planting that does not consider the functionality of the restored ecosystem. Most of the planting initiatives are not science-based, with little or no site pre-assessment to determine the best restoration approach. Wetlands International has introduced the Community Based Ecological Mangrove Restoration (CBEMR) approach to address some of these challenges. This innovative technique aims to restore mangrove ecosystems beyond planting. It advocates for researching the ecology and social issues of the site such as hydrology, mangrove stressors, local species, salinity, soil parameters, tidal range,

site elevation, site context, natural regeneration, site history and ownership to guide the restoration activitieKeywords: Restoration, Planting, Community, Ecology, Best practice, Natural regeneration

POSTER PRESENTATIONS

Trans-boundary mangrove dispersal in the Kenya-Tanzania coastal zone

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Knowledge of mangrove distribution and connectivity along tropical and subtropical coastlines continues to improve decisions on prioritization of their conservation and management. From their 'center of origin' in Indo-West Pacific, mangroves area hypothesized to have migrated to other parts of the world. Until recently, the explanation on the spatial distribution of mangroves was based on anecdotal pieces of evidence with no large-scale tests of actual dispersal factors. In the present study, a high-resolution ocean data on dispersal is simulated in an ocean particle tracking model to predict the trajectory patterns and dispersal distances of mangrove propagules. The study is set in the Western Indian Ocean, an area characterized by complex ocean surface currents that result from reversing monsoon conditions. The model results show propagules trajectories following established ocean surface current pathways of East Africa Coastal Current, from the southern hemisphere to the northern hemisphere into the Arabian Sea. Additionally, these results show characteristics of propagule dispersal (distance and pathway pattern) which had not been reported before in the region whereby both short and long dispersal distances are covered in days as well as months' floating periods considered in the model. It is these new pieces of evidence on propagule dispersal that are required when decisions are being made on establishing prioritized mangrove conservation areas.

Keywords: mangrove, dispersal, ocean model, marine connectivity, marine conservation, surface currents.

Comparative growth performance of marine Tilapia (*Oreochromis niloticus, L.*) cultured in hapa nets in different stocking densities using animal and plant protein diets

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The growth of aquaculture as an enterprise is hampered by the high cost of fish-based protein diets which account for 30-70% of production cost. The need for alternative and cheaper protein sources such as plant-based protein diets is paramount to guide fish farmers on feed efficacy and fish stocking densities. In view of this, this study analyzed growth performance of marine acclimatized Nile tilapia (*Oreochromis niloticus*) using fish meal (animal protein), soybean (plant protein) and wheat bran (control) formulated diets. Nile tilapia fingerlings of 13-17 g were cultured in hapa nets in three concrete based ponds and in stocking densities of 15 fish/m^3, 10 fish/m^3 and 5 fish/m^3 for each feed treatment. Water quality parameters such as temperature, dissolved oxygen, and salinity were monitored twice a week. Initial and final body length and weight were recorded at the start of culture period, and monitored throughout the experimental period on a fortnight basis for 57 days. Two-way ANOVA was used to determine if stocking density and feed treatment(s) had significant effect on fish growth performance. Result shows, weight gain of 10.28 ± 2.44 g was highest on soybean treatment. Stocking density of 5 fish/m^3 recorded the highest percentage survival rate of 85.6 % on wheat bran treatment. The study concludes that marine acclimatized Nile tilapia (*Oreochromis niloticus*) fingerlings had a high feed utilization for soybean meal compared to fish meal and wheat bran and therefore Soybean meal and a stocking density of 5 fish/m^3 can be adopted by farmers in the optimization and maximization of their fish produce.

Key words: stocking density, plant proteins, animal proteins, *Oreochromis niloticus*

Performance of different protein ingredients (Fish Meal (FM), *Terebralia palustris* (TP), Black soldier fly larvae meal (BSFL) and Blood meal (BM) in the growth of Nile tilapia (*Orechromis niloticus*) under controlled aquarium tanks

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The study was conducted at the Kenya Marine and Fishery Research Institute (KEMFRI's) wet laboratory of the Mari culture department with an objective of investigating growth performance of Nile Tilapia (Oreochromis niloticus) fed on four different protein ingredients: fish meal (FM), Terebralia palustris (TP), Black Soldier Fly Larvae (BSFL), and Blood meal (BM) protein sources. Fish were reared in 12 glass aquarium tanks of sizes 30 × 24× 24, feeding done twice every day for 80 days. 240 fingerlings of sizes 0.5- 0.6 grams were randomly selected from KMFRI raceways, conditioned for 2 days and distributed in the 12 aquarium tanks each holding 20 pieces. Feeding was done at 5% body weight throughout the study period. Specific growth rate (SGR) was high on Oreochromis niloticus fed on Terebralia palustris with 2.79 but not significantly different ($P > 0.05$) to the other treatments. The Blood Meal (FM) treatment was seen to have a higher FCR of 7.48 compared to the other treatments like FM which was seen to have 5.44, BSFL had 5.37 and TP was seen to be lower with 4.48. The Feed Conversion Ratio (FCR) values of all the treatments were not seen to be significantly different ($P > 0.05$) to each other. The b-values of all the treatments ranged from 1.95-2.61 with the highest being TP protein meal and condition factor of 1.51, 1.48, 1.43 and 1.38 for TP, BSFL, BM and FM respectively. Water quality parameters were not significantly different in all the treatments ($P > 0.05$). Net returns above VC and TC were all positive on BM, TP and BSFL treatments but negative on the FM treatments. Under this condition, Fish meal protein was seen not to be cost-effective for the production of Oreochromis niloticus compared to the other protein ingredient hence a recommendation that other local ingredients should be used in running a profitable fish enterprise budget.

Keywords: Oreochromis niloticus, protein ingredients, Growth factors, economic viability

Catch characteristics, gears, and fishing effort in reef fisheries: rabbit and emperor fish at Nyali landing site, Mombasa, Kenya

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Coral reefs are some of the most productive marine ecosystems, comprising a wide range of fish biodiversity and other marine organisms. Reef fisheries influence the ecosystem health, productivity and sustainability. The present study contributes to knowledge on the reef fish species, their sizes and the gears used with emphasis on Siganus spp and Lethrinus spp due to their importance as indicator fish families in the coral reef ecosystem. To achieve the goal, the study determined catch per unit effort of reef fishes by using in-depth key informant interviews targeting fishers and fish traders. Descriptive statistics was used to summarize the data, while Anova Single Factor analysis was used to evaluate differences in weight for different fishing gears. Findings revealed that 20 fish families with 32 fish species were recorded dominated by Siganidae contributing 19% and Lethrinidae contributing 18%. Lethrinidae and Siganidae were dominant in hand lines, basket traps and long lines. Average sizes were 22.81cm for Siganidae and 20.4cm for Lethrinidae. Overall, a fisher landed an average 5.4 $Kgday^{-1}$. On contribution to total landings basket traps landed 323kg, long lines 133kg, stationery gill net 88kg, hand lines 76kg, fence traps 36kg, spears 7kg and scoop net 4kg. Basket traps, long lines and hand lines landed the highest catches with 13, 11 and 10 fish families respectively. The results of this study are essential in catch assessment of reef fishery and contribute to formulating measures on conservation and management of coral reef ecosystems and sustainable blue economy.

Key words: Species composition, fishing gears, fish sizes, catch per unit effort, coral reef ecosystem.

Soil Organic Carbon Stocks in Degraded and Healthy Mangrove Formations in Tana River and Lamu Counties, Kenya

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Mangroves are critical ecosystem in the context of national climate change mitigation and adaptation. Although the spatial extent of mangroves ecosystem is several folds smaller compared to terrestrial forests, they capture and stores five times more carbon (~1023 t/ha) compared to terrestrial ecosystems (e.g. ~275 t/ha for tropical forest). Soil carbon is the largest carbon pool in mangrove ecosystem contributing up to 90% of the total ecosystem carbon stock. Measurement of soil carbon pool is therefore critical for determining long-term changes in carbon stocks. Transects perpendicular to the shoreline were established at about 100 m apart following the species zonation across intertidal area in both areas that were perceived to have intact and degraded forest. In each transect, square plots measuring 20 m x 20 m were established to determine the forest structure and species composition. Within each plot, environmental parameters (pH, temperature, oxygen saturation, salinity and conductivity) were measured in-situ. Sediment cores up to 100 cm (0-15, 15-30, 30-50, and 50-100 cm) were taken to determine soil carbon stocks and bulk density (g cm^{-3}). Preliminary results show that the bulky densities are low (<1) this is a clear indicator that the soils obtained are rich in organic matter. It is expected that the results will provide baseline information for potential blue Carbon offset projects to generate sustainable conservation finance, protect biodiversity and create incentives for communities in Kenya.

Key words: Mangroves, Soil organic, Carbon Stock, Lamu, Tana River

Molecular Characterization and Antibacterial Potential of Endophytic Fungal isolates from selected Mangroves along the Coastline of Kenya

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The increasing emergence and re-emergence of resistant pathogenic microbes causes a health threat to the human population. This study aimed to characterize mangrove endophytic fungi and evaluate their antibacterial activity. Heritiera littoralis, Rhizophora mucronata, Bruguiera gymnorrhiza, Avicennia marina and Xylocarpus granatum species were collected from Tudor Creek, Mida Creek and Gazi Bay. A total of 30 fungal isolates were subjected to molecular identification based on analysis of their ITS gene region. The isolates in the inferred phylogenetic trees were affiliated with the genus Aspergillus. Ethyl acetate and butanol crude extracts of 29 fungal isolates and eight mycelia samples were screened for antibacterial activity against Staphylococcus aureus (ATCC 27853), Escherichia coli (ATCC 25922) and Pseudomonas aeruginosa (ATCC 25923) using the disc diffusion method. A. marina and R. mucronata harboured the most fungal endophytes that showed the highest antibacterial activity. Minimum Inhibitory Concentration (MIC) activity for the seven isolates that exhibited high antibacterial activities against the test microorganisms compared to the positive control was determined. The ethyl acetate extracts of isolates BE5, BA11, LB4 and RC6 showed significantly lower MIC activity compared to the positive control against test microorganisms (< 0.05). Therefore, this study confirms that mangrove species harbour fungal isolates that have antibacterial activity and hence could serve as a novel source of antibiotics.

Key words: molecular characterization, sequence identity, ethyl acetate, antibacterial activity.

Mangrove Forest Management in Lamu and Tana River Counties, Kenya

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Mangroves are critical ecosystems providing numerous economic, ecological, and environmental benefits and services to coastal communities. It is estimated that 70% of the wood requirement by the local communities living adjacent to the mangrove forests in Kenya is met by mangroves. To enhance sustainable wood fuel consumption and reduce carbon emission, adoption of energy efficient cook stoves at household levels is highly promoted. Kenya is expected to cut its carbon emissions to 32% below business-as-usual (BAU) levels by 2030. To achieve this ambitious target, a raft of measures has been proposed including improving national forest cover to a minimum of 10% of the land area of Kenya and reducing reliance on wood fuel. In an effort to address this challenge, the proposed study will assess the impact of adopting energy efficient wood fuel - based cooking stoves to reduce wood consumption and enhance sustainable mangrove forest management in Lamu and Tana River Counties, Kenya. The study will involve desk-based reviews of relevant published and government documents, focus group discussions with local communities and interviews with key stakeholders and informants at national, sub-national and local levels. The adoption of energy efficient wood fuel - based cook stoves is expected to have some environmental impacts on mangrove forests in both Lamu and Tana River Counties through reduction in wood consumption thus relieving pressure on mangroves. As a result, this is expected to translate to reduction of annual CO2 emissions and as well as contribute to the achievement of Kenya's Nationally Determined Contribution targets (NDC). The energy efficient stoves are also expected to have some socio-economic impact such as improving the living conditions among the participating households.

Key words: Mangroves, Energy, Efficient, Wood Fuel, Cook Stoves, Lamu, Tana River

B) SCIENCE AND TECHNOLOGY FOR CLIMATE ADAPTATION AND RESILIENCE

ORAL PRESENTATION ABSTRACTS

Genetically Modified Organisms As An Intervention Strategy In Agribusiness Sector For Food Security In Kenya In The Context Of Climate Change

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Extreme weather events such as heat waves, floods, landslides and droughts have been observed to be increasing in their frequency, duration and intensity as a result of climate change. This long-term shift in temperature and weather pattern has been observed to have serious effects on human health and safety, employee productivity, crop yields, nutritional quality of major cereals, livestock productivity and the rate of economic growth. The cabinet in Kenya has recently approved food crops produced through biotechnology innovations, attracting praise and protestations in equal measure. The purpose of this study therefore is to provide a content analysis of extant literature consistent with genetically modified organisms for climate change adaptation and resilience in agribusiness sector in Kenya. The study revealed that Agriculture remains the backbone of Kenya's economy and is critical in food security, employment creation and uplifting living standards of people in Kenyan. The study also established that climate change complicates Kenya's long-term goal of attaining nutrition and food security. Further, rivulets of research on genetically modified organisms have returned conflicting results on nutrition value, human health, ownership of technology, seed sovereignty and capacity to test for quality standards. This paper therefore argues that there is inadequate data on cost benefit analysis of allowing open cultivation and importation of genetically modified food crops and livestock in Kenya. The position taken by this paper is that vulnerable communities being ravaged by hunger is due to distribution failure in agribusiness sector, than lack of food in Kenya. This implies that the premise upon which genetically modified organisms are being approved in Kenya is faulty. This study has proposed a model upon which propositions at the abstraction level can be advanced and empirically tested as hypotheses to generate data to enhance performance in agribusiness sector in Kenya.

Key Words: Climate Change Interventions, Agribusiness, Genetically modified organisms

Characterization of Existing Rural Finance Markets that can Enhance Adoption of Climate Smart Agricultural Technologies in Kenya

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In Kenya, small holder farmers face climate change related challenges. It is therefore imperative to enhance adaptive capacity through climate smart agricultural (CSA) technologies. Access to finance is a significant enabler for adoption of CSA technologies yet small holder farmers, especially women, have an acute financing gap for agriculture. The purpose of the study was to characterize existing rural finance markets that can enhance adoption of Climate smart agricultural technologies among small holder farmers in Kenya and also improve the participation of other agricultural value chain actors in climate smart agricultural technologies. This was to enhance a better understanding of existing rural financial services available to agricultural value chain actors and the potential of the financial institutions to increase credit access to the value chain actors. The study used cross sectional data gathered through questionnaires administered on farmers, rural financial institutions and other actors in eight, Kenya Climate Agricultural Project (KCSAP) counties in Kenya. Data was analyzed using the Stata statistical package. Findings revealed that rotating and savings credit associations (ROSCAs) were the main credit source for most households. Farmers were rarely accessing insurance for their farming activities. Unlike farmers, other actors for instance, agro processors and agro dealers get loans through mobile phones where short term loans were borrowed from different providers. Majority of financial institutions were serving the agricultural sector. The study suggests that financial institutions could leverage on existing models used by ROSCAs to increase access to rural financial services especially by women and youth. A gender-transformative approach should be considered to increase women's access to rural financial serviKey words: Characterization, Climate smart, rural financial markets, Technology, Kenya

Insect pest's diversity and abundance as influenced by Integrated Pest Management strategies on African Indigenous Vegetables and pulses in Murang'a County, Kenya.

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Climate change and the current surge in the abundance and diversity of insect pests are major constraints to agricultural production in Kenya. These constraints significantly lower the yield potential of locally

grown food crops. African indigenous vegetables (AIVs) and pulses form key dietary and economically important food crops in Murang'a County. Pulses play a crucial role in nitrogen fixation as well. Despite their economic potential, the production of AIVs and pulses is under threat due to the effects of climate change such as increased and diverse insect pest's populations. Insect pests control is a common challenge among all small-scale farmers in Kenya. Crops damage and economic losses caused by insect pests are leading causes of food insecurity and hunger. However, little is known about the effects of Integrated Pest Management strategies on the insect pests' diversity and abundance in AIVs and pulses. This study was conducted with an objective of evaluating the effects of selected IPM strategies on insect pests' diversity and abundance in two indigenous vegetables and three pulses. Selected IPM treatments were used in three replications; Blue and yellow stick rolls (1 meter long each), Pyegar Bio-pesticides (Pyrethrin and garlic extracts, 60ml/20 liters of water), water sprinkling (2 liters per plot), Farmer practices (Alpha kill insecticide, Alpha-Cypermethrin 10% EC, 30ml/20 liters of water) and control (no products were used). Five crops were studied; Solanum nigrum L (black nightshade), Vigna unguiculata L (cowpeas) as both vegetables and as a pulse, Vigna radiate L (green grams) and Cajunus cajun L (pigeon peas). The on-farm research experiments were set out in a randomized complete block design. Research plots measuring 3 meters by 3 meters were set out and planted with hybrid seeds. Treatment regimens were initiated 7 days after crops germination. Data collection began on week 2 after crops germination until final crop harvesting. Weekly data collection on pest's dynamics and yield parameters were recorded. Whiteflies were the most abundant insect pests followed by aphids, thrips and spider mites respectively. The results revealed significant differences in both yield levels and pests' population dynamics across all the treatment regimens ($p \leq\leq 0.05$). Therefore, insect pests' diversity and abundance in AIVs and pulses can be managed successfully through IPM Strategies and farmers can achieve significantly higher yields under the integrated pest management strategies.

Key Words: IPM Strategies, treatment regimes, AIVs, pulses, pest's diversity and abundance

Leadership Challenges and Mitigations on Climate Change in Kenya : Reviews

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Climate change is a threat to the future of our planet, but there is still time for us to adapt to it and mitigate its effects. This study reviewed leadership challenges and mitigations in the major contributors of climate change that is Transportation, processing Industry, Agriculture, and Land Use and Forestry. The specific objectives focused on challenges faced by leaders on transport industry on climate change and its mitigations , challenges faced by leaders on processing industry on climate change and its mitigations , challenges faced by leaders on agriculture industry on climate change and its mitigations , challenges faced by leaders on land use and forestry on climate change and its mitigations .The study

adopted desk top research whereby secondary data were reviewed related to each specific objective. The findings revealed that leaders in the transport industry cited that Climate change is likely to damage transportation infrastructure through higher temperatures, more severe storms and flooding, and higher storm surges, affecting the reliability and capacity of transportation systems. The leaders in the forest sector cited that the challenges include the effects of a changing climate, worsening fire seasons, and epidemics of forest pests and diseases. The challenges also include lack of capacity to keep our forests healthy and resilient. Mitigation strategies include retrofitting buildings to make them more energy efficient; adopting renewable energy sources like solar, wind and small hydro; helping cities develop more sustainable transport such as bus rapid transit, electric vehicles, and bio fuels; and promoting more sustainable uses of land Being Prepared to Sudden Weather Changes. Ensuring Ecosystem Compatible Drainage. Improved Irrigation Efficiency. Rainwater Harvesting. Precision Farming. Cover Crops. No-Tillage or Minimum Tillage. Use of Adaptive Crops

Key Words: Climate Change, Challenges, Mitigations, Transport Industry, Forestry and Land use.

Polyculture: A bait for farm pollinator diversity in Murang'a County, Kenya

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Crop production is declining globally due to climate change, pest, diseases and pollinator decline. Plant-pollinator interactions are important in maintaining ecosystem services thus need for their conservation. Lack of data on population and diversity trends of pollinators hinders conservation actions. Polyculture is a common practice in rural areas. Pulses and indigenous leafy vegetables are a crucial part of diet due to their nutritional value and they require pollination for production. This study was done to determine the effect of polyculture of pulses and leafy vegetables on pollinator diversity in Murang'a County. There is no previous study in Kenya. Target crops were cowpeas (Vigna unguiculata, L), green grams (Vigna radiata, L), pigeon pea (Cajanus cajan, L) and spider plant (Cleome gynandra, L). Randomized Complete Block Design (RCBD) with 16 treatments of pure stands and intercrops replicated three times in 3x3 meter plots was used. Limited time searches, pan and light traps methods were used to collect data on flower visitors for two rainy seasons. 2,009 specimens belonging to 6 Orders, 20 families and 49 species were recorded. Order Hymenoptera had the highest abundance of 86.76%. Season two had significantly higher diversity, richness and abundance. Polyculture of cowpea and spider plant had the highest pollinator diversity and richness while green gram and spider plant had highest abundance in

season one. Polyculture of cowpea and spider plant had the highest pollinator abundance while the Polyculture of cowpea and spider plant had the highest species richness in season two. Bee pollinators were the most common and polycultures have the highest diversity. The study recommends that polyculture should be encouraged to i) Conserve pollinators by providing floral resources, ii) Improve soil fertility to reduce use of inorganic fertilizers that kill ground-dwelling pollinators, iii) Provide food and nutrient security, iv) Create livelihoods from surplus products sales.

Key words: Polyculture, Pollinators, Diversity, Murang'a

Analysing Adaptation Measures Against The Covid Pandemic And Climate Change At Oloolua Nature Trail In Karen, Nairobi County, Kenya.

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Several studies have emphasised the nexus between the Coronavirus pandemic and climate change by highlighting the vulnerability and resilience of the urban tourism sector. The key global response to Covid-19 pandemic was the "lockdown" policy that reduced revenue to urban forests, highly reliant on tourist numbers for support. Thus, hampering the small-scale conservation and climate change education activities performed by such urban spaces. This study sought to investigate impacts of covid-19 on tourism activities in Oloolua Nature trail, Karen in Nairobi County. The objectives involved establishing the numbers of tourists over the past five years, identifying tourism activities and documenting implemented measures by the management. Primary data was obtained using questionnaires and interviews with the Nature trail ecologists and trail tourists. Secondary data on the tourist numbers for 2017 to 2021 were obtained from the park management. Data was analysed using descriptive statistical tools including the t-test method to compare the effects of the pandemic on tourist numbers. Results reveal that the nature trail had been on a positive trajectory (+49%) in terms of tourist numbers from 2017. However, after the "lockdown" policy, there was a decline in international tourists and school institutions but an increase from private citizens and residents in 2020. Unfortunately, the 2021 visitations (-20%) were not enough to recover back to the tourist numbers from 2019. The preferred activities were walks, picnics, hiking and dog runs which are naturally socially distanced activities and hence suitable despite the pandemic. Park management had instituted an effective four-prong approach to boost tourism numbers. The study confirms the high potential of local neighbourhoods in maintaining the conservation status of green spaces alongside enhanced healthy wellbeing levels in the community. There is need for a review of the climate risk management strategies for increased resilience and adaptation measures towards the

projected rise of global pandemics to cushion the fledging urban forest conservation in Kenya.

Keywords: Covid-19; lockdown; Climate adaptation; urban forest; tourism and risk management.

Assessment of impacts of the Highly Invasive Urtica dioica L. on Herbaceous Plants Diversity Across Kieni West, Nyeri County, Kenya

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Although the stinging nettle (Urtica dioica L.) is categorized globally as an invasive species and irritant weed, the plant is a source of vital nutrition and an ingredient in many indigenous medicine practices. Studies have shown that U. dioica is a drought resistant plant with dense rhizomes that ensures its survival, enduring adverse climatic conditions throughout the year. Unfortunately, there is inadequate data on the invasiveness of the species together with the subsequent impact on herbaceous flora diversity in the highlands of Kenya. Hence, this study sought to assess the invasive nature and biodiversity impacts of U. dioica in the Endarasha, Charity, and Watuka areas at semi-arid Kieni West Sub County in Nyeri County. Through stratified random sampling a hundred (100) meter-long transects and ten $1m^2$ quadrats were placed across roadside, riverbanks, pastureland, residential, and cropland areas for data collection. Correlation analysis was used to analyse the mean density of U. dioica and the diversity of other herbaceous flora. The mean density of U. dioica was statistically different at $p<0.05$ from that of other herbaceous species. There was a significant negative correlation coefficient between the density of U. dioica and other herbaceous species diversity ($r=-0.8$). In conclusion, areas with high U. dioica density had reduced density, diversity, and species richness of other herbaceous flora. The study recommends increasing public awareness of the benefits of drought resistant U. dioica to boost its consumption hence reducing its invasiveness.

Application of Ecosystem Service Assessment in Natural Resource Management at four Kenyan sites

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Ecosystems services are varied benefits that humans obtain from the environment. Information on the value of ecosystem services provided by a site can inform the formulation and implementation of its natural resource management plans and policies. Between 2014 and 2022, The Toolkit for Site Based Ecosystem Service Assessment (TESSA) was used to estimate the value of ecosystem services provide by Yala Swamp in Western Kenya, Tana Delta at the Kenyan Coast, Mount Kenya in the Cantal Kenyan Highlands and Dakatcha Woodland located in Kilifi County in the current and in future scenarios. Future scenarios were based on two contrasting development pathways: a Business as Usual Pathway where current land uses continue with little regard to sustainability and a Conservation Scenario where sustainability is mainstreamed into the land use and management through policy interventions. The ecosystem services assessed were climate regulation, crop production, wild good harvesting, water services and cultural services. At all the sites, a Business as Usual development pathway leads to short-term increase in food production and harvested wild goods at the expense of climate regulation, cultural and water services. A common recommendation from all the sites is the need to ensure a balance in the use of ecosystem services to ensure ecosystem sustainability. The findings of these studies have been instrumental in the formulation of site natural resource management plans and policies including Yala Swamp Land Use plan; Tana Delta Indigenous and Community Conservation Area Management Plan,2019-2029; Mount Kenya Forest Restoration Strategy; and Dakatcha Woodland Management Plan 2022-2028).

Nematode functional guilds in natural ecosystems and cropping systems under anthropogenic disturbance

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Nematodes occupy a key position in the soil food web. Disturbances that result from agriculture may affect the nematode functional guilds. The functional guilds of nematodes in natural ecosystems and cropping systems under anthropogenic disturbance in Embu, Kenya were evaluated. Nematodes were extracted and identified from soil samples collected from fields cultivated with tea and a conserved forest. There was a significant variation in the number of nematodes in Ba_2 ($P = 0.0004$), Pp_2 ($P = 0.03$) and Pp_3 ($P < 0.001$) functional guilds in tea fields and the forest. In the forest, Pp_2 and Pp_3 nematodes were present in greater numbers and there were low densities of Ba_2 nematodes. Tea fields did not have the Pp_2 genera, Malenchus and Paratylenchus. There were however high densities of the Ba_2 genera Cephalobus, Eucephalobus and Heterocephalobus. Information from this study can be used in designing ecologically sustainable tea cropping systems.

Improvement of survival and growth of tissue culture banana (*Musa* spp.) seedlings for smallholder farmers through acclimatization using arbuscular mycorrhiza fungi

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Production of banana seedlings through tissue culture provides a reliable source of numerous, disease free, quality plantlets. However, the micropropagation process is faced with a number of challenges. In this study we focused on improvement of survival and growth of the resultant plantlets during the acclimatization process. The viability of arbuscular mycorrhiza fungi (AMF) symbiont in the acclimatization process was assessed. Tissue culture bananas (Kienyeji, Kiganda and Ng'ombe local cultivars) were inoculated with single species AMF Rhizophagus irregularis and Funneliformis mosseae as well as commercial AMF Rhizatech. The survival rate was assessed and plant growth evaluated at a two-week interval. Destructive harvesting was conducted followed by assessment of root, shoot

and total biomass. The results demonstrated that Kiganda treated with Rhisophagus irregularis and Funneliformis mossae recorded better survival rates compared to treatments with NPK fertilizer and commercial AMF (Rhizatech). Kienyeji cultivar however had a better survival rate when treated with commercial AMF (Rhizatech). Ng'ombe cultivar was very resilient having 100 % survival rate when treated with indigenous as well as commercial AMF (Rhizatech) and NPK. There were significant differences in the shoot dry weight, root dry weight and biomass in the three banana cultivars. The results in this study confirm that the use of AMF in the acclimatization process improves the overall seedling output of the micropropagation process during the nursery stage of production. Rhisophagus irregularis and Funneliformis mosseae outcompeted commercial AMF bio-innoculant Rhizatech in improving micropropagated seedling survival and growth. These are potential candidates for field application during banana planting. However, the specificity of this symbiotic interaction requires further screening to select suitable host and treatment combination to ensure optimal conditions for the host plant.

Key words: Banana, acclimatization, mycorrhiza, tissue culture

Seasonal and Spatial Variability on abundance and diversity of honeybee corbicular pollen in three agrosystems in Kenya

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Pollen is the main protein source in honeybees' diet and contributes to brood development and overall colony health. Pollen quantity and nutritional quality varies across different flowering seasons of major source plants as well as across landscape types overtime. Understanding the role of landscapes, time and planting seasons is tremendously important for pollinator health particularly in agricultural landscapes, such as Murang'a County, where landscape is highly segmented and natural vegetation replaced by food crop cultivation. In this study, we determined how the corbicula pollen quality and quantity fluctuated across three different NDVI landscape types, and planting seasons. This was done through a 12-month sampling from 18 apiaries in Murang'a County. 26 plant families were found to be preferred by the bees, from which Lauraceae Poaceae, Asteraceae and Theaceae families were the most abundant. Cleomaceae and Asparagaceae were the least preferred plat families. Pollen abundance, diversity, and Crude Protein (CP) varied significantly among pollen from different plant families (0.01852). Shannon

Weaver diversity index showed that diversity peaked in the month of June (1.833), and was lowest in the month of March (0.347). Pollen abundance, diversity and CP did not vary according to NDVI landscape type. CP content ranged between 0.01 - 7.11 %. Pollen from Fabaceae, Lauraceae, and Solanaceae (7.11, 6.87, & 6.66%, respectively) had the highest amounts of crude protein. Sampling time had an effect on pollen abundance and CP (0.0003). The landscape of Murang'a is seasonally dynamic, and this may impose seasonal resource limitations for both managed and native bee species. There is therefore need to supplement domesticated bees with alternative pollen source due to the seasonal resource limitationsKey words:Pollen preference, floral origin, crude protein content, landscape types

Evaluation Of Agronomic Traits Among Tropical Maize Under Salt Stress And Identification Of Responsible Saltol Quantitative Trait Locus

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Maize is the main human food crop in Kenya. Most farmers in Kenya rely on rainfall to grow maize and other crops. However, the amount of the rainfall in many parts is not reliable resulting to irrigation. Crop production in the coastal areas of Kenya suffers greater constraints because of salinity. In coastal areas salinity is caused by accumulation of salt in soil as a result of salty borehole water. The goal of this research was to identify salt tolerant Quantitative Trait Locus (QTL) using Simple Sequence Repeats (SSR) markers in maize leveraging on the similar QTL in rice. In this study, five tropical maize inbred lines – CML 216, CML 395, CML 144, EO4, AO4 and four coastal open pollinated varieties (OPVs)– PH4, DHO4, SC DUMA 43 and DK 8031 were used for analysis of saltol QTL by evaluating their agronomic traits under various levels of Sodium Chloride (NaCl) treatment (0.0mM, 0.02mM, 0.06mM, 0.18mM and 0.54mM). Five replicate seeds of each maize variety were planted one inch in soil in pots and watered daily with one litre of each concentration. A 100% germination performance was observed on soil treated with 0.0, 0.02 and 0.06mM NaCl. At 0.18mM NaCl, DK 8031 and PH4 seeds were the most tolerant registering germination percentage of 80% whereas AO4, EO4 CML 144, PH4, DHO4 and CML 395 had 20% germination at the same concentration. The most susceptible lines were CML 216 and SC DUMA 43 with 0% germination at 0.18mM NaCl. In bred lines CML 216, CML144, CML 395, DK 8031 and DHO4 exhibited hormesis in 0.02mM NaCl. It was observed that at 0.02mMNaCl DK8031 shoots had a ratio of Na^+/K^+ as 180/250ppm and therefore DK8031 did not leak K^+ ions maintaining a normal Na^+/K^+ ratio for the cell homeostasis associated to saltol QTL. Among the OPVs, SC DUMA 43 had highest number of seeds 317.43± (11.7030) in 0.02mM NaCl. DK 8031 and SC DUMA 43 were superior with shorter anthesis-silking interval (80 and 78 days after planting) among

the OPVs, whereas in 0.02mM NaCl CML 216 and PH4 had poor grain yield with the least number of seeds (2.23± (1.7436) and 8.62± (7.3865) respectively with long anthesis-silking interval (107 and 110 days). Using simple sequence repeats (SSR) markers, this research identified a saltol QTL that confers salt tolerance in maize. Fourteen SSR markers were utilized to predict similar salinity tolerance QTL on maize, which were previously used for saltol-QTL mapping on chromosome 1 in rice. PCR was used to find QTLs. All SSR markers detected saltol QTL on chromosome 1 of rice, while five SSR markers (RM10694, RM490, RM10772, RM10764, and AP3206) detected saltol QTL in maize. The PCR amplified DNA fragments ranged from size 100 to200bp. From this study QTL of salinity tolerance was identified in DK8031 maize at the seedling stage using rice synteny regions. In conclusion SSR markers identified the saltol QTL in maize.

Abundance and diversity of floral resource reservoirs for wild bees in pumpkin farms at Masinga and Yatta sub-counties, Machakos County

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Pumpkin (Cucurbita maxima L.) is an economically important crop in tropical and subtropical regions with high reliance on animal-mediated pollination services. However, its production is constrained by lack of sufficient pollination. Flowers are not self-pollinated thus need bio-agent to enhance pollen deposition. The current global decline of managed bees due to anthropogenic factors and climate change have increased the vulnerability of pollinator-dependent plants and therefore, impacting negatively on food security and biodiversity. Finding alternatives to promote and augment feral pollination services by introduction of managed pollinators may be a good option. This study determined seasonal floral resource structure utilized by honeybees in Machakos County, Kenya. The study was carried out in two NDVI (Normalized difference vegetation index); low and medium in Yatta and Masinga Sub-Counties in two seasons, October 2019- March 2020 and April to August. Random sampling design was used to establish a 2 m^2 quadrat in the middle of the pumpkin farm for sampling of plants while a belt transects measuring 4 m x 50 m was used to collect data from the middle of the pumpkin farm towards non farmed areas. The observed plants differed significantly ($P<0.05$) among the plant type, NDVI class and seasons. In both 2 m and 50 quadrats there was variation of plant diversity across different seasons.

Generally, plants were more diverse outside cropped area in low NDVI (2.73-3.59) compared to medium NDVI (2.45-3.43). However, this was opposite within the cropped area with low NDVI showing less diversity (0.00-3.09) compared with the medium NDVI (0.63-3.05). There were more flowering plants in the long rains season compared with the short rain season across the NDVI classes. Findings will provide information that can be used to understand aspects of managing bee supplementation in the area to provide improved pollination services for the crops grown in the area.

Keywords: Pollinators, Normalized difference vegetation index, biodiversity, floral calendar,

Impact of Climate Change-Driven Floods as Perceived by Flood-Prone Residents of Yola Town-Adamawa State, Nigeria

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As climate change may likely exacerbate the frequency and intensity of extreme flood events, much awareness is needed to promote its mitigation and adaptation. In Nigeria, little research has been conducted on the perceptions of the effects of climate change-driven floods. This study sought to explore the perceptions of flood-prone residents in Yola Town Nigeria about the impact of climate change-driven floods and their preparedness in facing the challenge. Using qualitative descriptive approach, a semi-structured in-depth interview and field notes were used to collect data from 20 flood affected residents. Qualitative content analysis was use for data analysis. Themes that imaged from the resident's perception include past flood experience, flood warnings, house damage, drainage conditions, displacements, relocations, pollution of drinking water, health and economic problems. Major findings revealed that majority of residents perceived that their previous experience with frequent flooding in this area often accompanied with series of economic problems such as financial losses, relocations and sometimes displacements due to house damage. The study also found that the inhabitants of this area were not only faced with the problem of high contaminations of food and drinking water, but with many other health related problems including water borne related infections such as cholera, diarrhoea and typhoid fever. Similarly, the respondents maintained that whenever the floodwaters receded, bacteria and harmful fungi often remain, and hence increasing the rate of illnesses. The study concludes by suggesting that continuous research in the field of climate change driven extreme floods may help stakeholders in addressing climate change related floods and its impacts.

Keywords: Impact, Climate change related floods, Flood-Prone Residents Perception, Yola Town Adamawa, Nigeria

Heat Stress In Dairy Cattle And Its Mitigation In The Climate Change Era: A Review

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Rise in Temperature-Humidity Index as a result of climate change plays a negative significant role in livestock performance and could likely be of greater importance in the future as climate change continues. The aim of this paper is to provide the implications of heat stress in dairy cattle which is as a result of climate change as well as some strategies to mitigate it. Heat stress in dairy cows is caused by a combination of environmental factors such as temperature, relative air humidity, sunlight radiation, air circulation and precipitations. Some of the implication of heat stress in dairy cattle are; reduced feed intake, growth, production, reproduction, welfare and health. Some of the strategies that have been developed to reduce the magnitude of climate change on dairy animals include; selection of genetically resistant animals, conventional cross- breeding and manipulation of the animals' environment. Heat stress is one of the major challenge of the dairy industry in this climate change era which can reduce the overall performance and profit of the dairy industries. Ensuring close monitoring of dairy animals during the hot weathered periods and providing proactive measures to reduce its effect can go a long way in preventing heat stress.

Key words: heat-Stress, Dairy, Cattle, Mitigation, Climate.

Climate change and environmental influence on prevalence of visceral leishmaniasis in West Pokot County, Kenya

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Visceral leishmaniasis or kala-azar is a poor man's disease caused by Leishmania donovani in Kenya and transmitted by sand fly species. Kala-azar is endemic in over eleven counties mainly in the arid and semi-arid regions of the Country. Climate change-influenced seasonal weather variability and environmental alterations remain important determinants of many vector-borne diseases including kala-azar. The current study aimed at understanding the influence of climate change and environmenton kala-azar in West Pokot using combined descriptive cross-sectional and retrospective research design. Study area was purposively selected, locations were randomly selected and households systematically selected. Three hundred and sixty-three household questionnaires, eleven key informant interviews, and five focus group discussions were undertaken. Secondary data was obtained from Kacheliba sub-County hospital records. Statistical package for social science version 24 was used to analyze quantitative data while qualitative data was analysed to establish connection for interpretation. Kala-azar cases have been on the rise on aggregate and surge towards the end of dry season and just after the rains. Significant environmental factors included: presence of seasonal rain water pathways and rock piles around houses (AOR=4.7; 95% CI=(2.3-9.6), $p<0.05$); presence of acacia trees in and around homesteads (AOR=8.5; 95% CI=(2.5-28.6), $p<0.05$); presence of anthills around the homesteads (AOR=5.2; 95% CI=(1.2-23.4), $p<0.05$); and presence of animal shed within compound (AOR=2.8; 95% CI=(0.96-8), $p<0.05$). Climate change-induced seasonal weather variability; increased temperature and reduced precipitation as well as environmental alterations influence kala-azar occurrence in West Pokot. Community sensitization on disease prevalence, clearing of vector predilection sites and improving community environmental risk perception are imperative to promote disease prevention.

Keywords: Sand fly, Kala-azar, West Pokot, Environment factors, Climate change, Disease occurrence.

Proposed Adoption of Energy Efficient Wood Fuel-Based Cook Stoves for Sustainable Mangrove Forest Management in Lamu and Tana River Counties, Kenya

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Mangroves are critical ecosystems providing numerous economic, ecological, and environmental benefits and services to coastal communities. It is estimated that 70% of the wood requirement by the

local communities living adjacent to the mangrove forests in Kenya is met by mangroves. To enhance sustainable wood fuel consumption and reduce carbon emission, adoption of energy efficient cook stoves at household levels is highly promoted. Kenya is expected to cut its carbon emissions to 32% below business-as-usual (BAU) levels by 2030. To achieve this ambitious target, a raft of measures has been proposed including improving national forest cover to a minimum of 10% of the land area of Kenya and reducing reliance on wood fuel. In an effort to address this challenge, the proposed study will assess the impact of adopting energy efficient wood fuel - based cooking stoves to reduce wood consumption and enhance sustainable mangrove forest management in Lamu and Tana River Counties, Kenya. The study will involve desk-based reviews of relevant published and government documents, focus group discussions with local communities and interviews with key stakeholders and informants at national, sub-national and local levels. The adoption of energy efficient wood fuel - based cook stoves is expected to have some environmental impacts on mangrove forests in both Lamu and Tana River Counties through reduction in wood consumption thus relieving pressure on mangroves. As a result, this is expected to translate to reduction of annual CO_2 emissions and as well as contribute to the achievement of Kenya's Nationally Determined Contribution targets (NDC). The energy efficient stoves are also expected to have some socio-economic impact such as improving the living conditions among the participating households.

Key words: Mangroves, Energy, Efficient, Wood Fuel, Cook Stoves, Lamu, Tana River

POSTER PRESENTATIONS

Diurnal raptor diversity across three urban forests (Karura, Thogoto and Ngong Road Sanctuary) of the greater Nairobi, Kenya

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Diurnal raptors are a great group of birds to use for environmental monitoring. Being at the top of the food chain, raptor populations indicate the health of an ecosystem in general and show gradual trends as occasioned by environmental changes. Nairobi is a fast-developing urban metropolis and its development has led to reduction of green spaces in most places where there were forests and woodlands. This study was developed to help quantify the importance of urban forests by using diurnal raptors as indicators of forest value. Line transects were conducted in three large forest blocks within the greater Nairobi metropolitan; namely Karura Forest, Ngong Road Forest and Thogoto Forest. These transects were used to count all diurnal raptors seen or heard and then comparisons were computed to quantify the differences between the three forests. The study identified 15 diurnal raptor species in the three urban forests. The Shannon diversity index results showed that Thogoto Forest had the highest raptor diversity index (Shannon) at 1.08, followed by Ngong Road Forest Sanctuary at 1.05 and the lowest was Karura Forest at 1.03. However, the Analysis of Variance (ANOVA) results queried on the diversity indices showed that the indices were not statistically significant. Therefore, despite each forest having some species that did not occur in the other two forests; the three urban forests did not differ significantly in the numbers of species represented. The months of March and April recorded the highest raptor numbers in the three forests with June recording the lowest numbers.

Key words: raptor, Nairobi, forest

The potential of low-cost tissue culture technology application in sustainable micro-propagation of banana seedlings in Kenya

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The potential of low-cost tissue culture technology application in sustainable micro-propagation of banana seedlings in Kenya

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Banana is an important fruit crop in the world and its demand has been on the rise. Currently, production does not meet the demand and one of the major contributing factors to this is shortage of planting materials. Conventional tissue culture technology has been used in the production of high quality disease free seedlings. However, the cost of undertaking conventional tissue culture process is costly. This therefore calls for the need to venture into cost effective options. In this study, we explored the use of low-cost tissue culture technology in producing quality disease free seedlings for smallholder farmers. Use of local fertilizers as an alternative to conventional macronutrients and micronutrients reduced the cost of micropropagation by 90 % and 66.7 % respectively. Additionally, use of alternative equipment during tissue culturing process such as substituting of conventional tissue culture bottles with jam jars reduced the cost by 93 % of the total cost incurred. It was observed that those cultures placed in low cost initiation media supplemented with 3.0 mg/l BAP combined with 0.3 mg/l IAA took the shortest period (26.5 days) for the shoots to be initiated. Ng'ombe cultivar obtained from Kisii County was the most responsive in low cost tissue culture media in which an average of 10.61 shoots were produced and the multiplication rate was 5.50. There was a significant difference in the number of days the cultivars took for roots to be initiated in low-cost rooting media supplemented with 2 mg/l IBA. Based on the seedling output of the micropropagation process low-cost tissue culture technology is a viable alternative in the production of affordable banana seedling. Kiganda cultivar from Embu County, Kienyeji and Kienyeji cultivars from Kisii responded best to low-cost micropropagation. However, there is need for further development of low-cost micropropagation protocols better suited for Israel, sukari and muraru cultivarKey words: Banana, micropropagation, low-cost, cultivars

C) CHEMICAL SCIENCES

ORAL PRESENTATIONS

Utilization of a 3D Printer for Developing Low-Cost Electrodes and Components for Use in Electroanalytical Sensors

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Electroanalytical detection methods are frequently applied in many fields including chemistry, food science, and environmental science because they are more sensitive and easier to use than most chemical methods. Integral components in these methods are the working electrode where the relevant electrochemical reaction takes place and the reference electrode for maintaining a constant electrochemical potential. Carbon electrodes are most frequently selected due to their wide potential range and compatibility with many aqueous and organic solvents. However, the most commonly used carbon electrodes, such as glassy carbon, are often expensive and require an extensive cleaning procedure before use. In this presentation, I will describe our efforts toward the development of low-cost components for use in electroanalytical methods. Examples include a disposable pencil graphite working electrode, and an Ag/AgCl reference electrode. In addition, our system uses a novel reference electrode fabricated with the use of a 3D printer. The use of 3D printing allows for low-cost and adaptable designs for disposable electrodes. Results showing the effectiveness of the low-cost electroanalytical platform for the voltammetric determination of different analytes will be presented. In most cases, the performance of the low-cost fabricated electrodes compared favourably with the corresponding commercial counterparts. Our electroanalytical system presents a portable and inexpensive system for use in a variety of low-cost electroanalytical methods. Due to the associated low cost, our analytical system will get global applications in diverse fields, particularly in developing countries. Examples include low-cost agricultural and environmental analysis, fieldwork applications in remote labs, as well as electrochemical experiments at educational institutions.

Characterization of AlSO4-FeCl3-saponin-chitosan nanocomposite for removal of Cr (VI) in water

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Worldwide, over 700million people lack access to safe drinking water due to contaminants such chromium. Membrane technology, reverse osmosis and precipitation among other methods have been employed to remove such contaminants in water. The disadvantage of these techniques include the high cost involved and production of low tensile adsorbents that disintegrate in the water. To address such challenges, AlSO4-FeCl3 -saponin-chitosan was prepared and characterized before and after adsorption of Cr (VI) in water. The techniques SEM, FTIR, XRD and XPS were used. Visible pores on the nanocomposite disappeared after the adsorption process in the SEM images. FTIR spectrum indicated loss of certain functional groups as a result of removing Cr (VI) ions which disappeared after adsorption. Results from XRD shows an amorphous nanocomposite projecting a good adsorbent. In the XPS spectra, the peak areas decreased from 59.8 to 52.4% before and after adsorption respectively confirming removal Cr (VI) ions. The XPS analysis showed good agreement with the FTIR result, thereby confirming the presence of the reported functional groups and validating the observed presence of the incorporated materials on the nanocomposite with a potential to be up scaled for commercial application. The AlSO4-FeCl3 -saponin-chitosan nanocomposite for removal of Cr (VI) in water was prepared.

Key words: Nanocomposite, Chromium, Saponin.

Synthesis of Cellulose-Based Superabsorbent Hydrogel from Rice Husk Using a Microwave

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The present work focuses on the synthesis of a new environmentally friendly superabsorbent hydrogel derived from a cellulose derivative using 1, 2-ethanediol (glycol) as crosslinking agent. The cellulose isolated from rice husk, which has a basis to modify and obtain carboxymethylcellulose CMC using sodium hydroxide (NaOH) and monochloroacetic acid (MCA). Fourier transform infrared (FTIR) and X-ray diffraction (XRD) were performed in other to investigate the reactivity of the superabsorbent hydrogel. The Optimum conditions of power, time, CMC dose and amount of cross-linker required for

the production of most desirable, stable and high water absorptivity were investigated, the optimum swelling capacity was found to be 1162%.

Keywords: Cellulose, Superabsorbent hydrogel, Crosslinking, Microwave

Analysis of Selected Physicochemical Parameters of Soil for Isolation of Soil Actinomycetes with Antibacterial Activity

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Land use systems in Meru South sub county, Kenya are relatively unexplored and offer potential habitat for Actinomycetes that could produce novel bioactive compounds. Search for novel bioactive compounds from Actinomycetes in virgin habitats assumes significance as the emergence of multidrug resistant pathogens are threatening effective medical intervention through conventional antibiotics. The aim of the study was to assess the effect of selected soil physicochemical parameters on Actinomycetes load on land use systems in Meru South sub-County, Kenya as well as their antibacterial activity. Soil samples from different land uses were collected and their composite samples prepared. Physicochemical parameters of the soils like moisture content, pH, electrical conductivity, organic carbon, organic matter and exchangeable base (K, Na, and Mg) were evaluated, and later Actinomycetes populations were isolated on selective media through serial dilution to 10^{-3} and enumeration done per media and per region. The isolates were tested for their ability to combat the following six pathogenic bacterial strains; Staphylococcus aureus (ATCC 25923), Listeria monocytogenes (NCTC 11994), Streptococcus mitis (NCTC 12261), Escherichia coli (ATCC 25922), Vibrio furnissii (NCTC 11218), and Rauotella planticola (NCTC 19528). Enumeration of Actinomycetes on the selective media used for the study showed a significant difference ($p \leq 0.05$). The number of Actinomycetes varied from 3.32889×10^5 colony forming units (cfu) g^{-1} in waste dumpsite soil to 1.62069×10^5 cfu g^{-1} in intact soil. The distribution of Actinomycetes was highest in waste dump site soils compared to other soil samples. Results of soil

physico-chemical analysis revealed that pH (r=0.6341; p=0.0001), potassium (r=0.3148; p<0.0001) and organic content (r =0.1296; p=0.35) had a positive correlation with the Actinomycetes load. The antibiotic activity of the Actinomycetes isolates against Listeria monocytogenes varied significantly (p=0.05) among them. In comparison to standard streptomycin (16.3mm), isolate L6 (16.23mm) demonstrated the strongest antagonistic activity against L. monocytogenes, followed by isolates C50 (15.5mm) and C52 (12.25mm) against Raoultella planticola. The results indicate that the soils from land use systems could be an interesting source of Actinomycetes with potential antibacterial activity. Further search needs to be conducted on extreme environments within the county.

Keywords: Soil Samples, Soil Actinomycetes, Physicochemical parameters, Isolation, Enumeration, Antibacterial Activity

Bioremediation of mortar made from Ordinary Portland Cement degraded by *Thiobacillus thioparus* using *Bacillus flexus*

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Cement is widely used as a construction material in the construction industry. However, there are challenges affecting its durability efficacy. Cement mortar/concrete is subject to degradation by aggressive ions such as sulphates and chlorides. Sulphates can be introduced into the concrete or mortar by Sulphur producing bacteria of the species Thiobacilli. Microbiologically induced $CaCO_3$ precipitation (MICP) has found its application in bioremediating cement-based materials. It has been found to be environmentally friendly. However, no work has been reported on bioremediation of biodegraded cement-based materials. This paper presents findings of possible bioremediation of mortars after undergoing biodegradation. Bacillus flexus, a beneficial bacterium was used. The control mortars were prepared using Ordinary Portland Cement (OPC). The test mortars were prepared and cured in a solution of Thiobacillus thioparus, a Sulphur oxidizing bacteria, deleterious bacterium for 14, 28, 56 and 90 days. Compressive strength analysis was conducted on the 14th, 28th, 56th and 90th day of curing. Results showed that the lowest compressive strength was recorded on the 90th day as 31.02 MPa. This was a 34.17 % loss in compressive strength. Another category of mortar cured in Thiobacillus thioparus for 28 days was bioremediated for 28 days using Bacillus flexus solution. Compressive strength and Scanning Electron Microscopy (SEM) analyses were then done. The results show a compressive strength of 45.83 MPa at the 56th day. This represents a 99.91 % strength recovery from biodeterioration. The SEM analysis results revealed a denser material. This was due to massive precipitation of calcium carbonate in the mortar matrix and

pores / voids for bioremediated mortars as opposed to the biodegraded mortars. The results further revealed reduced ettringite crystals on the bioremediated mortars. Bacillus flexus could perhaps be used in restoring lost compressive strength as well as in sealing voids in degraded concrete in sewer lines and other cement-based materials. This could improve on its efficacy with minimal repair.

Key words: Biodeterioration, Mortar, Bioremediation, Ordinary portland cement, Thiobacillus thioparus, Bacillus flexus

Effect Of Processing On Nutritional And Anti-Nutritional Content Of Edible Insects

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Balanced diet is essential for the growth of a child's full human potential; otherwise lack of it may result in malnutrition. Entomophagy contributes to reduced malnutrition since insects have sufficient amounts of nutrients. However, processing of insects may affect their nutritional content. This research assessed the effect of processing on some nutrients and anti-nutrients in selected edible insects. Dry matter, proteins, minerals and anti-nutrients in fresh and processed edible insects were determined using standard methods. Moisture content for fresh grasshoppers and termites was 55.01% and 40.00% respectively and was significantly reduced to less than 10% on drying. The ash content was 2.8% and 2.23% for fresh grasshoppers and termites respectively and was significantly increased on processing. Crude protein was 16.24 g/100g and 19.20 g/100g for fresh grasshoppers and termites respectively and increased significantly on processing. There was no significant effect on zinc and iron mean levels on processing. However, calcium content was significantly reduced on drying the samples. The tannins, phytate and oxalate levels were 1.69±0.01 mg/100g, 0.67±0.01 mg/100g and 7.88±0.02 mg/100g for fresh termites, 0.93±0.01 mg/100g, 0.41±0.01 mg/100g and 14.03±0.03 mg/100g for fresh grasshoppers. These levels were lowered significantly on processing. Defatting and oven-drying are better processing methods that retain higher levels of nutrients in edible insects while oven-drying is the most appropriate in reducing anti-nutrient levels. Formulations of edible insects through defatting and oven-drying methods are recommended to alleviate malnutrition among children in a community.

Keywords: Nutrients, anti-nutrients, processing, edible insects

LC-MS Analysis and Hepatoprotective Activity of Methanol Leaf Extracts of Edible Solanum *villosum* (Linn.) and *Solanum scabrum* (Mill.) in Acetaminophen Induced Wister Mice

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Drug induced liver injury (DILI) remains a medical quagmire due to diagnostic challenges and insufficient safe drugs for treatment. Comestible variants of the Solanum nigrum are historically important sources of nutrition and indigenous medicine. However, gaps exist in scientific validation of their medicinal potential. LC-MS analysis of MeOH leaf extracts of Solanum villosum and Solanum scabrum were performed in the present study. Subsequently, the protective potential of the extracts against acetaminophen induced liver injury was investigated in model mice at 30, 100, 300 and 500mg/Kgbw, with silymarin 25mg/Kgbw as the positive control. Forty phytochemicals were identified in the extracts out of which, six including kaempherol-3-rutinoside, quercetin-3-rutinoside, solasonine, caffeoylquinic acid, di-caffeoylquinic acid and feruloyquinic acid were unique to S. villosum. Ten metabolites namely, solamargin, rutinoside, apigenin, genistic acid, cinnamic acid, caffeoylmalic acid, protocatechuic acid, luteolin and thioflavin were exclusive to S. scabrum. The rest were present in both extracts. Pretreatment with the extracts led to significantly ($P \leq 0.05$) higher stimulatory effects on WBCs compared to silymarin. Additionally, the extracts led to significant decline in % GRAN similar to positive group. Further, we found that both extracts significantly increased % LYM with highest activity in S. villosum. Similarly, the extracts lowered serum ALP, ALT, AST and GGT significantly compared to the negative control. Finally, the two extracts up-regulated activities of antioxidant enzymes SOD and GPx. Overall, S. villosum conferred stronger hepatoprotection than S. scabrum, attributed to specific secondary metabolites constituents. The results demonstrated that edible S. villosum and S. scabrum contain pharmacologically active metabolites with ameliorative effects against drug induced liver injury. The study provides a scientific framework for promotion of consumption of the two-vegetable species by persons at risk of DILI or compromised immunity. Similarly, it is a basis for conservation and exploitation of the species for the active metabolites.

Key words: *Solanum villosum*; *S. scabrum*; **secondary metabolites; hepatotoxicity; enzymatic antioxidants**

Comparative Study of Selected Macro and Micronutrients in Bio Slurry Samples from Different Feed Stocks and Inorganic Fertilizers

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In Kenya overuse of inorganic fertilizers have rendered soils in arable areas acidic leading to poor crop production and hence great risk of food insecurity. An alternative source of plant nutrients that can also address soil acidity is needed if the country is to be food secure. Bio slurry, a by-product from the biogas plant, can successfully be used to improve crop productivity and soil health. This study was conducted to determine the levels of macro and micro nutrients in bio-slurry from different feed stocks and compare with nutrients from conventional chemical fertilizers. Physical parameters were determined on site. The samples were digested using protein digestion method for nitrogen and acid digestion method for phosphorus, potassium, sodium and magnesium. Phosphorus was then determined using UV-Vis while metals a flame emission spectrophotometer was used. The levels of macro and micronutrients were found to be significantly high in bio slurry samples than in select inorganic fertilizers. This study indicates that bio slurry has basic pH and can be used to raise the pH of acidic soil upon prolonged application. In addition, pig waste slurry can serve better as a planting fertilizer due to its high P content while Cow dung slurry would best serve as a top dresser due to the high nitrogen content.

Keywords: Bio slurry; fertilizer; micronutrients; macronutrients; food security.

Phytochemical Profile Composition And Comparative *In Vitro* Antioxidant Properties Of Ethyl Acetate Extracts Of *Xerophyta Spekei* (Baker) And *Grewia Tembensis* (Fresen)

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Overproduction of free radicals in excess of antioxidants leads to oxidative stress which can cause harm to the body. Conventional antioxidants have drawbacks and are believed to be carcinogenic. The

present study sought to confirm folklore use and validate the antioxidant potentials of Grewia tembensis and Xerophyta spekei which have been widely used in the Mbeere community as medicinal plants. Antioxidant properties were determined through scavenging effects of DPPH and hydrogen peroxide radicals as well as iron chelating effects. The data obtained was assayed in comparison to the standards (Ascorbic acid and EDTA). Ascorbic acid had a significantly greater DPPH radical scavenging property with an IC_{50} value of 20.54±2.24µg/ml in comparison to the plant extracts, which had IC_{50} values of 33.00±1.47 µg/ml, 69.66±1.01µg/ml and 86.88±2.64µg/ml for X. spekei, G. tembensis leaf and G. tembensis stem bark extracts, respectively. EDTA demonstrated a significantly greater iron chelating effect having a significantly lesser IC_{50} value of 25.05±0.79µg/ml as opposed to 43.56±0.46µg/ml, 89.78±0.55µg/ml, and 120.70±0.71µg/ml for X. spekei, G. tembensis leaf, and G. tembensis stem bark extracts respectively. Additionally, ascorbic acid also exhibited stronger hydrogen peroxide radical scavenging effect than the studied extracts. Generally, X. spekei extract had higher antioxidant activities as compared to both the leaf and stem bark extracts of G. tembensis. The quantitative phytochemical screening demonstrated the presence of secondary metabolites associated with antioxidant properties. The present study therefore, recommends ethno medicinal and therapeutic use of G. tembensis and X. spekei in the treatment and management of oxidative stress related infections after further comprehensive study of their toxicity and safety profiles.

Keywords: Antioxidants, Grewia tembensis, Xerophyta spekei, Oxidative stress, Free radicals

Phytochemistry, Antioxidant Activities And Ameliorative Effects Of Dichloromethane: Methanol Extracts Of Selected Medicinal Plants Against Induced Hepatorenal Toxicity

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Hepatorenal drug induced injury stand to be a medical quagmire due to diagnostic challenges biocompatibility, affordability and are assumed associated with diverse adverse effects in their clinical application. Plant extracts of K. africana, T. brownii and A. hockii are potential source of natural antioxidants and indigenous medicine. However, gaps exist in scientific validation of their folkloric usage and medicinal potential. GC-MS analysis of DCM: MeOH stem bark extracts of K. africana, T. brownii and A. hockii were determined in the current study. Subsequently, the protective potential of the extracts against 0.1ml CCl_4-induced liver and gentamycin-induced kidney damage were determined in male mice model at 50, 100, and 150mg/kg bw, with silymarin (20mg/kg bw) and cystone (500mg/kg bw) as the positive control, respectively. Further in vitro non-enzymatic antioxidant activities of the three

plant extracts were determined using UV visible spectrophotometry. The K. africana, T. brownii and A. hockii had 34, 23 and 31 bioactive compounds, respectively from the following classes: glycoside, monoterpene, phenol, sesquiterpene, diterpene, triterpene, bycyclic terpene, phenylpropene, fatty acids, sterols and alkanes. The three plant extracts restored hematological, lowered liver and renal functions markers and lipid profiles in a dose dependent manner($p<0.05$). The results positive correlated with dose dependent restoration of the normal architecture of liver and kidney tissues. Further, the extracts of K. africana, T. brownii and A. hockii demonstrated a concentration dependent FRAP, Nitic oxide, DPPH radicals, metal chelating scavenging activities ($p<0.05$). The effects might be attributed to specific the bioactive compound. Generally, K. africana, T. brownii and A. hockii conferred stronger hepatoprotective, nephroprotective and antioxidant effects attributed to bioactive compounds. The findings demonstrated that K. africana, T. brownii and A. hockii stem bark extracts contained pharmacologically bioactive compound with ameliorative effects against drug induced hepatorenal damage. The study recommends the use and development of plant-based pharmaceutical product used in management of hepatorenal damage.

Key word: K. africana, T. brownii, A. hockii, hepatoprotection, nephroprotection, Antioxidant

Processing Techniques affects the Vitamin Quality of Edible Insects – Potential for Use in Complementary Foods

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Introduction Micronutrients are needed for normal cell function, growth, and development. Micronutrients are mainly obtained from the foods we eat and are denser in animal-based foods.

Aim: To assess the vitamin content of locusts, lake flies, grasshoppers, and termites when fresh, sun-dried, oven-dried and defatted.

Problem Statement: Micronutrient deficiency is prevalent in developing countries due to low intake of animal-based foods. Kenyan population has tripled in the last thirty-five years causing a strain in resources thereby exposing people to hunger; other food alternatives need to be sought. Previous work indicate that insects are rich in nutrients. However, few studies have been done on vitamin content in insects and on the effect of processing on the same.

Methodology: Prepared insect samples were ground and analyzed for vitamins using high-performance liquid chromatography. Analysis was done in triplicates and results expressed in mg/100g of dry insect sample.

Findings: Fresh insect samples had the highest vitamin concentrations with water-soluble vitamins being degraded most by sun-drying and fat-soluble vitamins being degraded most by oven-drying.
Conclusion: Fresh insects contain vitamins that meet the recommended dietary allowance (RDA) values for children aged 0-36 months. Processing reduces the levels to below RDA values except for ascorbic acid, thiamine and α-tocopherol in lake flies and termites; they can therefore be used in the formulation of complementary foods to meet 100% of the RDA. Grasshoppers can be used to meet part of the RDA requirements for riboflavin, niacin, and pyridoxine.
Recommendation: Use sun-drying for fat-soluble vitamins and oven-drying for water-soluble vitamins.

The hemilabile P-N complexes: Synthesis, characterization, X-ray crystal structure and evaluation in Heck reactions

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The Heck coupling reaction, commonly known as olefination of aryl halides, is one of the most powerful tools for the formation of new C-C bonds in organic synthesis of olefinic compounds [1]. It features applications that range from the preparation of hydrocarbons and industrial production of pharmaceuticals, to advanced synthesis of natural products [2]. A major challenge in Heck reactions is to design new ligands which would effectively promote the conversion of aryl halides into Heck products by stabilizing the intermediate oxidation states. Some new P-N complexes have been prepared before and investigated as catalysts for Heck reactions and Suzuki-Miyaura cross coupling reactions [3], and the complexes showed exceedingly high catalytic activities under mild reaction conditions. The advantages of these complexes include their ease of preparation, facile modification and convenience of handling [3].

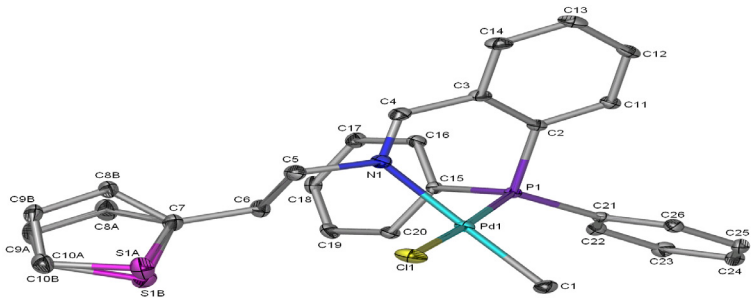

Fig. 1 Structure of the P-N palladium (II) complexes

In this work, we report the synthesis, characterization and molecular structure of novel P-N based palladium (II) complexes. The complexes will be evaluated as catalysts for Heck coupling reactions.

In Vivo Anxiolytic Activity Of Aqueous Extract Of *Curcubita Pepo*

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Background: Anxiety disorders are among the most common oxidative stress-related psychiatric disorders affecting all age groups. Demerits of conventional antianxiety therapies have necessitated research on medicinal plants as therapeutic alternatives. The present study studied anxiolytic effects of aqueous leaf extracts of Curcubita pepo, a highly valued plant for food and folk medicine. It is a member of Curcurbiteae family.

Methods: The anxiolytic activity was evaluated with the adult mice using elevated Plus maze (EPM) and Open Field (OF) models of anxiety in mice. The efficacy of three plant extract doses (50, 150 and 200mg/kgbw) was compared with diazepam (1 mg/kg i.p.), the standard anxiolytic drug. Following EPM and OF tests, Ex vivo antioxidant enzyme (SOD, GSH and Catalase) activities were determined. Quantitative phytochemical profile of the extract was determined using LC-MS.

Results: In the EPM, the three extract doses showed dose dependent anxiolytic effect, evidenced by increase in the time spent on open arms and the percentage of open arm entries compared to control group. In the open field test model, the extract, at all the tested doses, increased the central area crossing, the time spent and number of rearing in the center of arena. The extract elevated antioxidant enzyme activities compared with controls. LC-MS analysis revealed phytocompounds associated with antioxidant effects.

Conclusions: The findings indicated anxiolytic activity of Curcubita pepo, in line with its medicinal traditional use. The anxiolytic activity of the studied extract is linked to its antioxidant potential.

Keywords: Anxiety, Curcubita pepo, Elevated Plus Maze test, Open Field test, Antioxidant effect

In Vitro Antibacterial, *In Vivo* Immunomodulatory And Safety Properties Of Ethyl Acetate Leaf Extract Of *Ocimum Basilicum*

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Multi-drug resistant strains of S. aureus, MRSA, P. aeruginosa and E. coli have led to a demand for new treatment options. O. basilicum is an important medicinal plant whose safety and immune modulation potential have yet to be determined. We determined the in vivo immunomodulatory, safety and in vitro antibacterial effects of O. basilicum. This was a laboratory-based experimental study. Ocimum basilicum was obtained from Siakago, Embu County. The ethyl acetate leaf extract of O. basilicum was used to assess antibacterial efficacies, phytochemical and element composition. Phytochemical composition of the extract included terpenoids, alkaloids, essential oils, fatty acids, flavonoids and aldehydes. Of the mineral elements detected in the extract, Mg had the highest concentration (1241.6±0.42 mg/100g) while cobalt had the lowest concentration (0.08±0.02 mg/100g). Heavy metals were not detected. The extract exhibited a broad spectrum antibacterial activity. The highest activity was on P. aeruginosa (27.00±2.00 mm) while the lowest activity was on the isolate of S. aureus (17.33+0.58 mm). The extract reversed the effects of cyclophosphamide on the myeloid stem cells by restoring the counts of Hb, WBC and RBC's in blood. There was a dose dependent effect on humoral antibody responses. The extract exhibited an effect on neutrophil adhesion and a dose dependent effect on phagocytic indices. In DTH models, the different extract concentrations had dose dependent effects on TLC and PLT counts. In vivo safety tests revealed that the 1000 mg/kgbw concentration significantly lowered PLT counts (556.00±76.00 10^3/µl) while having no effect on other blood indices. These findings imply that this plant can be harnessed to develop alternative and complementary therapies.

POSTERS PRESENTATIONS

Organophosphate Pesticide Residues in Food Products in Kenya and their chromatographic detection: A Systematic Review

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Abstract

Background: Organophosphate pesticides are used worldwide to control several pests and meet food demand. These chemicals harm non-target animals and people when misused. Thus, they are a health and environmental concern.

Aim: The purpose of the systematic review was to synthesize the amount, breadth, and quality of evidence from empirical studies concerning the presence, type, and quantity of OPs in food products in Kenya.

Methodology: A systematic review was done by following the PRISMA protocol. For the identification of studies, the following databases were used: Google Scholar, Web of Science, Scopus, and PubMed. The study focused on peer-reviewed articles published between January 2001 and December 2021

Results: Twelve studies met the inclusion criteria for the scoping review. The main methods used in detecting and quantifying organophosphates in the studies were High Performance Liquid Chromatography (HPLC) and Gas Chromatography Mass Spectrometry (GC-MS). Most studies (86.67%) reported significant levels of OPs in food products, exceeding the MRLs and the Acceptable Daily Intake (ADIs) set by the World Health Organization. Six of the studies (50%) reported the presence of OPs in plant products (vegetables, cereals, and fruits), while three (25%) found residues in animal products (milk and meat). The most notable OP compounds detected were chlorpyrifos, acephate, profenofos, diazinon, omethoate, and dimethoate. Most of the food samples in the reviewed studies presented contamination, making them a significant risk to human health due to bioaccumulation.

Conclusion: Studies done in Kenya for the last 20 years continue to report high levels of organophosphate residues and their metabolites in food products, both from plant and animal origin. Although the residues are below MLRs in some samples, they can accumulate at higher levels in humans, becoming a severe health risk.

Keywords: Organophosphates, systematic review, HPLC, GC-MS, Acceptable Daily intake, Bioaccumulation.

Toxicity Of Toddalia Asiatica And Acacia Polyacantha Is Associated With Microcephaly And Hypochondroplasia In Mice

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In Kenya Toddalia asiatica leaf extracts are widely used in the management of malaria. Traditional medicine poses a risk of exposure to teratogens since in many instances their dosages are not standardized and their secondary metabolites have not been evaluated for their safety and teratogenic potential. The study investigated the teratogenic effects of T. asiatica collected from Subukia in Nakuru County, Kenya. Qualitative phytochemical screening was done to identify secondary metabolites present in the plant. The plant extract were reconstituted orally administration from day 6 through 15 of gestation. The animals were euthanized on the 19th day of gestation. Weight of the gravid uterus and pups, number of pups and gross examination to identify any physical abnormalities was done. Toxicity study used three treatments of six male mice per group. The animals aged between 6-7 weeks. Orals administration of 0.2mls of the drug was done daily for 28days. On the 29th day animals were sacrificed, cardiac puncture conducted and collected blood used for hematology and biochemistry testing. Numerical data obtained were analyzed using one way analysis of variance (ANOVA) followed by Tukey as the post hoc test. Statistical significance was set at 95% and a $p< 0.05$ for all comparisons. The extracts caused significant difference ($p<0.001$) of head size, birth weights and limbs. Teratogenic effects was directly proportion to the amount of the extract administered. The extract had no effects on hematology parameters. Extracts from T. asiatica exhibited teratogenicity thus should be used with caution during pregnancy.

Keywords: Teratogen, Toddalia, Acacia, Microcephaly, Hypochondroplasia

Antinociceptive and anti-inflammatory effects of alkaloid and flavonoid rich extract of *Urtica massaica* (Mildr) leaves in animal model

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Pain and inflammation presents a major clinical, social, and economic challenges to all human beings. Their management mainly involve use of conventional drugs which posses adverse effects such as

kidney failure and peptic ulcers etc. However alternatives methods of management includes use of plant sourced remedies such as Urtica massaica a herb that is also used as vegetable stable in several African communities. Nevertheless there is scarcity of data on scientific studies on efficacy of purified extracts of this plant on the two ailments. This study investigated the antinociceptive and anti-inflammatory effects of alkaloid and flavonoid-rich fractions of the methanol extract of U. massaica in mice. The antinociceptive assay was done using the formalin test while formalin-induced edema was used as the anti-inflammatory assay model. Pain was induced by administration of 50µl of 5% formalin in the sub-plantar region of the left hind paw. A time spent in manifestation of these signs was recorded for the first 5 minutes (acute pain) and 15-30 minutes (chronic pain) after formalin injection. Inflammation, manifested as paw edema, was indicated by the change in paw diameter after injection of formalin. Significant analgesic activities were exhibited by 10 and 20mg/kg doses of alkaloid rich extract during phase I and 5, 10 and 20mg/kg body weight doses during phase II ($p< 0.05$). Only the 5mg dose of alkaloid rich extract showed anti-inflammatory effects ($p< 0.05$) compared to diclofenac and 20mg at 60 minutes. The doses of 10mg/kg, 20mg/kg, 40mg/kg flavonoid extract exhibited significant antinociceptive effect ($P<0.05$) compared to that of diclofenac in phase II of nociception, at the 90th minute, 20mg/kg exhibited significant anti-inflammatory effect ($P<0.05$). Therefore from these observations it is highly probable that both the alkaloid and flavonoid rich extracts of U.massaica contain compounds with both antinociceptive and anti-inflammatory effects.

Key words: Urtica massaica, alkaloids, flavonoids, pain, inflammation

In vivo anti-inflammatory, cognitive-enhancing, and *in vitro* antioxidant efficacy, and acute oral toxicity effects of the aqueous and methanolic stem bark extracts of *Lonchocarpus eriocalyx* (Harms.)

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Oxidative stress is a critical etiologic factor and driver of many debilitating inflammatory and neurodegenerative conditions, such as cognitive impairment, resulting in high disability, financial burden, and emotional stress, especially in Sub-Saharan Africa, where over 80 % of the global disease burden lies. The conventional armamentaria for treating inflammation and cognitive deficits are only palliative and cause undesirable severe effects, are generally inaccessible, unaffordable, and have low

efficacies, warranting better alternatives. Lonchocarpus eriocalyx (Harms.) is used ethnomedicinally to treat inflammatory and oxidative stress-associated diseases such as cognitive deficits; however, its pharmacological efficacy and safety have not been validated empirically, prompting this study. The in vivo anti-inflammatory and cognitive-enhancing efficacy of the aqueous and methanolic stem bark extracts of L. eriocalyx were determined using the xylene-induced ear oedema, and the Morris water maze techniques, respectively, in experimental mice. In vitro antioxidant activities of the plant extracts were investigated using the lipid peroxidation assay, 1, 1-diphenyl -2-picrylhydrazyl (DPPH), and Ferric reducing antioxidant power assay methods. Moreover, the acute oral toxicity effects of the plant extracts were investigated according to the Organisation for Economic Corporation and Development (OECD) guidelines. The plant extracts showed significant dose-dependent in vivo anti-inflammatory, cognitive-enhancing, in vitro anti-lipid peroxidation, DPPH radical scavenging, and ferric-reducing antioxidant efficacies ($P<0.05$). Furthermore, the studied plant extracts did not elicit acute oral toxicity effects in mice (LD50 >2000 mg/kg B.W.); hence were considered safe. The studied extracts' anti-inflammatory, cognitive-enhancing, and in vitro antioxidant efficacies were attributed to various detected phytocompounds that possess diverse pharmacological effects, primarily through the amelioration of oxidative stress and associated sequelae. Further studies should be conducted to isolate and characterise the anti-inflammatory, cognitive-enhancing, and antioxidant amalgams, their specific mechanism(s) of action, safety, and toxicity profiles.

Keywords: Oxidative Stress; Inflammation; Acute Oral Toxicity: Cognitive Deficits; Medicinal Plants.

Nutrients and ant nutrients levels in raw and processed varieties of finger millet promoted for nutritional security

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Finger millet (FM) is a traditional staple cereal grown in some parts of the world, especially in low-income countries like Kenya. It is rich in nutrients like such as minerals vitamins, and amino acids. The nutritional configuration of FM contributes to reduced risk of T2D, high blood pressure, and gastrointestinal tract disorder when absorbed in the body. The finger millet, therefore, is a good candidate for promotion as a source of nutritional security among patients suffering from non-communicable diseases (NCDs) such as type- 2 diabetes (T2D). However, the levels of nutrients and their bioavailability depend on the variety grown, the levels of ant nutrients, and the type of processing used. The study determined the levels of nutrients and ant nutrients in several raw and processed varieties of finger millet being developed by the

Kenya Agricultural and Livestock Research Organization (KALRO) in Kenya. Raw finger millet seeds were obtained from KALRO Centers in Kenya and processed by germination and roasting, and levels of minerals were determined by AAS and AES. The raw FM variety with the highest levels of selected minerals was as follows; IE3779 (K), KERICHO PEEK (Mg), KNE 814(Ca), p224 (P), KAKW3 (Cr $^{3+}$), EUFM401 (Fe) and U-15 (Zn). On germination and roasting IE3779, IE4115, KAKW3, and p224 FM varieties showed a slight increase in the levels of minerals. The result shows that IE3779, IE4115, KAKW3, and p224 FM varieties contain sufficient K and Cr^{3+} that if administered alongside the drug therapy will be a long-term nutritional intervention for T2D and other NCDs. However, FM grains are extremely neglected and widely underutilized.

Keywords: Type 2 diabetes (T2D), Non-communicable diseases (NCDs), Finger millet (FM), Value addition (VA)

Phytochemical Composition, Anti-Rheumatoid Arthritis Potential And Toxicity Profiles Of Methanol Extracts Of *Zanthoxylum Usambarense* (Engl.) And *Rhamnus Prinoides* (L'hér)

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Zanthoxylum usamberense and Rhamnus prinoides are used to manage rheumatoid arthritis (RA) among Maasai Community. However, there is paucity of scientific evidence on anti-RA potential. This study was designed to determine the quantitative phytochemical composition, anti-RA effects, expressions of selected RA biomarker genes and toxicity profiles of methanol extracts. The quantitative phytochemical analysis was carried out using LC-MS and GC-MS. In the anti-RA assay, rats were assigned 6 groups of 5 rats: normal control, negative control, positive control, and 3 extract-treated groups. RA was induced using complete Freud's adjuvant and treatments administered orally from day 8. Animals were euthanized on day 29 and blood collected. Liver and tissue around the ankle joint were also detached and used for enzymatic antioxidant and gene expression assays, respectively. Gene expression was carried out using quantitative RT-PCR. In vivo acute and sub-acute toxicity tests were carried out according to the OECD guidelines. The majority of phytocompounds that were detected using LC-MS were polyphenols, whereas fatty acids were highly detected using GC-MS. The extracts significantly attenuated body weight loss, alleviated ankle joint edema, reduced arthritis scores, ameliorated increased thymus and spleen indices, attenuated aberrant hematological, liver and renal parameters, reduced levels of MDA and enhanced activities of enzymatic antioxidants in arthritic rats. The two extracts significantly downregulated

expression of NF-κB, TNF-α, IL-1β, IL-6, COX-2, MMP-3, STAT-3, and RANKL genes, as well as upregulated expression of IL-4, IL-10 and I-κBα genes in arthritic rats. The acute toxicity study of the two extracts neither caused toxicity signs nor fatalities. The sub-acute toxicity study of the two extracts did not adversely affect the body weights, hematological and biochemical parameters, except for AST levels in rats administered with R. prinoides extract at the dose of 900mg/kg bw. In conclusion, the two extracts possess phytochemicals with anti-RA potential.

The Use Of Heterogeneous Catalyst Prepared From Environmentally Benign Materials In The Transesterification Of Castor Oil

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The global environmental concern, accelerated depletion of fossil fuels coupled with frequent fluctuation of conventional fuel prices has sparked a global search for a suitable alternative fuel. In this regard, alkyl esters (biodiesel) derived from triglyceride via catalyzed transesterification present such a prime option. But the commercialization of this feasible alternative is hurdled by techno-economic issues including expensive and insufficient feedstock. In addition, application of non-reusable homogenous catalyst demand costly water washing and separation steps. The only way to make biodiesel economically viable is through utilization of non-edible feedstock coupled with incorporation of heterogeneous catalyst. However, the high FFA content of non-edible oils demands special pretreatment while on the other hand heterogeneous catalyst demand costly preparation steps. Fortunately, cheaper CaO based catalyst can be developed from waste while the FFA of the non-edible oils can be minimized by esterification. In this study, a composite catalysts (ASFiboNiCo/AEF) was developed by co-precipitation of eggshell, anthill, fishbone, nitrates of cobalt and nickel. AEF was then characterized by XRD, XRF and FT-IR before being used in a two-step methanolysis of extracted castor oil. Process optimization was done by varying reaction temperature (60-70 °C) and catalyst concentration (0-3 %). The synthesized alkyl esters were characterized by GC-MS and FT-IR then further tested for fuel properties relative to conventional fuels (automotive diesel and kerosene). The results showed that 9-Octadecenoic acid, 12-hydroxy, methyl ester was a major ester common in both AEF and NaOH catalyzed reactions. The flash point of the esters was much higher (>100 °C) than the referenced diesel fuels hence passed the flash point standards noted as EN-14214 (>101 °C) and ASTM 6751 (≥130 °C). The esters viscosity at 40 °C was 12 mm^2/s which was much higher than that of conventional fuel. In addition, the biodiesel was less volatile than diesel fuels. Hence, the biodiesel was blended to B5 and B20 on volume to volume ratio before re-characterizing for fuel parameters and composition by GC-MS. The blend of B20 demonstrated ideal properties of viscosity, density close to diesel fuel and distillation temperature in the range ±5% relative

to diesel fuel. The heating value was also higher than that of pure esters. An optimum yield of 99% was attained for both AEF and NaOH catalyzed at reaction temperature of 65°C, catalyst concentration of 3% w/w, methanol: oil ratio of 12:1, time 2hrs, Stirring rate 125 rpm under reflux. AEF catalyst is a viable substitute to NaOH catalyst in transesterification basing on its great efficiency in the transesterification of castor oil. In addition, the castor oil methyl ester had fuel properties closer to those of conventional diesel hence it sufficed as alternative to conventional fuels.

D) BASIC AND APPLIED SCIENCES IN INFECTIOUS AND NON-INFECTIOUS DISEASES

ORAL PRESENTATIONS

Climate change and environmental influence on prevalence of visceral leishmaniasis in West Pokot County, Kenya

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Background: Visceral leishmaniasis or kala-azar is a poor man's disease caused by Leishmania donovani in Kenya and transmitted by sand fly species. Kala-azar is endemic in over eleven counties mainly in the arid and semi-arid regions of the Country. Climate change-influenced seasonal weather variability and environmental alterations remain important determinants of many vector-borne diseases including kala-azar.

Aim and methods: The current study aimed at understanding the influence of climate and environmental changes on kala-azar in West Pokot using combined descriptive cross-sectional and retrospective research design. Study area was purposively selected, locations were randomly selected and households systematically selected. Three hundred and sixty three household questionnaires, eleven key informant interviews, and five focus group discussions were undertaken. Secondary data was obtained from Kacheliba sub-County hospital records. Statistical package for social science version 24 was used to analyze quantitative data while qualitative data was analyzed to establish connection for interpretation.

Results: Kala-azar cases have been on the rise on aggregate and surge towards the end of dry season and just after the rains. Significant environmental factors included: presence of seasonal rain water pathways and rock piles around houses (AOR=4.7; 95% CI=(2.3-9.6), $p<0.05$); presence of acacia trees in and around homesteads (AOR=8.5; 95% CI=(2.5-28.6), $p<0.05$); presence of anthills around the homesteads (AOR=5.2; 95% CI=(1.2-23.4), $p<0.05$); and presence of animal sheds within compounds (AOR=2.8; 95% CI=(0.96-8), $p<0.05$).

Conclusions: Climate change-induced seasonal weather variability; increased temperature and reduced precipitation as well as environmental alterations influence kala-azar occurrence in West Pokot. Community sensitization on disease prevalence, clearing of vector predilection sites and improving community environmental risk perception are imperative to promote disease prevention.

Keywords: Sand fly, Kala-azar, West Pokot, Environment factors, Climate change, Disease occurrence.

Seroprevalence of non-typhoidal *Salmonella* disease and associated factors in children in Mukuru settlement in Nairobi County, Kenya

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Background: Invasive Non-typhoidal Salmonella (iNTS) infections remain a significant public health challenge especially in sub-Saharan Africa. Data is limited on background exposure to NTS in the population in endemic areas and the general immune status of the community most affected. The aim of the study was to determine the proportion of children exposed to iNTS and the associated host and environmental factors among children attending selected healthcare facilities in Mukuru, Nairobi County, Kenya.

Methods: A cross-sectional case-control study was conducted among patients and apparently healthy participants aged 0-5 years. ELISA was carried out to test for the presence of antibodies against iNTS. A questionnaire was administered to obtain relevant information on factors associated with iNTS exposure. Descriptive analysis was performed to aid describe the study population. Multivariate logistic regression analysis was used to determine the associated host and environmental factors.

Results: Seroprevalence of iNTS was 12.6%. Mean age of iNTS exposed was 4.1-5 years and those not exposed was 3.1-4 years. Seroprevalence of iNTS among the female and male was not significantly different. iNTS exposure among the apparently healthy was found to be associated with malarial test results, participant's axillary temperature, municipal tap water used for cooking and washing. Having received polio virus vaccine, BCG vaccine and treating water using chlorine or boiling method was identified as being protective against contracting Salmonella Typhimurium and S. Enteritidis. Among the patients, the proportion of exposure was significantly associated with keeping animals.

Conclusion: There is a high exposure to iNTS among young children below five years of age. Host and environmental factors were found to be associated with exposure to iNTS. There is need for the

government and policy makers to increase the intake of the available vaccines specifically by residents of the Mukuru settlement region.

Keywords: Invasive non-typhoidal Salmonella, apparently healthy, patients, proportion, seroprevalence, risk factors.

Annual effective dose and excess lifetime cancer risk in quarry sites located in Kisii, Kakamega and Busia counties

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External background ionizing radiation is produced by terrestrial radiation, anthropogenic radiation, and cosmic radiation. Public exposure to background ionizing radiation has recently become a significant issue in Kenya. Despite the fact that Kenya is not radio-profiled to ascertain the magnitude of ionizing radiation emitted from stones used in building, a considerable number of permanent structures are built with stones derived from submerged rocks. Annual public exposure should not exceed 1 mSv, according to the World Health Organization (WHO). Furthermore, while radionuclides occur naturally in soils and rocks, human activities such as mining increase the relative concentrations of radionuclides such as uranium, thorium, and potassium. This study sought to establish the annual effective dose (AED) and excess lifetime cancer risk (ELCR) brought about by background ionizing radiation in quarries sites located in Kisii, Kakamega and Busia counties. Ionizing radiation levels were detected using handheld radiation detectors (digilert 200) in quarry sites. Results herein show that the computed average annual effective dose (AED) was 0.335±0.021 mSv in Kisii County, 0.413±0.024 mSv in Kakamega County and 0.398±0.019 mSv in Busia County. Furthermore, the calculated excess lifetime cancer risk (ELCR) in quarries fluctuated from $1.12*10^{-3}$ in Kisii County to $1.33*10^{-3}$ in Busia County. The computed AED values in the quarry sites in this study are below the recommended annual threshold of exposure for the general populace as defined by the International Commission on Radiological Protection (1 mSv), thereby posing no radiological health concern. Further, the ELCR values were above the ceiling of $0.29*10^{-3}$. Nonetheless, the contribution of ELCR due to background ionizing radiation in quarry sites sampled herein is negligible since the AED values are below the acceptable limits.

Keywords: Radioactivity; Quarries; Annual effective dose; Excess lifetime cancer risk.

Ethnobotanical survey and antimicrobial screening of selected medicinal plants used in traditional medicine in parts of Kiambu County, Kenya

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Medicinal plants have been used in the treatment of various ailments in man. This can be attributed to their affordability, availability and accessibility. However, in some cases, documentation and evidence of their efficacy has not been done. A study was done to identify and document medicinal plants found in Lari, Kiambu County. Selected plants were tested for their phytochemicals and antimicrobial properties. Questionnaires were administered to the area residents and herbalists to collect data on medicinal plants used in the treatment of various ailments in man. Twenty-eight medicinal plants were identified to be used in the treatment of ailments such as upper respiratory tract infections, stomach and skin infections. Phytochemical screening on methanoic extracts of selected plants: Croton macrostachyus, Cordia africana, Elaeodendron buchananii, Senna didymobotrya and Coleus barbatus revealed the presence of bioactive compounds such as alkaloids, cardiac glycosides, flavonoids, steroids, tannins and saponins. Antimicrobial susceptibility test revealed that the extracts were most effective on Gram positive bacteria; Staphylococcus aureus, Streptococcus pyogenes and Bacillus subtilis. However, the extracts were not effective against Gram negative bacteria. Based on these findings, it is concluded that the local community has knowledge of medicinal plants and that the selected plants have the potential to treat ailments associated with the tested microbes. This study recommends sustainable harvesting techniques and conservation of the medicinal plants. In addition, further studies should be carried out to isolate and identify the active principles present in the medicinal plants.

Key words: Medicinal plants, phytochemicals, ethnobotany, antimicrobial activities.

In Vitro Antibacterial, *In Vivo* Immunomodulatory And Safety Properties Of Ethyl Acetate Leaf Extract Of *Ocimum Basilicum*

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Multi-drug resistant strains of S. aureus, MRSA, P. aeruginosa and E. coli have led to a demand for new treatment options. O. basilicum is an important medicinal plant whose safety and immune modulation potential have yet to be determined. We determined the in vivo immunomodulatory, safety and in vitro antibacterial effects of O. basilicum. This was a laboratory-based experimental study. Ocimum basilicum was obtained

from Siakago, Embu County. The ethyl acetate leaf extract of O. basilicum was used to assess antibacterial efficacies, phytochemical and element composition. Phytochemical composition of the extract included terpenoids, alkaloids, essential oils, fatty acids, flavonoids and aldehydes. Of the mineral elements detected in the extract, Mg had the highest concentration (1241.6±0.42 mg/100g) while cobalt had the lowest concentration (0.08±0.02 mg/100g). Heavy metals were not detected. The extract exhibited a broad spectrum antibacterial activity. The highest activity was on P. aeruginosa (27.00±2.00 mm) while the lowest activity was on the isolate of S. aureus (17.33+0.58 mm). The extract reversed the effects of cyclophosphamide on the myeloid stem cells by restoring the counts of Hb, WBC and RBC's in blood. There was a dose dependent effect on humoral antibody responses. The extract exhibited an effect on neutrophil adhesion and a dose dependent effect on phagocytic indices. In DTH models, the different extract concentrations had dose dependent effects on TLC and PLT counts. In vivo safety tests revealed that the 1000 mg/kgbw concentration significantly lowered PLT counts (556.00±76.00 10^3/µl) while having no effect on other blood indices. These findings imply that this plant can be harnessed to develop alternative and complementary therapies.

Anopheles gambiae and *Plasmodium falciparum* compatibility interactions in a malaria endemic region

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Molecular mechanisms underlying Plasmodium infections and mosquito genotypes influencing parasite adaptations to diverse Anopheles species are critical in understanding host-parasite interactions which are a potential target for developing transmission-blocking interventions. Cross-sectional mass blood screening in children between 5 to 15 years was conducted in Chulaimbo, Kisumu County during the dry and wet seasons

in 2018 and 2019. Plasmodium falciparum gametocyte carriers were identified using microscopy and subjected to membrane feeding to determine infectious Pfs47 haplotypes to laboratory-reared An. gambiae. Out of 4481 children screened for malaria, 885 were malaria positive with an infection prevalence of 19.7% (95% Cl: 0.003 – 0.007). Of these, 95% (841) were P. falciparum infections, 1.6% (14) P. malarie, 0.3% (3) P. ovale, 2.7% (24) Pf/Pm and 2.7% (3) Pf/Po mixed infections. Out of 841, 16.9% (142) had confirmed for P. falciparum gametocytes. Out of all membrane feeds conducted (n=109), 30.3% (33) infected mosquitoes. Of 109 MFAs, 37 were paired experiments. Infection rates were 0.9% and 0.5% in serum replacement and whole blood respectively, however, no significant difference in both experiments (P=0.738). Six haplotypes were identified from 24 of the 33 sequenced infectious blood samples. Hap_1 had dimorphic codons E27D and L240I, Hap_2 (S98T0), Hap_3 (E27D), Hap_4 (L240I), Hap_5 (E188D) and Hap_6 had none. Genotyped parasite DNA from blood infected with Hap_4 was the most frequent at 29.2% (7/24) followed by Hap_3 (E27D) and Hap_6 (no polymorphic sites) each with frequencies of 20.8% (5/24). Haplotype 1 with mutations E27D and L240I had a frequency of 16.7% (4/24) whereas Hap_2 (S98T0) and Hap_5 (E188D) had frequencies of 4.2% (1/24) and 8.3% (2/24) respectively. Hap_4 (L2401) had the highest positive oocyst results. These findings expand our understanding of the interactions between Anopheles and Plasmodium, necessary for developing strategies to prevent the transmission of malaria.

Prevalence of overweight and weight related disease conditions among public primary school administrators in Kwale County, Kenya

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Overweight and obesity are disease conditions impacting on most body systems. These health conditions affect the heart, kidneys, liver, reproductive system and joints and they lead to a number of non-communicable diseases (NCDs), including cardiovascular diseases, stroke, hypertension and various forms of cancer, type 2 diabetes as well as mental health issues. There have been numerous deaths affecting administrators in various work environments in Kenya. Anecdotal reports indicate that most health conditions, hospitalizations and deaths among local school administrators are caused by overweight and weight related diseases. The causes of these disease conditions have been blamed on overworking, alcohol drinking and unhealthy eating lifestyles all punctuated with sedentary lifestyle due to lack of time exercise at least for a minimum of 150 minutes prescribed by the world health organization. To establish the extent of impact of overweight and weight related disease conditions among school administrators in Kenyan local schools, a sample of 141 study participants from Kwale County were requested to fill a questionnaire indication whether they had been diagnosed or treated for two conditions including hypertension and diabetes within the period they have been administrators. Those suffering the conditions prior to their appointment as administrators were excluded. Of

the sampled population, 56.7% had hypertension and 24% of the hypertensive were diabetic. Only 2.7% were diabetic but non hypertensive. Fifty seven administrators or 40.3% of the sampled population were neither suffering from hypertension or diabetes. Among the hypertensive but non diabetic, their mean age was 43 years with administrative experience of 9.5 years. Only 11.5 % had normal weight. The overall prevalence of overweight and obesity in this group was 26.2 % and 62.2 % respectively. This group reported to spend an average of 60 minutes of physical activity per week against the WHO recommended minimum of 150 minutes. Among the diabetic and hypertensive, 68.4 % and 21% were obsessed and overweight respectively. The mean age of this category was 49 years with female administrators reporting an average of 37 minutes per week of engaging in physical activities but men had 58 minutes per week in physical activities. Among the non-diabetic non hypertensive, the mean age was 45 years (this group comprised of relatively young administrators). However, only 16 % were of normal weight. Obesity and overweight accounted for 56.1% and 28%. The group reported spending an average of 54 minutes per week on physical activities. Based on these findings, the study concludes that there is high prevalence of overweight and obesity among school administrators, and that this group remains extremely susceptible of obesity and overweight related disease which could be impacting negatively on school attendance as affected administrators spend more time seeking healthcare services. It is recommended that, there is urgent need for the TSC to develop policy and guidelines on physical activity breaks at workplace for school administrators. There should also be advocacy programs targeting school administrators with aim of changing the lifestyles of the teachers and also dietary changes to help mitigate a catastrophe in our education sector. It is important for this study to be expanded to other Counties in Kenya, with the hope of gathering important comprehensive data to support the development of key policy guideline to be used to support the health welfare of school administrators.

Keywords: Prevalence, overweight, weight related diseases, hypertension, diabetes, school administrators.
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Differential infestation of mosquitoes, the primary vectors of Rift Valley Fever in an endemic habitat of Lake Baringo basin, Kenya

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The Lake Baringo basin ecosystem is one of known Rift Valley Fever disease hotspots in Kenya. The ecology of this hotspot comprises of different mosquitos' habitats, one of them being the Loboi wetland and homesteads that include areas adjacent to the compounds. Communal free grazing of livestock during the day is generally practiced in Loboi wetland area. Cattle, goats and sheep are released into the grazing grounds in the morning and herded back in the evening into the homesteads. In this study, the ecology was stratified into two microhabitats; the communal swampy grazing area; and the homesteads microhabitats. Mosquitoes were trapped using CDC light traps once in a month for a period of 12 months. The captured mosquitoes were identified morphologically and by molecular techniques. A total of 40,832 individual mosquitoes comprising of nine genera were trapped with 8 identified species and 12 unidentified. Of the catches, 58% were from homesteads and 42% from communal swampy grazing microhabitat. There was a significant variation in the monthly catches of mosquitoes between the homesteads and communal swamp grazing habitats $F_{(11,12)}$ =3.5, p=0.05). In addition, there was significant spatial variation in mosquito abundance between the two microhabitats ($F_{(8,9)}$ = 6.59, p=0.05). However, the Shannon - Weiner diversity index indicated that the communal grazing area was rich in species diversity with an index of 1.35 compared to the homesteads microhabitat that had an index of 1.21. The findings would inform on contingency plan and early warning system in the event of an outbreak of Rift Valley Fever disease in Lake Baringo basin.

Key words: Lake Baringo, Rift Valley Fever, microhabitats, mosquitoes, livestock

Prevalence and diversity of *Plasmodium* species in pregnant women attending antenatal clinics in selected health centers of Kakamega County, Western Kenya

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Malaria remains a major public health concern around the world with tropical and subtropical regions bearing the greatest brunt despite up-scaling of control strategies. Despite the provisioning of insecticidal nets to expectant women attending antenatal care facilities, Plasmodium infection was a recurrent problem in Kakamega County. We hypothesized that socioeconomic factors were risk factors for the high prevalence levels of asymptomatic Plasmodium infections (API) among pregnant women in the County. A prospective cohort of 304 asymptomatic pregnant women aged 18 years and older was identified to assess the association between patient characteristics and risk of API using a cross-sectional study design. The study was conducted across four representative antenatal clinics (ANC) in the region. A pre-structured and pre-tested questionnaire was used to obtain the socio- demographic characteristics, residence, and knowledge of malaria. The questionnaire was followed by a face-to-face interview. Each participant provided a finger prick blood sample for a thick and thin blood smear for parasite studies at Masinde Muliro University Science and Technology. The slides were examined at ×100 oil immersion. Plasmodium and the developmental stages were checked, quantified, and recorded. The data were analyzed using SPSS ver 16. Differences in parasite densities for various parameters were assessed using Mann Whitney U and Kruskal Wallis non-parametric tests. Ordinary linear squares (OLS) regression was used to uncover any significant associations at 95% CI and p –value ≤0.05. The majority of the women had a post-primary education (75%), were married (60.9%), multigravidae (50%), in their second trimester (41.4%), residing in rural areas (62.2%), used ITNs (77%), and did not practice IRS (67.8%) as a malaria prevention method. Plasmodium species infection prevalence was (24.34%; 95% CI, 19.52–29.16) P. falciparum (82.4%; 95% CI 73.72–91.08) accounting for the majority of infections. The parity and gestation status of the pregnant women were found to have a significant association with API. This study showed that a significant number of women in Kakamega County attending ANCs were asymptomatic for Plasmodium malaria. We propose that malaria screening through microscopy and treatment should be incorporated into maternal health within the county.

Characterization Of Hepatitis B Viral Genotypes And The Associated Sero-Virological Markers Among Patients Attending Moi Teaching And Referral Hospital Liver Clinic

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Introduction; HBV belongs to the genus Orthohepadnavirus and is the smallest human DNA virus with a genome of 3200 bp in a partially double-stranded circular DNA. At least 10 hepatitis B virus genotypes (A to J) have been reported with distinct geographic distributions and predictive of liver disease progression.
Main Objective: To characterize the HBV genotypes and correlate them with the Sero-Virological markers of patients with Chronic Hepatitis B attending MTRH Clinic.

Problem Statement: HBV prevalence is highest in the WHO Western Pacific Region and the WHO African Region at 6.2% and 6.1% respectively of the adult populace.

Justification: Data on HBV genotypes has shown potential for use in the prediction of disease progression identification patients who can benefit from specific treatment.

Methodology: A cross-sectional descriptive study with laboratory investigation was conducted. Patient plasma samples were obtained for HBV genotyping and DNA viral load using PCR. Serological assays were performed for HbsAg, HbeAg and Anti-HBc. Liver enzymes ALT and GGT serum levels were determined using COBAS Integra 400 plus.

Findings: HBV genotype were A (66.7%) genotype A&B (11.1%) and others undetected genotypes at (22.2%). Associated sero-virological parameters were determined as; HBeAg positive (17.1%) and HBeAg Negative (82.9%) with HBV DNA <10 IU/ml (51.4%) and HBV DNA >10 IU/ml (48.6%). Normal GGT (82.4%), Abnormal GGT (17.7%), Normal ALT (79.4%) and Abnormal ALT (20.6%).
Conclusion: Predominant genotype among these patients was genotype A followed by mixed co-infection of genotype A/B. Genotype A was associated with HBV DNA viral loads > 10IU/ml, HBeAg positivity and elevated liver enzymes, ALT and GGT.
Recommendations: With a large proportion of patients at MTRH being genotype A with low viral load, they are likely to respond to interferon therapy. Genotyping (pharmacogenetics) should be adopted to guide choice of treatment of hepatitis B patients at.

Key Words: Orthohepadnavirus, hepatitis B virus, genotypes, Sero-Virological

Anxiolytic and teratogenic effects of *Carissa spinarum* and *Azadirachta indica* aqueous extracts in mice

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Background: Carissa spinarum (mũkawa in Gĩkũyũ, lamuriak in Maasai) and Azadirachta indica (neem, mwarubaini in Kiswahili) have widespread use in African communities whereby they are used as food and as treatment for numerous illnesses including cancer, malaria, dental carries, chest pain, and pain during pregnancy. However, there is little documented research on their anxiotropic and teratogenic effects.

Objective: To determine the anxiotropic and teratogenic effects of C. spinarum and A. indica extracts in Swiss albino mice.

Methodology: The elevated plus maze (EPM) and the light dark box (LDB) were used in the anxiety assays with diazepam as the reference drug. FDA reproduction studies protocols were used for the teratogenicity assay and phenytoin sodium used to induce teratogenicity. Extracts were administered in the doses 100, 250, and 500mg/kg bw. Data were tabulated and analysed using one-way ANOVA/Dunnett's post hoc test. The significance limit was set at $p<0.05$. Atomic absorption spectrophotometry was used for mineranalysis of the plant samples.

Results: Both C. spinarum and A. indica exhibited anxiolytic effects, with C. spinarum 100mg/kg significantly ($p<0.001$) increasing the time mice spent in the open arms of the EPM and C. spinarum 100mg/kg, C. spinarum 500mg/kg, and A. indica 500mg/kg significantly ($p<0.05$, $p<0.05$, and $p<0.001$ respectively) increasing the time mice spent in the light chamber of the LDB. All administered doses of both plant extracts exhibited significant ($p<0.001$) teratogenicity, with weight loss in the gravida and foetal resorption being observed across all C. spinarum and A. indica groups, an effect comparable to that of phenytoin. Pups from the C. spinarum 100mg/kg and A. indica 500mg/kg groups had significantly ($p<0.001$) reduced head sizes (microcephaly) and significantly ($p<0.001$) elongated limbs. Premature birth and significantly ($p<0.05$) higher birth weights were also observed in the latter group. The plant samples showed high levels of cadmium, iron, chromium, manganese, lead, and zinc which may have added to the toxicity observed.

Conclusion: C. spinarum and A. indica exhibited significant anxiolytic effects and teratogenic effects. The plants should be used with caution during pregnancy. Levels of heavy metal contamination in the country should be assessed.

Key words: anxiety, anxiolytics, teratogenicity, pregnancy, resorption, malformations microcephaly

Risk Factors Associated with Malaria Resurgence in Two Rural Villages of Western Kenya Highlands

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Abstract

Background: Malaria is still a public health concern around the world despite up-scaled prevention methods at both the household and community levels. Human activities that aggravate the transmission remain focal points in stalling transmission. This study sought to assess the risk factors associated with the resurgence of malaria in two rural villages of Western Kenya highlands.

Materials and methods: This was a longitudinal cross-sectional study carried out from November 2018 to October 2019. A pre-tested questionnaire was used to collect data on socio-demographic characteristics and the history of malaria episodes of the participants. Houses were observed for associated risk factors, while the bed nets were physically observed for their status. Anopheline larval habitats were surveyed for three consecutive days monthly and their distance from the nearest residence measured in meters. Data analysis was done using GPPS in which descriptive statistics were carried out to determine the relative frequencies of all the surveyed variables. Pearson's Chi-square and Fisher's exact tests were used to determine the association between risk factors and history of malaria episodes.

Results: Of the study population, females were 54.87%, with primary or higher education level 83.00%, self-employed or employed 87.05% and earning less than 50 US dollars were 92.76%. All the four socio-demographic factors: house structures, the status of the LLIN, the distance of the residences from the nearest anopheline larval habitat, and anopheline larval densities were significantly associated with malaria episodes.

Conclusion: The studied risk factors increased the proportion of people at risk of malaria transmission overriding

the impact of the instituted control measures. Thus, may have led to the observed upsurge of malaria episodes in these rural villages of western Kenya highlands. This knowledge has a greater potential to revitalize efforts towards effective malaria control strategies. Further studies should include more parasitological components to avail more evidence and provide risk maps for future action by the authorities.

Keywords: Risk factors, socio-demographics, bed net status, larval densities, Kenya highlands

In Vitro Anthelmintic Properties Of Dichloromethane Extracts Of *Maytenus Senegalensis* And *Dalbergia Melanoxylon*

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The high cost and widespread resistance of conventional dewormers has caused most farmers to revert to use of herbal dewormers that are effective and readily available. Maytenus senegalensis and Dalbelgia melanoxylon have been used traditionally to manage helminthiasis. However, their described anthelmintic potentials among Mbeere community, Kenya have not been scientifically validated. This study aimed at determining the in vitro properties of DCM extracts of Maytenus senegalensis and Dalbelgia melanoxylon on Pheretima posthuma. The plants samples were collected from Embu County, Kenya. Worms were collected from Murang'a County, Kenya. The study used controlled randomized design (CRD) whereby 75 worms were grouped into 5 test groups in 3 replications. Group I (normal control) was only treated with distilled water (50 ml). Group II (positive control) was treated with albendazole (reference drug) at dose of 25 mg/ml. The experimental groups III, IV and V were treated with plants extracts at concentration levels of 12.5, 25 and 50 mg/ml, respectively. Time taken for paralysis and death of the treated earthworms was recorded. It was found that the extracts conferred paralytic effects on worms after exposure periods ranging between 03.07 and 11.25 min for M. senegalensis and 02.13 and 07.24 min for D. melanoxylon. The extracts showed mortality effects on worms after periods ranging between 04.45 and 13.29 min for M. senegalensis and 03.36 and 08.76 min for melanoxylon. Limonene, octadecanoic acid, n-hexadecanoic acid and β-pinene were associated with the anthelmintic potential of the plants. The study concluded that M. senegalensis and D. melanoxylon possess anthelmintic potential by causing paralysis and death of worms. There is need to undertake in vivo anthelmintic studies on the extracts of M. senegalensis and D. melanoxylon to confirm the observations obtained from in vitro studies.

Keywords: Maytenus senegalensis, Anthelminths, Pheretima posthuma, Dalbelgia mealanoxylon

POSTER PRESENTATIONS

Phytochemical profile and antidiarrheal activity of aqueous leaf extract of *Plectranthus barbatus* (lamiaceae)

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Background: Diarrhea is still the second leading cause of death among children under the age of five worldwide. Drugs in the market are associated with side effects, contraindications, and the risk of resistance. In Kenya, the use of traditional medicinal plants to treat diarrhea has long been practiced. Despite the lack of an in vivo study to support its therapeutic efficacy, P. barbatus Andr. is one of the plants that has been claimed to be traditionally used in the treatment of diarrhea in children under the age of five. This study aimed at evaluating the antidiarrheal activity and safety of crude aqueous extract of P. barbatus leaves.

Methods: The extract's antidiarrheal activity was tested using castor oil-induced diarrhea, enteropooling, and small intestine transit models. The extract was given to the test groups in various doses (100, 200, and 400 mg/kgbw), while positive controls received Loperamide (3 mg/kgbw) and negative controls received distilled water (10 ml/kgbw). Phytochemical screening was done using LC-MS.

Results: The extract significantly ($p<0.05$) prolonged diarrhea onset, decreased frequency of defecation, and weight of feces in castor oil-induced diarrhea model at all test doses. Additionally, the extract caused a significant ($p<0.05$) decrease in the volume and weight of intestinal contents at doses of 200 and 400mg/kgbw. Furthermore, the extract resulted in a significant ($p<0.05$) reduction in gastrointestinal motility in the charcoal meal test in a dose-dependent manner. The extract's phytochemical profile revealed the presence of quercetin, kaempferol, naringenin, p-coumaric acid, β-sitosterol and steroidal saponins which possess antidiarrheal activity. LD_{50} >2000mg/kgbw justified its safety.

Conclusions: P. barbatus aqueous leaf extract has promising anti-diarrheal effects and is safe, lending credence to its traditional use in the treatment of diarrhea in children.

Keywords: antidiarrheal activity; aqueous extract; castor oil-induced diarrhea; Plectranthus barbatus

In vivo anti-inflammatory potential of methanol leaf extracts of C*issampelos parreira* (linn), *Lantana camara* (linn) and O*cimum gratissimum* (african basil) in mice model

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Inflammation has been managed mostly through conventional medicine such as diclofenac, aspirin, among others that are associated with adverse effects such as renal and liver damage. However, alternative therapy such as herbal extracts possess less side effects and are readily available. The aim of this study was to determine anti-inflammatory potential of methanol leaf extracts of L. camara, C. parreira and O. gratissimum in Swiss albino mice. The three plant samples constituting of leaves were collected from Embu County, Kenya. Quantitative phytochemical composition of the three methanol leaf extracts was performed through LC-MS and GC-MS method. Eight groups of five mice were used in each test: normal control group, positive control group, negative control group and experimental groups ranging 50, 100, 150, 200 and 250 mg/kg bw extracts. The animals were first treated with various treatments and plant extracts through the intraperitoneal route of administration. Then thirty minutes later, inflammation was initiated through injection of 0.01ml of 1% carrageenan solution into the sub plantar region of the left hind paw of mice. Diclofenac 15 mg/kg bw and 5% DMSO was used as the positive and negative controls, respectively. The same was repeated by orally administered treatments. Bioscreening results from methanol extracts of L. camara, C. parreira and O. gratissimum indicated that they possess potent anti-inflammatory activity which were comparable to that of the reference drug diclofenac. The three extracts demonstrated greatest anti-inflammatory activity in the intraperitoneal route. Phytochemical analysis revealed that these plant extracts possess phytochemicals that are associated with anti-inflammatory activity. The study confirmed the folklore use of these plants in the treatment of inflammation. The study recommend their use and development as alternative anti-inflammatory agents.

Keywords. L. camara, C. parreira, O. gratissimum, Inflammation, Phytochemicals.

E) ADVANCED MATERIALS AND NANOTECHNOLOGY

ORAL ABSTRACTS

ZnO: The future materials for solid state lighting, photovoltaics, and gas sensing.

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Zinc oxide (ZnO) is a remarkable, multifunctional semiconducting material with a direct, wide bandgap (Eg ~ 3.4 eV) and high exciton binding energy (60 meV). It has intrinsically high transparency over the whole visible range, and a resistivity that can be tuned from semi-insulating right through to semi-metallic by doping. Undoped ZnO has two characteristic emissions in the ultraviolet and visible regions related, respectively, to excitonic recombination and intrinsic defects. X-ray photoelectron spectroscopy (XPS) data demonstrated a correlation between the visible emission and intrinsic defects. Upon doping, both the excitonic and defect emissions can be suppressed because of non-radiative energy transfer from ZnO to dopant ions. ZnO, especially with particle sizes in the nanoscales, has a wide variety of applications in solid state lighting, solar cells and gas sensors. The fundamental properties of doped and undoped ZnO nanoparticles and their applications will be discussed.

Women contributions to ground breaking discoveries and advancement of Science

Miriam M. Nyamai,

South African Radio Observatory

The word “Women in Science” has become a buzzword in recent years with movements encouraging more women to join the STEM fields. Throughout history, women have been involved in ground breaking and advancing humanity’s science. This talk highlights some of the major discoveries made leading to both social and political changes. The number of women doing research in Science and technology still remains low. Therefore, past successes help to encourage and pave the way for young women to participate in advanced Science and Technology research today.

Use of supported Internet of Things (IoT) and Fuzzy Logic Method Based on effective use of Renewable Energy Resources

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Abstract: The use renewable energy systems have impacted positively on power quality, electrical grid stability, and reliability. However, major challenges are involved in the modeling, control, and general operation of these systems. Smart Grid technology employs information, communication, and automation technology to deploy a power grid integrated with smart power generation, transmission, distribution, and the integration of renewable energy sources. In particular, Smart Grids integrated with smart meters, electric vehicle charging stations, and home/building energy management system are the key enabling factors toward the Micro Grid, Smart Building, and Smart City concepts. Since wind and solar PV power resources are intermittent, accurate predictions and modeling of wind speed and solar insolation are necessary. Indeed, wind and solar photovoltaic generation require operating the systems near their maximum power output point. With the ever-increasing capacity of the Internet and demand for human lives, Internet of Things (IoT) applications is increasing like never before, primarily to facilitate smart homes and smart cities. However, consumers have become increasingly cognizant of the negative effects of energy consumption as well as the importance of footprint reduction. As a result, effective use of computational intelligence techniques, such as fuzzy systems for the controlling and modeling of renewable power generation in a Smart Grid, turns out to be critical for successful operations of the system. In this study, we considered a system based fuzzy logic and supported Internet of Things (IoT) for renewable energy sources. The system achieved 20% energy efficiency.

Key Words: Renewable energy, Fuzzy logic, Internet of Things (IoT), efficiency, Smart Grid.

Solar Photovoltaics Inspection And Assessment Using Smart Uvf (Ultra-Violet Floresence) And Infra-Red Thermography

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Most defects in PV modules cannot be detected through visual (naked eyes) inspections. Defects such as microcracks take time to cause a decline in power measurements hence need to be detected at the earliest opportunity possible. Methods used in PV assessment include Power measurement, Electroluminescence imaging, Infrared Thermograph, and Ultraviolet Florescence (UVF). Power measurement and Electroluminescence are invasive procedures while Infrared Thermography (IT) and UVF are non-invasive.

In Photovoltaic (PV) application, IT and UVF are used to analyse the degradation of the encapsulant (yellowing effect) in PV modules, cracks and microcracks, hot cells and photobleaching. Microcracks at the onset do not cause significant drop in power output of the PV modules. Power output drops dues to thermal cycling as microcracks mature into cracks and fingers separate. Hence detecting presence of micro-cracks on module has the advantage of isolating such modules from the strings before affecting the PV system power performance. Florescence is a form of luminescence which involves emission of light by an activated materials that absorbs light. UVF involves irradiation of the whole module or cell of interest with an excitation UV smart light source and observing the florescence effect by naked eye or camera. Since UVF and IT are non-destructive, non-invasive, and easy to deployment, it is possible to inspect up to 5,000 modules in one day. The UVF inspection is done after sunset since it has wavelength of between 200 nm to 290nm that is outside the visible range while IT is done during the day. Images can be recorded using any camera with filters or phone camera. UVF has a limitation of not showing the proportion of the cells that is isolated hence it forms a basis of recommending isolated modules in a string for a superior non-destructive detection known as electroluminescence imaging (EL)

Key words: Ultra-Violet Florescence, Electroluminescence, microcracks, Infrared Thermography

POSTER PRESENTATIONS

Positron-Impact Excitation Of The Lowest Autoionizing State In Sodium Atom Using Distorted Wave Method With Absorption And Polarization Potential

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Many calculations have been performed on electron impact excitation of the lowest autoionizing state of sodium, but there is less research done with positron impact which is of equal importance. So in this study, differential cross-sections and integral cross sections for positron impact excitation of the lowest auto ionizing state of sodium have been calculated using distorted wave method. In the distorted wave method, no calculations have been performed for positron impact excitation of sodium atom using complex distortion potential. That is why in this study, distorted wave method has been used to calculate differential cross sections and integral cross sections for the positron impact excitation of the lowest lying autoionizing level of sodium (Na) atom using the complex distortion potential which comprises of static, absorption and polarization potentials. The static potential of the target atom in its initial state plus absorption and polarization potentials as the initial channel distortion potential and a linear combination of the static potentials of the target atom in its initial and final states plus absorption and polarization potentials as the final channel distortion potential has been applied.

Roothan Hatree Fock wave functions, due to Clementi and Roetti have been used. Numerical calculations have been done using a modified DWBA1 FORTRAN computer program which was originally written for hydrogen atom. Present results for positron impact excitation of the lowest autoionizing state of sodium will be compared with the available experimental and theoretical results for positron and electron impact excitation of the same and presented in the conference.

Fabrication Of A Smart Air-Conditioner Controler For Energy Conservaton

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Growth in space cooling demands due to adverse climatic conditions has led to rise in desire for air conditioning (AC) systems. If at all we have to achieve the efficacy of these systems that we so desire, then we ought to work on improving their efficiency as well as solve the challenge of energy conservation since their long running time leads to high power usage. Technology is playing a key role in digitization of AC systems with sensors and microcontrollers being used extensively. Energy conservation remains the main focus of scientists and engineers working on ACs. In line with working towards developing energy efficient systems, we carried out a research to optimize the control of air conditioners for energy conservation purposes. This research was geared towards having an energy efficient system. In this research, temperature, proximity and passive infrared detectors have been used as smart sensors. The system is designed such that when room occupants' approach a room, the system is activated and rapid cool down or warm up achieved within a predetermined time depending on the size of the room. As long as there is occupant in the room, the system quickly settles into the set conditions. When there is no one in the room, the system need not to be working and therefore it switches off. This reduces the running time of the AC hence helps in energy conservation thus reducing bills paid by users. The designed prototype, which can be monitored through and android app, is able to detect room occupancy, responds perfectly to temperature changes as well as human presence in the field of view of the PIR with an overall performance efficiency of 55.95% which is a good start towards actual implementation of an energy efficient A.C. control system.

Keywords: Energy conservation, energy efficiency, performance efficiency, air conditioning system

Synthesis of aptamer conjugated InP/ZnS quantum dots for cancer biomarker detection

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Quantum dots (QDs) are spherical inorganic semiconductor nanocrystals with a size range of between 2-10 nm which possess unique size and shape dependent optical properties. Quantum dots have shown great potential in biochemistry and biomedicine in bioimaging, therapeutics, drug delivery, drug analysis, drug targeting, diagnosis, or detection, and biosensing due to their unique properties. The aim of the study is to synthesize aptamer conjugated InP/ZnS QDs, detect cancer biomarker through fluorescence microscope, flow cytometer, and mass spectroscopy. Cancer is a global health burden, it is a leading cause of diseases, death, as well as emotional and financial distress. It is of utmost importance to reduce the burden of cancer and increase the survival rate. Development of methods for early detection of cancer as well as detection of the progress of the disease and the impact of treatment are of utmost importance. Diagnosis of the disease followed by targeted treatment strategies is the only viable solution to increase the survival rate and reduce the burden of the disease. Two methods were used for the synthesis of QDs namely the hot-injection method and the green synthesis method. The time of synthesis, source of indium, and source of phosphine were varied to synthesize QDs with minimal spectral overlap for multiplex application. The QDs were functionalized with an organic ligand to produce water soluble QDs and provide a functional group for conjugation of aptamers. Aptamers were conjugated to the water soluble QDs using EDC/NHS chemistry. The aptamer conjugated QDs were successfully used in biomarker detection by means of flow cytometer assays, fluorescence microscope bioimaging, and mass spectroscopy assay.

Design and simulation of thin film lithium niobate ridge waveguide for integrated optics applications

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With the explosive growth of bandwidth intensive applications such as video streaming, 5G networks, internet-of-things and cloud-based service, high speed, low power, broadband optical interconnects have attracted much attention due to deep penetration of mobile phones. Photonic integrated circuits (PICs) play a crucial role in such applications that require dense integration of optical components in a single chip. Thin film lithium niobate (TFLN) has gained global attention in PICs owing to its strong nonlinear optical properties that find varied applications ranging from frequency converters, to spontaneous parametric down conversion (SPDC) for single photon generation, to supercontinuum generation just to name a few [1-3] The traditional commercially available proton exchange (PE) lithium niobate (LN) waveguides usually have large footprint due to low refractive index contrast. TFLN is proving to be alternative to silicon photonics as it offers tight optical confinement in waveguide structures attributed to large refractive index contrast. The next generation of PICs are expected to be miniaturized and scalable to meet the ever-growing demand of high capacity optical networks and deployment in datacenters.

Here we design a TFLN ridge waveguide structure and investigate the optical confinement loss, radiation losses in mode coupling and bending losses. Figure 1 shows the optical field confinement of the designed TFLN ridge waveguide at 1550 nm telecom wavelength. The TFLN ridge waveguide consists of Silicon substrate, an oxide layer of thickness 4.7 µm, thin film of LN with thickness 0.2 µm, an LN ridge of bottom width 0.7 µm and slant angle of 80◦ with a SiO2 cladding. Such a waveguide structure has great potential in miniaturization of integrated photonics devices for a range of applications e.g. sensing

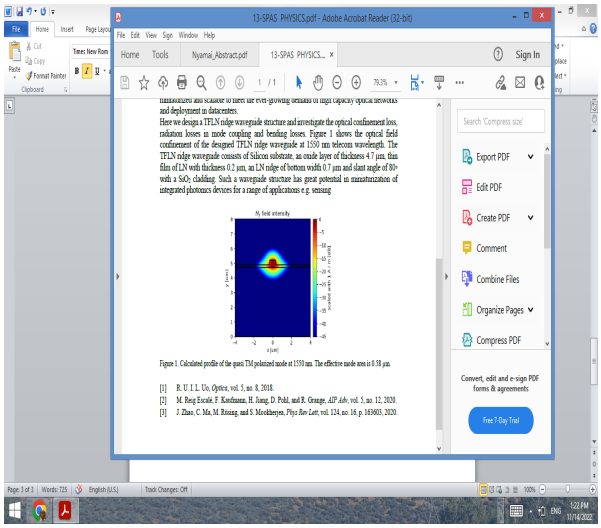

Figure 1. Calculated profile of the quasi TM polarized mode at 1550 nm. The effective mode area is 0.58 µm.

Design and Fabrication of Greenhouse Monitoring and Control System Based on Global System for Mobile Communication and Bluetooth

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Greenhouse technology should be embraced as a way of minimizing food insecurity in Kenya. Greenhouses have attempted to solve this problem by enclosing crops in a climatically controlled environment. In the past, greenhouses utilized electromechanical devices such as thermostats to monitor and control the greenhouse environment. Mechanical systems lack the flexibility and precision required for greenhouse control. Some modern greenhouses use computers-based controllers, which are station-based, bulky and costly. In this study a wireless greenhouse monitoring and control system that is flexible, cheap, easy to maintain and easy to assemble was developed and implemented. The general objective of this research work was to design, fabricate and implement a microcontroller-based system to monitor and control greenhouse parameters using sensors, short message service (SMS) technology and Bluetooth signals. The hardware consisted of ATmega328 microcontroller, Global System for Mobile communication (GSM) module, HC05Bluetooth module, Liquid Crystal Display (LCD) module, 5-Volts 4-Channel relay module, Light dependent resistor (LDR) sensor and digital humidity and temperature (DHT11) sensor. The designed system is able to measure temperature, humidity, and light levels in the greenhouse and display the values on the LCD. The system also transmits the measured values to owner's phone via Bluetooth or GSM and keeps these parameters at optimum levels by use of two fans, a heater, a bulb and a sprinkler. From experiments, at stable cooling state the maximum cooling efficiency of the designed system was 78%. This project therefore provides a cost effective and efficient means of monitoring and controlling greenhouse parameters. In addition, the system allows mobility during monitoring and control process. The reliability of the designed system can be exploited to build a network of such monitoring and control systems for several greenhouses. The agricultural sector in Kenya, can apply the designed prototype in the design and implementation of smart greenhouses.

Keywords: GSM module, Atmega 328, DHT11 sensor, LDR sensor, HC05 Bluetooth.

Effect Of Absorption And Polarization Potentials In The Distorted Wave Calculation Of Positron Impact Excitation Of Autoionizing State Of Rubidium

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Studies have been done involving positron and electron impact on alkali atoms. However, for positron impact excitation of the autoionizing state of rubidium atom, there are only few results available. The positron impact excitation of rubidium's autoionizing state has been investigated in this work with inclusion of absorption and

polarization potentials as distortion potential. Differential cross sections, integral cross sections and angular parameters have been calculated using the distorted wave method and compared with available results. With all the potentials – static, absorption, polarization included, the current results for cross sections and angular parameters are qualitatively in good agreement with the results available in the literature. Absorption potential lowers differential cross sections while polarization potential increases differential cross sections when the impact energy is low. As the impact energy increases, the effect of these two potentials becomes insignificant because the projectile moves at a high speed and hence spends very little time in the interaction region. Absorption potential also decreases integral cross sections up to impact energies of about 150 eV while polarization potential increases integral cross sections up to about 150 eV impact energy. Inclusion of polarization potential also introduces resonance near the excitation threshold. Absorption potential and polarization potential increase the magnitude of the alignment parameter at low impact energies.

Effects of engineered silver nanoparticles on selected tissues of the Nile tilapia *Oreochromis niloticus*

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Silver nanoparticles are thought to have unique antimicrobial properties which can be incorporated into biosensor materials, the textile industry, and cosmetic products, among others. Continuous use of silver nanoparticles can lead to their accumulation in the aquatic environment and consequently, bioaccumulation in the tissues of aquatic organisms. Although, it is known that silver nanoparticles (AgNPs) have potential to cause harm, there is still scanty information on their effects on tissues of the Nile tilapia *Oreochromis niloticus*. **This study was carried out to determine the effects of silver nanoparticles on ventilation rate and selected tissues of Nile tilapia** *Oreochromis niloticus*. **108 tilapia of the same size were divided into four groups, the first three groups being exposed to three sub-lethal concentrations of silver nanoparticles for a period of 24 hours, 48 hours and 72 hours. The control set up was placed in untreated water. Ventilation rate of tilapia fish was determined by the opercular movement method. Blood samples of the fish taken after 24 hours were analyzed for the effects of AgNPs on hematological parameters. Analysis of variance (ANOVA) showed that the MCV in the treatment groups decreased as the concentration of AgNPs increased ($P<0.05$). Ihe MCH values showed an increasing trend as the concentration of AgNPs increased ($P<0.05$). There was a decrease in lymphocytes following exposure up to 10µg/L. Regression analysis showed that ventilation rate increased upon exposure to silver nanoparticles. Histological studies showed alterations in structures of the liver, gills, cardiac muscle and spleen following exposure to AgNPs. The results demonstrated that AgNPs induce significant changes in hematological parameters, ventilation rate, and tissues of** *Oreochromis niloticus*. **The study recommends proper disposal of items suspected to contain silver nanoparticles to avoid contamination of water bodies. It is also important to clearly label the items**

containing silver nanoparticles.

Key words: Silver nanoparticles *Oreochromis niloticus,* **ventilation rate, haematological parameters, fish tissues.**

Remediation and Improvement of Physico-chemical properties of mortar by Use of Bacteria

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Oral Presentation

The building and construction industry mainly uses cement as the major raw material. However, the performance of the cement in concrete or mortar is affected by aggressive agents. Further, improved performance of the mortar or concrete is subject to additives to cement. Beneficial bacteria, when added with the right feed materials, precipitate calcite when incorporated in cement. The resultant calcite serves to improve the physico-chemical properties, and remediate deteriorated concrete or mortar. This paper presents a series of results on the use of beneficial bacteria, including Bacillus megaterium, Bacillus cohni, and Lysinibacillus Spaericus. The paper also reports the results of Starkeya novella as a deteriorative bacterium after which the cement was remediated using beneficial bacteria. The physical performance of the mortar investigated showed that compressive strength and flexural strength significantly improved when the mortar was subjected to beneficial bacteria. Scanning Electron Microscopy (SEM)showed significant microstructural improvement including residual cement hydration, densification of the mortar due to increased calcium-silicate-hydrate and portlandite formation. Deteriorative bacteria manifested its attack through disintegration of cement and formation of sulphate products. The remediation of the disintegrated mortar using beneficial bacteria showed improved microstructure and physico-chemical performance. The results show that bacteria can be used to improve the physico-chemical performance of mortar or prevent mortar from aggressive attack or remediate deteriorated mortar, and by extension, concrete.

Key Words: Mortar, Concrete, Bacillus megaterium, Bacillus cohni, Starkeya novella and Lysinibacillus Spaericus

F) MATHEMATICAL AND COMPUTATIONAL MODELLING

ORAL PRESENTATIONS

On the Fischer-Clifford matrices of an extension group and its quotient group

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Let G = P.G be a finite extension of a non-abelian p-subgroup P by a group G. Choose the smallest non-trivial characteristic subgroup K of P such that P K = P1 is an elementary abelian p-group p n.Then it follows that the quotient group Q =K and G have structures P1.G and K·Q, respectively. Furthermore, it is required for P1 to be a n-dimensional module for G over the finite field GF(p). Since K / G we can lift the ordinary irreducible characters Irr(Q) of Q to G where the set Irr(Q) is identified with χi □ Irr(G) such that K ≤ Ker(χi). In the paper [1], a powerful method described how to construct the ordinary character table of an extension group, with the kernel a p-group, using so-called Fischer-Clifford matrices. This Fischer-Clifford matrices technique is based on Clifford theory. From the above discussion of the lifting of characters, it follows that the Fischer-Clifford matrices Mg(gi) of Q are embedded in the corresponding Fischer-Clifford matrices M(gi) of G where the gi's are class representatives of the group G. Since the kernel of the extension Q is an elementary abelian p-group, the matrices Mg(gi) of Q can be easily computed which is not the case with the corresponding matrices M(gi) of G where the kernel of the extension is non-abelian. In this talk, we will show, with the aid of an appropriate example,how the matrices M(gi) of G can be constructed from the corresponding matrices Mg(gi) of Q and hence the ordinary character table of G is obtained. In a sense, the matrices Mg(gi) are "lifted"to the matrices M(gi) in G.

Event-triggered H filtering for networked systems subject to deception cyber attacks

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The filtering problem is one of the most fundamental issues in control theory. In general, due to the presence of external disturbances in the systems dynamic, the H control has proven to be an effective method for analyzing this type of problem. In this paper, we study the event-triggered H filtering for networked systems subject to deception cyber attacks. Firstly, the improved output-based event-triggered scheme is designed for networked systems, which can further reduce data transmission to save more network resources. Secondly, the communication channel is considered to be vulnerable to stochastic cyber attacks and the Bernoulli process is used to establish the random deception attack model. Furthermore, by constructing appropriate Lyapunov-Krasovskii functional candidates, we formulate sufficient conditions to ensure the filtering error system achieves stochastic asymptotic stability with prescribed H performance. Consequently, we design the desired filter parameter gains. The superiority of the improved event-triggered scheme adopted in this paper versus the traditional event-triggered scheme is demonstrated by a comparison simulation, which shows a significant reduction in the event-triggered instants and illustrates the validity of the theoretical methodologies proposed. Thus, the improved event-triggered scheme employed in this paper can significantly lower the consumption of the limited network resources.

Keywords: Event-triggered scheme, H filtering, Deception cyber attacks, Networked control system

Mathematical Model Of Immune System Responses During Viral Evolution

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Viral evolution is the change in the genetic makeup of virus in order to escape from antibody responses. As the viruses mutate and multiply, over time can determine the outcome of the viral infection. As more and more virus strains escape immune responses and accumulate, a given specific immune response can only recognize smaller fractions of the viral population. The unrecognized viruses continue to infect and impair the susceptible cells.This leads to antigenic diversity which can contribute to viral infection progression. The main objective of this paper will be to analytically elucidate the dynamics of viral evolution towards escape from antibody responses with the hope that insights gained will help to determine the possibility of viral clearance by the immune system responses only or whether intervention by treatment is necessary. To achieve this a discrete mathematical model will be developed that captures the following variables: Susceptible cells,(S), cells infected by strains i = 1 to i = n, (Yi), antibody responses specific to strains i = 1 to i = n, (Ai), and Cytotoxic T Lymphocyte (CTL) responses, (T), that are taken to be cross reactive and can respond to all virus strains. The Basic reproduction number will be computed to determine the condition for either viral persistence or clearance. The equilibrium points of the model will be determined and simulation done for two cases: initially weak & un sustained CTL response and strong and sustained CTL response. It is hoped that the simulations will yield valuable insight into how the immune system interact with the viral infections with the aim of strengthening understanding of different treatment protocols of viral infections. The model will therefore acas a tool to simulate different treatment protocols before administering to patients and reliably predict the out come of the treatment.

Mathematical modelling and optical control analysis of fractal Covid 19 disease transmission dynamics with incubation and latent delay

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The COVID-19 pandemic is still a big issue three years after the rst discovery, but mortality have decreased globally as a result of government policies, delayed availability of some vaccinations, and increased knowledge of the virus. It is critical to comprehend how the virus spreads so that we can forecast similar circumstances in the future and limit the potential harm to the human population. Mathematical models have been widely recognized as eective tools for studying illness transmission patterns. Therefore, this study oers a mathematical model made up of a sequence of non linear fractional-order dierential equations with incubation and latent delays for Covid 19. The model's equilibrium solutions are found to be locally asymptotically stable. The basic reproduction number R0 have been calculated using the principle of next-generation matrices. $R0 < 1$ implies that the disease will die out, hence the disease can be controlled. A global stability analysis of the solutions has been performed using the Routh-Hurwitz and the Lyapunov function approaches. We have carried out sensitivity analysis to determine the eect of various parameters on R0. We have use some control strategies for optimal control theory with incubation and latent delay to investigate the positive eects on the dynamic transmission of the virus. Adams-Basforth-Moulton method has been used to solve numerically the model and analyzed the performance of the controls by taking into consideration various simulated control pairs. The investigation demonstrates that fractional order with incubation and latent delay eectively enriches the dynamics and increase the stability condition of the model. Results indicates that, the spread of disease is declining with time. So, policy makers will see the need to implement this study to regulate the spread of covid 19. Also, by decreasing p1, p2 will lead to decrease of death rate of human population to the virus.

Keywords: Covid 19, Mathematical modelling, optimal control, Incubation and Latent delay, Frac-tional Order dierential equation

On the character table and associated Fischer-Clifford matrices of an extension group 216:Sp8(2)

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Lydia Nyambura Njuguna, Department of Mathematics and Actuarial Science, Kenyatta University, Kenya
Abraham Love Prins, Department of Mathematics and Applied Mathematics, Nelson Mandela University, South Africa
Lucy Chikamai, Department of Mathematics and Actuarial Science, Kibabii University, Kenya

The symplectic group Sp8(2) has a unique absolutely irreducible module 216 of dimension 16 over the field GF(2). Hence a split extension group of the form G = 216:Sp8(2) exists and its ordinary irreducible character table of G, up to now, is not yet known. Therefore, in this talk, it will be shown how the ordinary character table of the group G has been constructed by the current authors, using the Fischer-Clifford matrices technique [1]. This method is very powerful when the kernel P of a finite extension group P.G is an elementary p-group, as in the case of the group G. Since the size of the group G is extremely large, existing routines in the computer algebra system, GAP [2], to assist in the computations of the conjugacy classes [gi]G and Fischer-Clifford matrices M(gi) of G, failed. These conjugacy classes of G with representatives gi must be grouped in a certain coset-analysis format (see [3]), according to each class representative gi of Sp8(2) . Hence novel GAP routines were developed to aid in obtaining the classes of G in this coset-analysis format. Having obtained the classes of G in the coset-analysis format, we have used brute force to compute the Fischer-Clifford matrices of G and hence construct the ordinary character table of G successfully. Consistency checks have been done in GAP to test the correctness of the character table of G.

Mathematical Modelling Of Covid-19 With Vaccination Strategy

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Corona virus 2019 (Covid-19) have been endemic both in Africa and the whole world. In our work, we have formulated and analyze mathematical model of covid-19 that monitors the temporal dynamics of the disease in the presence of preventive vaccine since the most effective ways of controlling the transmission of infection disease is through vaccination and treatment. Due to transmission characteristics of covid-19, we have divided the population into six classes. That is; susceptible(S), vaccinated (V), infective (I), hospitalized (H), home based care (HB) and recovery(R). We have formulated non-linear system of differentials equation governing the model to compute and solve using quantitative analysis. Feasibility region, positivity of model variable, disease free equilibrium and local stability of the model are discussed. The solution has been computed using numerical classical fourth order Runge-Kutta integration method to gauge its effectiveness. The model monitor reproduction number RO which describe the dynamics of the Covid-19.The disease free equilibrium is local asymptotically stable when Ro<1 and unstable when Ro>1. We use MAPLE to carry out the simulation

and graphical results, then presented and discussed to explain the solution of the problem.our computations indicates that vaccination reduce the spread of disease.

Investigation of the Effect of Absorption and Polarization Potentials in e^+ - K $3p^5 4s^2\ {}^2P$ Excitation using Distorted Wave Method

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Synopsis Integral cross-sections of the lowest auto-ionizing state of potassium were determined using a non-relativistic first-order distorted wave method to investigate the effect of absorption and polarization potentials in positron impact excitation of alkalis. Including polarization potential, the results show the near-threshold resonance structure revealed in the experimental data from electron impact excitation. The absorption potential has a small contribution to the results at low impact energies near the excitation threshold. In the recent decades, positron scattering from alkali atoms has triggered considerable involvement of both experimentalists and theoreticians due to their intriguing features such as low ionization potential and high polarizability [1, 2]. The alkali atoms have a comparatively simple electronic structure with the outermost shells consisting of a single electron. In this study, the full distortion potential comprised static, polarization [3], and absorption [4] potentials. In the initial channel, the static potential was the static potential of the target atom in its initial state while in the final channel it was is a simple average of target atom static potentials in its initial and final states[5]. We used the Roothan- Hartree-Fock (RHF) multi-zeta atomic wave functions given in the Clementi and Roetti tables [6]. The single configuration Hartree-Fock model used is not highly accurate for the lowest states. Also, the Contribution of the transitions from other excited states to the lowest autoionizing level was neglected. The study was based on the understanding that the interaction potential can be chosen arbitrarily to reproduce reliable results. Integral cross-section results using static potential have the same trend as the only available theoretical results of [7]. The disparity in the cross sections in low and intermediate impact energies is attributed to the choice of distorting potential. That is the choice of static potential in the final channel. We see the effect of absorption at low impact energies near the excitation threshold. This is because of the inelastic processes, such as positronium formation and excitation and ionization of the target, which have a contribution to the integral cross sections at low impact energies.

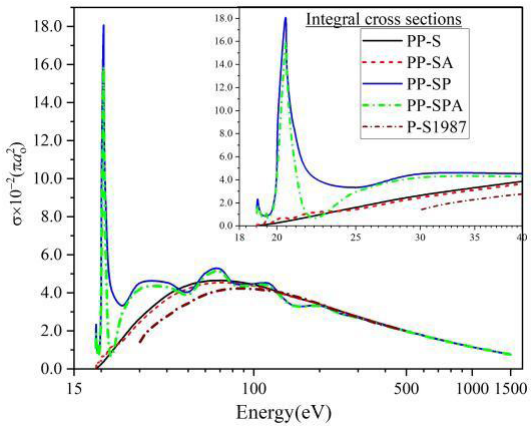

Figure 1. Integral cross section results for e^+ impact excitation of lowest autoionizing state of potassium. PP-S - static only; PP-SA - static + absorption; PP-SP static + polarization ; PP-SPA - static + polarization + absorption; P-S1987 - e^+ impact results of [7] A distortion potential with polarization potential produced results that have a sharp resonance structure near the excitation threshold. This shows that the behavior of the target as the projectile approaches (polarization) has a high contribution to the integral cross sections in this energy region.

The Role of Dynamic Absorption and Polarization Potentials in Relativistic Excitation of Noble Gases

Presenter

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Collision data on excitation of rare gases is important in the study of plasma displays, lighting and lasers. Due to the difficulties and costs associated with setting up collision experiments, one of the major goals of theoretical atomic physics has been to develop reliable computational methods to describe actual collision experiments. From literature, both relativistic and non-relativistic computations performed on electron impact excitation of low-lying resonance states of argon, krypton and xenon gases often fail to give satisfactory agreement with available experimental data at low impact energies. With this in view, we have applied a relativistic distorted wave approach (RDW) to excitation of these noble gases by using a complex distortion potential consisting of absorption, polarization, exchange and electrostatic potentials, to solve Dirac equations and hence obtain electron wavefunctions used for obtaining scattering probabilities or cross sections. Present results from this study predict that the absorption potential improves results at higher impact energies and it is more dominant with the heaviest of gases which is xenon, while the dynamic polarization potential improves results at low near-threshold impact energies for all the gases, hence giving cross sections in good agreement with experiments at all impact energies under investigation. This mathematical approach should also be tested for excitation of the metastable states of the heavy noble gases.

Genetic diversity and forensic application of 21 autosomal STRs in GlobalFiler® Kit for the Kenyan population

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Kenya is a diverse and populous nation, having an established DNA database that utilizes DNA evidence in its criminal justice system. Our country thus requires updated reliable information on autosomal profile variation across the country and in its many ethnic groups. Kenya's indigenous population originated from migrations of Cushitic, Nilotic, and Bantu-speaking groups. The goal of this study was to advance the current Kenyan DNA database by seeking to provide reference data and assess population structure, by determining allele frequencies for the Kenyan population using the GlobalFiler® PCR amplification kit. To achieve this goal, this study, therefore, analyzed 21 autosomal DNA short tandem repeats (STRs) using the GlobalFiler® multiplex in a sample of 510 male Kenyans representing the country's eight former provinces, 43 of its 47 counties, three main linguistic families, and all 29 ethnic groups that each comprises >0.5% of the 2019 census population. To execute the aims of this study, buccal swabs were collected from 510 healthy unrelated indigenous Kenyan males at Kenyatta University after informed consent and approval of the ethical committee of Kenyatta University. Genomic DNA was extracted and purified using the Wizard® Genomic DNA Isolation and Purification Kit protocol and then quantified using a Nanodrop ND-8000 spectrophotometer. GlobalFiler® multiplex was used to generate profiles based on 21 autosomal loci. Amplification was performed on a Veriti PCR machine and fragment detection on an ABI 3500 Genetic Analyzer in accordance with the manufacturer's protocols. Gene Mapper ID-X software v1.4 was used for allele calling and interpretation. The polymorphism information content, power of discrimination, power of exclusion, random match probability, observed heterozygosity, matching probability, paternity index, and gene diversity (expected heterozygosity) were calculated in correspondence with Hardy-Weinberg equilibrium using STRAF and Arlequin software applying AMOVA at 95% confidence interval. This study established significant genetic differentiation between the three Nilotic language sub-families, with Western Nilotes showing greater similarity to the Bantu than the Paranilotes who showed closer affinity to the Cushitic speakers, which concurs with previous genetic, linguistic, and social studies. Several rare off-ladder alleles were noted whose structure was determined by Sanger sequencing. The unusual feature that could affect profile interpretation was a deletion of Amelogenin Y but no other forensic marker. A triallelic pattern at TPOX and an extremely short SE33 allele falling within the expected size range of D7S820 were observed. The locus SE33 in GlobalFiler® was found to be the most variant with 45 alleles and the most informative with a value of 0.924, thus compared with the currently implemented Identifiler multiplex, random match probabilities decreased from 6.4×10^{-19} to 3.9×10^{-27}. This

study thus established that the autosomal amplified with GlobalFiler® has high discrimination powers in the Kenyan population highlighting her structured genetic landscape. The genetic data generated in this study would thus advance the existing autosomal data of the Kenyan population and would also be useful for forensic application, anthropological, and demographic studies.

Keywords: Kenyan Population, GlobalFiler®, Forensic Autosomal STRs, Language family

POSTER PRESENTATIONS

Robustness Analysis For A Nonlinear Gantry Crane System Using Fuzzy Logic Controller

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Abstract

Gantry cranes are equipment used for loading and unloading heavy items. They are majorly used in the industries and shipyards to transport heavy loads. Generally, operational requirements for the gantry crane is to move the load with minimum swing angle, high positioning accuracy and with minimum time possible. External and environmental disturbances affects the performance of the gantry crane when in operation. Control of the gantry crane system has over many years attracted many researchers with interest in designing a robust gantry crane system free of swing motions. Several researchers have proposed the use of PID controllers. However, their control methods have limitations among them, being sensitive to disturbances. Thus, for the crane to operate effectively, trolley positioning and swing motion of the load need to be controlled. The main goal of this research is to design a robust control mechanism for the gantry crane system against swing motion due to uncertainties. The gantry crane system has been designed using mathematical modeling with assumption that the load is attached to a trolley using one rope and moves in 2D plane. The robustness analysis of the FLC has been simulated in MATLAB/Simulink environment and comparison done with PID controller using different input signals and external disturbances. Various transient response performance indices specifications have been used to determine the effectiveness of the controller model. The final results have demonstrated that FLC is capable of producing better results of minimizing swing motion as compared to PID controllers.

Key words: Gantry crane, anti-swing, position control, PID controller and Fuzzy Logic Controller

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CONFERENCE ON BASIC AND APPLIED SCIENCES				
Embracing Science & Technology for Resilience and Transformation				
KENYATTA UNIVERSITY, MAIN CAMPUS, THIKA ROAD				
16TH – 18TH November, 2022				
Time: 8.00 am – 5.00 pm				
Venue: BSSC Rm 14				
Zoom Link: Join Zoom Meeting **https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyOERERU4ybHBvVlovRkEyUT09**				
Day 1 Wednesday 16th November 2022				
Theme: Investing in Basic and Applied Sciences				
7.30 - 8.30	Registration			
8.30 - 9.00	Welcome Address			
9.00 - 10.30	Opening Ceremony			
	CHIEF GUEST Professor Walter Oyawa Director General NACOSTI			
	LECTURE Participatory, Gender-responsive Evaluation of Climate Smart Bananas for Enhanced Food Security and Improved Livelihoods DR. MARY MWANGI Research Scientist/Faculty Member School of Pure & Applied Sciences			
10.30 - 11.00	BREAK			
11.00 - 1.00	PANEL SESSION I			
	Moderator: Prof. J N Ngeranwa			
	Rapporteur: Dr. John Maingi			
	Does Basic Science Matter for Economic Development?			
	Prof. Dickson Andala - CEO NRF			
	Prof. Nicholas Gikonyo - Director National Center for Phytotherapeutic Research			
	Dr. Bridget K. Mutuma - AAS Affiliate (2021-2025), ASLP Fellow, ARISE-PP Fellow *Department of Chemistry, The University of Nairobi*			
	Dr. Nancy Soi - UNEP Regional Seas Programmes Coordinator.			
	Dr. Domitila Kyule-Muendo (PhD) - Research scientist/Centre Director *Kenya Marine & Fisheries Research Institute (KMFRI)*			
1.00 - 2.00	BREAK			
2.00 - 4.00	PARALLEL SESSIONS			
	COASTAL RESOURCES & BLUE ECONOMY	CHEMICAL SCIENCE	BASIC & APPLIED SCIENCE IN INFECTIOUS AND NON-INFECTIOUS DISEASE	S&T FOR CLIMATE ADAPTATION AND RESILIENCE
4.00 - 5.00	POSTER SESSIONS FOR ALL THEMATIC AREAS			
DAY 2 Thursday 17th November 2022				
Theme: Science Education & Science Communication				
7.30 - 8.30	Registration			
8.30 - 9.00	Welcome Address			

9.00 – 9.30	LECTURE: INNOVATIONS IN HEALTH Dr. PETER GICHUHI MWETHERA, PhD, MBCH BSc (Hons, Kenya); Mphil (Bristol, UK); PhD(Bristol, UK); Post Doc(North Carolina, USA); IVF (Leuven, Belgium) DIRECTOR INSTITUTE OF PRIMATE RESEARCH			
9.30 - 10.30	PANEL SESSION II			
	Moderator: Dr. Miheso Marguerite			
	Rapporteur: Dr. Syprine Otieno			
	Educating Today for Tomorrow			
	Prof. Catherine Ngila Fmr. Ag.Executive Director, The African Academy of Sciences; Fellow of TWAS, AAS, & ASSAf			
	Prof Mary W. Gikungu – Director, National Repository and Research, NMK			
	Prof Meoli Karshoda – Director KENET			
	Bibiana Iraki – Science Communication ISAAA			
	Dr. Chip Kingsbury – Association for Faculty Enrichment in Learning and Teaching (AFELT)			
	Dr. Joy Owango – CEO, Training Center in Communication-Africa			
10.30 – 11.00	BREAK			
11.00 – 1.00	PARALLEL SESSIONS			
	COASTAL RESOURCES & BLUE ECONOMY	CHEMICAL SCIENCE	BASIC & APPLIED SCIENCE IN INFECTIOUS AND NON-INFECTIOUS DISEASE	S&T FOR CLIMATE ADAPTATION AND RESILIENCE
1.00 – 2.00	BREAK			
2.00 – 4.00	PARALLEL SESSIONS			
	ADVANCED MATERIAL AND NANOSCIENCE		MATHEMATICAL AND COMPUTATIONAL MODELING	
4.00 – 5.00	POSTER SESSIONS FOR ALL THEMATIC AREAS			
DAY 3 FRIDAY 18TH 2022				
THEME: KNOWLEDGMENT MANAGEMENT & SCIENCEPRENEURSHIP				
8.00-8.30	Registration			
8.30-9.00	Welcome Address			
9.00-9.30	GUEST SPEAKER PROF. SAMUEL KARIUKI KENYA MEDICAL RESEARCH INSTITUTE			
9.30-10.00	PARALLEL SESSIONS			
10.00 – 10.30	BREAK			
10.30 – 12.30	**PANEL SESSION III**			
	Moderator: Dr. Perez Onono			
	Rapporteur: Dr. AnnCarol Karanja			
	From Scientific Idea to StartUp			
	Prof Judith Kimiywe - Director ,Center of Research Ethics & Safety Kenyatta University			
	Prof Maina Mwangi - Director, Innovation Incubation & University Industry Partnerships Kenyatta University			
	Adan Mohammed - CEO Ecodudu			
	Prof Thomas Bayer (HNU, Germany)			

	Mr. Geoffrey Monari - Chair Alliance of African Entrepreneurial Universities
12.30 - 1.00	**CLOSING CEREMONY/ BEST POSTER AWARDS & RECOGNITIONS**
	Prof Grace N. Njoroge - Deputy Commission Secretary CUE
1.00 - 2.00	BREAK
2.00 - 4.00	VISIT TO ECODUDU (RSVP)

CBAS-2022

PARALLEL SESSION

ADVANCED MATERIALS AND NANOSCIENCE IN HEALTHCARE, AGRICULTURE, ENERGY AND ENVIRONMENTAL SAFETY

THURSDAY 17TH NOVEMBER 2022

Venue: BSSC Rm 14

Zoom Link: Join Zoom Meeting

https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyQERERU4ybHBvVlovRkEyUT09

Moderator: Dr. Peter Kinuthia Chairperson Department of Physics

Rapporteur: Professor C. S. Singh Department of Physics

Time	Presenter	Affiliation	Title	Format
2.00 - 2.15	Prof. O. M. Ntwaeaborwa	University of the Witwatersrand	ZnO: The future materials for solid state lighting, photovoltaics, and gas sensing.	Online
2.15 - 2.30	Dr. Miriam Nyamai	University of Cape Town, South Africa Radio Observatory	Women contributions to ground breaking discoveries and advancement of Science	Online
2.30 - 2.45	Prof Lydia Roos	Laboratoire de physique nucléaire et des hautes énergies (IN2P3/LPNHE) French National Centre for Scientific Research (CNRS)	Particle physics with the ATLAS experiment at the LHC	In-person
2.45 - 3.00	Nicholas Musila	Kenyatta University, Department of Physics	Improving DSSC performance by using TiO2 nanoparticle Compact Layer and nanotubes	
3.00 - 3.15	Maritim, Kiprotich Joseph.	Moi University, Department of Mathematics, Physics and Computing	Use of supported Internet of Things (IoT) and Fuzzy Logic Method Based on effective use of Renewable Energy Resources	
3.15 - 3.30	Sospeter Koome	Kenyatta University, Department of Physics	Positron-impact excitation of the lowest autoionizing state in sodium atom using distorted wave method with absorption and polarization potential	
3.30 - 3.45	Kavita D.M.	Kenyatta University Department of Physics	Fabrication of a smart air conditioner controller for energy conservation	
3.45 - 4.00	Shonny Nkuna	DST/Mintek Nanotechnology Innovation Centre, Department of Chemistry, University of the Western Cape, Bellville, South Africa	Synthesis of aptamer conjugated InP/ZnS quantum dots for cancer biomarker detection	
4.00 - 4.15	Nyaga S. G.	Kenyatta University, Department of Physics	Design and Fabrication of Greenhouse Monitoring and Control System Based on Global System for Mobile Communication and Bluetooth	

4.15 - 4.30	David Musyoki Munyao	University of Embu, Department of Physical Sciences	Remediation and Improvement of Physico-chemical properties of mortar by Use of Bacteria	
4.30 – 4.45	IM Kwembur	Department of Physical Sciences, South Eastern Kenya university	Solar photovoltaics inspection and assessment using smart uvf (ultra-violet floresence) and infra-red thermography	
POSTER PRESENTATION **16TH & 17TH NOVEMBER 2022**				
Moderator: Dr. Walter Njoroge - Department of Physics **Rapporteur: Dr. Matthew Munji – Department of Physics**				
4.00 – 5.00	DISMAS CHOGE K.	University of Eldoret, Laser and Optical Fiber Research Group, Physics Dept	Design and simulation of thin film lithium niobate ridge waveguide for integrated optics applications	Poster
	Zakayo Kitui Opungu	Kenyatta University, Department of Physics	Effect of absorption and polarization potentials in the distorted wave calculation of positron impact excitation of autoionizing state of rubidium	Poster
	Zachariah W. Chesoli	Kenyatta University, Department of Zoological Science	Effects of engineered silver nanoparticles on selected tissues of the Nile tilapia *Oreochromis niloticus*	Poster

PARALLEL SESSION

BASIC & APPLIED SCIENCE IN INFECTIOUS AND NON-INFECTIOUS DISEASE

DAY 1

16TH NOVEMBER 2022

Venue: BSSC Rm 14

Zoom Link: Join Zoom Meeting
https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyOERERU4ybHBvVlovRkEyUT09

Moderator: Dr. Matthew Piero Ngugi – Chairperson, Department of Biochemistry, Microbiology & Biotechnology

Rapporteur: Dr. Joshua Mutiso – Department of Zoological Sciences

Time	Presenter	Affiliation	Title	Format
2.00 – 2.20	Eric Broyles, Esq.	Nanocan Therapeutics Corporation USA	The global cancer burden and Nanotechnology Therapy: Current status and Future perspectives	Online
2.20 – 2.40	Bulle Abdullahi	Kenyatta University	Climate change and environmental influence on prevalence of visceral leishmaniasis in West Pokot County, Kenya	In person
2.40 – 3.00	Schola K. Peter	Centre for Microbiology Research, Kenya Medical Research Institute	Seroprevalence of non-typhoidal *Salmonella* disease and associated factors in children in Mukuru settlement in Nairobi County, Kenya	In person
3.00 – 3.20	Phillip Einstein Ogola	Kenyatta University	Annual effective dose and excess lifetime cancer risk in quarry sites located in Kisii, Kakamega and Busia counties	In person

3.20 – 3.40	Maina A.	Kenyatta University	Ethnobotanical survey and antimicrobial screening of selected medicinal plants used in traditional medicine in parts of Kiambu County, Kenya	In person
3.40 – 3.55	Boniface Maina Mwangi	Department of Biochemistry, Microbiology and Biotechnology, Kenyatta University	In vitro anthelmintic properties of dichloromethane extracts of *Maytenus Senegalensis* and *Dalbergia Melanoxylon*	In person
4.00 – 5.00	Emmah Clarice Ajwang	School of Medicine, Uzima University,	Phytochemical profile and antidiarrheal activity of aqueous leaf extract of *Plectranthus barbatus* (lamiaceae)	Poster
	Kimuni Susan Nyawira	Kenyatta University	*In vivo* anti-inflammatory potential of methanol leaf extracts of C*issampelos parreira* (linn), *Lantana camara* (linn) and O*cimum gratissimum* (african basil) in mice model	Poster

PARALLEL SESSION

BASIC & APPLIED SCIENCE IN INFECTIOUS AND NON-INFECTIOUS DISEASE

DAY 2

17TH NOVEMBER 2022

Moderator: Dr. Anthony Kebira – Department of Biochemistry, Microbiology & Biotechnology

Rapporteur: TBD

Time	Presenter	Affiliation	Title	Format
11.00 - 11.15	Shirley A. Onyango	Tom Mboya University College – UC Irvine Joint Laboratory, Kenya	*Anopheles gambiae* and *Plasmodium falciparum* compatibility interactions in a malaria endemic region	Online
11.15 - 11.30	Patrick M. Mutua		Prevalence of overweight and weight related disease conditions among public primary school administrators in Kwale County, Kenya	Online
11.30 - 11.45	Samuel Kamau Kabochi	Kabete Veterinary Investigation Laboratories, Directorate of Veterinary Services	Differential infestation of mosquitoes, the primary vectors of Rift Valley Fever in an endemic habitat of Lake Baringo basin, Kenya	Online
11.45 - 12.00	Caroline Wangui Gikunyu	Department of Laboratory Services, Moi Teaching and Referral Hospital	Characterization of hepatitis B viral genotypes and the associated sero-virological markers among patients attending Moi teaching and referral hospital liver clinic	Online
12.00 0 12.15	Diana Musungu Waiswa	Masinde Muliro University of Science and Technology,	Prevalence and diversity of *Plasmodium* species in pregnant women at ending antenatal clinics in selected health centers of Kakamega County, Western Kenya	Online

12.15 - 12.30	Yvonne W. Wabai	Kenyatta University	Anxiolytic and teratogenic effects of *Carissa spinarum* and *Azadirachta indica* aqueous extracts in mice	Online
12.30 - 12.45	Kipcho D. Mukabane	Masinde Muliro University of Science and Technology	Risk Factors Associated with Malaria Resurgence in Two Rural Villages of Western Kenya Highlands	Online
4.00 -5.00	Emmah Clarice Ajwang	School of Medicine, Uzima University,	Phytochemical profile and antidiarrheal activity of aqueous leaf extract of *Plectranthus barbatus* (lamiaceae)	Poster
	Kimuni Susan Nyawira	Kenyatta University	*In vivo* anti-inflammatory potential of methanol leaf extracts of C*issampelos parreira* (linn), *Lantana camara* (linn) and O*cimum gratissimum* (african basil) in mice model	Poster

PARALLEL SESSION				
CHEMICAL SCIENCE				
DAY 1				
WEDNESDAY 16TH NOVEMBER 2022				
Venue: BSSC Rm 14				
Zoom Link: Join Zoom Meeting https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyOERERU4ybHBvVlovRkEyUT09				
Moderator: Dr. Harun Mbuvi – Chairperson, Department of Chemistry				
Rapporteur: Dr. Margaret Ng'ang'a. Department of Chemistry				
Time	**Presenter**	**Affiliation**	**Title of Presentation**	**Format**
2.00 - 2.15	Prof James Kariuki	University of Alberta, Augustana Campus.	Utilization of a 3D Printer for Developing Low-Cost Electrodes and Components for Use in Electroanalytical Sensors	
2.15 - 2.30	Beatrice Anyango	Kenyatta University	Preparation of Binary metal oxide saponin-chitosan nanocomposite in water purification	
2.30 - 2.45	Adamu Abdulhameed	Kenyatta University	Synthesis of Cellulose-Based Superabsorbent Hydrogel from Rice Husk Using a Microwave	
2.45 - 3.00	Judith M. Gitari	Chuka University	Analysis of Selected Physicochemical Parameters of Soil for Isolation of Soil Actinomycetes with Antibacterial Activity	
3.00 - 3.15	Ngari, Reginah Wangui	Kenyatta University	Bioremediation of mortar made from Ordinary Portland Cement degraded by *Thiobacillus thioparus* using *Bacillus flexus*	
3.15 - 3.30	Anne Gachihi	Kenyatta University	Effect of processing on nutritional and anti-nutritional content of edible insects	

3.30 - 3.45	Kenneth Onyango Osano	Kenyatta Unversity	LC-MS Analysis and Hepatoprotective Activity of Methanol Leaf Extracts of Edible *Solanum villosum* (Linn.) and *Solanum scabrum* (Mill.) in Acetaminophen Induced Wister Mice	
3.45 - 4.00	J. Gichuru Kinaichu	JKUAT	Comparative Study of Selected Macro and Micronutrients in Bio Slurry Samples from Different Feed Stocks and Inorganic Fertilizers.	
4.00 - 4.15	Paul Ochieng Nyalo	Kenyatta University	Phytochemical profile composition and comparative in vitro antioxidant properties of ethyl acetate extracts of *Xerophyta spekei* (Baker) and *Grewia tembensis* (Fresen)	
4.15 - 4.30	Eliakim Mbaka	Kenyatta University	Phytochemistry, antioxidant activities and ameliorative effects of dichloromethane: methanol extracts of selected medicinal plants against induced hepatorenal toxicity	
4.30 - 4.45	Virginia Wambui	Kenyatta University	Processing Techniques affects the Vitamin Quality of Edible Insects – Potential for Use in Complementary Foods	
PARALLEL SESSION				
CHEMICAL SCIENCE				
CBAS-2022 DAY 2				
Thursday 17th NOVEMBER 2022				
Moderator: Prof. Hudson Nyambaka – Department of Chemistry				
Rapporteur: Dr. Alphonse Wanyonyi – Department of Chemistry				
Time	**Presenter**	**Affiliation**	**Title of Presentation**	
11.00 - 11.15	Prof Martin Onani	University of Western Cape, South Africa	The hemilabile P-N complexes: Synthesis, characterization, X-ray crystal structure and evaluation in Heck reactions	Online
11.15 - 11.30	Mathew Piero Ngugi	Kenyatta University	In vivo anxiolytic activity of aqueous extract of *Curcubita pepo*	
11.30 - 11.45	AMBANI, JAPHETH RAPANDO		In vitro antibacterial, in vivo immunomodulatory and safety properties of ethyl acetate leaf extract of *Ocimum basilicum*	

POSTER PRESENTATIONS				
16th AND 17TH NOVEMBER 2022				
Moderator: Dr. Eric Masika – Department of Chemistry				
Rapporteur: Dr. Lucy Kiruri – Department of Chemistry				
4.00 – 5.00 pm	Asamba Micah	Kenyatta University	Organophosphate pesticide residues in food products in kenya and their chromatographic detection: a systematic review	
	Gichuru M. Joseph	Kenyatta University	Toxicity of *Toddalia asiatica* and *Acacia polyacantha* is associated with microcephaly and hypochondroplasia in mice	
	Kihara Evalyne Wandia	Kenyatta University	Antinociceptive and anti-inflammatory effects of alkaloid and flavonoid rich extract of *Urtica massaica* (Mildr) leaves in animal model	
	Gervason Apiri Moriasi	Mount Kenya University	In vivo anti-inflammatory, cognitive-enhancing, and in vitro antioxidant efficacy, and acute oral toxicity effects of the aqueous and methanolic stem bark extracts of *Lonchocarpus eriocalyx* (Harms.)	
	Nyabuti George	Kenyatta University	Nutrients and ant nutrients levels in raw and processed varieties of finger millet promoted for nutritional security	
	Kamau Kimani James	Kenyatta University	phytochemical composition, anti-rheumatoid arthritis potential and toxicity profiles of methanol extracts of *Zanthoxylum usambarense* (Engl.) and *Rhamnus prinoides* (L'Hér)	
	Samson W. Kuria,	Kenyatta University	The use of heterogeneous catalyst prepared from environmentally benign materials in the transesterification of castor oil	

PARALLEL SESSION				
CBAS-2022				
Day 1				
Wednesday 16th NOVEMBER 2022				
Venue: BSSC Rm 14				
Zoom Link: Join Zoom Meeting https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyQERERU4ybHByVlovRkEyUT09				
COASTAL RESOURCES AND BLUE ECONOMY				
FISHERIES AND AQUACULTURE				
Moderator: Dr. Jemimah Simbauni – Chairperson Department of Zoological Sciences, Kenyatta University				
Rapporteur: Dr. Fredrick Tamooh - Department of Zoological Sciences, Kenyatta University				
Time	**Presenter**	**Affiliation**	**Title of Presentation**	**Format**

11.00 – 11.20	Dr. David Mirera		A forgotten "blue-chip" resource for economic and livelihood transformation: An overview of the mariculture impact and potential in Kenya	
11.20 – 11.40	Nicholas Gichuru	Kenya Marine and Fisheries Research Institute, Kisumu Research Centre	Gillnet selectivity and its' effects on population structure of two key species in Lake Victoria (Kenya)	
11-40 – 12.00	Okeri MN	Kenya Marine and Fisheries Research Institute, MOMBASA	Assessment of stock status of specific grunts, seabreams and snappers along the Kenyan coast	
12.00 – 12.20	Gladys M. Okemwa	Kenya Marine and Fisheries Research Institute	Marine capture fisheries and opportunities for blue economy growth	
12.20 – 12.40	Julie Bwoga	Ramogi Institute of Advanced Technology	Advancing Economic Opportunities for Women and Youth in the Blue Economy Sector; Contextual Analysis of Lake Victoria and Lake Turkana in Kenya	
12.40 – 1.00	Evelyne Ndiritu	CORDIO East Africa	Impact of increasing the mesh size of the traditional basket trap on catch rate and size structure of target species in Kenya	
PARALLEL SESSION				
CBAS-2022				
Day 2				
THURSDAY 17th NOVEMBER 2022				
COASTAL RESOURCES AND BLUE ECONOMY				
COASTAL ECOSYSTEMS				
Moderator: TBD				
Rapporteur: TBD				
Time	**Presenter**	**Affiliation**	**Title of Presentation**	**Format**
1100	Amina Juma Hamza	Kenya Marine and Fisheries Research Institute	Importance of coastal habitats in reducing exposure to coastal hazards in Kenya	
1120	Nyaega Lilian	Wetlands International Eastern Africa, Nairobi, Kenya	Opportunities for Big Data in Delivering Mangrove Restoration at Scale: Application of Global Mangrove Watch in Kenya	
1140	Kipkorir Sigi Lang'at	Kenya Marine and Fisheries Research Institute	Delivering the ocean climate actions: Building a blue carbon information base to facilitate and enhance the incorporation of blue carbon solutions into Kenya's climate commitments	

1200	Tamooh, Fredrick	Kenyatta University, Department of Zoological Sciences	Carbon stocks and stable isotopic signatures of soil organic sources across the mangroves of kenya	
1220	Cherono Shawlet	Wetlands International Eastern Africa	Beyond Planting - Adoption of Community Based Ecological Mangrove Restoration for Sustainable Mangrove Forest Management in Lamu and Tana River, Kenya	
1240	Nguu Josphat	Kenya Marine and Fisheries Research Institute	Trans-boundary mangrove dispersal in the Kenya-Tanzania coastal zone	

POSTER PRESENTATIONS 16TH AND 17TH NOVEMBER 2022				
4.00 – 5.00	Anthony M. Kamau	Kenyatta University, Zoological Sciences	Comparative growth performance of marine Tilapia (*Oreochromis niloticus, L.*) cultured in hapa nets in different stocking densities using animal and plant protein diets	
	Thuo, P.	Kenya Marine and Fisheries Research Institute	Performance of different protein ingredients (Fish Meal (FM), *Terebralia palustris* (TP), Black soldier fly larvae meal (BSFL) and Blood meal (BM) in the growth of Nile tilapia (*Orechromis niloticus*) under controlled aquarium tanks.	
	Cliford Justus Ochiel	Kenyatta University	Catch characteristics, gears, and fishing effort in reef fisheries: rabbit and emperor fish at Nyali landing site, Mombasa, Kenya.	
	Momanyi Bernard	Kenyatta University, Department of Zoological Sciences	Soil Organic Carbon Stocks in Degraded and Healthy Mangrove Formations in Tana River and Lamu Counties, Kenya	
	Teresia Nyambura Wacira	Department of Pure and Applied Sciences, Technical University of Mombasa	Molecular Characterization and Antibacterial Potential of Endophytic Fungal isolates from selected Mangroves along the Coastline of Kenya	
	Kioko Felix	Kenyatta University, Department of Environmental Sciences and Education,	Proposed adoption of energy efficient wood fuel-based cook stoves	

PARALLEL SESSION				
MATHMATICAL AND COMPUTATIONAL MODELLING				
DAY 2				
THURSDAY 17TH NOVEMBER 2022				
Venue: BSSC Rm 14				
Zoom Link: Join Zoom Meeting https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyOERERU4ybHBvVlovRkEyUT09				
MODERATOR: DR. WINIFRED MUTUKU – Department of Mathematics & Actuarial Science				
Rapporteurs: Dr. Opondo / Dr. Thommas Mutemi				
Time	**Presenter**	**Affiliation**	**Title of Presentation**	**Format**
2.00 - 2.15	Langson Jeremiah Kapata	Department of Mathematics and Applied Mathematics, Nelson Mandela University, South Africa	On the Fischer-Clifford matrices of an extension group and its quotient group	
2.15 - 2.30	Christopher Munyiwa Kaneba	School of Mathematics and Statistics, Zhengzhou University, P.R. China	Event-triggered H filtering for networked systems subject to deception cyber attacks	
2.30 - 2.45	Dr. Charles Wahogo	Mathematics, Statistics & Actuarial Science, Karatina University	Mathematical model of immune system responses during viral evolution	
2.45 - 3.00	Hiver Damien Ngoma	Department of Mathematics, Pan African University, Institute for Basic Science, Technology and Innovation, Nairobi, Kenya	Mathematical modelling and optimal control analysis of fractal covid-19 disease transmission dynamics with incubation and latent delay	
3.00 - 3.15	David Mwanzia Musyoka	Department of Mathematics and Actuarial Science, Kenyatta University, Kenya	On the character table and associated Fischer-Clifford matrices of an extension group 216:Sp8(2)	
3.15 - 3.30	RAEL JEROP	UNIVERSITY OF ELDORET	Mathematical modelling ofcovid-19 with vaccination strategy	
3.30 - 3.45	N N William	Department of Physics, Kenyatta University, Nairobi, Kenya	Investigation of the Effect of Absorption and Polarization Potentials in e+ - K (3p54s2) 2P Excitation using Distorted Wave Method	
3.45 - 4.00	Alex M. Marucha	Department of Physics, Kenyatta University, Nairobi, Kenya	The Role of Dynamic Absorption and Polarization Potentials in Relativistic Excitation of Noble Gases	

4.00 - 4.15	Jane Mbithe Muinde	Department of Biochemistry & Biotechnology, Kenyatta University, Nairobi, Kenya	Genetic diversity and forensic application of 21 autosomal STRs in GlobalFiler® Kit for the Kenyan population	
4.15 - 4.30	Kenneth Nguru	Department of Electrical Engineering, Technical University of Mombasa	Robustness analysis for a nonlinear gantry crane system using fuzzy logic controller	

PARALLEL SESSION				
SCIENCE & TECHNOLOGY FOR CLIMATE ADAPTATION & RESILIENCE				
Day 1				
Wednesday November 16th 2022				
Venue: BSSC Rm 14				
Zoom Link: Join Zoom Meeting https://us06web.zoom.us/j/82495743717?pwd=QlRwYzcyOERERU4ybHBvVlovRkEyUT09				
Session Chair: Dr. Paul Muoria – Chairperson Department of Plant Science/Dr. Adelaide Mutune – Dept of Plant Science				
Rapporteur: Dr. Rebecca Karanja/Dr. Elijah Karugia/ Dr/ Lydia Asande – Department of Plant Science				
Time	**Presenter**	**Affiliation**	**Title**	**Format**
2.00 - 2.15	DR. PATRICIA MATHABE	Royal Agricultural University - UK	The role of technology in agriculture	Online
2.15 - 2.30	Evans Mwasiaji	Kenyatta University	Genetically Modified Organisms as an intervention strategy in Agribusiness Sector for food security in Kenya in the context of climate change	Online
2.30 - 2.45	Miriti Lydiah	KALRO-KANDARA	Characterization of existing rural finance market that can enhance adoption of climate smart agricultural technologies in Kenya	
2.45 - 3.00	Eric Muthama	KENYATTA UNIVERSITY	Insect pest diversity and abundance as influenced by integrated pest management strategies on African indigenous vegetables and pulses in Murang'a County, Kenya	
3.00 - 3.15	Romano Okwi Elingit	KISII UNIVERSITY	Leadership challenges and mitigation on climate change in Kenya	
3.15 - 3.30	Musyoki A.M	KENYATTA UNIVERSITY	Polyculture: A bait for farm pollinator diversity in Murang'a county, Kenya	
3.30 - 3.45	Dr Grace Ngaruiya	KENYATTA UNIVERSITY	Analysing Adaptation Measures Against the Covid Pandemic And Climate Change At Oloolua Nature Trail In Karen, Nairobi County, Kenya	
3.45 - 4.00	Joseph Kamicha	KENYATTA UNIVERSITY	Assessment of impacts of the Highly Invasive *Urtica dioica* L. on Herbaceous Plants Diversity Across Kieni West, Nyeri County, Kenya	Online
POSTER PRESENTATION 16TH & 17TH NOVEMBER, 2022				
Moderator: Dr. Stanley Kimaru - Department of Plant Science Rapporteur: Dr. Samwel Muiruri – Department of Plant Science				

4.00 – 5.00 PM	Washington Wachira -poster	KENYATTA UNIVERSITY	Diurnal raptor diversity across three urban forests (Karura, Thogoto and Ngong Road Sanctuary) of the greater Nairobi, Kenya.	Poster
	Caroline Wahome	KENYATTA UNIVERSITY	The potential of low-cost tissue culture technology application in sustainable micro-propagation of banana seedlings in Kenya	Poster

PARALLEL SESSION				
SCIENCE & TECHNOLOGY FOR CLIMATE ADAPTATION AND RESILIENCE				
Day 2				
Thursday, 17th November, 2022				
Session Chair: Dr. Titus Magomere – Department of Biochemistry, Microbiology & Biotechnology				
Rapporteur: Dr. Grace Ngaruiya – Department of Plant Science				
Time	**Presenter**	**Affiliation**	**Title**	**Format**
11.00 - 11.15	Dr Paul Muoria	KENYATTA UNIVERSITY	Application of Ecosystem Service Assessment in Natural Resource Management at four Kenyan sites	
11.15 - 11.30	Julius Leiririo	UNIVERSITY OF EMBU	Nematode functional guilds in natural ecosystems and cropping systems under anthropogenic disturbance	
11.30 - 11.45	Prof Omwoyo	KENYATTA UNIVERSITY	Improvement of survival and growth of tissue culture banana (Musa spp.) seedlings for smallholder farmers through acclimatization using arbuscular mycorrhiza fungi	
11.45 - 12.00	Sheila Koech	ICIPE/ KENYATTA UNIVERSITY	Seasonal and Spatial Variability on abundance and diversity of honeybee corbicular pollen in three agrosystems in Kenya	
12.00 - 12.15	Mary Munyao	KENYATTA UNIVERSITY	Evaluation of Agronomic Traits Among Tropical Maize Under Salt Stress and Identification Of Responsible Saltol Quantitative Trait Locus	Online
12.15 - 12.30	Marystella N Wekhanya	KENYATTA UNIVERSITY	Assessment of Abundance and Diversity of Pollination Reservoirs for Wild Bees in Pumpkin Farms at Masinga and Yatta Sub-Counties	Online
12.30 - 12.45	Mohammed Adamu	FEDERAL COLLEGE OF EDUCATION YOLA, NIGERIA	Impact of Climate Change-Driven Floods as Perceived by Flood-Prone Residents of Yola Town-Adamawa State, Nigeria	Online
12.45 - 1.00	Abbaya Hassan Yohanna	Adamawa State University, Mubi, Adamawa State, Nigeria	Heat Stress in Dairy Cattle and Its Mitigation in The Climate Change Era: A Review	Online

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