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JOMO KENYATTA UNIVERSITY OF
AGRICULTURE AND TECHNOLOGY

QUALITY ASSURANCE BULLETIN

Volume 7, 2013

SETTING TRENDS IN HIGHER EDUCATION, RESEARCH AND INNOVATION

JOMO KENYATTA UNIVERSITY OF
AGRICULTURE AND TECHNOLOGY

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MOU between JKUAT and UN Habitat on 15th May, 2013. The partnerhip will lead to the development of a Graduate Academy at JKUAT that will spearhead training and research in urban studies. Urban Planning students will also benefit from internship opportunities at UN Habitat.

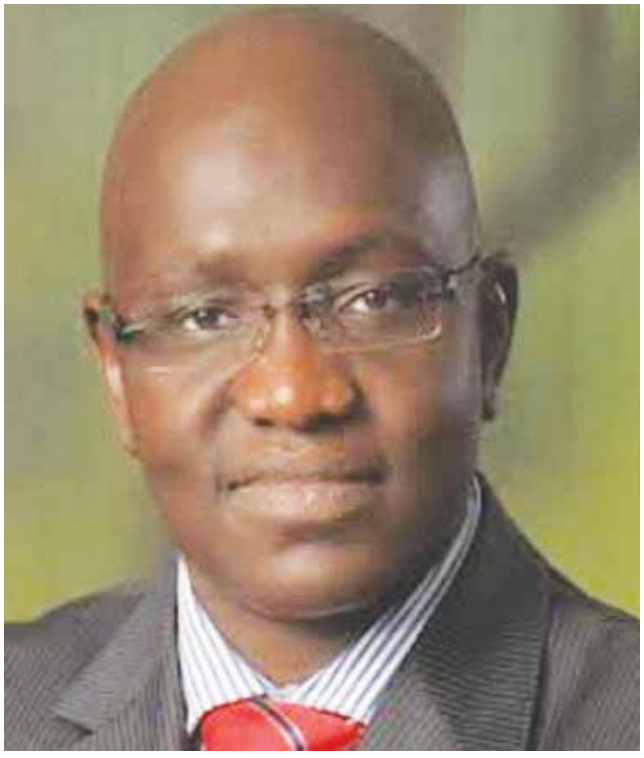
Compiled by:
Directorate of Academic Quality Assurance (DAQA)

VISION

A University of global excellence in Training, Research and Innovation for development

MISSION

To offer accessible quality training, research and innovation in order to produce leaders in the fields of Agriculture, Engineering, Technology, Enterprise Development, Built Environment, Health Sciences, Social Sciences and other Applied Sciences to suit the needs of a dynamic world



Dr. Ekuru Aukot
Chairman of Council

CONTENTS

MESSAGE FROM VICE CHANCELLOR

Jomo Kenyatta University of Agriculture and Technology is committed to ensuring academic quality through the implementation of good practices for quality assurance by applying standards and criteria formulated by competent authorities. It strives to develop an adequate internal quality assurance system that can be bench marked internationally. This can be achieved through self-assessment instruments for internal quality assurance of the teaching and learning processes spearheaded by the Directorate of Academic Quality Assurance (DAQA).

The University community too, continues to be encouraged to participate in research and innovation activities that focus on providing solutions for value addition to empower the society. For the said reasons, JKUAT has realized the importance of its programmes to the economic development of the country and the ever evolving multiple stakeholder community, which is why it has doubled its efforts in ensuring academic quality in order to remain relevant and competitive.

Further, the University continues to play a significant role in the realization of Vision 2030 by introducing relevant quality undergraduate programmes in various disciplines such as Medicine. It has also expressed interest in the assembling of Lap tops for standard one pupils starting next year. The University has also distinguished itself on the international scene as demonstrated by the consistent registration of an upward trend in Webmetrics ranking to stand at position 3,232 out of 21,250 institutions of higher learning worldwide. It was ranked 2787 on the excellent attribute, confirming its strides towards the achievement of global excellence in higher education, as well as the admission of post graduate students at the Pan African University Institute for Basic Science and Technology. In its bid to increase the provision and access of higher education to the masses, JKUAT has started Campuses in Kisumu, Arusha in Tanzania and Kigali in Rwanda among others.

It is for the same reasons that the production of this bulletin will serve as a testimony of commitment by JKUAT community in conducting research and publishing imbued with the spirit of knowledge sharing. I acknowledge the members of staff for providing their On-going research and publications details for the production of this bulletin. I believe the information provided herein will help improve the quality of teaching and learning. I take this opportunity to thank DAQA staff for their efforts in the improvement and timely production of this seventh volume of the Academic quality assurance bulletin.

Thank you.

Prof. Mabel Imbuga, Ph.D.
Vice Chancellor

MESSAGE FROM THE DEPUTY VICE CHANCELLOR ACADEMIC AFFAIRS

In higher education quality is a matter of negotiation between the academic institution and the stakeholders. Quality has different dimensions. It ranges from quality of inputs, process and outputs. Quality is about achieving our goals and aims in an efficient way, assuming that the goals and aims reflect the requirements of all our stakeholders in an adequate way. Jomo Kenyatta University of Agriculture and Technology strives to be a University of global excellence in training, research and innovation for development. This is only possible through emphasis on academic quality. Quality is about offering stakeholders what we promised. A programme should facilitate a balanced learning process; ensure that students are able to acquire such cognitive, effective and psychomotor skills that are consistent with educational goals and aspirations of JKUAT to global excellence.

At JKUAT quality means the value added to the students during education and training. It is the way of formulating learning outcomes to realizing the outcomes in the graduates. The value addition is hinged in the ability to offer accessible quality training, research and innovation in order to produce leaders in Agriculture, Engineering, Technology, Enterprise Development, Built Environment, Health and other Applied Sciences to suit the needs of a dynamic world. Here, students and staff are encouraged to participate in research that provides solutions to specific challenges that hinder full exploitation of available resources. Research and innovation are necessary for change and long term survival of the University in the competitive global market. Academic quality is also improved through research, innovation and information sharing. The University also assures academic quality through provision of adequate teaching and learning resources. For instance, automation of the library provides a wide range of teaching and research materials for information and knowledge sharing.

All members of staff at JKUAT are encouraged to participate in research and innovation. By doing so, the academic quality improves and the competitive edge of the university is maintained. Finally, my gratitude goes to the University community for their research and publication contribution and to DAQA for the production of this bulletin.

Prof. Romanus Odhiambo, Ph.D.
Deputy Vice Chancellor Academic Affairs.

MESSAGE FROM THE DIRECTOR

Quality Assurance System: Quality has always been part of the academic tradition. This has been driven by several factors which include: the labour markets' expectation of graduates of higher education with higher qualification with adequate Knowledge, skills and attitude important for the right job fulfillment; in Internalization and globalization of higher education, consumer protection, massification of higher education, society becoming more interested in higher education and increasing pressure for student exchange and international cooperation, and international recognition of qualification. Therefore need for a structured; well defined and documented framework of an internal quality assurance system in the University.

Internal quality assurance: are policies and mechanisms implemented in a an institution or programme to ensure that it is fulfilling its own purposes and meeting standards that apply to higher education in general or to the profession or discipline.

The main objective of an internal quality assurance system at a University is to continually promote and improve the quality of core activities and the institution as a whole. It should be able to monitor; evaluate and improve quality of the institution. Externally quality assurance include benchmarking activities and external quality assessments, that leads to accreditation (ensures that minimum standards and acquirements are met).

The confidence of students and other stakeholders is increased and maintained through quality assurance activities which ensure that academic programmes are well designed, regularly monitored and periodically reviewed to make them relevant and current. The quality assurance the programmes and degrees awarded include:

(a) Development and publication of explicit Expected outcomes;

(b) Systematic curriculum and programme design and content;

(c) Availability of appropriate learning resources;

(d) Formal programme approval procedures by the senate or equivalent;

(e) Specific needs for different modes of delivery (face to face, distance- learning, e-learning, full-time, part- time etc.)

(f) Programmes should be reviewed every cycle (Including external panels); and

(g) Involvement of stakeholders in curriculum development and review.

These among others have been addressed by the directorate in 2012 /2013 academic year. Thanks to all who participated in this activity in one way or the other, set trends for others to follow.

Prof. David M. Mulati, Ph.D.
Director, Directorate of Academic Quality Assurance

INTRODUCTION

1.0 Academic Quality Assurance

According to a UNESCO (2000) report, the quality of knowledge generated within higher education institutions, including universities, and its availability to the wider economy of a country have become increasingly critical to national competitiveness. Quality assurance, which is the continuous process of **evaluating, assessing**, **monitoring, guaranteeing, maintaining and improving** the quality of higher education systems, institutions or programmes is therefore critical to university education.Higher education must convince all stakeholders that they are doing their utmost best to prepare young people to fit in their communities and to lead productive lives.

1.1 High quality teaching

High quality teaching should be able to motivate open and flexible learning that will improve learning outcomes, assessment and recognition. These learning outcomes are statements about achievements and abilities that are expected to be acquired by students at the end of their academic programme: that is, knowledge and understanding; applying knowledge and understanding; making judgement; communicating skills; and learning skills.

Teaching that focuses only on knowledge and understanding, misses the opportunity to help students engage with their learning at a deeper level. Teachers should plan for and deliver coherent learning which accelerates progress, deepens knowledge and understanding and develops skills and learning behaviors.

Further more achievements, in all subjects should be determined by learning outcomes. This fundamental change is not yet fully percolated through to teaching and assessment. Therefore there is need for institutions at all levels of education and training to adapt in order to increase relevance of their teaching to students and the labour market and to widen switch between different educational and training path ways.

Quality higher education should help students build a wider base on which they can build ther future professional competencies. Once outside the institution of higher education, individuals should be able to to have their skills assessed, validated and recognised, providing a skilled profile for potential employers. Fast changes in technology, and generally in the way we work, make hard skills rapidily obsolete. Transversal skills or soft skills, such as the ability to think critically, take initiatives, solve problems and work collaboratively will prepare individuals for today's varied and unpredictable career paths.

High quality teaching enhances creative skills and learning outcomes such as:

i. Complex thinking i.e. problem solving, reciprocal learning, experimental learning.

ii. Social skills and participatory learning.

iii. Personal shaping of knowledge i.e. progressive mastery, individual pacing, self correction, critical reflection, empowered self direction and internal drive/motivation.

DAQA's mandate is to check the quality of the teaching administered to the students by the lecturers and the university at large.This is done though various activities of the directorate outlined below:

1.2 Student Lecturer Evaluation

We believe in the University that academic staff are employed not just to teach, but to teach well, to a high professional standard. At the end of every semester, pre-formatted questionnaires are issued to all students. The filled questionnaires are then collected and analyzed at DAQA office against four (4) parameters: course requirements, attendance and teaching efficiency, course conduct and tests and evaluation. The results are summarized in reports that are delivered to the Deans and Directors for action.

This exercise has enabled the university to come up with innovative ways of rewarding lecturers based on their performance. In the 2011/2012 academic year a total of 933 lecturers were evaluated by students. Those considered for recognition were lecturers with a minimum of 15 students in the course units and those who taught in May/ August and September/ December 2012 semesters.

The best lecturer had a score of 4.80 (out of a five) from the Institute of Tropical Medicine & Infectious Diseases (ITROMID). The list of the best performing lecturer is indicated in Table 1. The best performing Faculty/ School/ Institute was ITROMID with a score of 4.41. There was a tie with the Institute of Energy and Environmental Technology (IEET); however ITROMID emerged the winner because they had a higher number of students (3328 students). This list of the best performing Faculty/ School/Institute is summarized under Table 2.

Table 1: Best performing lecturer in the 2010/2011 academic year student-lecturer evaluation

S/N	FACULTY/ SCHOOL/ INSTITUTE	SCORE
1	ITROMID	4.80
2	AGRICULTURE	4.74
3	SCIENCE	4.56
4	IEET	4.50
5	SHRD	4.49
6	ICSIT	4.49
7	ENG	4.42
8	SABS	4.40

Table 2: Best performing Faculty/School/ Institute in the 2010/2011 academic year student-lecturer evaluation

S/N	FACULTY/SCHOOL/ INSTITUTE	SCORE	TOTAL STUDENT POPULATION (SEM 1 AND SEM 2)
1	ITROMID	4.41	3328
2	IEET	4.41	355
3	IBR	4.40	99
4	AGRICUTURE	4.24	5995
5	SCIENCE	4.18	8077
6	ADP	4.13	9468
7	SHRD	4.09	10,734
8	ENG	4.07	24,510
9	ICSIT	*3.98*	7884
10	SABS	*3.98*	5576

1.3 Annual audits in collaborating institutions

The University has been collaborating with various educational institutions in Kenya for the last ten years through the auspices of the School of Distance and E-Learning (SoDEL).There are 33 programmes offered at 15 University-approved centres.

1.4 Programmes offered at SoDEL centres

A total of thirty three (33) programmes are offered at the SoDEL centres. These are: Bachelors degrees in: Information Technology (IT), Computer Technology, Business and Information Technology, Commerce, Commerce and Business Administration, Business and Office Management, Cooperative Business, Medical Laboratory Sciences, Public Health, Purchasing and Supplies Management, Diploma programmes in: Information Technology, Computer Technology, Management and Information Technology, Business and Information Technology, Purchasing and Supplies Management, Business Administration, Public Relations, Advertising and Sales, Mass Communication, Clinical Medicine, HIV/AIDS Management, Community Development, Human Resource Management and Microfinance, Certificate courses in: IT, Management and Information Technology and Purchasing & Supplies Management, HIV/AIDS Management. Post graduate degrees in: MSc Finance, MSc Finance & Economics, MSc public Policy and Analysis, MSc Economic Policy & Analysis and PGD Business Science.

1.5 List of SoDEL centres

The names of the 15 SoDEL centres are: Nairobi Institute of Business Studies, Nairobi Institute of Technology, Regional Centre for Mapping of Resources for Development, Inoorero University, Zetech College, Embu College, Cooperative University College, Kenya Defence Forces Technical College, Nairobi Institute of Business Studies, Muranga University College of Technology, Alphax College, Kenya School of Monetary Studies, AIRADS, United Africa College, Lake Institute of Tropical Medicine.

1.6 Objectives of auditing SoDEL centres

To ensure that quality of teaching is maintained; DAQA conducts scheduled audit visits. The objectives of the visits are:

1. To ensure that qualified and experienced resource persons servicing units at the affiliated institutions and approved centres are as per University policy.
2. To ensure that academic resources availed to the students are relevant, adequate and meet University requirements.
3. To ensure that there is provision of sufficient facilities at the affiliated institutions and approved centres for students' welfare.
4. To ensure teaching is conducted in line with the syllabus.

1.7 Quality assurance visit general findings

Arrangements were made to visit all centres that offer JKUAT programmes to find out whether quality requirements were adhered to. During the visit, it was established that students' population was reducing across all the centres. The following positive findings and areas for improvements were gathered in most centres. Students appreciated JKUAT team for visiting centres to check on the quality of teaching and learning.

1. Most students expressed satisfaction with the syllabus coverage.
2. Student supervision during attachment was well coordinated.
3. Most centres had arranged with private companies to provide medical care for the students.
4. Most student unions were operational.
5. Students had access to recreational facilities.

1.8 Areas for improvement

1. There was need to speed up processing of results slips and issuance of transcripts.
2. Infrastructure such as library space required expansion in some of the centres.
3. Internet bandwidth and access points need to be increased.
4. In order to boost their library collection; centres were advised to liaise with JKUAT library for access to e resources.

1.9 Monitoring research

Research is an essential to improving quality of academic programmes. The Directorate collects information on research activities in form of publications and On-going research. The information is presented according to Departments.

SECTION A: COMPENDIUM OF ON-GOING RESEARCH ACTIVITIES

1 COLLEGE OF ENGINEERING AND TECHNOLOGY (COETEC)

1.0 DEPARTMENT OF GEOMATIC ENGINEERING AND GEOSPATIAL INFORMATION SYSTEMS

Topic:	An Automatic System for Extracting Vehicle Registration Number, Class, Number of Axles, and Colour for Vehicular Management
Researcher(s):	Thomas G. Ngigi
Status of Research:	On-going
Topic:	Foolproof automated Intensity-Based Mosaicking of Digital Images
Researcher(s):	Thomas G. Ngigi
Status of Research:	On-going
Topic:	Mix-unmix Pan sharpener: New Pan-sharpening Method Based on Mixing Multispectral Bands and Unmixing Panchromatic Band
Researcher(s):	Thomas G. Ngigi and Charles Ndegwa
Status of Research:	On-going
Topic:	Towards Achieving Kenya Vision 2030: Production of 3D Digital Topographical / Thematic Maps of Kenya Case study: Kiambu County
Researcher(s):	Thomas Ngigi and Edward Waithaka
Status of Research:	On-going
Topic:	Geographical Scale Replicability of the Mix-unmix Classifier
Researcher(s):	Thomas G. Ngigi, Ryutaro Tateishi, David Kuria, Moses Gachari and Edward Waithaka
Status of Research:	On-going
Topic:	Mapping Locations of Nesting Sites of the Indian House Crow in Mombasa
Researcher(s):	Muye Chongomwa, Thomas Ngigi and David Kuria
Status of Research:	On-going
Topic:	Precise determination of geoid model and reference height system for the establishment of modern vertical geodetic datum.
Researcher(s):	Patroba Achola Odera
Status of Research:	On-going
Topic:	Use of PP-GIS for Cultural Diversity Management and Development in Kenya: A case Study of Emuhaya Constituency.
Researcher(s):	Fanon Ananda, Moses M. Ngigi, David N. Kuria
Status of Research:	On-going
Topic:	Extent and effects of climate change through GIS based land use/cover change and wildlife distribution analysis in the Mara Ecosystem
Researcher(s):	Moses M. Ngigi, Charles N. Mundia, Eunice Wanjiku Nduati
Status of Research:	On-going

Topic:	Development of A Web-based Water Resources Management system
Researcher(s):	Magondu, Moffat Githiro, Moses M. Ngigi
Status of Research:	On-going

1.2 DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

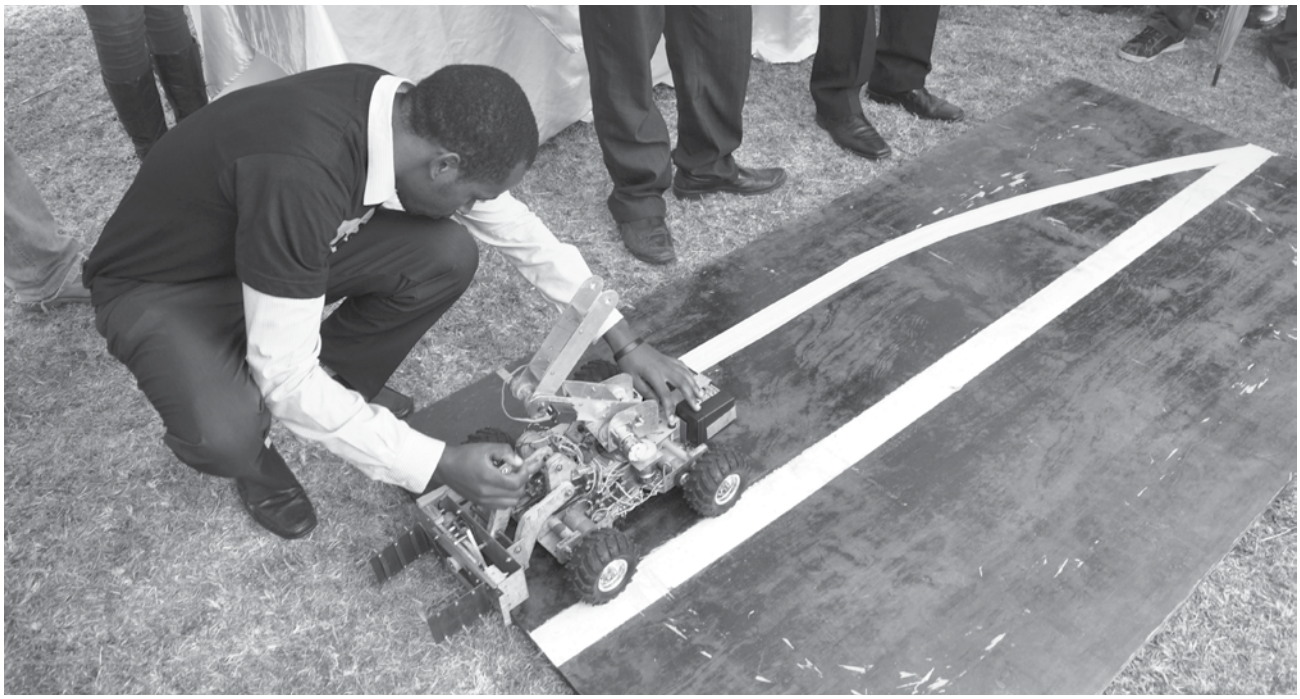
Topic:	ANFIS-Based Multi-Antenna Techniques for Quality of Service (QoS) Improvement in Wireless Communication Networks.
Researcher(s):	Muiga Rugara, Stephen Musyoki, P. K. Kihato
Status of Research:	On-going
Topic:	Impact of Integrating Wind Power Generation on the Transient Stability of the Kenyan Power System
Researcher(s):	Orenge S. R., Kaberere K. K. and Muriithi C. M.
Status of Research:	On-going
Topic:	Evaluation of power systems congestion using nodal pricing and use of Distributed Generation in congestion management and loss reduction
Researcher(s):	Muisyo Irene, Kaberere Keren, Mureithi Christopher
Status of Research:	On-going
Topic:	Dynamic Voltage Stability Analysis of the Kenya Power System Using Decision Trees
Researcher(s):	Njoroge Samson Njuguna, Muriithi Christopher, Ngoo Livingstone
Status of Research:	On-going
Topic:	Design and Development of Microcontroller Based Motor Vehicle Speed Governor with Magnetostrictive Amorphous Wire as Speed Sensor
Researcher(s):	Mercy Kiio, John Nderu, Stanley Kamau
Status of Research:	On-going
Topic:	Design and Sizing of a Grid Connected Photovoltaic System for Enhancement of Electrical Power Supply in Kenya: A Case Study of Nairobi Embakasi Suburb
Researcher(s):	G.G. Kidegho, K. K. Kaberere, M.S. Mbogho
Status of the Research:	On-going
Topic:	Design and Sizing of a JKUAT Solar Photovoltaic Battery Charge Controller- Suitable for use in Rural Solar Home Systems of Kenya
Researcher(s):	G.G. Kidegho, Tsutomu Ohzuku (Osaka City University), Francis Njoka
Status of Research:	On-going
Topic:	Underdetermined Blind Speech De-Noising for Enhanced Teleconferencing Using Machine Intelligence.
Researcher(s):	Denis Ombati, E N Ndun'gu and L. M. Ngoo
Status of Research:	On-going
Topic:	Electronic Load Controller for Mini/Micro Hydro Power Generation
Researcher(s):	C. K. Kitur, J. N. Nderu, K. Kaberere
Status of Research:	On-going

Topic:	Static Voltage Stability Analysis of Nairobi Area Power Distribution Network
Researcher(s):	S. Oketch, C. M. Muriithi, K. K. Kaberere
Status of Research:	On-going
Topic:	Adaptive Real-Time and Virtual Monocular Car Vision using Modular Artificial Neural Networks
Researcher(s):	Inno Odira, P. K. Kihato, S. I. Kamau
Status of Research:	On-going
Topic:	Application of Neural Network for Short Term Load Forecasting
Researcher(s):	Ireri T. Gichovi, N. O. Abungu, D. K. Murage
Status of Research:	On-going
Topic:	Analysis and Design of Electrical machines Speed monitoring systems using amorphous wires
Researcher(s):	J.N. Nderu, Dr. P.K. Kihato, A. Muhia
Status of Research:	On-going
Topic:	Performance Analysis of a Generator Operating on Dual Fuel Comprising of Biogas and Diesel
Researcher(s):	Nelson Muchiri Gachoki, Peterson K. Hinga, Njeri S. Kahiu, Stephen Wanjii
Status of Research:	On-going
Topic:	Optimization of Base Station Location in 3G Networks Using Metaheuristics
Researcher(s):	A. O. Onim, P. K. Kihato, S. Musyoki
Status of Research:	On-going
Topic:	Optimal beamforming using an improved version of the particle swarm optimization algorithm in adaptive antenna array systems
Researcher(s):	Robert Macharia Maina, Kibet P. Langat, Dr. P. K. Kihato
Status of Research:	On-going
Topic:	1.Capacity Development for promoting Rural Electrification Using Renewable Energy. 2. Small Hydro Energy 3. Renewable Energy-Laboratory for wind Energy Conversion.
Researcher(s):	Nemoto (AIT), S. Maranga, R. Kinyua, P. Anangi, Doreen, Njihia.
Status of Research:	*O*n-going
Topic:	Advanced Power Distribution Systems & Insulating Materials
Researcher(s):	Eng. W.K. Mbugua
Status of Research:	On-going

1.2 DEPARTMENT OF BIOMECHANICAL AND ENVIRONMENTAL ENGINEERING

Topic:	Exploring the Utility of Low Cost Seed Oils as a Potential Feedstock for Biodiesel Fuel Production
Researcher(s):	Shitanda S; Anyangu A
Status of Research:	On-going
Topic:	Design, Performance Testing and Commercialization of Green House Solar Dryer with Forced Convection
Researcher(s):	Njuguna Ndirangu; Urbanus N. Mutwiwa; Erick Rono
Status of Research:	On-going
Topic:	Reservoir Sedimentation Measurement and Assessment in Kenya Pilot Project
Researcher(s):	J. Sang, J.M. Gathenya, P.G. Home, U.N. Mutwiwa, J Dunbar, P. Allen, Moriasi, Steiner
Status of Research:	On-going.
Topic:	Enhancement of Mango Production and Value Addition – Upper Athi River Basin
Researcher(s):	Sila D; Mutwiwa U N; Wanjala F; Kaluli J W
Status of Research:	On-going
Topic:	Exploration of Inland and Marine Microalgae for Biofuel Production.
Researcher(s):	Mutwiwa U N; Ondimu S; Odalo J; Bosire J; Wangai L
Status of Research:	On-going.
Topic:	Comparison of Water Savings of Paddy Rice under System of Rice Intensification (SRI) growing rice in Mwea, Kenya
Researcher(s):	Ndiiri J A; Mati B M; Home P G; Odongo B; Uphoff N
Status of research:	On-going
Topic:	The economic benefits of Paddy Rice under System of Rice Intensification (SRI) growing rice in Mwea, Kenya
Researcher(s):	Ndiiri J A; Mati B M; Home P G; Odongo B; Uphoff N
Status of research:	On-going
Topic:	Determining the Scientific Basis for Up-Scaling the System of Rice Intensification (SRI), for Increased Rice Production in Kenya
Researcher(s):	Bancy M. M; Wanjogu R; Odongo B; Home P G
Status of Research:	On-going
Topic:	Evaluation of capillary wicks for use in irrigation for intensive horticultural crop production in Kenya
Researcher(s):	J.M. Wesonga; P.W. Masinde; F.K. Ombwara; P.G. Home
Status of research:	On-going
Topic:	Increasing rice productivity in Kenya
Researcher(s):	E.M. Kahang'i; H. Murage; P.G. Home; R. Wanjogu, and others
Status of research:	On-going
Topic:	Development and performance testing of prototype rotary weeder applicable to system of rice intensification
Researcher(s):	P.G. Home, J.T. Makanga
Status:	On-going

Topic:	Design and Development of Rice Combine harvester for Small Holder Farmers in Kenya
Researcher(s):	Kanali C; Mailutha J; Home P; Dr. Kituu G; Nduati C; Mulamu
Status of Research:	On-going
Topic:	Gasifying and briquetting rice husks as an energy source
Researcher(s):	I.N. Onchoke, B. Mutwiwa, M. Hunja, X. Ochieng
Status of Research:	On-going
Topic:	Development of system for producer gas powered CI engine
Researcher(s):	I.N. Onchoke, B.Mutwiwa, A. Anyangu, G. Wanjala
Status of Research:	On-going
Topic:	Development of a Decision Support Tool for Sustainable land Management technologies for Enhanced Eco-system Services and Climate Change Adaptation in the Upper Tana Catchment
Researcher(s):	Kahiga P M; Gathenya G M; Home P G; Wamuongo J W
Status:	On-going



An engineering student demonstrating a robot at a recent exhibition

1.3 DEPARTMENT OF MECHATRONIC ENGINEERING

Topic:	Design and Development of a precision blow molding machine
Researcher(s):	Kabini S. K., Njiri J. G., Ikua B.W., D'oketch J. A.
Status of Research:	On-going
Topic:	Optimization of Pocket Milling Tool Path for improved tool life and machining time
Researcher(s):	Wanja L., Nyakoe G. N., Ikua B. W.
Status of Research:	On-going

Topic:	Neuro-fuzzy modeling and control of Nd: YAG Laser Percussion drilling of nickel based super alloys.
Researcher(s):	Ruthandi M. M., Nyakoe G. N., Ikua B. W., Keraita J. N.
Status of Research:	On-going
Topic:	Design and development of a CO2 laser beam delivery system for use in research and laser machining demonstration
Researcher(s):	Gituku E. W., Ikua B. W., Nyakoe G. N.
Status of Research:	On-going
Topic:	Development of an Integrated Maintenance Optimization Model for Improving Kenyan Maintenance Practices.
Researcher(s):	Muchiri, A.K., Ikua B.W., Kibicho, K., Muchiri, P.N.
Status of Research:	On-going
Topic:	Study on Effectiveness of Magnetic Field Assisted Flushing in Improvement of Process Parameters in Electrical Discharge Machining
Researcher(s):	Macben M.M., Ikua B.W., Nyakoe G. N.
Status of Research:	On-going
Topic:	Development and Performance Analysis of a vision-based guidance and navigation system for an autonomous mobile robot
Researcher(s):	Oroko J., Nyakoe G. N., Ikua B. W.
Status of Research:	On-going
Topic:	Development of a Vision Guided Autonomous Mobile Robot with Wireless Communication Capability.
Researcher(s):	Nyakoe G. N., Ikua B. W.
Status of Research:	On-going
Topic:	Design and Development of an Electro Discharge Machine
Researcher(s):	Ikua B. W., Nyakoe G. N., Keraita J. N.
Status of Research:	On-going

2. COHES (COLLEGE OF HEALTH SCIENCES)

2.0 DEPARTMENT OF BIOCHEMISTRY

Topic:	Characterization of tricorn protease from *Trypanosoma brucei brucei*
Researcher(s):	Florence Atieno Ngo'nga, Steven Ger Nyanjom, Peter Onyimbo Lomo, Vincent Owino Adunga and Daniel Masiga
Status of Research:	On-going
Topic:	Genomic and Proteomic Characterization of Olfactory Proteins in *Glossina fuscipes fuscipes* - Tsetse Fly Vectors of Human Trypanosomiasis
Researcher(s):	Steven Ger Nyanjom, Peter Onyimbo Lomo, Ahmed Hassanali, Paul O. Mireji and Daniel Masiga
Status of Research:	On-going
Topic:	Chemotherapy of Co-infection of *Leishmania major* and *Schistosoma mansoni* in Balb/C mice
Researcher(s):	Khayeka C. Wandabwa, Hellen L. Kutima, Venny C. S. Nyambati and Christopher O. Anjili.
Status of Research:	On-going
Topic:	Polymorphisms in *Pfcrt* gene and the effects on antimalarial drug resistance in Kenyan *Plasmodium falciparum* isolates of 2008-2011.
Researcher(s):	Luicer A. I. Olubayo, Jacob D. Johnsons, Wallace D. Bulimo, Mabel O. Imbuga and Venny C. S. Nyambati
Status of Research:	On-going
Topic:	The Application of Forensic Entomology in Post mortem Analysis in Pigs.
Researcher(s):	Maxwell E. Ong'ura, Frederick M. Wanjala, Judy M. Inyangala, Christopher O. Anjili and Venny C. S. Nyambati
Status of Research:	On-going
Topic:	Analysis of antibody clearance mechanism as a potential virulence factor in African trypanosomes
Researcher(s):	Joel Ltilitan Bargul, Francis McOdimba, Daniel Masiga, Markus Engstler
Status of Research:	On-going
Topic:	Chemical synthesis and anti-malarial evaluation of hybrid drugs using artemisins, quinolines, anilines and cyclopentane diols pharmacophores as scaffolds
Researcher(s):	Nganga J K, Kinyua J K, Kariuki D, Kirira P G and Muregi F W
Status of Research:	On-going
Topic:	Evaluation of meat tenderizing qualities of proteinases from Kenyan papaya fruits
Researcher(s):	Kariuki D, Wanzala F K, Sila D and Metzner D
Status of Research:	On-going
Topic:	Soil fertility assessment in tea growing areas of Kenya: working towards improved application of fertilizers in tea farms.
Researcher(s):	Kinyua J K, Kariuki D W, Njue M, Karanja S and Muhoho S
Status of Research:	On-going

Topic:	Antimicrobial studies and other pharmacological and health benefits of tea
Researcher(s):	Obwoge J, Magoma G, Kinyua JK and Kariuki DW
Status of Research:	On-going
Topic:	Assessment of catechins and polyphenols as parameters of tea quality in Kisii, Muranga and Meru ecological zones.
Researcher(s):	Mangenya TM, Kinyua JK, Kariuki DW, Magiri E and Obanda M
Status of Research:	On-going
Topic:	Bio-prospecting for effective antibiotics from selected Kenyan medicinal plants against *Salmonella typhimurium*
Researcher(s):	Ogoti PM, Magiri E, Magoma G and Kariuki DW
Status of Research:	On-going
Topic:	The feasibility of using Dipeptidyl peptidase IV/CD26 as a surrogate marker in monitoring anti-retroviral drug therapy.
Researcher(s):	Maina K Ayub, Korir JK and Kariuki DW
Status of Research:	On-going
Topic:	Phenotypic and molecular characterization of Kenyan basmati rice variants lines for germplasm Preservation.
Researcher(s):	Mwendwa FM, Magiri E, Kariuki DW, Kinyua JK and Ger SN
Status of Research:	On-going
Topic:	Studies on Vitamin D levels in serum of HIV infected patients: Their effect on progression towards AIDS
Researcher(s):	Gichuhi CW, Kariuki DW and Nyerere E
Status of Research:	On-going
Topic:	Experimental and in silico drug design against *Leishmania major*
Researcher(s):	Mutoro C, Kinyua J K, Kariuki DW and Ng'ang'a J K
Status of Research:	On-going
Topic:	Experimental and Computational Drug Design against *Schistosoma mansoni*
Researcher(s):	Njuguna J, Kinyua JK, Kariuki DW and Ger SN
Status of Research:	On-going
Topic:	Determination of flavour and aroma associated genes in *C sinensis* clones grown in Meru and Kisii Counties.
Researcher(s):	Maina SW, Magiri E, Muhoho S, Kinyua JK and Kariuki DW
Status of Research:	On-going
Topic:	Molecular and culture based analysis of soil bacteria in Ngere tea catchment area of Muranga county, Kenya
Researcher(s):	Wafula EN, Kinyua JK, Muigai A, Mwirichia R and Kariuki DW
Status of Research:	On-going
Topic:	Identification of soil nematodes in Ngere tea catchment area of Muranga County, Kenya
Researcher(s):	Kibet TK, Kinyua JK, Mamati EG, Onguso JM and Kariuki DW
Status of Research:	On-going
Topic:	Experimental and in silico drug design against *Plasmodium*

	falciparum
Researcher(s):	Ng'ong'a F, Kinyua J K, Kariuki D W and Ng'ang'a J K
Status of Research:	On-going
Topic:	Effects of *Agaricus bisporus* and Vitamin E on mice fed with Methionine Choline Deficient diet
Researcher(s):	Makau CM and Kariuki DW
Status of Research:	On-going
Topic:	In Silico modification of Allyl propyl disulfide to improve its anti-diabetic characteristics
Researcher(s):	Nassir A and Kariuki DW
Status of Research:	On-going
Topic:	Qualitative analysis of bioactive compounds from the ex-Embu variety of Morus Alba plant grown in Kenya.
Researcher(s):	Muthoni EK and Kariuki DW
Status of Research:	On-going

3.0 FACULTY OF SCIENCE

3.1 DEPARTMENT OF CHEMISTRY

Topic: Environmentally cleaner utilization of cashew nut shell liquid (CNSL) as an industrial raw material in Kenya.
Researcher(s): Patrick M. Mwangi
Status of Research: On-going

Students at a practical session

3.2 DEPARTMENT OF PHYSICS

Topic: A Feasibility study of clean development mechanism for Photovoltaic and improved cook stores utilization in rural Kenya
Researcher(s): Micheal Wekesa and Mulati D.M.
Status of Research: On-going

Topic: Development of sustainable business model for a PV solar Home System
Researcher(s): Martin Wanderi and Mulati D.M.
Status of Research: On-going

Topic: Determination of the performance life cycle and disposal of photovoltaic systems storage batteries in Kenya
Researcher(s): Dickson G. Kivindu and Mulati D.M.
Status of Research: On-going

3.3 DEPARTMENT OF ZOOLOGY

Topic:	Field release and recovery of *Liriomyza* leaf miner endoparasitoid, *Phaedrotoma scabriventris* NIXON (HYMENOPTERA: BRACONIDAE) in vegetable production systems of Kenya
Researcher(s):	Foba C.N., Lagat Z.O., Gitonga L.M, and Fiaboe K.K
Status of Research:	On-going
Topic:	Migration pattern of *Tetranychus evansi* and *Phytoseiulus longipes* on *Solanum scabrum* and its implications on acaricide treated-net management technique
Researcher(s):	Kungu M., Lagat Z.O., Gitonga L., S. Sevgan and Fiaboe K.K
Status of Research:	On-going
Topic:	An integrated pest management approach of Amaranth insect pests in Buuri District, Meru County
Researcher(s):	Kagali R., Lagat Z.O., Muya, S.M. and Kioko E.
Status of Research:	On-going
Topic:	An integrated approach towards management of Russian Wheat Aphid, *Diuraphis noxia* KURDJUMOV (HOMOPTERA: APHIDIDAE) in Kenya
Researcher(s):	Mwangi S.N., Gitonga, L.M., Marina, J., Lagat Z.O. and Mehmet C.
Status of Research:	On-going
Topic:	Clinical, demographic and hematological characteristics of ferbile children in a malaria endemic region: changing patterns in the era of HIV
Researcher(s):	Marete I.K., Osiemo-Lagat Z.,Simba J.M., Obala A.I.,Marithi A.I.,Chumba J.C., and Mutugi M.
Status of Research:	On-going
Topic:	Termitomyces diversity in Taita Taveta County, Kenya
Researcher(s):	Kujah J., Makonde H., Osiemo-Lagat Z. and Hamadi I.Boga
Status of Research:	On-going
Topic:	Assessment of dynamics of nitrogen species and microsymbionts in soils, guts and nest materials of termites.
Researcher(s):	Muwawa E., Budambula, N., Osiemo-Lagat Z. and Hamadi I.Boga
Status of Research:	On-going
Topic:	The impact of farming practices on Avifauna diversity in Masaba South District, Western Kenya
Researcher(s):	Obiri M., Osiemo-Lagat Z., Mwangi P., Njoroge P. and Ochora J.
Status of Research:	On-going
Topic:	Ecological characteristics of tree frogs in the rehabilitated Bamburi quarries, Mombasa, Kenya
Researcher(s):	Maugo P., Osiemo-Lagat Z., Ng'endo R., Ochora J., and Malonza P.
Status of Research:	On-going
Topic:	Diversity and abundance of Chameleons in Kisii County, Kenya
Researcher(s):	Ongoto H., Osiemo-Lagat Z., and Ng'endo R.
Status of Research:	On-going

Topic:	Growth performance of Singida Tilapia, *Oreochromis esculentus* on different feeding regimes under aquaculture system in Western Kenya
Researcher(s):	Muga E., Osiemo-Lagat Z., Ochora J. and Nyanchiri E
Status of Research:	On-going
Topic:	Prospects of endophytically-inoculated bean plants in the control of leaf miner flies in the field
Researcher(s):	Gathage J., Osiemo-Lagat Z., Kutima H. and Fiaboe K.K
Status of Research:	On-going
Topic:	Host specificity of *Diaeretiella rapae* and *Aphidius colemani* on key crucifers and okra aphid pests
Researcher(s):	Wanambisi S., Osiemo-Lagat Z., Kutima H. and Mohammed S
Status of Research:	On-going
Topic:	Characterization of Cytolytic T cells in *Theireliaparva* infection
Researcher(s):	Rebecca Waihenya, Dr. SteinnaLucilla, Jerome Mwendwa and Phillip Toye
Status of Research:	On-going
Topic:	Development of Rodenticide from Yellow Oleander Extract
Researcher(s):	J. M. Keriko, Rebecca Waihenya
Status of Research:	On-going
Topic:	An Integrated pest management approach to insects pests of Amaranth in Meru County, Kenya
Researcher(s):	Kagali Robert Nesta, Zippporah Lagat, Muya Shadrack, Kioko Esther
Status of Research:	On-going
Topic:	Ecological impacts of invasive *Lantana camara* on floral divers in Nairobi National Park, Kenya
Researcher(s):	Yusuf Robert Simba. Abel Kamweya, Mwangi et al.
Status of Research:	On-going
Topic:	Effects of anthropogenic activities on abundance of the orchid *Polystachya fusiformis* in Manga Range Ecosystem, Kisii Kenya
Researcher(s):	Evans Mageto, Abel Kamweya; Ochora, J.
Status of Research:	On-going
Topic:	HIV infection risk factors among Child Domestic Workers in Nairobi, Kenya
Researcher(s):	Samuel Munyuwiny, Abel Kamweya, et al
Status of Research:	On-going
Topic:	Diagnostic Procedures, Epidemiology and Genetic Diversity of Cryptosporidiosis in Bungoma District, Kenya
Researcher(s):	Eric WekesaWasike, Helen Kutima, Shadrack Muya
Status of Research:	On-going
Topic:	Assessment of the Burden of Cystic Echinococcosis in Northern Turkana-Kenya
Researcher(s):	Joseph Kere Odero, Japhet Kithinji Magambo, Helen Lyanda Kutima, Lucy Ndahi and Francis Kimani Njonge
Status of Research:	On-going

Topic:	Reproductive Biology of the Marbled parrotfish, Leptoscarusvaigiensis (Quoy and Gaimard, 1824) along fishing gradient on Kenyan Coast
Researcher(s):	Gamoe L., Albert1, Kaunda-Arara Boaz, Wakibia Joseph, Shadrack Muya
Status of Research:	On-going
Topic:	Molecular Characterization and Barcoding of Varroa Mites and Varroa Mites Associated Viruses in Kenyan Honey Bee Colonies
Researcher(s):	Irene Awino Onyango, Shadrack Muya, Muo Kasina, Helen Kutima
Status of Research:	On-going
Topic:	Development of DNA markers for use in wildlife forensics to enhance wildlife protection in Kenya
Researcher(s):	Julius Kinuthia, Erastus Gatebe, Shadrack Muya, Charles Kimwele
Status of Research:	On-going
Topic:	An Integrated Pest Management Approach of Amaranth Insect Pests in Meru County Kenya
Researcher(s):	Kagali Robert Nesta, Zipporah Osiemo, Shadrack Muya, Esther Kioko
Status of Research:	On-going
Topic:	Effects of Land Use on Butterfly Diversity and Conservation Status in Kisii Highlands Kenya
Researcher(s):	Rose Sagwe, Shadrack M. Muya, Evans Mwangi, Rosebella O. Maranga
Status of Research:	On going
Topic:	Development of a bioinformatic tool to manage Kenya rhinoceros population genetics: (FaruGenBiT)
Researcher(s):	Shadrack M. Muya, A. W-T Muigai, Cindy Harper, B. Okita-Ouma, L Kariuki, M O Otiende and F Gakuya
Status of Research:	On-going
Topic:	Ligand-receptor process in pregnant baboons (*Papioanubis*) infected with *Plasmodium knowlesi*
Researcher(s):	Joab Nyamagiri Ogembo, Dr. Rebecca Waihenya, Dr. Lucy Ochola, Dr. Hastings Ozwara
Status of Research:	On-going
Topic:	Exploring Natural Ways to Exceptional Long Health span – The Naked Mole-Rat Case: Preliminary Genetic Diversity Survey in Kenya
Researcher(s):	Shadrack M. Muya, Anne W Muigai, Mercy W Mwaniki, Matthias Platzer, Thomas Bernd Hildebrandt, Karol Szafranski
Status of Research:	On-going
Topic:	Performance and quality assessment of laboratory diagnosis of malaria in public hospitals in Busia County, Kenya.
Researcher(s):	Josephat Mulwa Yundu, Helen Lydiah Kutima and Charles Mwandawiro
Status of Research:	On going
Topic:	Evaluation of the impact of strengthening community health services on community usage of malaria control interventions in Migori County
Researcher(s):	Athuman Nyae Chiguzo, Evans Mathenge and Helen L. Kutima
Status of Research:	On going

Topic:	Host Specificity of *Diaeretiella rapae* & *Aphidius colemani* on key crucifers and okra aphid pests (*Brevicoryne brassicae, Lipaphis pseudobrassicae & Aphis gossypi*).
Researcher(s):	Sylvia Khakasa Rabecca Wanambisi, Samira Mohammed, Zipporah Osiemo Lagat and Helen Lydia Kutima
Status of Research:	On going
Topic:	Uptake of integrated malaria management approach and its impact on the burden of malaria in Ahero, Nyando district
Researcher(s):	Kenneth Koome Mbijiwe, H.J. Ouma and Helen Lydia Kutima
Status of Research:	On going
Topic:	Performance of the quantitative buffy coat malaria test, Q.B.C F.A.S.T. ™ test and the SD Bioline™ malaria rapid test in malaria diagnosis at Ahero sub-district hospital, western Kenya
Researcher(s):	Adera Anastasia Wanda, Helen Lydia Kutima, Andrew Nyerere, Michael Ong'echa
Status of Research:	On going
Topic:	Test based management of malaria and treatment failure of Artemisinin combination treatment among patients in Kenyan health facilities in different epidemiologic zones
Researcher(s):	John Oluoch Nyamuni, Helen Lydia Kutima, Ouma, John Henry
Status of Research:	On going
Topic:	Utilization of laboratory results (RDT/Microscopy) in clinical management of malaria at Homa Bay district hospital
Researcher(s):	Daniel Owino Nanzai, John H. Ouma, Helen Lydia Kutima, Peter Wanzala
Status of Research:	On going
Topic:	Diagnostic procedures, epidemiology and genetic diversity of cryptosporidiosis in Bungoma district, Kenya
Researcher(s):	Eric Wekesa Wasike, Helen L. Kutima and Shadrack Muya
Status of Research:	On going
Topic:	Intestinal parasites among inmates in Nairobi Remand and Langata Women's prisons
Researcher(s):	Stephen Njoroge Gichuhi, Sammy Njenga and Helen L. Kutima
Status of Research:	On going
Topic:	Developing phytomedicines and pharmaceuticals against malaria using *Zanthoxylum usambarense* and *Warburgia ugandensis*
Researcher(s):	Patrick Simiyu Were, Helen L. Kutima, Hastings Ozwara and Waudo Walyambillah
Status of Research:	On going
Topic:	Relationship between *Schistosoma haematobium* morbidity and absenteeism in schools for children aged between 7-14 years, a case study of Msambweni district
Researcher(s):	Dennis Mwiri Wali, John H. Ouma, J. Muttunga and Helen Lydiah Kutima
Status of Research:	On going
Topic:	Processing and evaluation of anthelmintic drug From *Entada leptostachya* Harms (Mimosaceae)
Researcher(s):	Kenya Jackson Mutembei, Patrick Kareru, Francis K. Njonge and

	Kutima Helen Lydia
Status of Research:	On going
Topic:	Isolation and characterization of antihelmintic agents from selected plants used in the Lake Victoria Basin, Kenya
Researcher(s):	Leah Nyangasi, Patrick Kareru, Mary Ndungu and Helen Lydia Kutima
Status of Research:	On going
Topic:	Antischistosomal and Molluscicidal Effects of Extracts of selected medicinal plants
Researcher(s):	Susy Muchika, Helen Lydia Kutima and Kennedy Ogila
Status of Research:	On going
Topic:	Control of Beetle Pests of Bees in Kenya
Researcher(s):	Irene A. Onyango, Muo Kasina, Shadrack Muya and Helen Lydia Kutima
Status of Research:	On going
Topic:	Prevalence of Soil Transmitted Nematodes among primary school children in Kisumu County, Kenya.
Researcher(s):	Okeyo Joseph, Helen Lydia Kutima and J.M. Ouma
Status of Research:	On going
Topic:	Chemotherapy of BALB/c Mice co-infected with *Leishmania* major and *Schistosoma mansoni* with Praziquantel and Pentostam
Researcher(s):	Christopher Khayega, Helen Lydia Kutima and Christopher Anjili
Status of Research:	On going
Topic:	Assessment of the burden of Cystic Echinococcosis in Northern Turkana, Kenya.
Researcher(s):	Odero Joseph, K., Japheth K. Magambo Helen Lydia Kutima, Lucy Ndahi and Francis Njonge
Status of Research:	On going
Topic:	Antobody response in baboons experimentally inoculated with HIV-I
Researcher(s):	Njenge H.K., Helen Lydia Kutima and Elizabeth Bukusi
Status of Research:	On going
Topic:	Frequency of variant human cytokine genes in malarial infections with drug resistant parasites in different endemic zones in Kenya
Researcher(s):	Undisa, S.M., Helen Lydia Kutima, and Elizabeth Bukusi
Status of Research:	On going
Topic:	Modifiable factors associated with low full immunization coverage at Alupe Sub district Hospital, Busia County
Researcher(s):	Okunga Emmanuel Wandera, Helen Lydia Kutima
Status of Research:	On going

4.0 FACULTY OF AGRICULTURE

4.1 DEPARTMENT OF HORTICULTURE

Topic:	Production of disease-free papaya (Carica papaya L.) planting materials of known sex for commercial fruit production
Researcher(s):	Fredah K. Rimberia Wanzala, Agnes W. Kihurani, Mercy Mwaniki and Monica M. Waiganjo
Status of research:	On-going
Topic:	Deployment of natural enemies in the attract and kill approach for sustainable management of the banana weevil
Researcher(s):	Mwaniki, S.W., Kimenju, W. Kihurani, A.W., Wachira, P., Gathaara, V.
Status of research:	On-going
Topic:	Developing appropriate Technologies for the control of Blossom end rot in Tomato
Researcher(s):	Muriuki, A.W., Gesare A, Kihurani, A.W., Ndegwa, A.
Status of research:	On-going
Topic:	Disease Diagnostics for sustainable Cassava Productivity in Africa
Researcher(s):	Ateka E.M.
Status of research:	On-going
Topic:	Pesticidal components in African nightshade against the tomato spider mite
Researcher(s):	Lucy K. Murungi
Status of research:	On-going
Topic:	Semiochemical based interactions between root-knot nematodes and high-value vegetables
Researcher(s):	Lucy K. Murungi
Status of research:	On-going

Rice demonstration farm at the main campus

4.2 DEPARTMENT OF FOOD SCIENCE

Topic:	The hard to cook defect in common beans: towards food security and sustainability in sub-Saharan Africa
Researcher(s):	Daniel N. Sila, Prof. Marc Hendrickx
Status of research:	On-going
Topic:	Improvement in mango production and value-addition: towards increased marketing, food sustainability and security
Researcher(s):	Daniel N. Sila, Fredah Wanzala, Urbanus Mutwiwa, James Wambua
Status of research:	On-going
Topic:	Modification of the fatty acid profiles of farmed tilapia and catfish for improved health and livelihood in Kenya
Researcher(s):	Arnold N. Onyango, Peter W. Masinde, Keneth O. Ogila
Status of research:	On-going
Topic:	Nutritional Vulnerability Profiling Survey on Care and Treatment of Clients attending Comprehensive Care Clinics in Kenya
Researcher(s):	Yeri Kombe, Ibrahim Mohamed, Lydia Kaduka, Zipporah Bukania-Apungu, Florence Kyallo, Ruth Akelola
Status of research:	On-going
Topic:	Nutritional quality, Toxicological Safety and Utilization of insects in Kenya
Researcher(s):	Monica Ayieko and Glaston Kenji
Status of research:	On-going
Topic:	Chemical Hazards associated with Agriculture produce irrigated with raw sewage in lower Eastern Nairobi
Researcher(s):	Monica Ayieko, S. Mathenge and G.M.Kenji
Status of research:	On-going
Topic:	Nutritional evaluation of selected seaweeds potential for sustainable Nile tilapia production in semi-intensive ponds in Kenya
Researcher(s):	Joseph Wakibia, Glaston Mwangi Kenji, Jonathan Munguti
Status of research:	On-going
Topic:	The identification and improvement of Bamboo species for food-feed-fibre-fuel applications to diversify food base and help stem the tide of deforestation
Researcher(s):	Mompe Edward, Glaston Kenji, Oscar Mokodi, Margret Karebu and Ben Kanyi
Status of research:	On-going

4.3 DEPARTMENT OF LAND RESOURCE PLANNING AND MANAGEMENT

Topic:	Dynamics of Soil Nutrients and Crop Yields under Conservation Agriculture Systems in Humic Nitisols of Eastern Kenya.
Researcher(s):	Alfred Ngera Micheni, David M.Mburu, Mugai Njue and Fred Kanampiu
Status of research:	On-going

Topic:	Developing Reforms for Promoting ASAL communities in Drought Mitigation and Maximization of Livestock Resources for Improved Livelihoods through Strategic Linkages
Researcher(s):	P. Kanyari, E. Karuri, John Kagira, Ole Sarioyo, Kabuage, Kinoti, Mwanyumba
Status of research:	On-going
Topic:	Toxoplasmosis, a neglected tropical zoonosis with serious reproductive and neurological implication in man: The case for Thika District
Researcher(s):	S. Karanja, John Kagira, Naomi Maina, Maina Ngotho, Maina Ichagichu, John Mokua, Edwin Ogendi
Status of research:	On-going
Topic:	Development of biomarkers for diagnosis and staging of sleeping sickness disease
Researcher(s):	Naomi Maina ,John Kagira, Simon Karanja, Maina Ngotho, Maxwell Waema, Beatrice Muthoni, Dawn Maranga
Status of research:	On-going
Topic:	Safety and toxicity of selected herbal preparation in use in Kenya
Researcher(s):	Naomi Maina, John Kagira, Simon Karanja, Maina Ngotho, Achila
Status of research:	On-going
Topic:	Effectiveness of Farmer Field Schools in Empowering Small-scale Farmers to Adopting Agro forestry Technologies in Gatundu, Kimabu County
Researcher(s):	Ruth Ng'ang'a, Joseph Kariuki Muriithi, Mathew G.Gicheha
Status of research:	On-going
Topic:	Optimising Breeding Strategies Incorporating Risk, Disease Resistance and Producer's Preferences in Dairy Goats for Low-Input Smallholder Farmers in Kenya
Researcher(s):	Alex Amayi, Alexander Kahi, Mathew G. Gicheha
Status of research:	On-going
Topic:	Sanitation Standards and their implications on Sanitation Provision in Nairobi Metropolitan Areas of Karengata and Ongata Rongai
Researcher(s):	Philip Kiama, Aggrey D.M. Thuo and Sammy Letema
Status of research:	On-going
Topic:	The effect of land management practices on soil carbon sequestration in small holder farms of Murang'a County.
Researcher(s):	Lucy Ng'ang'a, Simon Onywere and Aggerey D.M. Thuo
Status of research:	On-going

5.0 SCHOOL OF ARCHITECTURE AND BUILDING SCIENCES (SABS)

5.1 DEPARTMENT OF LANDSCAPE ARCHITECTURE

Topic:	A Factor Analysis of Residents' Attitudes of the Built Environment in Nairobi, Kenya.
Researcher(s):	Mugwima Bernard Njuguna
Status of Research:	On-going
Topic:	Students' perception of the built environment: Implications for Pedagogy.
Researcher(s):	Mugwima Bernard Njuguna, Ephraim W. Wahome
Status of Research:	On-going
Topic:	Post occupancy evaluation of slum upgrading projects: a comparative study between self help initiatives and government sponsored initiatives
Researcher(s):	Susan N. Kibue, Josephine W. Muchogu, Rita W.Mugo, Carolyne W. Nthiwa, Janet K. Ondieki, Brenda M. Bhoyyo (QS), Jedidah Muchoki (Linear Cost Consulting Ltd.), Mercy Mugure (EngPlan Consulting Engineers), Gyneth Magiri (City Council of Nairobi).
Status of Research:	On-going
Topic:	Green Infrastructure Planning Within Middle Income Residential Neighbourhoods of Nairobi: A Case Study of Tena Estate
Researcher(s):	Allan Peter Obatsa Nandwa
Status of Research:	On-going
Topic:	The Design and Construction of Nairobi - Thika Super Highway: What would the Landscape Architect Do?
Researcher(s):	Caleb Toroitich, Janet Ondieki
Status of Research:	On-going

6.0 INSTITUTE OF BIOTECHNOLOGY AND RESEARCH (IBR)

Topic:	Molecular analysis of biofortified cassava with pro-vitamin A in confined field trials.
Researcher(s):	A. B. Nyende, P. K. Telengech and Joyce Malinga.
Status of Research:	On-going
Topic:	Agrobacterium-mediated transformation of pigeon pea with CRYAcgene for pod borer resistance
Researcher(s):	A. B. Nyende, P. A. Okemo, J. Machuka and S. de Villiers
Status of Research:	On-going
Topic:	Elimination of cassava brown streak virus from infected cassava
Researcher(s):	A.B. Nyende, M. Mwangangi and E. Ateka
Status of Research:	On-going
Topic:	Distribution, diversity and conservation of yam species in Kenya
Researcher(s):	A.B. Nyende, E. Mamati and Z. Muthamia
Status of Research:	On-going
Topic:	Regeneration protocol for the coconut plant
Researcher(s):	A.B. Nyende, J. Onguso, J. Neondo and C. Mweu
Status of Research:	On-going
Topic:	Selection of quality and resistance to coffee Berry Disease in the coffee Arabica L. Composite cultivar, Ruiru 11.
Researcher(s):	A.B. Nyende, E. Mamati, and M. Gichimu
Status of Research:	On-going
Topic:	Mass propagation of cocos nucifera (coconut) using tissue culture technique
Researcher(s):	Cecilia Mweu, Grace Wacheke, Johnstone Neondo and Aggrey Nyende
Status of Research:	On-going
Topic:	Mass propagation of Rose using tissue culture technique
Researcher(s):	Cecilia Mweu, Jane Njambi, Johnstone Neondo and Aggrey Nyende
Status of Research:	On-going
Topic:	Mass propagation of Passion using tissue culture technique
Researcher(s):	Cecilia Mweu, Jane Njambi, Johnstone Neondo and Aggrey Nyende
Status of Research:	On-going
Topic:	Bioprospection of Biocontrol agent against striga from maize growing fields in Western region
Researcher(s):	Johnstone Neondo, Amos Alakonya, Remmy Kasili, Jesse Machuka
Status of Research:	On-going
Topic:	Genetic transformation of maize using PAP gene for enhanced phosphorous acquisition
Researcher(s):	Johnstone Neondo, Amos Alakonya, Remmy Kasili, Jesse Machuka
Status of Research:	On-going

7.0 INSTITUTE OF ENERGY AND ENVIRONMENTAL TECHNOLOGY (IEET)

Topic:	Study, Development & Standardization of a locally manufactured & low cost small wind turbine for water pumping & electricity generation in Arid & Semi-arid region
Researcher(s):	Francis Xavier, Sauda Swaleh, Michael Omondi
Status of Research:	On-going
Topic:	Assessment of radiation exposure levels associated with gold mining activities in Sakwa Wagusu Area, Bondo District, Kenya.
Researcher(s):	Robert Kinyua, Willis Ougo Aguko.
Status of Research:	On-going
Topic:	Evaluation of the Potential of Water Hyacinth as a Biogas Feedstock for electricity generation in Kenya.
Researcher(s):	Paul Njogu, Francis Njoka, Purity Njeru, Yasuyuki Nemoto.
Status of Research:	On-going
Topic:	Conversion of Biomass Wastes to Bio-Butanol Fuel for Petrol Engines and Domestic Cooking in Kenya
Researcher(s):	Agatha Wagutu, Robert Kinyua, G.T. Thiong'o, T. Thoruwa
Status of Research:	On-going
Topic:	Generation of Hydrogen Fuel from Biomass through Anaerobic Digestion Process.
Researcher(s):	Fanuel Keheze, Robert Kinyua, P. Kareru
Status of Research:	On-going
Topic:	Development of Standardized Procedure for Testing Improved Biofuel Cookstoves in Kenya.
Researcher(s):	Geoffrey Akoth, Robert Kinyua, T. Thoruwa
Status of Research:	On-going
Topic:	Investigation towards using Geothermal Fluid in Processing Soda Ash in Magadi Prospect, Kenya.
Researcher(s):	Atuya Gershom, Robert Kinyua, John Githiri
Status of Research:	On-going
Topic:	Fabrication and Characterization of a Prototype Improved Solar Concentrator and Steam Turbine for Electricity Generation.
Researcher(s):	Millien Kawira, Robert Kinyua, J. Kamau
Status of Research:	On-going
Topic:	An Evaluation of the Contribution of Occupational Noise to the Burden of Disease in Kenya.
Researcher(s):	Muteti Christopher, Robert Kinyua, Charles Mburu.
Status of Research:	On-going
Topic:	Assessment of Benefits and Risks of Outsourcing Environmental, Health and Safety Management by Organizations.
Researcher(s):	James Thiaine, Robert Kinyua, Pius Makhonge.
Status of Research:	On-going.

SECTION B: COMPENDIUM OF COMPLETED RESEARCH ACTIVITIES

1 COLLEGE OF ENGINEERING AND TECHNOLOGY (COETEC)

1.0 DEPARTMENT OF GEOMATIC ENGINEERING AND GEOSPATIAL INFORMATION

Title: Applications of GIS to Logistics and Transportation in Efficient Collection and Delivery of Milk for Githunguri Dairy Cooperative Society Ltd

Researcher(s): Wangai, Lenard Mwangi, Moses M. Ngigi

Background: Management and enhancement of the logistics activities has been undertaken by companies with the aim of decreasing production costs while increasing performance through improvement in the efficiency and effectiveness of their operations. In the dairy industry, GIS and logistics can be applied in several ways such as in asset management, mapping, vehicle tracking, facility sitting, network analysis, among a myriad of other activities in the sector.

The study took a case study of a fast-growing dairy society operating in Githunguri District in, Kiambu County, which lies about 50 kilometres northwest of the capital city of Nairobi. The catchment area for the dairy society is mainly Githunguri Division, where its most of the members reside. Milk collection from the members is undertaken twice a day within a stipulated time frame by a fleet of trucks and transported to a single processing factory within 2 hours of collection. This operation is undertaken via ten routes. The milk company has, through experience, a scheduled collection routine, where trucks have designated routes to operate, but have not employed any logistic solutions in planning or in scheduling their operations.

The milk society cites high operational cost in milk collection as one of its biggest challenges. Lack of all weather roads in the area, especially during the rainy season, increases the cost of transport through longer distances travelled besides other factors such as time spent during milk collection, capacity of the trucks, poor design of the routes, and scattered location of collection points. Lack of a logistics system contributes to a complicated process in proper milk collection, delivery and distribution, and suitable routes assignment for trucks; besides the routes and collection points not being mapped. In general, there is lack of skills and knowledge on the adoption and use of modern technology such as GIS in milk collection and delivery system.

Methods: The data used in this project included: administrative boundaries, road network data, milk collection centres location data, location of the dairy's processing plant, trucks and vehicle data. The roads data was compiled from existing vector data from the Kenya Rural Roads Authority. The spatial location of the collection centres, as well as that of the processing plant, was collected with the aid of Android GPS enabled phone receiver, and attribute updated with the aid of the dairy's staff. All the spatial data was integrated in ArcGIS software under the Universal Transverse Mercator (UTM) Zone 37S map projection system.

ArcGIS 10 was used in this study to view and manipulate the geographic data. The software was used specifically to query, explore and analyse data from a statistical and spatial perspective. In specific, most of the analysis was achieved via the Network Analyst extension. Network Analyst extension allows the user to perform Vehicle Routing Problem (VRP), which solves a network problem by finding the 'least cost impedance' path on the network from one specified stop to one or more stops.

The study started with the identification of all the milk collection centres. A GPS-enabled Android mobile phone was used to collect the spatial coordinates of most of the collection centres; others were identified from Google Earth and their coordinates digitized. All these were then imported into a personal geodatabase in ArcGIS software. Attribute information of the collection centres necessary in solving the VRP for the daily were then added. Of the 68 collection centres whose spatial locations were mapped, only 40 had complete information that could be used for further analysis.

A network dataset was then created from participating feature classes: the road data, milk collection centres, and the milk factory. Of great importance in the network data creation is setting the hierarchy of the road links. The hierarchies were set to match the surface type of the road with the highest being gravel, followed by surface dressing, then premix, and the lowest being the earth surface. From the network dataset created, routes that were used by the dairy were then mapped, and from it, the time and distance taken per route determined. The total time and distance covered by all the routes was also derived. The logistics solution of VRP was then solved to determine the optimal paths to serve the 40 collection centres, and similarly the time and distance taken per route determined. A comparison of the currently used routes by the dairy and those derived by the VRP solution was done.

Results:

A geodatabase with all the milk collection centres, administrative boundaries, roads, major shopping centres was compiled from which necessary maps such as the dairy's catchment area could be easily retrieved and printed for spatial awareness and empowerment of the dairy staff in its operations and planning. This database could easily be expanded to accommodate other milk collection centres, and for planning further expansion of the dairy activities. The mapping also demonstrated the applicability of GPS-enabled Android phone for application in mapping.

Ten routes were generated from the Vehicle Routing Problem analysis. The routes serve a total of 40 collection centres. The collection centres were assigned to routes based on several factors such as; vehicle capacity, maximum distance that can be travelled, total time spent, the number of centres visited and pick up volume of each centre. Similarly, the routes being used by the dairy were simulated and a similar report generated. Both routing problems were generated under the same conditions, i.e. same roads, same vehicle capacity, maximum distance travelled per day. A comparison of the two revealed that the dairy could efficiently and effectively collect the milk using only 8 routes.

Of the 10 routes, the results revealed that two routes had zero time and distance, which implied that eight routes were adequate to serve the 40 collection centres effectively and efficiently. The results show that the total distance travelled currently was far much greater than

the optimal routes generated via VRP solution by 52, 424.29 metres, and time wise by 8 hours and 45 minutes for the morning shift. However, simulation of both morning and afternoon shifts with the 8 routes, showed that the generated optimal routes were more costly in distance by 6,235.76 metres, but saved on time by 1 hour 26 Minutes.

Title: Application of GIS in Scheduling Deliveries and Emergency Responses: A Logistic Solution

Researcher(s): Limoke, Oscar M., Moses M. Ngigi

Background: In Kenya, logistics companies like G4S have to battle with very poor roads and poorly managed transport networks. The road conditions are a nightmare to the logistic companies that rely on the road as the primary delivery means. Traffic jam within the city of Nairobi roads is yet another business cost, with snarl ups occurring on major key links such as Mombasa, Thika, Ngong, Jogoo, and Argwings Kodhek roads.

Logistics Companies like G4S have suffered in terms of delays in delivery of products and services to the intended destinations due to both the poor roads and traffic jams. By delivering high risk products like money to their customers, any delays translate to very huge losses other than exposing the cargo to various risks like burglary and theft that in turn means high insurance premiums that are passed down to their customers translating to high cost of doing business.

Delays also occur due to the lack of a central geographical database upon which deliveries can be referenced. By relaying on "conventional" location names and addresses, lots of time and cost are wasted in locating the exact location for the delivery. No routing solution is used in determining the best route for delivering.

Methods: A logistics solution for deliveries and scheduling was developed. The key elements of the project were researched and developed as individual units. Then all the individual units were put together to create a single versatile system. To achieve this, a combination of tools and software from both proprietary and Open Source licences were employed. The linkage between the proprietary and Open Source tools and products was very seamless and provided a very versatile and compact GIS system. The core components of the system involved are:

- creating a spatial database of all the business clients and developing of address locators for geo-coding of the addresses.
- creating of a network dataset for creating of route plans and network analysis to improve on cargo delivery and emergency response.
- Development of a Web GIS interfaces for visualization of the addresses and routes and allow for simple spatial queries and measurements.

Results: This research works served to look into the application of GIS in logistics with key emphasis on scheduling deliveries and responding to emergencies. Specifically the ArcGIS suite was used as the key GIS engine. It successfully was used to create GIS solutions using the network analyst extension. Key logistics solutions were successfully created and optimized using cost elements of length and time. It was possible to optimize on the time taken to make deliveries taking care of the distance covered. It was possible to compare on various

alternatives in a GIS environment and model using various constraints to realize the most optimum routes. Vehicle routing problems were solved to enable for better and efficient on-time deliveries that obey the logistics rules of time and quantity.

It was possible also to solve for emergency response using the network and geocoding solutions created. Using the geocoding solution created, it was possible to identify instances of incidences like fire outbreak or burglary. These instances were added to the emergency response network and then using the network analyst, solutions like nearest police stations, nearest health centres solved based on elements of travel time. For instance it was possible to solve for the nearest fire stations within a 30 minute travel to a fire incident. Similar it was possible to solve for the nearest police stations near burglary scene.

The display of the spatial data and results was realized over the map server platform. Using the pmapper engine, it was possible to have a simple web GIS solution that allowed the clients and staff to have access to routes and client locations remotely. The main merit of this system is that it allows one person to be in charge of all the logistics solutions thus saving on cost.

Title: Use of GIS in the Implementation of Alcoholic Drinks Control Act: A Case Study of Karima Location, Othaya Kenya

Researcher(s): Kimwatu, Duncan M., Moses M. Ngigi

Background: In order to address the problem of alcoholism in Kenya, the government, through its provincial administration, ordered for the full implementation of the Alcoholic Drinks Control Act. This mandate was delegated down the ranks of the authority to the local chiefs and assistant chiefs together with the administrative policemen under their jurisdictions. In Karima Location of Othaya Division in Nyeri County, there had emerged notable trends in the sale and consumption of alcoholic drinks, and the enforcement of the Act was not seen as being effective. The law was only implemented partially since the restriction of spatial distance of 300 metres from the learning institutions was not considered, and when this was evoked most of bars in Karima location were affected. This created tension whereby some bar operators ordered to close their premises claimed that their businesses were not within 300 metres from schools; they also claimed that they needed better methods of determining distances to be used, rather than the estimation method that was being used by the law enforcing agencies.

Methods: This research aimed to demonstrate the use of GIS and geospatial technologies in addressing the issue of uncertainty in the in the implementation of the spatial component of the Alcoholic Drinks Control Act. In specific, the project sought to identify all the bars and pubs operating within the restricted distance of 300 metres from learning institutions as stipulated by the Act. It also aimed at providing detailed information on the spatial distributions of bars and schools within Karima Location. This research would also give the necessary technical support to the process of licensing of bars and aid in determining suitable sites where bar operators could relocate or start new outlets after taking into account the restrictions stipulated in the Alcoholic Drinks Control Act. In addition, there was a need to determine the optimal routes which police officers and other

administrators enforcing the Act would use when carrying out patrol and inspection to the bars and pubs.

Results:

The research demonstrated the application of GIS in the implementation of the Alcoholic Drinks Control Act. The spatial distribution of bars and pubs in relation to learning institutions in Karima Location was mapped; through spatial queries and buffering, the bars operating within the restricted distance of 300m from the schools were found. Additionally, accurate distances between the schools and affected bars were derived to provide adequate evidence to be used before any step such as the revocation of the trading licences, or other measures as stipulated in the Alcoholic Drinks Control Act are taken. These results can assist the law enforcement authorities with adequate and reliable support information before enforcing the Alcoholic Drinks Control Act.

Optimal routes between police stations and shopping centres with alcohol-selling outlets were derived. The capability of GIS to simulate these optimal routes on demand provides a good tool for the law enforcement officers to plan their inspection itineraries, saving both on time and resources. This could assist in ensuring that effective patrol is carried out in Karima location through proper coordination among the police officers in the two police posts. Further analyses on suitability of areas that could be used by alcohol-selling outlets were derived. The recommendation of regions where bars could operate is an important result in the research as this would enable the issuance of trading licences only to those bars that met the specified criterion, as well as serve as a guide to would-be investors in the alcohol business within Karima Location. These results showed GIS to be a worthy and powerful tool in decision making and therefore need to be integrated in the implementation of the Alcoholic Drinks Control Act.

The research demonstrated that with adequate spatial data on bars and schools, effective decisions on issuance and revocation of trading licences can be made. This calls for NACADA and other law enforcers to incorporate GIS and geospatial technologies in decision making as spatial data can be handled more effectively and efficiently, and the necessary analysis and map results derived fast at will and effectively.

1.1 DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Title:

Design and Analysis of Neural Fuzzy Based DC-DC Converter Controller Optimized With Swarm Intelligence

Researcher(s):

Michael Matui Kanai, John. N. Nderu, Peterson. K.Hinga

Background:

The electric power is not normally used in the form in which it was generated or distributed. Practically all electronic systems require some form of power conversion. A device which transfers electric energy from the source to the load using electronic circuits is called a Power Supply.

A typical application of a power supply is to convert utility AC voltage into regulated DC voltages required for electronic equipment. Nowadays, in most power supplies providing more than a few watts,

the energy flow is controlled with power semiconductors that are continuously switching ON and OFF at high frequency. Such power supplies are called Switched Mode Power Supplies (SMPS). In general, SMPS can be classified into four types according to the form of input and output voltages: off-line power supply or a rectifier (AC-DC converter); voltage converter (DC-DC converter); frequency changer or cycloconverter (AC-AC converter) and inverter (DC-AC converter). In this research, the modeling, control and design challenges will be analyzed for DC-DC converters only.

Switching-mode power-electronic converters are nonlinear dynamic systems. The nonlinearities arise primarily due to switching power devices and passive components such as inductors and capacitors. The converters are required to provide robust behavior and to operate without instability under a variety of operation conditions. Hence the converter system may be subject to the disturbances of load, input voltage, and system components variations. To improve the dynamic performances of converters, closed-loop control is applied.

Generally, the linear small-signal model obtained using state-averaging and linearization techniques around an operating point is adopted for the controller design. However, since the model is dependent on the operating conditions and system configuration, the controller with fixed parameters (e.g., the PI and optimal controllers) which are adequate under the designed condition may not be so for other operating conditions. It is well known that Artificial Intelligence control technique is an effective method for dealing with parameter variations.

With the advent of digital signal processors, advanced control methodologies through Artificial Intelligence have been applied in most of the industrial applications. The practical challenge in most of the DC-DC converters is to design the advanced control strategies to tackle the nonlinearity, stability and uncertainty of parameters. DC-DC converter controllers have been implemented in numerous control methods, which include: Voltage Mode Control and Current Mode Control in analogue controllers, Fuzzy Logic Controllers Neural Network controllers; or a combination of these: Fuzzy-Neural Networks.

The Adaptive Network-based Fuzzy Inference System (ANFIS), developed in the early 1990s by Jang, combines the concepts of Fuzzy Logic and Neural Networks to form a hybrid intelligent system that enhances the ability to automatically learn and adapt. The basic idea behind these neural-adaptive learning techniques is to provide a method for the fuzzy modeling procedure to learn information about a data set, in order to automatically compute the membership function parameters that best allow the associated Fuzzy Inference System (FIS) to track the given input/output data. The membership function parameters bounds are tuned using Back-Propagation (BP) algorithm or a combination of Least Squares Estimation (LSE) and Back-Propagation (BP) algorithm. These parameters associated with the membership functions will change through the learning process similar to that of a neural network. Their adjustment is facilitated by a gradient vector, which provides a measure of how well the FIS is modeling the input/output data for a given set of parameters.

Because of inherent drawbacks of training methods i.e. Back Propagation (Gradient of Descent (GD) and Least Square Estimation (LSE), the Particle Swarm Optimization (PSO) algorithm based on Swarm Intelligence is proposed, which gets the optimal values in terms of range and shape of input membership's functions parameters. The optimal controller will realize improved performance of the DC-DC converter.

Methods:

In this chapter, the problem of designing buck converter and its components i.e. inductor, capacitor, diode and MOSFET is presented. The component values follows the given design specifications. Design of neural-fuzzy controller with its parameters optimized with Particle Swarm Optimization (ANFIS-PSO) is also formulated. For comparison purposes, neural-fuzzy controllers optimized by Gradient Descent (ANFIS-GD) and Hybrid (ANFIS-HB) methods are also presented. MATLAB Fuzzy Logic Toolbox and Simulink are used for the design of the buck converter and ANFIS controllers, since it includes a convenient graphical user interface (GUI).

Results:

In order to verify the design of ANFIS-PSO controller a validation of the obtained results is be made in both time and frequency domains.

Soft Start

Three different controllers are considered. First, the ANFIS Controller with parameters adjusted with Gradient Descent (ANFIS-GD) is designed. Second, the ANFIS-HB is designed based on the Hybrid training method to find the membership functions. The third ANFIS controller is designed based on the PSO to search the optimal input membership functions parameters (ANFIS-PSO).

Load Transient

In second test, load transient experimental results for the output load changes from 2.5 Ω to 5 Ω (100% load change) at and back to at . Response in open loop condition, as demonstrated the output voltage ripples are beyond design specification of and output current ripple design specific of . From the graph, the output voltage goes beyond and which is way far bigger than from design requirement.

The output voltage settles inside the range in the open loop within time period of .At this state of open loop, the duty cycle is zero.

Line Transients

In third test, the input voltage is varied from (nominal voltage) to and back to between and. In the time period of and the input voltage is varied from to. Again at the time period and the input voltage is varied from to (maximum allowed by design).

The response of the system when there is no controller; the system overshoots to 7.8 V (56%) and takes 0.25 ms to settle at desired reference voltage ( ). The output of the ANFIS-GD controller that has the output voltage within the bounds of design value, but with much pronounced oscillations of output current during the transition of input voltage.

Frequency Response of Buck Converter

In this section relationship between transient response (time response) and frequency response is discussed. The design of control systems is

very often carried out on basis of frequency response. The main reason for this is the relative simplicity of this approach compared to others. Since in many applications it is the transient response of the system to aperiodic inputs rather than the steady-state response to sinusoidal inputs that is of primary concern, the question of transient response and frequency response arises. For the standard second-order, the relationship between transient response and frequency response can be obtained easily .Based on averaging small-signal buck converter modeling approach; the frequency response behavior of the converter is investigated through analyzing its output dynamics transfer functions.

Efficiency Curves

It is noted that the lower the input line (for this case at 8.5 V), the higher the efficiencies at which the converter operates. This is mainly because the higher the input line, the lower the duty cycle, and the higher the conduction and switching losses of the primary switches. The ANFIS-PSO controller in overall provides higher efficiency of up to 85% as compared to 83% and 79% for ANFIS-H and ANFIS-BP controllers respectively.

Conclusions:

This work has addressed the issues of analysis and design of DC-DC converter neural-fuzzy controller with its parameters optimized with particle swarm optimization. The major accomplishments are given below.

A control design procedure based on the neural-fuzzy method has been applied successfully to design a controller for buck converters in order to achieve robust output in spite of different uncertainties.

A design example for buck converter was carried out to verify the control design procedures presented in the thesis. The effectiveness and robustness of the proposed control system was confirmed by simulation results, where the MATLAB Fuzzy Logic, Control Design and Simulink Toolboxes [43] are used as a setup platform for design and validation.

In this research, the optimal ANFIS controller is designed using Particle Swarm Optimization Algorithm. The voltage of buck converter is controlled by means of three different controllers. The proposed controller (ANFIS-PSO Controller) gives better results in form of rise time, overshoot, settling time and steady state error i.e. the controller is adaptive and possesses good robustness.

A control topology of ANFIS for control of the buck converter has been implemented in this research. A simulation in MATLAB was used to evaluate the robustness capabilities of the proposed controller when variations of input voltage, load resistance occur and during start-up. Simulation results show that the proposed method is robust and capable of reducing the effect of external disturbances such of input voltage and load resistance variations.

Title:

Impact of Spartial Diversity Techniques in Combating Interference and Multipath Fading in Wireless Communication Systems

Researcher(s):

Muiga Rugara, D. O. Konditi, S. Musyoki

Background: The next-generation wireless communication systems are required to have high voice quality as compared to current cellular mobile radio standards and provide high bit rate data services (up to 2 Mbits/s). At the same time, the remote units are supposed to be small lightweight pocket communicators. Furthermore, they are to operate reliably in different types of environments: macro, micro, and picocellular; urban, suburban, and rural; indoor and outdoor. However wireless communication systems require signal processing techniques that improve the link performance in hostile mobile radio environments. Most existing wireless systems use simple antenna arrays transmitting in a fixed direction (directional antennas) or all directions (omnidirectional antennas). This causes interference between subscribers. Furthermore, with the rapid increase in cellular subscription, capacity will be an issue in future communication systems, One approach to increase capacity is to reduce interference and compensate for multipath fading and a cost effective method of achieving this is the use of diversity techniques. The technique proposed in this paper is a simple transmit diversity scheme which improves the signal quality at the receiver on one side of the link by simple processing at the transmit antennas on the opposite side. The proposed transmit diversity scheme will improve the error performance, data rate, or capacity of wireless communications systems. The scheme may also be used to increase the range or the coverage area of wireless systems.

Methods: To demonstrate the optimum combining in a fading environment, an experimental system will be modeled and simulated. Simulation will comprise an m transmit antennas and n receive antennas, a channel estimator will be used at the receiving antennas. The combiner builds the incoming signals that are sent to the maximum likelihood detector. These combined signals are then sent to the maximum likelihood detector which, for each of the signals uses the decision rule to determine the strongest signal combination. The resulting combined signals will be expected to be equivalent to that obtained from two-branch MRRC. The only expected difference is phase rotations on the noise components which do not degrade the effective SNR. Therefore, the resulting diversity order from the new m-branch transmit diversity scheme with n receivers is expected to be equal to that of two-branch MRRC.

Results: A 2-transmit 2-receive (2x2) MIMO channel with Maximum Likelihood (ML) decoding receiver structures gives a good performance. However it is inferior to alamouti 2-transmit 2-receive STBC. However, it was found that the use 2×2 MIMO with Maximum Likelihood (ML) equalization achieves a performance closely matching the 1 transmit 2 receive antenna Maximal Ratio Combining (MRC) case. It is also apparent that the use of a higher order constellation like 64 QAM, then computing Maximum Likelihood equalization might become prohibitively complex. With 64 QAM and 2 spatial streams we need to find the minimum from 642 = 4096 combinations. In such scenarios we might need to employ schemes like sphere decoding which helps to reduce the complexity and which are outside the scope of this research.

Conclusions: Use of multiple antennas at the transmitter and the receiver in wireless communication systems have been known to increase diversity to combat channel fading. Each pair of transmit and receive antennas provides a signal paths from the transmitter to the receiver. By sending signals that carry the same information through different

paths, multiple independently faded replicas of the data symbol can be obtained at the receiver end; hence more reliable reception is achieved.

It is also clear that the BER performance for a 2-transmit 2-receive (MIMO) Alamouti STBC Channel is much better than 1-transmit 2-receive antenna MRC case. This is because the effective channel concatenating the information from 2 receive antennas over two symbols results in a diversity order of 4. In general, with N receive antennas, the diversity order for 2 transmit antenna with Alamouti STBC is 2N. As with the case of 2-transmit, 1-receive Alamouti STBC, there is no cross talk after the equalizer since the matrix is diagonal and the noise term is still white.

Title: Voltage Stability Analysis of Nairobi Area Power Distribution Network.

Researcher(s): Samuel A Oketch, .C.M.Muriithi, K.K. Kaberere

Background: In the last few years the need to increase the transfer capacity of the existing distribution networks without major investments and also without compromising the security of the power system has led to a situation where utilities operate power systems relatively closer to voltage stability limit. Under such circumstances, the continued growth in load demand, a disturbance, or changing network conditions can lead to a state of voltage instability, and eventually, voltage collapse which manifest by a progressive and uncontrollable decline of voltage profiles in one or significant part of the network.

Incidents of severe voltage instability have been reported in other parts of the world, in the recent past. These incidents were reported to have contributed adverse impacts on the economies and lives of the people of the countries concerned. As a consequence voltage stability has become a major concern for utilities in power system planning and operation. Nairobi Area network which supplies over 50% of Kenya's power demands has experienced growth in loads over the years. The urban developments and environmental considerations have hindered the expansion of the network infrastructure over the same period. Some locations served by the network experience occasional load shedding during peak hours despite availability of adequate generation.

Studies conducted on the Kenyan system so far have concentrated mainly on the Transmission network. Therefore there was need to undertake a research to assess the status of the voltage stability of Nairobi Distribution network.

Methods:

1. Modeling of the Nairobi Area Distribution Network
2. Sensitivity Analysis
3. Modal Analysis
4. PV and QV curves analysis methods

Results: Sensitivity – Network is voltage stable

Modal analysis- identified weak buses and branches in the network.

PV curves – MW distance to voltage stability limit.

QV curves-MVAr distance to voltage stability limit

Conclusions: The network is voltage stable, however it is approaching voltage stability limit, and voltage collapse, with continued growth in load demands, unless specific counter measures are put in place.

Title: Mitigation if Harmonic Distortions and Low Power Factor in Unbalanced Three Phase System using Fuzzy Logic Controller

Researcher(s): Charles Ndungu, Livingstone Ngoo, and John Nderu

Background: In recent times, the issue of power quality has attracted a lot of attention due to extensive emphasis by power utility on the power system efficiency and end users awareness of power quality issues. This has happened mainly due to the sensitivity of the modern electronic devices which are vulnerable to poor power quality especially harmonic distortions and the deregulation of the power distribution that result to competition of supplying a quality power. In addition, there are usually massive losses to both power utility and power users as result of poor power quality supplies which fall below the set standards. Power quality primarily consists of voltage dip/ swell, power system interruptions (power outage), harmonic distortions, voltage flickers and frequency deviations. Research done on both power utility and power users revealed that power outage attracted myriad complains seconded by harmonic distortions. Nevertheless, end users sector suffer more from harmonic problems than does the utility sector. Industries with Variable Speed Drives (VSD), arc furnace, induction furnaces, are more susceptible to problems stemming from harmonic distortions.

Harmonic distortion is the change in the waveform of the supply current/ voltage from the ideal sinusoidal waveform [1]. The primary source of distortions of the waveform is non linear loads. The non linear loads generate current harmonic distortions and reactive power from ac mains. A device or equipment is said to be non-linear when the relationship between the instantaneous voltage and current is not linear. Examples of non linear loads include computers, switched mode power supplies, fax machine and printers among others. These non linear loads inject back harmonic distortions into power distribution systems through the Point of Common Coupling (PCC); point where end users are connected to the power grid by the power utility.

Harmonic distortions have several adverse effects on the distribution system and the end users. When present in the power lines harmonics result in various problems such as; greater power losses in distribution and transmission lines, problems of electromagnetic interference in communication systems, operation failure of protection devices and electronic devices. In addition, they cause errors in energy measuring equipment and capacitor banks failure. These problems result in high expenses for industry and commercial ventures, since they can lead to a decrease in productivity and to a reduction of quality in the products or services.

Inductive load requires reactive power for proper operation (magnetization) which the source must supply, hence increasing the current from the generator and through power lines. Total current distributed through the conductors and transformers consist of two components namely; active component and reactive component.

High reactive current implies increase of total current. High current makes conductors and transformers overheat due to the resistive

dissipation by the conductor (i2R), hence demanding conductors of larger cross-section area and bigger size of transformers. If reactive power is supplied near the load, the line current can be reduced or minimized, hence reducing power losses and improving voltage regulation at the load terminals. The reactive power is defined as component of the instantaneous power with frequency equivalent to 100 Hz in a 50 Hz system. The reactive power oscillates between the ac source and the capacitor or inductor and also between them (inductor and capacitor) at a frequency equal to two times the rated value. Due to this behavior, it can be compensated using active power filter to prevent it from circulating between the load (inductive or capacitive) and the source, hence improving power factor at the point of common coupling.

Methods: The level of harmonic distortions was carried out at various metering points (point of common coupling) to establish the point where harmonic distortions are severe. This was followed by simulating an active filter using MATLAB -SIMULINK for eliminating harmonic distortions at the point identified to be having high harmonic distortions.

Results: Data collected indicates that, the most polluted points at common coupling (PCC) were low voltage (415V) systems supplying non–linear loads and hence most of the digital meters installed at these points were found to be recording low power factor, which is intermittently below the statutory level of 0.9 vis – á –vis those connected at medium and high voltage three phase system.

The simulation results of designed active filter for compensation of reactive and harmonic current of the distorted unbalanced three phase system cancelled the harmonic distortions and compensated reactive power hence realizing a power factor above 0.9 as required by the statutory regulation.

Conclusions: The analysis of the data obtained on harmonic distortions on utility power system and simulation carried out of APF using MATLAB – SIMULINK environment lead to the following conclusions;

(a) The three phase power end users supplied by low voltage are generating high current harmonic distortions beyond the recommended threshold as per IEEE 519-1992 power quality standard contrarily to the medium and high voltage power users. This has resulted in most of these end users not meeting the power factor statutory level of 0.9 as required by the power utility. This is presumed is due to the advent of multifunctional digital meters, which are capable of measuring harmonic energies up-to to 63rd harmonics levels. This, therefore, increases apparent power recorded by the energy meter, hence low power factor.

(b) Due to installation of harmonic mitigating transformer at medium and high voltage power users, the harmonic distortion levels are found to be well below the recommended level at PCC. The CPF recorded by the digital energy meter is usually above 0.9 as required by power utility except where the end user over compensates the reactive power (leading PF) using capacitor correction banks. The novel digital energy meter does measure in all the four quadrants, hence able to measure a leading power factor as contrarily to electromechanical energy meter, which could only measure in two quadrants.

(c) In this study, an active power filter has been used to mitigate current harmonic distortions and low PF for low voltage power users at PCC. The active filter was simulated using MATLAB- simulink, where IRP p¬_q theory algorithm proposed by Akagi and others was used to generate the reference current. By use of Fuzzy logic controller to regulate the dc bus of VSI, it has been shown that the distorted three phase load current waveforms are sinusoidal at PCC.

(d) The IRP p_q theory has proven it can provide a better approach for compensating of the reactive components of non linear load in un balanced three phase system. As result, the power source only supplies active power thus reducing technical line losses, power outages and also improves the voltage profile at the power users.

(e) It can be summarized that the simulated shunt active powers filter;

- Dynamically compensate the current harmonic distortions,
- Dynamically compensate the reactive power hence improving the power factor at PCC and
- reduces the values of the currents supplied by the source to the load by compensating the reactive current required by the supplied loads.

(f) Time domain provides fast response for harmonic and reactive compensation as the system parameters are analyzed on real time. This ensures that the harmonic distortions at PCC are within the recommended level by IEEE 519-1992 and the meter consequently records a power factor that is well above the statutory requirement of 0.9.

Title: Application of neuro-fuzzy controlled technique in a three phase hybrid filter for harmonic mitigation

Researcher(s): N. Bett, J.N. Nderu, P.K. Hinga.

Background: The use of power converters has become widespread in consumer electronics and industrial processes introducing a great amount of harmonic currents into power systems. Harmonics are currents and voltages with frequency that are integer multiples of fundamental frequency (50 Hz or 60 Hz). The effects of harmonics are not new, but recently they have attracted more research attention. Advancement in semiconductor devices technology has also fuelled a revolution in application of power electronic devices over the past years, and there are indications that this trend will continue as per the literature. Most methods that have been used to eliminate harmonics depend mainly on mathematical models that lead to delay and inaccurate data processing. Therefore, artificial intelligence which does not depend on mathematical models has to be used to improve harmonic mitigation efficiency.

Methods: Mathematical design and analysis. Software simulation to proof the performance of the system

Results: Current THD under both steady-state and transient-state was reduced from approximately 52.86 % to 6.93 % with ANFIS controlled shunt APF. With the proposed hybrid APF, the source current THD is further

reduced to 1.9 %. Thus, the harmonic filtering performance of the proposed topology of shunt C-type high-pass filer and shunt ANFIS controlled APF is superior compared to the shunt ANFIS controlled APF alone.

Conclusions: It was found that the proposed shunt hybrid power filter (ANFIS controlled filter) has capability of reducing THD effectively in both steady state and transient response. The THD of the source current after compensation is approximately 2% which is less than 5%, the harmonic limit imposed by the IEEE-519 & IEC-6000-3 standard.

1.2 DEPARTMENT OF BIOMECHANICAL AND ENVIRONMENTAL ENGINEERING

Title: Assessment of the System of Rice Intensification (SRI) for Improving Crop and Water Productivity in Mwea Irrigation Scheme, Kenya

Researcher(s): Bancy M. Mati; Raphael Wanjogu; Benson Odongo and Patrick .G. Home

Background: This study was conducted to evaluate a system of rice intensification (SRI) that would increase water and crop productivities relative to the conventional production system. The effects of SRI on total water input and the yield of three rice varieties were investigated at the Mwea Irrigation Scheme of Kenya.

Methods: This entailed assessing SRI for three rice varieties (Basmati 370, BW 196 and NERICA1). The component practices of the conventional system were: transplanting of 25 day-old seedlings, multiple seedlings per hill, 10 cm x 10 cm interplant spacing, continuous flooding, and hand weeding. In the modified conventional system interplant spacing was 25 cm x 25 cm, with all the other practices being similar to those of the conventional system. SRI was defined by: transplanting 14 day-old seedlings, single seedling per hill, 25 cm x 25 cm interplant spacing, intermittent irrigation by alternate wetting and drying and use of a rotary weeder

Results: Average grain yield was higher in SRI (14.85 t ha-1) compared to conventional production system (8.66 t ha-1). Compared to the conventional system, grain yield under SRI was increased by 70%, 80%, and 61% for Basmati370, BW196 and NERICA1 respectively. Total volume of irrigation was 111 m3, 94.7 m3 and 84.24 m3 for conventional, modified conventional and SRI systems respectively. SRI increased crop and water productivity in the MIS by 71% and 90% respectively.

1.3 DEPARTMENT OF MECHATRONIC ENGINEERING

Title: Optimization of Ultrasonic waves in an acrylic pipe powder transport system

Researcher(s): Murimi E., Kihiu J., Nyakoe G.N., Mutuli S.

Background: The transport of powder materials is an important aspect of process engineering. Modern systems demand powder transport systems which

have a high quantitative accuracy. Therefore, the ultrasonic material transport process technology has in the last few years developed into an attractive alternative compared to the classical technologies. This technology involves transfer of powder through a pipe in which the ultrasonic waves are transmitted. However, this technology is not refined.

Methods: In this research, the traveling ultrasonic waves in an acrylic pipe were optimized by investigating the optimal placement of the transducer on the pipe, the optimal length and thickness of the pipe and the optimal frequency. The finite element analysis was used in modeling, due to its ability to analyze a material in small cells and then combine the results for the whole material. Thereafter, experiments were conducted in order to validate the model.

Results: An optimal ultrasonic traveling wave was obtained at the resonant frequency of 48.4 kHz at an optimal amplitude of 0.6mm can be used for powder transportation. The results showed that the optimal position of placing the transducer was 3mm from the edge of the acrylic pipe of optimal length of 500mm and internal and external diameter of 9mm and 14mm respectively.

Conclusions: This optimization is important in developing new powder feeding mechanisms which have simple design, consume low power and exhibit high accuracy. Such a powder feeding device is useful where accurate control of powder in small quantities is required in industries such as pharmaceutical, manufacturing and chemical processing industries.

2. COHES (COLLEGE OF HEALTH SCIENCES)

2.0 DEPARTMENT OF BIOCHEMISTRY

Title: Computational Identification of Putative Odorant Binding Proteins in *Glossina pallidipes, Glossina palpalis gambiensis* and *Glossina tachinoides* (Diptera: Glossinidae) Tsetse Flies

Researcher(s): Steven Ger Nyanjom, Peter Onyimbo Lomo, Paul Odhiambo Mireji, Ahmed Hassanali and Daniel Masiga

Background: Tsetse flies (*Glossina*) comprise of *Glossina fuscipes fuscipes, Glossina tachinoides* and *Glossina palpalis* vectors of Human African Trypanosomiasis (HAT) and *G. pallidipes, G. morsitans morsitans* and *G. longipennis* vectors of African Animal Trypanosomiasis (AAT). In these vectors, olfaction plays a critical role in the detection and location of preferred hosts, selection of mates and identifications of oviposition sites, and overall survivorship of the vector. The olfaction is mediated by Odorant-Binding Proteins (OBPs), Pheromone Binding Proteins (PBPs), Chemosensory Proteins (CSPs), Odorant Degrading enzymes (ODEs) and Odorant receptors (Ors). An understanding of how these factors interact at molecular level is essential for engineering novel approaches develop for management of these vectors.

Methods: Expressed Sequence Tags (ESTs) were obtained from sequencing of cDNA libraries from antennae of *G. pallidipes* and heads of *G. p. gambiensis* and *G. tachinoides*. The ESTs were clustered and annotated using cDNA Annotation™ Software and Phylogenetic estimation using Maximum Likelihood (PHYML) routines, involving multiple sequence alignments, phylogenetic analyses and searches against non-redundant (NR) protein database, conserved domains database (CDD), *Drosophila melanogaster*, *Anopheles gambiae, Aedes aegypti* and *Culex quinquefasciatus* genomes.

Results: A total of 1127, 906 and 830 ESTs were obtained for *G. pallidipes, G. p. gambiensis* and *G. tachinoides* cDNA libraries respectively. The ESTs from *G. pallidipes*, *G. p. gambiensis* and *G. tachinoides* formed 296, 305 and 232 clusters respectively. The *G. pallidipes, G. p. gambiensis* and *G. tachinoides* clusters were composed of 18, 36 and 54 contigs, and 278, 269 and 178 singletons respectively. The analyses identified six (6) putative OBP genes (2 each from *G. pallidipes* antennae, *G. p. gambiensis* and *G. tachinoides* head). The putative OBPs belonged to diverse but closely related multi-gene families.

Conclusions: These results suggest that olfactory process in tsetse may involve integration between signals generated by OBPs at recognized olfactory tissue (antennae) as well as those in other tissues and this may need to be taken into account to elucidate comprehensively the molecular basis of olfaction in these insects.

Title: Evaluation of Hydroquinone Content in Commercial Cosmetic Products.

Researcher(s): Ogoma, P. O., Lomo, P. O. and Nyambati, V. C. S.

Background: Hydroquinone is used as a topical application to lighten the skin colour. Studies have revealed that it can cause exogenous ochronosis, a disfiguring disease in which blue-black pigments are deposited onto the skin. The use of hydroquinone is therefore banned in some countries, including the member states of the European Union. Adult rats were found to have increased rates of tumours. The aim of the study was to

find the concentration of hydroquinone present in selected cosmetic products in Kenya.

Methods: Six samples were selected based on information from consumers gathered from some salons. These were given code numbers BS 03652, BS 01295, BS 01296, BS 01297, BS 01298 and BS 00045.Hydroquinone was extracted from the cosmetic products using a mixture of water and methanol in a water bath maintained at 60° C for 20 minutes. Determination of the concentration of hydroquinone in the resulting solution was performed by reverse phase High Performance Liquid Chromatography.

Results: The results were based on IS: 4011 – Indian standard Methods for Dermatological Tests for cosmetics. All the six samples contained hydroquinone. BS 03652 had 0.0543% m/v; BS 01298 had 0.015% m/v; BS 01295 had 0.00385% m/v. Both BS 01296 & BS 01297 had 0.00086% m/v; and BS 00045 had 0.00164% m/v.

Conclusions: BS 01296 and BS 01297 showed negligible quantity of hydroquinone and are safe for use. BS 01295 and BS 00045 had low hydroquinone content while BS and BS 01298 and BS 03652 showed significantly high amounts of hydroquinone. These four samples are not safe for use.

Title: Determining the Effects of Cinnamon Extracts and Retinoic acid on Alloxan induced Diabetic mice.

Researcher(s): Kiprotich T. and Nyambati, V.C.S.

Background: Obesity is thought to be the primary cause of Type 2 diabetes mellitus in individuals who are genetically predisposed to the disease. Retinoic acid is transported by Retinol binding protein 4 (RPB4) which causes insulin resistance in obese subjects. Cinnamon has been reported to have insulin-potentiating properties and may be involved in the alleviation of the signs and symptoms of diabetes.

Methods: Mice were diabetically induced with 5% alloxan monohydrate and divided into three groups. The groups were respectively treated with cinnamon; retinoic acid and water. In all the groups, RBP4 and blood glucose levels were monitored weekly.

Results: Mice treated with cinnamon gave a significant improvement in blood glucose levels and also reduced RBP4 levels as compared to those with retinoic acid.

Conclusions: Cinnamon and retinoic acid may be used to control blood glucose levels in alloxan induced diabetic mice.

Title: Localization, life-stage expression and RNAi-mediated gene silencing of an aquaporin-like gene from tsetse fly (Glossina pallidipes)

Researcher(s): Bargul JL, Wamunyokoli FW, Masiga DK.

Background: Tsetse flies are vectors of African trypanosomes, the protozoan agent of devastating disease, trypanosomiasis that afflicts both humans and animals. Currently, there is no promising vaccine in the horizon and treatment efforts are further constrained by the rapid increase in parasite drug resistance observed in patients. In addition, little effort is being made to develop new and effective drugs. Alternative methods to control trypanosomiasis and its transmission are therefore required. The trypanosome parasite develops into its infective metacyclic stage in the salivary glands of the tsetse fly, where the saliva provides a specific medium for its maturation and also becomes the fluid vehicle for the transfer of the parasites to the host through a blood meal.

Water exchange across the salivary gland membrane occurs through aquaporin (AQP) water channels in brown dog tick, Rhipicephalus sanguineus. This study focused on the role(s) played by a putative water channel protein identified in the salivary glands of tsetse fly, Glossina pallidipes, in relation to feeding and survival.

Methods: A gene fragment encoding a putative member of the aquaporin (GpAQP1) gene family was PCR-identified from the cDNA prepared from G. pallidipes salivary glands. The study aimed at investigating tissue localization, expression patterns (in relation to developmental stages), and the functional role of GpAQP1 in relation to feeding success and survival rates of tsetse flies, G. pallidipes, after gene silencing by RNA interference (RNAi).

Results: The GpAQP1 protein has a predicted molecular mass of 25.22 KDa. Comparison of the GpAQP1 deduced protein sequence with the GenBank of NCBI and GeneDB database revealed significant homology to many aquaporin genes, including 99.3% identity to G. m. morsitans GM-509 (EZ422025) coding sequence. Topographic analysis suggested that GpAQP1 has the general aquaporin topology and possesses two conserved 'NPA' signature motifs (Asn-Pro-Ala) found in aquaporins. Multiple sequence alignment and protein distant tree plotted using Neighbour-Joining method shows that GpAQP1 is more closely related to many insect AQPs than vertebrates'. The GpAQP1 transcript was localized to the salivary glands, head, malpighian tubules, and midgut among other tissues. The gene was detected, by semi-quantitative reverse transcription (RT)-PCR, in different life-cycle stages of the fly; 2nd instar larva (dissected out from the pregnant female tsetse fly), 3rd Instar larva (just deposited by the female), pupa, unfed teneral fly (<24 h post-emergence) and adult tsetse fly (60 days old). Our findings indicate the presence of GpAQP1 mRNA transcript in all the above stated developmental stages (Replicates; N=3). However, the transcripts in the 2nd instar larva were not readily detectable (when resolved through ethidium bromide-stained 1% agarose gel) after 1st, but until the second PCR was performed using the product of the 1st PCR as the template. Silencing of GpAQP1 was carried out using RNA interference technique; where gene-specific double stranded RNA (GpAQP1 dsRNA, 10 μg) was injected into experimental flies. The control group was injected with nuclease-free water (NFW, 2 μl). The effects of transient gene silencing were monitored by RT-PCR, and relevant bioassays (survival and feeding success). GpAQP1 knockdown was not lethal to the flies as they continued to survive and feed. Survival rates of over 80% were achieved in both injected test and control groups. Binomial test of proportions showed no significant differences in the feeding success between the test (dsRNA-injected) and control (NFW-injected) flies at $p<0.05$. The importance of AQPs in tsetse fly has not been established and they could be involved in the elimination of excess water that comes along with a blood meal. Therefore, studies on aquaporins could reveal the mechanisms of water management in tsetse fly biology. Water is an important component of tsetse fly saliva that provides a fluid medium for transport of infective metacyclic trypanosomes into the vertebrate host during feeding. The salivary gland aquaporins of tsetse fly, through which saliva exchange occurs, may form potential target avenue for disrupting transmission cycle of the African trypanosome which causes a devastating disease, trypanosomiasis that afflicts both humans and domestic animals.

3.0 FACULTY OF SCIENCE

3.1 DEPARTMENT OF ZOOLOGY

Title:	Molecular termite species delimitation using genetic distances
Researcher(s):	Michael Bacht, Andreas Marten and Osiemo Zipporah
Background:	Recently the use of DNA-sequences has become more important for the inventory and diversity assessment of diverse taxa as well as taxa which are difficult to determine. Termites are among the ecologically important and diverse arthropods whose taxonomy and determination to species level mostly relies on characters of the soldier caste which is rarely sampled during ecological surveys. Only few studies attempt to compare the results of molecular work with a more traditional species delineation approach based on morphological characters.
Methods:	854 sequences of a 681bp fragment of the COII gene of termites were extracted from GenBank and used to define molecular thresholds for termite species delimitation by means, medians and a threshold method introduced by Lefébure et al. (2006). Therefore we calculated pairwise genetic distance matrices for comparisons within species (S), between species of one genus (G) and between genera of one family (F).
Results:	A threshold value of 0.058 K2P-sequence divergence per site was calculated for termite species delimitation, using COII sequences of termites from GenBank. For termites from Kakamega Forest, which all belong to the family Termitidae, a family-specific threshold of 0.056 was calculated to delimit the species.
Conclusions:	A species-specific threshold molecular thresholds were determined for termite species delimitation

Title:	Biodiversity assessment of termites using DNA Barcodes
Researcher(s):	Eugen Egorov, Andreas Marten and Osiemo Zipporah
Background:	Biodiversity studies require species level analyses for its accurate assessment. However, specialized taxonomic knowledge for difficult and hyperdiverse arthropods like the termites, is rarely available for routine identifications. This poses a great challenge to taxonomists who are responding to increasing biodiversity loss especially in tropical rain forests with threatened biota. Kakamega Forest (W-Kenya) is an eastern outpost of the Congolian forest block and recently threatened by increasing human population. The termite diversity of the forest is poorly known.
Methods:	A total of 240 termite samples were collected from Kakamega Forest to assess the regional species pool of termites. They were morphologically summarised to belong to at least 11 genera and 16 morphospecies. For 161 samples sequences of the mitochondrial COII gene were obtained a linearized Neighbour Joining (NJ) tree based on K2P-distances were calculated. Using the molecular thresholds we calculated the numbers of Molecular Operational Taxonomic Units (MOTUs) across the NJ tree of the samples from Kakamega Forest. To estimate the real number of species from the morphological and molecular approach we used an extrapolation method published by Chao (1987) and implemented in the vegan-package of R.

Results: At least 16 termite species were observed in Kakamega Forest by morphological determination whereas at least 22 species (MOTUs) were found by molecular species delimitation. *Odontotermes, Pseudacanthotermes* and *Microtermes* are the most abundant termites in the forest.

Conclusions: Our results highlight the advantage that molecular based species delimitation reveals some morphological cryptic species. Termites without sampled soldiers could be assigned to their respective phylogenetic clusters. A more comprehensive picture and fast assessment of termite species in the forest was given. This is a first approach towards establishing a DNA barcode library for termite species identification and biodiversity assessment using sequences of the mitochondrial COII gene.

Title: Validation of coloured sticky traps with LUREM-TR attractants for effective monitoring of thrips dynamics on French beans in Kenya

Researcher(s): Muvea A.M., Subramanian S., Kutima H.L.,Osiemo-Lagat Z., Waiganjo M., de Kogel, W.J, and Teulon D.A.J

Background: Thrips are one of the key pests hampering the production of French beans by inflicting both quantitative and qualitative damage to the crop. Effective monitoring and timely implementation of pest management strategies is key to successful thrips management. This research was aimed at evaluating the response of thrips species occurring on French beans to coloured traps with LUREM-TR attractant and validating the same for effective monitoring of thrips dynamics.

Methods: Field experiments were carried out over two cropping periods in a randomized complete block design with four replicates. Six treatments were adopted: blue, yellow and clear sticky traps with and without LUREM-TR attractant. Blue sticky traps caught 2.05 – 3.52 times as many thrips as yellow traps, and 22.07 – 29.31 times as many as clear traps.

Results: Blue traps were more attractive to *Megalurothrips sjostedti* (Trybom), *Frankliniella schultzei* (Trybom) and *Frankliniella occidentalis* (Pergande), while *Hydatothrips adolfifriderici* (Karny) was mostly attracted only to yellow traps. Addition of LUREM-TR attractant increased percentage thrips captures on coloured traps between 29.6 _ 158.4%. Among the other insects attracted, yellow traps where most attractive to aphids, whiteflies, hoppers, coccinelids and thrips natural enemies like *Ceranisus* sp. and *Orius* sp. Blue and clear traps were attractive mostly to only dipterans and coleopterans, respectively. Correlations between total trap captures and absolute measure of thrips per plant estimated with destructive and the non-destructive sampling indicated significant positive correlation. Weather parameters and thrips density had little or no correlation in the first trial. However, maximum temperature, mean temperature and wind run had significant effect in the second trial.

Conclusions: The high proportion of thrips captured suggests that the blue sticky traps and LUREM-TR can be an important element for monitoring these species

Title:	Nectar meal as a resource for mosquito specialist predators that target malaria vectors
Researcher(s):	Kuja Josiah, Osiemo-Lagat Z. and Karanja R.
Background:	Spiders are normally characterized as predators that feed primarily on insects, however there is a growing appreciation that spiders also often feed on nectar taken from plants. Members of Saltcid, *Evarcha culicivora* have been observed at floral and extrafloral nectarines of plants, presumably feeding on nectar.
Methods:	Nectivory was observed in laboratory rearing for survivorship experiments, direct observation on plants and nectar ingestion was confirmed with cold anthrone testing which detected the presence of fructose in spiders in relation to *Anopheles gambiae* (malaria vector) capture proficiency. The role of feeding on nectar in the biology of jumping spiders (family Salticidae) was investigated, with special emphasis on the role feeding on nectar plays in the biology of *Evarcha culicivora*, a Salticid that singles out malaria vectors as preferred prey.
Results:	The findings suggest that nectar feeding by *Evarcha culicivora* increases their rate of capturing blood fed *Anopheles gambiae* mosquitoes. 100% (6/6) of the individual juvenile spiders that captured prey were fructose positive while 30% (12/40) that captured prey were fructose negative. Plant nectar significantly affected the Anopheles capture-proficiency.
Conclusions:	Our findings demonstrate that E. culicivora acquires fructose from its natural diet and can ingest fructose directly from plant nectaries.

Title:	Molecular phylogeny of fungus-growing termites (MACROTERMITINAE: ISOPTERA) in Kenya
Researcher(s):	Zipporah B. Osiemo, Manfred Kaib, Linus M. Gitonga, Hamadi I. Boga and Roland Brandl
Background:	Fungus-growing termites of the subfamily Macrotermitinae are abundant in African and Asian tropics where they play a major role in the decomposition of plants. Recent studies based on genetic markers have largely increased our knowledge about the evolutionary history of the symbiosis between fungus-growing termites and their fungi. The obligate mutualism between fungi of the genus *Termitomyces* and termite species within Macrotermitinae is as a result of a long co-evolutionary process, with a single phylogenetic origin in African tropical forests during the early Tertiary. Studies focusing on interaction specificity have been conducted elsewhere in Africa but none so far has been done on Eastern Africa despite the high generic richness of host termites in this area.
Methods:	One main focus was laid on the species-rich genus *Macrotermes*, which we believe was underrepresented in previous studies. To achieve this, we sampled Termitomyces from 40 colonies across three termite genera and at least seven species from geographically diverse regions in Kenya. We sequenced the ITS region of the fungi and used additional ITS sequences from African to reconstruct phylogenies by different methods. Afterwards, a randomization approach was used to test for the distribution of host genera and host species across the phylogenetic trees of the fungi.
Results:	The fungal sequences represent four well supported major clades with strong sequence divergence in between. Each clade was almost

exclusively associated with one host genus, showing that specific symbionts have coevolved with termites at the genus level. However, within the clade associated with the host genus Macrotermes, fungi lineages occurred in several species indicating low host specificity. Furthermore, same lineages occur across steep environmental gradients.

Conclusions: Therefore, the association of the fungal lineages with several host species is not as a result of an allopatric distribution of fungi among climatic regions.

Title: Assessment of the microbiome of some fungus-cultivating termites using Sanger sequencing and 454 pyrosequencing

Researcher(s): Makonde, H.M., Boga, H.I., Osiemo, Z., Mwirichia, R., Stielow, J.B., Göker, M., and Klenk, H.-P.

Background: Our understanding of the mutualistic interaction between termites and their gut symbionts has continued to attract the curiosity of researchers over time. Africa has a rich termite fauna with over 664 known species of termites whose diversity varies within and between regions. The Fungus-cultivating termites (*Isoptera, Termitidae, Macrotermitinae*) predominate in Asian and African tropics and impact greatly on the decay of plant biomass. They have evolved a unique and sophisticated mutualistic symbiosis with basidiomycete fungi (genus *Termitomyces*), which they cultivate on combs. The economically important genera include *Macrotermes, Odontotermes and Microtermes*. Their high abundance, cryptic and unpredictable foraging patterns, coupled with the diversity of their gut symbionts; challenge the development of termite management strategies. Termites harbor a complex gut microbiota, which contribute to digestion, termite nutrition and gas (CH_4, CO_2 and H_2) emission, hence provide a good model to study relationships between hosts and their gut microbial community, structure and function. However, information on the gut microbial diversity of fungus-cultivating termites is still inadequate and entirely lacking for some genera such as *Microtermes*. In addition, owing to the impact they have on the soil properties, the question of whether the fungus-feeding termites induce soil microbial changes as those observed in soil-feeders arises. These form the principle objective of this study with a focus on bacterial and fungal community structure in the different termite guts, mounds and soil microbial ecosystems.

Methods: Therefore, culture-dependent and culture-independent methods were used to comprehensively assess the bacterial and fungal diversity associated with Odontotermes, Macrotermes, Microtermes and Microcerotermes species. Termites were identified using mitochondrial cytochrome oxidase II (COII) genes. Termitomyces cultures were isolated from fungal combs. Internal transcribed spacer (ITS) clone libraries were constructed from termite guts. Presence of Termitomyces was confirmed using specific and universal fungal primers. Termitomyces species boundaries were estimated by cross-comparison of macromorphological and sequence features and ITS clustering parameters accordingly. Furthermore, overall trends in coverage of Termitomyces diversity and host associations were estimated using Genbank data. 16S rRNA gene sequencing of clone libraries and PCR-denaturing gradient gel electrophoresis (PCR-DGGE) analyses were used to characterize and compare bacterial diversity and community structure in the guts of Odontotermes and Microtermes species. Clone libraries were screened by restriction

fragment length polymorphism (RFLP) and representative clones and DGGE bands were sequenced. Furthermore, 454 pyrosequencing-based analyses of 16S rRNA and ITS genes sequences was used to profile the bacterial and fungal community structure between the termite guts, their mounds and surrounding (savannah) soil.

Results: Results from the ITS clone libraries indicate a monoculture of Termitomyces in the guts as well as the isolation sources (fungal combs). However, cases of more than one Termitomyces strains per mound were observed since mounds can contain different termite colonies. The newly found cultures, as well as the clustering analysis of GenBank data indicate that there are on average between one and two host genera per Termitomyces species. Saturation does not appear to have been reached, neither for the total number of known Termitomyces species nor for the number of Termitomyces species per host taxon, nor for the number of known hosts per Termitomyces species. The DGGE analysis revealed a sharp contrast between the bacterial community structure of Odontotermes and Microtermes. The 16S rRNA gene sequencing of clone libraries and PCR-DGGE analyses indicated seven bacterial phyla: Bacteroidetes, Spirochaetes, Firmicutes, Proteobacteria, Synergistetes, Planctomycetes and Actinobacteria. The major gut phylogenetic groups for the Odontotermes and Microtermes species were Bacteroidetes, Spirochaetes and Firmicutes. The affiliation and clustering of the sequences, often with those from other termites' guts, indicate a majority of the gut bacteria are autochthonous having mutualistic relationship with their hosts.

Conclusions: In conclusion, the diversity of the fungi thus seems to be higher than the one of their termite hosts and Termitomyces strains can be associated with different termite genera. Termitomyces is the most abundant fungus genus, but other fungal genera other than Termitomyces exist in the gut of fungus-cultivating termites. The bacterial diversity between the wood-feeding termite (Microcerotermes sp.) and the fungus-cultivating termites differed significantly. Moreover, termites harbor some gut-specific bacterial lineages that are unique and significantly different from those of mound and soil environments. The fungus-cultivating termites could be regarded as true metabionts since they create special micro-environments that support specific organisms such as fungi/ bacteria that may adapt, evolve and hence diversify. Their activities modify the soil environment and drastically affect fungal (ascomycete) community structure. The study gives a deeper understanding of the microbial diversity within the different termite groups, mounds and surrounding soil and it shows how different environments shape the microbial community and structure. The findings will add up to the clone-based inventories of termite gut microbiota and contribute to understanding of the diversity, specificity and mutualistic relationship of gut symbionts with their termite hosts, which is critical for their adaptation, survival and developing termite management strategies.

Title: Immunomodulatory effects Of *Brucella*on cytokine production that promote Spontaneous abortions

Researcher(s): Wamonje F. O., Waihenya R. K., Ng'ang'a Z. Ngeranwa J. N.

Background: By use of a murine model and the S19 strain this study sought to determine if *Brucella* causes spontaneous abortions by changing the cytokine profile in pregnancy. IL-2, IFN-γ and TNF-α represented the Th1 cytokines while IL-4 and IL-5 represented the Th2 cytokines. A

pro- abortion cellular response was expected from an intracellular bacterium like *Brucella*.

Methods: Pregnant mice were injected intraperitoneally with live S19 strain of Brucella and cytokine profile evaluated over the three trimesters of pregnancy.

Results: The results showed a hummoral response. Th1 cytokines had no significant differences between cytokine levels for control and test groups [p>0.05.] IL-4 levels had significant differences in all three trimesters of pregnancy [t (13) (0.036, 0.0071, 0.0277 p<0.05] IL-5 levels had significant differences second trimester [t (14) 0.0075 p<0.05]

Conclusions: Elevated IL-4 levels with corresponding suppression of IFN-γ can be used as a marker for successful pregnancy in Brucellosis

Title: Determination of the existence of CCR5-Δ32 and CCR2-64I host gene polymorphisms in HIV-1 exposed infants in Nairobi Province, Kenya

Researcher(s): King'oo J. M., Khamadi S. A., Muigai A. W., Waihenya, R., Onguso J.

Background: An estimated 600,000 children per year are infected with HIV-1, majority of them through mother-to child transmission (MTCT). The chemokine co-receptor 5 (CCR5) and the δ-chemokine co-receptor (CX3CR4) are the major chemokine receptors involved in the binding and entry of non syncytium inducing (NSI or M- trophic) HIV-1 strains. The chemokine co-receptor 2 (CCR2) is used as a secondary co-receptor for the HIV-1 entry into the cell. The CCR5-Δ32and CCR2-64I gene polymorphisms are associated with protection against HIV infection and slowing down progression rates. The objective of this study was to determine the existence of CCR5-Δ32 and CCR2-64I gene polymorphisms in HIV-1 exposed infants in Nairobi Province.

Methods: The CCR5 and CCR2 genes were amplified from 240 blood samples of infants obtained from different health facilities within Nairobi Province.

Results: None of the infants possessed homozygous CCR5 mutant allele. Four infants (1.7%) exhibited the heterozygous state (CCR5/ CCR5-Δ32 genotype). The wild type (WT) allele (CCR5/CCR5 genotype) accounted for 236 (98%) of all the infants studied. For the CCR2 gene, 63 (26.25%) of all the infants studied had the CCR2-64I gene polymorphism. Of these, 53 (22.1%) possessed heterozygous allele (CCR2/CCR2-64I genotype). Ten (4.2%) of the infants under study carried homozygous CCR2-64I allele (CCR2-64I/CCR2-64I genotype). The CCR2-64I mutation was present in 63 (26.25%) of the 240 infants studied compared to 4 (1.7%) of the CCR5-Δ32 gene polymorphism. It was concluded that CCR5-Δ32 gene polymorphisms are rare among the infants. The CCR2-64I gene polymorphisms exist within the population of HIV positive and HIV negative infants. The homozygous CCR2-64I gene polymorphism within the Nairobi population has a lower frequency than the heterozygous CCR2-64I

Conclusions: It was concluded that CCR5-Δ32 gene polymorphisms are rare among the infants. The CCR2-64I gene polymorphisms exist within the population of HIV positive and HIV negative infants. The homozygous CCR2-64I gene polymorphism within the Nairobi population has a lower frequency than the heterozygous CCR2-64I. It was confirmed that the CCR2-64I gene polymorphism is more frequently distributed among the black population as shown in earlier studies.

Title: The Prevalence of Co-Infections of Malaria*, SchistosomiasisMansoni* and Soil-Transmitted Helminthiasis in School Children in Nyamatongo Ward in Serengerema, District

Researcher(s): Humphrey D.Mazigo, Rebecca Waihenya, Nicholas J.S.Lwambo Ladislaus M. Laurent, Elingaya J. Kweka, JeremiahSeni, Anthony Kapesa, StephenE.Mshana and Gerald M.Mkoji

Background: In endemic areas of Africa, concomitant parasitic infections are common, yet most studies concentrate in single parasites infections in groups at risks. This investigation assessed the extent of co-infections of *P. falciparum, S. mansoni*, hookworm and their association to anemia among school children in Nyamatongo ward Sengerema district, northwest Tanzania.

Methods: A cross sectional study was conducted in Sengerema district among 400 school children of ages between 8 and 16 years in schools located close to the shores of Lake Victoria Kato Katz technique was used to screen faecal samples for *S .mansoni* and hookworm eggs. Giemsa staining was used to examine blood smears for *P. falciparum* while Hemocue technique was used to determine haemoglobin concentration.

Results: The prevalence of *P. falciparum*, hookworm infections and *S mansoni* were 13.5% (95%CI, 10.2-16.8), 38% (95%CI, 33.2-42.8) and 64.25% (95%CI, 59.6-68.9) respectively. Co-infections of *P. falciparum* + hookworm, *P.falciparum* + *S.mansoni* and hookworm + *S.mansoni* were 18.3% (95%CI, 14.5-22.1), 6% (95%CI, 3.7-8.3), 1.5% (95%CI, 0.03-2.7) and triple infections was 2.8% (95%CI, 1.15-4.4) respectively. Increasing infections of *S.mansoni* was significantly correlated with an increased likelihood of concomitant hookworm infections (OR=2.12, P<0.019, OR=2, P<0.008). The prevalence of anemia was 19.8% and showed an association with *S. mansoni* (OR=2.29, 95%CI, 1.01-5.2, P<0.048). None of the helminth showed association with *P. falciparum*.

Conclusions: Multiple parasitic coinfection with *P. falciparum, S. mansoni* and hookworm is a common feature among school children. Heavy infections of *S .mansoni* are associated with anemia. The findings provide information on the magnitude of public health concern to co-infection, the significance of which may yield synergistic opportunities for the control strategies, however requiring further investigation.

Title: CD38 as A Surrogate Marker for HIV Infection in Antiretroviral Naive and Antiretroviral Experienced Patients in Kenya

Researcher(s): A.N Njuguna, R Waihenya, R Mathaai, S Mpoke, M Mbuchi, P Otieno, P Nyakundi

Background: Measurement of viral load poses a challenge in that besides being expensive it requires skilled manpower, equipment and other logistics not readily available in many settings where such measurements are required hence the need to address other markers in management of HIV. CD4 absolute counts on the other hand cannot be used solely to determine the overall status of immune system of the patient. The objectives of the study were to establish the correlation between CD38 ABC and viral load and usefulness of CD38 ABC in management of HIV.

Methods: This was a cross sectional study carried out at Mbagathi district hospital Nairobi Kenya and National public reference laboratory using 84 HIV-1 patient adults

Results: A positive correlation r =0.046 existed between CD4 and CD38 for participants on drugs whereas a negative correlation coefficient r= -0.476 was observed for participants not on drugs p= 0.002. CD38 was compared with viral load a positive correlation r = 0.121, p=0.001 was observed for participants not on drugs whereas, a negative correlation r = -0.092 was evident for participants on drugs. A negative correlation r =-0.498 is illustrated for participants not on drugs, whereas for group on drugs a positive correlation r =0.041, p= 0.002 is exhibited between CD4 and viral load

Conclusions: The findings of this study show evidently that CD38 expression, viral load and CD4 count differ significantly between the two study groups. There was also a significant correlation between CD38 ABC and viral load. CD38 levels for the group not on drugs was elevated the same way viral load was elevated whereas for the group on drugs CD38 levels were lowered the same way as viral load. These results suggest that $CD8^+CD38^+$ can be used as an independent parameter to monitor disease progression in HIV-1 patients. Quantitation of CD38 may therefore be an affordable test that can serve as an extra tool in HIV-1 management.

Title: Molecular Identification, Phylogeography and Genetic Diversity of Mosquitoes collected from areas endemic to Rift Valley Fever in Kenya

Researcher(s): Cecilia Njeri Rumberia, Anne W-T Muigai, Steve Kemp, IlmaTapio, Shadrack Muya.

Background: Rift Valley Fever virus in Kenya is primarily transmitted by Aedes and Culex mosquitoes. The disease is zoonotic and is endemic in specific areas in Kenya. For a long time RVF mosquito vectors been classified according to morphological characteristics/tools which have been found to be subjective and not very effective in classification. Current molecular tools in use for mosquito classification such as Polymerase Chain Reaction- Restriction Fragment Length Polymorphism (PCR-RFLP) are cumbersome and thus more reliable and efficient tools are needed

Methods: In this study, validation of internal transcribed spacer (ITS) 1 and 2 was done and molecular tools were developed targeting eleven sections of intergenic/ intronic spacers and tested for applicability in vector identification. Validation and study of the different selected loci was done using next generation sequencing using the 454 sequencer of amplicons derived from laboratory reared mosquitoes and field mosquitos from different RVF endemic regions in Kenya. Sequence and phylogenetic analysis of the resulting sequences was carried out using various GS (Genome Sequencer) software, ClustalX/ W, BioEdit and MEGA5

Results: The ITS1 region was found to be highly divergent displaying a high degree of intraspecific and interspecific variation while ITS 2 was found to be highly conserved in the different species. These two loci (ITS1 and ITS2) thus would not be appropriate tools for taxonomic and phylogeographic analysis of vector populations. Three loci (ANG12432, ANG26425 and ANG20760) out of the eleven intergenic/ intronic regions were found to be conserved within distinct species and variation existed between species. These sites are thus appropriate for RVF vector classification. In the study of population structure, none of the eleven sites used revealed distinct geographical distributions.

Conclusions: The three loci (ANG12432, ANG26425 and ANG20760) can therefore be applied for accurate identification of mosquito species. ANG00020

loci separated distinctly the samples

Title: Phenotypic plasticity in reproductive traits of the marbled parrotfish, Leptoscarusvaigiensis (Quoy and Gaimard, 1824) among reefs in coastal Kenya

Researcher(s): Gamoe L., Albert, Kaunda-Arara Boaz, Wakibia Joseph and Muya Shadrack

Background: Parrotfishes (Scaridae) play a significant role in coral reef ecosystems throughout the tropics, functioning ecologically as algal consumers and bioeroders and are also economically valuable in local fisheries. As consumers of algae, the Scaridae play a role in shaping the distribution, community structure, standing crop and production rates of benthic algae on coral reefs; thus they increase the ability of reefs to resist or recover from loss of live coral cover, an increasing problem on coral reefs across the globe. Heavy removal of these fishes from reefs by fishing or predation may therefore affect local aqua community structure and trophodynamics on reefs. However, fish species have potential plasticity in their life history attributes that may make them resilient to the effects of fishing.

Methods: Phenotypic plasticity in the reproductive traits of the marbled parrotfish; Leptoscarusvaigiensis was studied among various reefs in coastal Kenya from May 2011 to April 2012. Baited fishing traps were used to capture fish samples within two no-take marine parks (Malindi and Watamu) and their adjacent reserves with controlled fishing. Fish samples from two reefs (Kanamai and Vipingo) with no protection from fishing were purchased from commercial catches landed at designated landing stations adjacent to the sites.

Results: Mean fecundity estimates among park and reserve sites were not significantly different across sites ($F= 1.78$; $p = 0.154$) whereas among unprotected sites, they were significantly different ($F = 10.664$; $p = 0.000$) indicating the role of controlled fishing effort in inducing homogenized reproductive potential (fecundity) among park and reserve sites. Differential fecundities among unprotected sites is thought to result from uncontrolled fishing intensities at these sites. Clustering of fecundity estimates and gonadosomatic indices on the basis of site protection following multidimensional scaling (MDS) analysis signify the influence of fishing in shaping reproductive patterns of fish among reefs experiencing differential fishing intensities. Smaller lengths at first maturity among fish occurring in intensely fished sites relative to those in less fished or non-fished sites is indicative of fishing induced phenotypic plasticity in reproductive attribute of length at first maturity for L. vaigiensis.

Conclusions: The findings of this study are useful in guiding decision makers when designing fisheries management and conservation programs of reef fishes in coastal Kenya.

Title: Haemoglobin as a simple marker of HIV disease progression among ARV naïve adults in Nairobi, Kenya

Researcher(s): Mary N. Mutisya, Rebecca Waihenya and Kutima, Helen Lydia

Background: Acquired immunodeficiency syndrome (AIDS) caused by the human immunodeficiency virus (HIV) continues to be a major threat to human kind. Quantitative measures of CD4+ T- lymphocytes and viral load in peripheral blood are still considered to be the most reliable markers of HIV disease progression; however the processing of blood samples for

CD4+ T-cell counts requires complicated and expensive machines that are not available in most Kenyan health facilities. Full blood count to determine haemoglobin levels can be cheaply and conveniently done in most district hospitals and CDF-funded health centers' countrywide

Methods: The study was carried out at the KEMRI-FACES clinic and laboratory at the Centre for Respiratory Diseases Research (CRDR), KEMRI. Ethical approval for the use of patient blood samples was granted by the KEMRI Ethical Review Committee (ERC). A total of 167 patients aged between 18-60 years from both sexes who obtained full blood count, CD4+ and CD3+ T-cell measurements were enrolled for the study. Blood was taken by venipuncture and collected in 4ml vacutainer tubes with 1.0ml EDTA anticoagulant. CD4+ and CD3+ T- lymphocytes counts were measured by FACS count (BD Sciences) while haemoglobin levels were determined by full blood count using automated analyzers (Nihon Kohden). The patients were followed for six months with the first follow-up visit after three months and the second follow-up visit after six months .Correlations between CD4+ T cell count, haemoglobin levels and WHO clinical staging system were evaluated using Spearman rank correlation

Results: The correlation between haemoglobin and CD4+ T cells at enrolment was 0.388 while at follow-up one, 0.0089 and 0.0547 at follow-up two. At enrolment, patients in WHO stage 1 had a median CD4 count of 588 and were negatively correlated at -0.05. The correlation between haemoglobin and CD4/CD3 ratio at enrolment was 0.861, at follow-up 1, 0.798 and at follow-up 2, 0.422. This was not significant. At 95% confidence interval, the difference was not significant.

Conclusions: From the results of this study, it was concluded that with the new WHO CD4+ T cell count cut-off of above 350, haemoglobin levels, CD3/CD4 ratio and WHO staging do not correlate, hence haemoglobin is not a suitable marker of HIV disease progression

Title: Pharmacological and therapeutic potential of Prosopis juliflora (SW.) DC (Fabaceae), an invasive tree in Kenya

Researcher(s): Rehab S. Odhiambo, Patrick G. Kareru, Helen Kutima, Daniel W. Gakuya, Gathu Nyagah, Francis K. Njonge

Background: Incidents of epidemics due to drug resistance pose enormous threat to human and animal health and the emergence of resistance due to indiscriminate use of conventional drugs require the need to look for alternative sources of treatment such as the rational localization of bioactive phytochemicals with therapeutic potential. The objective of this study was to evaluate pharmacological and therapeutic potential of Prosopis juliflora, an invasive plant found in Kenya

Methods: Phytochemical screening and quantification were done using standard procedures while in vitro anthelmintic activity was done at various concentrations in comparison to albendazole. Spectroscopic and thin layer chromatographic techniques were employed to determine the antioxidant activity while assessment of antimicrobial activity of P. juliflora was done against clinical isolates of Candida albicans, Staphylococcus aureus, Bacillus subtilis, Escherichia coli and Pseudomonas aeruginosa using paper disc diffusion method

Results: Significant concentration-dependent anthelmintic effects of ethanolic extracts were observed ($P < 0.05$) and all the extracts had inhibitory effect on the growth of all the bacterial isolates. There was no significant difference ($P>0.05$) between the activity of the plant

extracts at 100mgmL-1 compared to the activity of chloramphenical, erythromycin and minocycline and the ethanolic extracts exhibited better antifungal activity compared to cotrimoxazole. All the extracts had saponins, tannins, flavonoids and alkaloids; phytochemicals with known pharmacological properties.

Conclusions: The study showed that extracts of P. juliflora have significant pharmacological potential that can be incorporated in the treatment of various ailments.

Title: Additional sequence analysis and recombinant expression of RIM36, a 36 kDa cement protein of the ixodid tick Rhipicephalus appendiculatus

Researcher(s): Naftaly Githaka, Richard Bishop, Stephen Mwaura, Helen Kutima, Marion Mutugi, Satoru Konnai and Robert Skilton

Background: Ticks are blood-feeding ectoparasitic arthropods causing acute economic losses to the livestock industry, especially in the tropics and subtropics, by transmitting a range of pathogens including viruses, rickettsiae and protozoa. In addition, ticks cause direct damage through attachment to the host and by the injection of toxins. Globally, ticks and tick-borne diseases cost the cattle industry between US$13.9 and US$18.7 billion per year (de Castro, (1997). Currently the most widely adopted method to control ticks on livestock is through the frequent topical application of acaricides. However, the use of acaricides is unsustainable because of the development of tick resistance and an increasing awareness of the negative effects of acaricides on the environment and human health. Since mammalian hosts can develop resistance to feeding ticks (reviewed by

Willadsen, 1980) host vaccination against ticks might become a sustainable, alternative method of tick control. The development of anti-tick vaccines is an active research area, although at present there is only one commercial vaccine against ticks, based on the gut antigen Bm86 of Boophilus microplus (Riding et al. 1994; Willadsen et al. 1995).

Tick salivary gland proteins are of great interest in the development anti-tick vaccines (Valenzuela et al. 2002; Mulenga, 1999; Tsuda, 2001; Trimnell, 2002; Bergman et al. 2000; Valenzuela, 2002; Bior, Essenberg, Sauer, 2002; Nene et al. 2002). These molecules function in tick attachment to the host, aid uptake of the blood meal, modulate host immune mechanisms, and also play a role in pathogen transmission (Gilespie, Mbow and Titus, 2000; Ribeiro, 1995; Sauer et al. 1995; Wikel and Bergman, 1997; Ribeiro and Francischetti, 2003). The salivary glands of most ixodid tick species secrete a proteinaceous adhesive 'cement' to anchor the tick mouthparts to the host during feeding, and to protect the mouthparts from host immune responses (Sonenshine, 1993). Because cement proteins are essential for tick attachment and feeding, they are candidates for inclusion in anti-tick vaccines (Tsuda et al. 2001; Trimnell et al.; Nuttall and Paesen, 1999).

The ixodid tick Rhipicephalus appendiculatus is the most important vector of the protozoan parasite Theileria parva, the causative agent of East Coast fever, a rapidly fatal disease of cattle in eastern central and southern Africa (Norval, Perry and Young, 1991). Previously, Bishop et al. (2002) characterised Rhipicephalus Immuno-dominant Molecule 36 (RIM36), a 36 kDa glycine (G)/serine(S)/leucine (L)/proline (P)-rich cement protein of R. appendiculatus that is located in secretory cells of the salivary gland. Sequence analysis of the predicted protein

revealed a major size variant, plus minor sequence polymorphisms. RIM36 has two distinct domains: one towards the N-terminus with repeating GLS-rich motifs, and a P-rich C-terminal domain. RIM36 appears to be an immunodominant antigen of R. appendiculatus cement in cattle: antisera from Bos indicus cattle exposed to R. appendiculatus ticks react strongly with a bacterial recombinant C-terminal domain. In addition, antibodies to the recombinant C-terminal domain and antisera from cattle infested with R. appendiculatus react strongly with a 36 kDa protein in immunoblots of salivary gland and cement proteins. However, the protective capacity of this antigen was not investigated. We have further characterised the RIM36 protein, and herein describe additional size and sequence variants of RIM36. Also, in the context of potential vaccination and as an additional marker of cattle exposure to R. appendiculatus, we describe the expression and purification of the recombinant G-rich N-terminal domain.

Methods:

Salivary gland material and RNA purification Rhipicephalus appendiculatus tick material was derived from the Muguga stock that has been maintained as an experimental colony at ILRI for more than 40 years. Salivary glands were dissected from 450 adult female Rhipicephalus appendiculatus fed on rabbits for 4 days. Total RNA was purified and analysed for yield and quality as described (Nene et al. 2002). The yield of total RNA was 1.027 mg.

Reverse transcription: cDNA was synthesised from total RNA using the Reverse Transcription System (Promega, Madison, WI 53711, USA) with oligo dT priming according to the manufacturers' instructions.

Cloning and expression of RIM36

A PCR using Taq DNA polymerase (Promega), with total salivary gland cDNA as the template, was performed using cycling conditions of 1 min each at 940C, 550C and 720C for 30 cycles. For amplification of a 5' domain (encoding approximately 65% of the entire open reading frame) oligonucleotide primer ILO9250 (5'-CGCGGATCCTTCTATGGCGGAAGTTTCTCTAGC-3')wasusedwith ILO9251 (5'-CGCAAGCTTGAGACCCATGGACAGGGGACCGTA-3'). For amplification of the entire RIM36 open reading frame less the predicted 5' signal peptide, oligonucleotide primer ILO9250 was used with ILO9252 (5'-CGCAAGCTTAGATTGCAACGTGTTCCT-3'). Each primer incorporated synthetic BamH I or Hind III sites (underlined). PCR products were purified with a QIAquick PCR purification kit (Qiagen) and cloned in pGEM-T Easy plasmid vector (Promega). Six independent recombinant plasmid clones were sequenced with BigDye™ Terminator Cycle Sequencing Ready Reaction Kit version 3.1 (Applied Biosystems, 850 Lincoln Centre Drive FosterCity, CA94404 USA). Samples were run on an ABI377 Genetic Analyser for 3 h using the SeqRun 36E-2400 module. DNA sequences were aligned with the CLUSTAL W algorithm of OMIGA v2 (Oxford Molecular). One RIM36, clone C3, was subcloned into BamH I/Hind III double-digested pQE30 expression vector (Qiagen). In order to optimize yield of recombinant protein, pQE-30/RIM36/C3 construct was transformed into several E. coli strains; (BL21, Tuner, Rosetta-Blue and Origami series (Novagen, Merck KGaA Frankfurter Str.250 64293 Darmstadt Germany). Expression and purification of recombinant protein essentially followed protocols in the QIAexpressionist product manual (Qiagen, 27220 TurnberryLane Suite200 Valencia, CA 91355, USA). Expression was induced with 1 mM isopropyl thiogalactoside for 4 h. Harvested bacteria were lysed in lysis buffer (50 mM NaH_2PO_4, 300

mM NaCl, 6 M guanidine HCl, 10 mM imidazole, pH 8). After clearing the lysate by centrifugation, the expressed protein was bound to a 10 ml Ni-NTA agarose (Qiagen) affinity column. The column was washed with wash buffer (100mM NaH_2PO_4, 10 mM Tris-HCl, 8 mM urea, 10 mM imidazole, pH 6.3), and the protein was eluted with elution buffer (45 mM NaH_2PO_4, 5.4 M guanidine HCl, 270 mM NaCl, 150 mM imidazole, pH 7). The eluted material was dialysed against PBS (pH 8).

Polyacrylamide gel electrophoresis and western blotting

Bacterial lysate proteins and purified recombinant proteins were separated by 12% SDS–PAGE and transferred to nitrocellulose filters (Schleicher & Schuell) using standard methods (Harlow & Lane, 1988) and blocked in 1% BSA. The filters were incubated at room temperature for 1 h with anti- HisTag antibody (Amersham). After washing, the bound antibody was detected by Protein G/alkaline phosphatase conjugate (Calbiochem, Merck KGaA FrankfurterStr. 250 64293 Darmstadt, Germany) with Western Blue BCIP/NBT as chromogen (Promega).

Results:

Sequence analysis

One sequence for RIM36, AY045761, has been previously reported (Bishop et al. 2002). In the current study, RT-PCR amplification of the RIM36 from R. appendiculatus (Muguga) salivary gland RNA yielded six novel RIM36 sequences (Accession numbers pending, Table 1 and Fig 1). In addition, three more sequences, TC1400, TC5518, & TC1399 were obtained from the R. appendiculatus Gene Index (Nene et al. 2004). These sequences were characterized by size polymorphisms within two domains. In addition there were single amino acid changes at four other positions, although we cannot rule out the possibility that they may be the result of Taq DNA polymerase fidelity errors. The polymorphisms show the diversity of RIM36 within the Muguga stock is greater than first reported (Bishop et al. 2002). As previously reported (Bishop et al. 2002), RIM36 polymorphisms may reflect immune selection pressure exerted by the host. However, because the size polymorphisms reported here occur in areas of tandem repeats (GLG and GSPLSGF) they may instead reflect imperfect crossover events during sexual recombination. The number of GLG repeats can be 4, 5 or 6, while the number of GSPLSGF repeats can be 11, 12 or 13. Sequence 13 (AX003897, UK patent W09924567) is a RIM36 sequence variant reported in Bishop et al. (2002). This sequence is characterised by a 58 amino acid residue deletion towards the C terminus. In RIM36, the region corresponding to the deletion is rich in P and V, perhaps to mimic the mammalian host's skin components such as collagen (Bishop et al. 2002). In RIM36 the sequence deleted from sequence 13 (or inserted into other RIM 36 sequences) is GVVRQRLVPA PYRVPHPVPV PQPFPVPQPY QVDVPVPKPV EVPVPRPEPI HTVTEVTN (this represents residues 248-305 of RIM36 accession number AY045761 of Bishop et al. 2002 and is 29.3% P and 25.8 % V, whereas overall the RIM36 sequence has 11.4 and 8.7% respectively of P and V. The deleted portion has numerous VP or PV motifs, but no motifs of contiguous Ps or Vs. The deletion occurs towards the C terminus, and corresponds to a hydrophilic region of the protein which may contain immunodominant epitopes. Bishop et al. (2002) showed that the C-terminus (which contains this region) was highly immunogenic in cattle exposed to tick infestation. The deletion of a region that may contain dominant epitopes possibly indicates immune

selection against this region. In addition to a signal peptide, RIM36 is also predicted to contain two transmembrane helices, at positions 54-76 and 83-105.

Conclusions:

The presence of two TMH domains suggests that while the RIM36 is thought to be a component of the tick cement, it could also be a component of a membrane protein during processing of the protein. Antibodies raised to this portion of the protein could be used to determine if at any time the protein is membrane bound (after signal peptide cleavage), which would signify possible expression in other tissues, other than the salivary glands. From a BLAST search of RaGI, a similar G-rich protein was identified: TC1274. Like RIM36, TC1274 has a N-terminus with G-rich repeats, and a smaller C-terminal P/V-rich domain. In addition, TC1234

and RIM36 have several small domains with good sequence identities, indicating that a family of proteins related to RIM36 may exist within the salivary glands of ixodid ticks. Indeed, cDNAs coding for proteins with sequence homology with RIM36 have been isolated from fed female Ixodes scapularis (Guilfoile & Packila, 2004). One of those cDNAs, designated as Is 9, seems to be highly upregulated in female ticks during blood acquisition. Is 9 is glycine rich, like RIM36, with 12 GLX repeats (mostly GLG) comparable to the 19 GLX repeats in RIM36. The putative protein encoded by the Is 9 cDNA is 50% glycine, closely matching the N-terminal section of the RIM36 protein which is ~44% glycine. Similarly, 64P, a glycine rich (~30%) protein component of the cement cone of R. appendiculatus (Trimnell et al. 2002) shows substantial sequence similarity to the putative Is 9 protein of IRecombinant expression Eluted the protein from the beads with 10 ml of elution buffer (45 mM NaH2PO4, 5.4 M GuHCl, 270mM NaCl, 150 mM Imidazole, pH 7.0). Repeated the elution 3 more times, each elution yielding slightly more than 9ml of the eluate to give a total of 38 ml of eluate scapularis. In addition, 6 litres of bugs were grown and RIM36 purified as above but the protein was not eluted.

The resins beads with bound protein (15ml of 50% washed beads used for the 6 litres of bugs) kept at -80 oC. The concentration of the protein bound to the beads was 4 mg/ml of beads as quantified by spectroscopy. Despite the high yield, the recombinant antigen was virtually insoluble in PBS, diminishing its application in the enzyme-linked adsorbent assay. The capacity to generate sufficient quantities of soluble and possibly functional tick antigens remains a challenge, relying on such fragile expression systems like the insect-cell baculovirus system. Qing, G. et al (2004) recently developed a protocol for high production of soluble proteins in E. coli using cold-shock induction promoters, and numerous such expression vectors are commercially available currently. This approach would potentially reduce the accumulation of the recombinant proteins as insoluble aggregates as was the case in the present study. SDS-PAGE and immunoblot analysis of bacterial cell lysates showed high level of over expression of the recombinant RIM36. Purified material showed that the RIM36 was very pure, with little or no contamination by bacterial proteins. Also, the analysis showed the protein to be highly stable. In addition to insolubility, recombinant proteins expressed in E. coli may differ from those generated through eukaryotic systems such as yeast and Baculovirus insect-cells system, with the latter undergoing posttranslational modifications (PTMs). PTMs are important for functional activity of many proteins, including protein antigens that rely on PTMs to form antigenic conformations.

Alarcon- Chaidez et al. (2003) expressed recombinant p36, an immunosuppressant from the tick vector Dermacentor andersoni, in E. coli and also its functional counterpart in insect cells using pIZV5/ His insect cell expression system. While both forms of the protein were recognized by antibodies raised against tick-derived p36, the E. coli recombinant form did not inhibit mitogen-driven proliferation of lymphocytes in vitro, an observation that was attributed to the lack of post-translational modifications such as N-linked glycosylation. The lack of PTMs could be responsible for the lack of protection in cattle vaccinated with bacterial forms of RIM36. However, this may not apply to all tick antigens, as exemplified by the case of Bm86, a 86-kDa glycoprotein derived from R. microplus gut used in commercial anti-tick vaccines in S. America. Recombinant forms of this antigen produced in bacteria, yeast or baculovirus system are equally protective against field tick challenge (Garcia-Garcia et al. 1998). Recently, Imamura et al, (2008) demonstrated some level of transmission blocking against T. parva using a vaccine cocktail comprising of the C-terminal RIM36 domain and two R. appendiculatus serpins. However, the contribution of RIM36 to this protection was not evaluated. It would be of interest to investigate the full-length RIM36 antigen in future vaccine trials, especially in combination with p67 (Musoke et al. 1992). Despite its limited potential as an anti-vaccine component, RIM36 can be a valuable marker for tick exposure in the field, and by extension, the risk of T. parva infection.

3.2 DEPARTMENT OF BOTANY

Title: Substantial molecular variation and low genetic structure in Kenya's black rhinoceros: implications for conservation

Researcher(s): S. M. Muya, M. W. Bruford, A. W.T. Muigai, Z. B. Osiemo, E. Mwachiro, B. Okita-Ouma, B. Goossens

Background: Kenya's black rhinoceros population declined by more than 98% from 20,000 individuals in the 1970s to around 400 individuals in 1990 due to the effects of poaching, at which time the surviving individuals were isolated in a series of demographically inviable subpopulations. An initial management exercise translocated the survivors into four high security sanctuaries to control poaching and enhance breeding, and this measure successfully arrested the decline. Subsequently, new sanctuaries were established and the metapopulation size reached 650 animals by 2008. However, translocations and the current management strategy that partitions the metapopulation into 'montane' and 'lowland' rhinoceros may have substantial consequences at the population level and their impact on population genetic diversity has not been investigated. In this study, 12 of the 16 extant subpopulations were analysed using 408 bp of mitochondrial control region sequence (n = 170) and nine microsatellite loci (n = 145). Both markers detected oderate to high genetic diversity (h = 0.78 ± 0.027, n = 170; HO = 0.70 ± 0.087, n = 145) consistent with previous studies on Diceros bicornis michaeli. However, mtDNA and nDNA diversity varied substantially between subpopulations.

Methods: Sampling was carried out in 12 of Kenya's 16 current black rhinoceros subpopulations. Two subpopulations—Meru National Park and Mugie Ranch were not sampled because they were established between 2004 and 2006 with animals from Solio Ranch, Nairobi National Park, Lake

Nakuru National Park and the Lewa Down Wildlife Conservancy. Hence sampling the source subpopulations was expected to capture the genetic composition of these subpopulations. The fourth unsampled subpopulation, Masai Mara Triangle, is not distinct from Masai Mara National Reserve because the animals occupy the same unfenced ecosystem. The Aberdares National Park is the only montane park in Kenya inhabited by black rhinoceros and is managed separately by KWS with translocation not allowed in or out this subpopulation. Only fresh dung samples were obtained in this subpopulation, since tissue or blood samples were not available. All other 15 subpopulations are considered as lowland subpopulations and translocations are allowed. A total of 295 samples were analysed. They included tissue (86), serum (54), whole blood (37) and dung (118) collected from known different individuals. Serum, whole blood and tissue samples were preserved in either 70% ethanol at -20_C or in 25% dimethylsulphide (DMSO) saturated with sodium chloride at room temperature. Dung samples were preserved in 90% ethanol. Molecular methods A DNeasy_ Tissue Kit was used to extract DNA from tissue and serum while a QIAmp_ DNA Stool Mini Kit was used to isolate DNA from dung samples. In both cases the manufacturer's instructions (QIAGEN_ Hilden, Germany) were followed. The extracts were dissolved in 150 ll of elution buffer and stored at -20_C. Extractions blanks and positive controls were used to monitor contamination during extraction and amplification.

Results: The results suggest that the Masai Mara is more differentiated, inbred and isolated than other subpopulations. It also suggests that there are neither distinct montane and lowland groups nor other detectable historical barriers to gene flow. Instead the large majority of genetic diversity was partitioned at the level of individuals; highlighting the need to conserve as many individuals as possible.

Conclusions: Future translocations should consider the genetic profile of individuals and the demographic history of both the donor and recipient subpopulations.

Title: Superficial Mycoses among Psychiatric Patients in Mathari Hospital, Nairobi, Kenya

Researcher(s): M. Ogutu, Z. Ng'ang'a, M. Namasaka and M. Wambura

Background: The study was conducted on prevalence of superficial fungal infections among psychiatric patients in Mathari Hospital, Nairobi, Kenya during the period of July to November 2009. 152 patients were assessed and samples collected from 25 patients with clinically suggestive symptoms of dermatomycosis revealed a 12.5% prevalence of superficial mycosis.

Methods: This prospective study was conducted at Mathari Mental Hospital, Nairobi, Kenya and Jomo Kenyatta University of Agriculture and Technology at the Medical Laboratory Science, Departmental Laboratory. The sample population consisted of patients admitted at the Mathari Mental Hospital. Patients who presented with superficial mycoses of hair, nail and skin and consented were included in the study. one hundred and fifty two patients were sampled, 25 patients fulfilled the criteria of fungal infection (A sample size of 25 subjects was randomly selected) (11). Simple random sampling was used to select the subjects. Clinician examined the patients for dermatomycosis and also determined those with or without insights. The identified

subjects with insight were issued with a consent form and those without insight, their next of kin consented for them. Questionnaires were pre-tested and administered. The affected area was thoroughly washed with either soaked gauze pad. The infected hair and nail of the selected subjects were cut from the tip attached to the cutaneous and the skin was scrapped using a scapel blade (3). The material was put in a sample envelope, sealed and transported to the laboratory for analysis. Wet mount using 10% KOH was prepared for every sample by emulsifying some scrapings in a drop of 10% KOH on a glass slide and left for 30 minutes (skin scales) or two hours (nail). After softening of material, the cover glass was gently pressed so to lie straight (4). This was examined microscopically at x40 objective for the spores. The specimens were cultured on Sabouraud Dextrose Agar in sterile petri dishes and incubated at room temperature in a humid chamber. The cultures were examined daily for two to four weeks for morphological features. Identification of the mycoses was done by noting the colour of culture, appearance and mode of spread. Microscopy using lactophenol cotton blue was used to identify the type of conidia and hyphae. Disk diffusion technique was used to determine the most effective drugs for dermatophytosis (12). Chi-square and the P – value obtained from statistical table was compared with the calculated value to get the most effective drug ($P>0.05$).

Results: There was no significant difference between males and females with superficial mycosis ($P>0.05$). Twenty percent of the patients who were on topical application had no viable organisms. Microsporum was the predominant species isolated while the skin was the site most commonly affected (64 %). Epidermophyton was the least prevalent. Terbinafin was the most effective antifungal while ketoconazole was the least effective.

Conclusions: All patients admitted at Mathari hospital should be screened for fungal infection and treated. Terbinafin can be used as first line treatment of dermatomycosis after screening all psychiatric patients in Mathari Mental hospital.

4.0 FACULTY OF AGRICULTURE

4.1 DEPARTMENT OF HORTICULTURE

Title: The effect of subsequent storage of tuberose (*Polianthes tuberosa* L) bulbs after low temperature pre - treatment improves growth, percent sprouting and cut flower quality.

Researcher(s): Arnold Onyango Watako

Background: Tuberose (*Polianthes tuberosa* L), an ornamental bulbous plant native to Mexico, is one of the most important cut flowers in tropical and subtropical areas. In Kenya, it occupies a prime position in the floriculture industry as an important export crop. During peak planting time in commercial tuberose cut flower production lack of seed materials occasionally occur. Most producers also source planting materials which have not been adequately stored resulting in poor performance of the crop. For improved productivity in tuberose cut flower value chain, ways of increasing the availability of planting materials and improving the growth performance need attention. This study examined the effects of subsequent warm temperature storage after low temperature treatment of tuberose bulbs on growth, sprouting and flower quality.

Methods: Five bulbs per treatment were placed in perforated polyethylene bags. The perforated polythylene bags together with the bulbs were then pre-treated at 5 ^{o}C or 10 ^{o}C for 3 months dry storage in a biotron. The relative humidity in the biotron was maintained at 40% to 50% with continuous lighting from fluorescent tubes (Nippon Electric Company (NEC) 100V, 47.5W, 50Hz). The experiment was laid in a split plot arrangement in a completely randomized design. The main effects were pre-treatment temperatures at 5 or 10 ^{o}C, whilst subsequent temperature storage treatments constituted the sub-effects After 3 months of dry storage, bulbs were transferred to 20 ^{o} C adjusted biotron storage. The control received no subsequent temperature treatment but planted directly in the greenhouse beds. Samples of five bulbs were removed from 20 ^{o}C storage compartment at two, four and six weekly intervals and planted in greenhouse beds. In the greenhouse, the treatments were laid in a randomized complete block design with three replications. The data collected included cumulative days to and percent shoot sprouting, days to and percent flowering. Upon harvesting, number of flower stems harvested per m2, inflorescence length, stem thickness and floral spike length measured in centimeters were recorded. The number of florets per spike was also measured. The data were tested by two-way factorial and ANOVA. Treatment means within temperature treatments were separated by Duncan's multiple range tests, at $P \leq 0.05$. Grouped treatment effects were compared with single degree - of freedom contrasts for temperature versus storage duration interactions.

Results: Days to sprouting were significantly earlier (14.9) when tuberose bulbs were pretreated at 10 ^{o}C followed by 20 ^{o}C subsequent temperature storage for 6 weeks compared to 51.1 at 5 ^{o}C pretreatment with no subsequent temperature storage. The highest percent sprouting (99.2%) was obtained with 10 ^{o}C pretreatment followed by 20 ^{o}C thawing for 6 weeks. Pre - treating tuberose bulbs at either 5 ^{o}C or 10 ^{o}C then planting directly resulted in 69.3% and 88.3% sprouting, respectively, whilst similar pretreatments resulted in 70.0% and 81.2% flowering. The number of days to flowering were significantly ($P < 0.05$

) reduced (110.8) at 10 °C pre-treatment followed by 20 °C subsequent thawing for 6 weeks compared to 143.1 at 5 °C pretreatment with no thawing respectively. Stem length of inflorescences significantly ($P< 0.05$) improved to 106.8 cm at 10 °C with thawing at 20 °C for 6 weeks compared to 98.2 cm at 5 °C pretreatment and no thawing respectively. Number of florets per spike also significantly ($P< 0.05$) increased to 42.4 compared to 34.9 for similar treatments. Storage of tuberose bulbs at low temperatures followed by warm subsequent storage for 2, 4 or 6 weeks besides improving sprouting and quality of flowers could enhance the availability of planting materials for crop production. The planting materials could be bulked with possibility of commercial exploitation.

Title: Distribution of commercial mobydick (Gomphocarpus spps) grown in Kenya as revealed by morphological characterization.

Researcher(s): Saggafu, S.M, Watako, A.O., and Mamati, G.E.,

Background: Mobydick (Gomphocarpus spp.) cut flower is widely grown commercially among smallholder enterprises in Kenya. The species cultivated are mainly native to African continent and comprises Gomphocarpus physocarpus and Gomphocarpus fruticosus. Among the distinguishing characteristics between the cultivars include boll size and shape, maturity date and whether the plant height is tall or short. In the farmer's field Gomphocarpus physocarpus and Gomphocarpus fruticosus integrate to form a continuum since they hybridize and are difficult to distinguish between them. A survey was done in commercial farms to determine distribution and morphological characterization of commercial crop.

Methods: The survey was conducted between April and June, 2011. The sampled areas were selected at random to give a more realistic statistic data on commercial species grown in Kenya. The regions covered were Central, Eastern and Nyanza. A total of 145 farmers were selected at random and interviewed using structured questionnaire. Information on data analysis involved descriptive agronomic characteristics. Statistical Package for the Social Sciences (SPSS) was used for analysis.

Results: The results showed that of the 145 farmers interviewed, 84.8% grow the tall mobydick cultivar while the rest, 15.6 % grew the short cultivar. There were significant differences in occurrence of mobydick cultivars in the sampled districts ($p < 0.001$) As regards altitude 84.8% of all mobydick farmers grow the tall cultivar between 887-1388 m above sea level. These farmers fall between latitudes S2.90 to N20 and longitudes E34.50 to E35.90. The respective chi – square probability distribution of the likelihood ratio was greater than 5% significant level for agro – ecological zones, districts, altitude, and soil texture indicating no significant variation for the parameters. The tests for null hypothesis that mean of tall cultivar equals mean of short cultivar showed no pattern of distribution but were random. In conclusion, the tall cultivar proved to be the most frequent and seems to dominate all agro-ecological zones of the commercial mobydick cultivars among the farmers.

4.2 DEPARTMENT OF FOOD SCIENCE

Title: The microbial assessment of yoghurt processed by small enterprises in Thika with respect to quality and safety

Researcher(s): Wawire, M.M., Gichuru, W.P.

Background: Yoghurt is a popular fermented milk product and consumed either as a part of a main course meal (e.g. ugali, githeri) or as a refreshing beverage. It is obtained by lactic acid fermentation of milk through the action of a starter culture containing Streptococcus thermophilus and Lactobacillus bulgaricus. The quality of industrial yoghurt varies greatly with chemical composition of yoghurt milk, method of production, type of flavor added, quality of starter culture and the storage environment. The quality of processed yoghurt can be assessed by performing a microbial assessment of the yogurt. This can give one an idea about the processing and storage conditions of the yogurt and in turn it can be used to infer the safety of the yoghurt. Since the production of yoghurt involves use of bacteria, poor processing and storage conditions can lead to a growth of bacteria that are harmful to the consumer. Thus, with this regard, a microbial assessment of yogurt is important in determining the quality and safety of the yoghurt.

Methods: Yoghurt samples (30 samples) were collected from different small enterprises around Githurai, Juja and Thika towns and stored in a cool box and transported immediately to food science laboratories in JKUAT for analysis. The analysis involved physicochemical assessment (acidity), microbial analysis, that is enumeration, isolation and characterization (S. aureus, lactic acid bacteria, coliforms and E. coli) using the A.O.A.C (2003) methods. During the sample collection a questionnaire was administered to the yogurt vendors with aim of finding out whether good manufacturing practices (GMP) were followed during the processing and subsequent storage of the yogurt.

Results: The results from the questionnaire indicate that, in general, there was a poor administration of GMP by the small scale vendors and processors of yoghurt. That is, more than 50% of the vendors do not conduct quality tests on raw milk upon reception (that is before processing), and also 50% of the vendors do not have a refrigeration system to store the processed yoghurt and for those that posses a refrigeration unit, 30% of the units do not work properly an indicator of a likely temperature abuse during storage. The general hygiene of the working environment is indicated by practices such as general cleanliness of the premises, sterilization of the equipment used in milk processing and the cleanliness of the personnel. The results indicated that only 37% of the sampled vendors had an adequate supply of portable water while only 16% sterilized their equipment. This results were corroborated by the microbiological assessment which showed high quantities of coliforms (105 MPN/ml) at an average of 1.1±0.0012, E.coli (104 cfu/ml) at an average of 5.05±0.0024 and S.aureus (105 cfu/ml) at an average of 0.484±0.0013. This indicates poor hygiene, lack of sterilization and poor storage of the processed product.

Conclusions: The yoghurt processed and sold by vendors in this market does not meet the safety and hygiene standards mainly due to poor GMPs by the vendors and they pose a health and safety risk to the consumers.

Title: Determining the microbial quality of cabbage and tomato salads in Githurai area.

Researcher(s): Wawire, M.M., Owuor, J.K

Background: Street vending is a popular way of selling food products in Kenya, however when it is used to sell pre-prepared meals such as cabbage and tomato salads, it poses a health risk to the consumers. This is because vending surroundings lack basic hygiene facilities such as toilets, running water, garbage disposal and refrigeration facilities.

	Furthermore the vendors lack training in proper handling of food. Thus the aim of the research was to assess the impact of the lack of hygiene facilities for street vendors on the food quality and safety of pre-prepared meals with a case study of cabbage and tomato salads using a microbiological assessment of the food.
Methods:	Cabbage and tomato salad samples were collected from street vendors in Githurai (200g) and after multi stage sampling 10g of sample each was used to carry out a microbiological assessment of total plate count, S.aureus, total yeast and mould count using the A.O.A.C (2003) methods.
Results:	The vegetables showed a high count of S.aureus (5.6 ± 2 (103) cfu/g), an aerobic plate count (15.01 ± 5.03 (104) cfu/g), yeast and moulds (4.48 ± 2.12 (103) cfu/g). These results indicate that the salad was processed, handled and stored under poor hygienic conditions both from the surroundings and from the handlers. Also, they indicate that the salad was likely not freshly prepared for the day that is they have been prepared several days before the sell date.
Conclusions:	Cabbage and tomato salad processed and sold by vendors in this market does not meet the safety and hygiene standards mainly due to poor GMPs by the vendors and they pose a health and safety risk to the consumers. Furthermore there is need to improve the hygienic conditions under which they are processed and sold and the vendors need to undergo some training on food handling.

4.3 DEPARTMENT OF LAND RESOURCE PLANNING AND MANAGEMENT

Title:	Evaluating the Efficiency of the Two-tier Nucleus Systems for Breeding Dairy Goats in Kenya
Researcher(s):	Alex Amayi, Alexander Kahi and Mathew G. Gicheha
Background:	Objective 1 of Topic 2 above; a manuscript presenting the findings from the research (see tile above) is in preparation for submission to the relevant journal.
Methods:	The computer programme ZPLAN described in Karras et al. (1997) was used to simulate four alternative two-tier nucleus breeding systems for dairy goats in Kenya. Using the gene flow methods and selection index procedures, the programme simulates different breeding plans in any livestock species. It calculates the genetic gain for the aggregate breeding value, the annual response for each selection and correlated trait defined and the profit per female animal in the population by subtracting breeding costs from returns. The programme uses genetic, biological and economic parameters provided by the user to calculate the costs and returns.
Results:	An open nucleus system with certain proportion of commercial-born does being introduced in the nucleus to breed nucleus does while at the same time utilising young bucks from the nucleus to breed sires and dams for both nucleus and the commercial sector (ONSybd) resulted in the highest genetic gains for all the objectives. Use of young bucks in a closed nucleus system (CNSyb) to disseminate superior genes to the commercial sector resulted in higher total return and profit per doe than use of old bucks (CNSob).

5.0 SCHOOL OF ARCHITRECTURE AND BUILDING SCIENCES (SABS)

5.1 DEPARTMENT OF LANDSCAPE ARCHITECTURE

Title: Reflections on the Conservation of Urban Heritage Attractions: The case of Nairobi 1898 to 1948.

Researcher(s): Ephraim W. Wahome, Mugwima B. Njuguna, and Wycliff N. Nyachwaya

Background: The city of Nairobi has grown into a complex urban heritage since it sprung up as a railway camp site in 1899. Emergent historical sites reflect the global nature of the city which first developed as a colonial headquarter and later as a post-colonial capital with the trappings of metropolitan heritage. This study explores the development of touristy characteristics of historic Nairobi while vouching for their protection for posterity. This is a moral challenge given the negative perceptions of imperialism globally. However, tourism tends to transcend these perceptions as a beneficially of both colonial and post-colonial systems. The study looks at the state of preservation of the physical character of the city through existing normative procedures recommended by the World Tourism Organization (WTO). Conservation is the single most challenging social dilemma in a developing urban centre. Development is usually averse to the notion of preservation especially in an economically vibrant environment.

Methods: Content Analysis, Observation of the built environment, Archival method.

Results: This study has shown that Nairobi has enjoyed international links that endear it to motivated cultural tourists. By emphasizing its historic urban character, Nairobi has the prospect of transforming its economic fortunes through increased urban cultural tourism and associated business activities. New peripheral commercial areas are emerging in Upper Hill and Parklands, outside the central business district (CBD), as well as distant locations like Tatu City and Konza Technopolis which clearly intimate that Nairobi's position is threatened. A report by the Sunday Nation dated 20th May, 2012 indicated that the city is developing in the realm of informal employment while the formal sector is moving to other smaller towns of Nakuru, Eldoret and Kisumu. This trend is likely to continue as decentralised county governance takes root. In such a scenario most cities will result to cultural heritage tourism for their economic revival and continued relevance. Early industrial cities in Europe have largely resulted to this tactic to avoid being relegated into the status of ghost towns in the face of onslaught from upcoming and relevant urban giants in this era of globalisation.

Conclusions:

Title: Continuity and Change in Conservation: study of the Relationship between Attitudes and the Built Environment in Historic Old Town of Mombasa.

Researcher (s): Mugwima B. Njuguna

Background: Dynamics of growth and development put enormous strain on land use activities in urban historic areas. New spatial patterns emerge that lead to both visual and functional contradictions, which are manifest in the inappropriate scale in urban historic areas. The variety and

complexity inherent in traditional cities is being replaced by insipid high-rise accommodation. Old Town of Mombasa, Kenya, is one such historic area that is losing its historic built heritage and individuality at an alarming rate. Mombasa has been for centuries a leading trading town on the East African littoral, bearing an architectural legacy of historic buildings and spaces having Arabic, Indian, European and Swahili heritages. Its old town has ornately carved doors, covered balconies, narrow streets and alleyways, rendering it a truly unique area. The study posits that the current situation is occasioned by lack of local community participation in the formulation of the standards and guidelines that govern conservation, hence the social disconnect. This study seeks to establish the typo-morphological characteristics of the historic built environment, and the residents' attitudes towards this environment. It further endeavours to establish the factors underlying the resident's perception of their urban historic neighbourhood.

Methods: A field survey was conducted, whereby a sample of 693 residents was interviewed along a semantic differential scale, in order to elicit attitudes towards their built environment. Principal Component Analysis, based on correlation matrices, was used to uncover the latent structure of a large set of variables that influence the residents' perception of their conserved area.

Results: The results indicate that conservation in the old towns should strive to achieve appropriate order, maintenance and upkeep, scale, create serial vision; open views and panoramas where possible, enhance orientation and continuity, and achieve the necessary complexity without creating information overload or monotony. This flexible approach forms the basis of a framework for conservation of the local distinctiveness, so that the built heritage is experiential and not habitual.

Conclusions:

Title: Influence of physical characteristics of edges on activities of public urban open spaces: a case of Mombasa town public open spaces

Researcher (s): Carolyne W. Nthiwa

Background: In many urban areas, the historic core of the city is surrounded by physically separated new suburbs, which are nevertheless functionally linked to the urban centre. After 1977, urbanisation rose rapidly, and it has accelerated since, so that established urban settlements are being swept away to accommodate infrastructural developments and newcomers (Seabrook, 2007; Zetter& White, 2002). This leads to growth in road traffic, resulting in the loss of biodiversity and fragmentation of the natural environment. In this context open spaces play a vital role. Their environmental importance is underlined by their potential to mitigate adverse effects of climate change, which are likely to be especially marked in urban areas (Woolley, 2003). Open spaces give the built areas their meaning, function and character. They provide a breathing space within the structure of the city especially with a growing urban population. As recent as 1975, only a third of the world's population lived in urban areas. It is expected that by the year 2025 half of the global population, anticipated at some three billion people, will be living in cities (UNCHS, 1996). Thus the city and the urban environment will become extremely important in the daily lives of increasing numbers of people across the world (Woolley, 2003). The quality of that urban environment will have an impact on a wide range of elements of daily life including housing, education, health, crime,

employment and leisure, both for individuals and communities or populations as a whole. There is a need for urban designers to analyze and design the built environment for the good; that is to synthesize the public open spaces with the surrounding built environment in order to effectively serve its purpose. The design of high quality urban spaces, involving inputs from community groups, is also an increasingly important aspect of the planning process. Such places help to define the public life of a village or town by strengthening the local spirit. On the other hand, urban open spaces expected to serve as nodes within the busy street networks seem deserted and unpleasant with the exception of a few like Piazza San Marco in Venice and Trafalgar Square in London, which are always crowded with people (Alexander, 1977; Lynch 1960).This study is concerned with edges that label public open spaces. It views the edges as boundaries which provide uses that are appropriate in nature and scale with the surrounding open spaces. It is what Trancik (1986) refers as *three-dimensional frame* that defines the edges of the space, the degree of enclosure, and the characteristics of the spatial wall. The nature of edges to a certain degree determines the use and effervescence of the open spaces they enclose (Zeisel, 1990). They determine connectivity or linkage to the open spaces, degree of enclosure, size, shape, and quality of building facades, functional use and hardness or softness of the space (Makdii, 2011). Nasar (1988) points out that the aesthetic quality of the surroundings of a place may affect immediate experience in those surroundings. It may influence subsequent reactions to both the setting and its inhabitants and spatial behaviour in that individuals are attracted to an appealing environment and are likely to avoid an unpleasant one. With knowledge of the relationship between properties of the visual environment and human effect, there is need to study how to create and maintain places that are appropriate to their users and context and are well used over time (Carr et al., 1992). This may contribute to enhancing the quality of life.

Conclusions:

Methods: Structured Interviews, Observation, Archival Method.

Results: The activities within the studied open spaces were diverse and greatly depended on the physical characteristics of the edges. The permeability, interest and functional use were the attributes that influenced the use of the open spaces. Most of the respondents in these open spaces had a connection to the functional use of the edges. Their choice of activity and the position of carrying out the activity were dependent on the permeability and interest of the edge. For instance, illegal activities were observed and reported to be taking place along the Aga Khan Academy edge of Mama Ngina Park. This was due to the fact that there were no physical and strong visual connections between the edge and the open space due to the presence of heavy vegetation cover. The activity is also dependent on the design of the interface between public and private domains. Thresholds act as shared environments and meeting places or transitional space between public and private space. In this case, the public space is that which is experienced in the public open spaces while private space is that within the edges. Likewise, visual permeability through an interface can enrich the public domain and will affect the way it is used. It becomes a controlling and enabling constraint. It is therefore imperative to enhance the visibility and

	legibility of the relationship and the transition between private and public domains.
Title:	Towards Vision 2030: Developing a responsive curriculum for Landscape Architecture in Kenya
Researcher (s):	Caleb K. Toroitich and Finzi Zaidi Ph.D (South Africa)
Background:	As Kenya, and the city of Nairobi in particular, sets its vision for 2030, questions need to be asked as to the relevancy and adequacy of the contemporary landscape architecture education in Kenya and whether a different set of skills and knowledge are necessary for the goals of the vision to be achieved. This paper explores the relevancy of landscape architecture education through a critical examination of the curriculum at Jomo Kenyatta University of Agriculture and Technology (JKUAT) in the light of the future skills requirements of the city in pursuit of the 2030 vision.
Methods:	Comparative Analysis, Transitional curriculum Theories, qualitative methods.
Results:	The paper on examination of the historical development of the JKUAT landscape architecture curriculum identified the factors that influenced selection and packaging of knowledge and skills, and also to outline how the curriculum has evolved over the years. It shows that the environmental problems that were envisaged at the time the landscape architecture programme was initiated were in many ways different to what the City of Nairobi, and the country at large, is currently facing. Some of the paper's major concerns are that the traditional ways of delivering the solutions have changed with governments emphasizing Public-Private Partnerships. Further, Squatter settlements have grown in stature within the city and that their eradication is no longer a solution but their incorporation into the city is the preferred solution. These are problems that landscape architects have to find solutions for in conjunction with other built environment professionals. Therefore, the paper argues that there is a need to re-examine what is taught and suggest new material and methods of teaching, what needs to be taught.
Conclusions:	

6.0 INSTITUTE OF BIOTECHNOLOGY RESEARCH (IBR)

Title:	Efficient somatic embryogenesis of Jatropha curcas L. from petiole and leaf discs
Researcher(s):	Cecilia Mweu, Justus Onguso, Aggrey Nyende, Jesse Machuka
Background:	Jatropha curcas L. is peculiar treasured tree species for its uses and considerable economic potential as a biofuel plant. Propagation of Jatropha is mainly done through seeds and cuttings. Propagation using seeds is limited by low viability and germination hence unable to provide enough planting material. This is a major constraint in Jatropha production in the major growing regions of Kenya. In this study five Jatropha accessions JRV1, JCO4, JE4, JN1 and JNY1 each representing the major Jatropha growing regions in Kenya were selected randomly and used in the development of an In vitro regeneration protocol.
Methods:	Mass production of J. curcas regeneration from leaf discs and petioles using different treatments of plant growth regulators (PGRs): 6-benzyl aminopurine (BAP), Kinetin (KIN), Indole -3-acetic acid (IAA) and Thiadiazuron (TDZ) was explored.
Results:	Maximum callus formation efficiency (85.00%) and the shoot proliferation per explants (8.25) was observed on MS medium supplemented with 1.5 mg/L BAP, 0.6 mg/L KIN, 0.3 mg/L IAA and 0.1 mg/L TDZ. Rooting was induced from elongated shoots cultured on half strength MS medium fortified with different regimes of indole-3-butyric acid (IBA) and Naphthalene acetic acid (NAA). MS supplemented with 3.5 mg/L IBA and 3.5 mg/L NAA gave optimum root formation of 2.5 cm on JCO4, JN1, JE4 and JRV1 accessions. The rooted plants were established in forest soil, sand and manure mixed in the ratio of 2: 1:1 in the green house with 20% survival rate.
Conclusions:	An efficient regeneration system of Jatropha through somatic embryogenesis was established using both leaf discs and petiole explants. The results showed that type and concentration of Plant Growth Regulators, source and type of explants and genotype significantly influenced the regeneration process. There is however need for more studies on green house acclimatization.
Title:	Morphological characterization and yield potential of selected Kenyan Jatropha curcas germplasm.
Researcher(s):	Cecilia Mweu, Justus Onguso, Aggrey Nyende, Jesse Machuka
Background:	Jatropha curcas is a potential species for biodiesel production in tropical and sub tropical regions of the world, varietal improvement and yield potential have not been documented in Kenyan germplasm. The objective of this study was to characterize selected Kenyan germplasm using morphological characters and assess their yield potential.
Methods:	Eleven Jatropha accessions collected from different regions in Kenya and later planted on an experimental plot at JKUAT farm were evaluated. A randomized complete block design was used. Data on stem diameter, plant height, branch number, branch length, leaf length and leaf number was collected after every two months. The data were subjected to multivariate analysis using Principal Component Analysis (PCA) and clustering criteria.

Results:	The results indicate that the characters contributing most variability are stem height, branch number, branch length and leaf length. Dendrogram generated through agglomerative hierarchical clustering revealed four main groups. Cluster A had Rift valley, Eastern and Coast accessions, B and C had Eastern and Rift valley accessions while cluster D had only one accession from Rift valley. Possibly cluster D accessions were introduced recently from Tanzania through Namanga boarder and has not spread to other regions in the country.
Conclusions:	Morphological diversity estimated in the present study showed that there is variability in Kenyan Jatropha germplasm which can be used in conservation, genetic improvement, breeding of higher yielding varieties or screen for cultivars resistant to pests and diseases. However further confirmatory studies using genetic characterization to accurately detect and classify the Jatropha accessions grown in Kenya are required.
Title:	Molecular characterization of selected Kenyan Jatropha curcas using RAPD markers
Researcher(s):	Cecilia Mweu, Justus Onguso, Aggrey Nyende, Jesse Machuka
Background:	Jatropha curcas (L.) is a species which is highly valued for its biodiesel potential as it produces non-edible oil seeds. In addition the species is a multipurpose plant thus making it the species of choice by small-scale farmers. However, despite the species attributes there is limited research on its genetic diversity and conservation in Kenya. This has restricted the species improvement hence limiting its prospects of being a successful candidate for biodiesel production.
Methods:	The present study was carried out to assess genetic diversity in a representative set of sixty nine accessions of Jatropha from Coast, Eastern, Rift valley, Western, Central and Nairobi regions of Kenya using random amplified polymorphic DNA (RAPD) markers. Four RAPD primers were used to generate 119 scorable polymorphic bands which were used to estimate genetic distances among populations and for construction of neighbour joining phenograms.
Results:	Analyses of Molecular Variance showed significant genetic difference with more variation (57 %; P = 0.01) among populations and less (43%; P = 0.01) variation within populations. No variation (0%; P > 0.01) across region was observed. Cluster analyses using UPGMA algorithm placed the 69 genotypes into 5 main clusters. The analyses separated the populations in accordance with their geographical origin where Central, Western, Coastal and Eastern were quite distinct while Rift valley and Nairobi clustered together.
Conclusions:	The DNA finger printing of 69 Kenyan Jatropha accessions indicated a considerable genetic variation. The results of genetic diversity study provide estimates on the level of genetic variation among diverse materials that can be used in germplasm management, varietal protection and Jatropha improvement.
Title:	Agronomic and cultural practices of Jatropha curcas in Kenya
Researcher(s):	Cecilia Mweu, Justus Onguso, Aggrey Nyende, Jesse Machuka
Background:	In the last decade Jatropha curcas has gained a lot of interest globally as a result of its potential as a biofuel plant. However in Kenya it is still considered a semi-wild plant and systematic crop improvement programmes need to be undertaken to exploit its full yield potential. Research on its germplasm collection, distribution and management

are prerequisite. Aim of this study was to document Jatropha distribution, agronomic and cultural practices and factors impeding its production.

Methods: Field surveys were conducted on major Jatropha growing regions in Kenya using a structured questionnaire, interviews and personal observation. Germplasm collection in form of seeds, cuttings and seedlings was done in parallel. Data on germplasm collection, cultural and agronomic practices and production constraints were recorded. Analysis of variance was performed and significant means calculated.

Results: Analysis of variance indicated that propagation was mainly done through seeds 100 % and cuttings 50% and no case of tissue cultured plantlets was reported. A diverse range of production constraints was recorded which included pests such as spider mites and red beetle, diseases like powdery mildew and leaf curl, market, unreliable rains, planting material and knowledge on management practices. Marketing was a major constraint in all regions.

Conclusions: Based on the results Jatropha was found to be grown in dry areas of Kenya with agronomic and cultural practices attributing to better performance. There is need for research on the best cropping system for Jatropha.

7.0 INSTITUTE OF ENERGY AND ENVIRONMENTAL TECHNOLOGY (IEET)

Title: Investigation of the Effectiveness and Social Impacts of Wastewater Treatment Technologies in Smallholder Tea Factories of Kenya.

Researcher(s): Virginia Chege, George Ndegwa and Leonard Gitu.

Background: Tea farming as an agricultural activity utilizes high volumes of water through irrigation and tea processing. The average water consumption for tea processing activities in smallholder tea factories is approximately 30,000 cubic meters per day hence large volumes of wastewater are generated. This study aimed to investigate effectiveness of wastewater treatment technologies currently used in selected smallholder tea factories in Kenya.

Methods: This was done by determining the quality of wastewater generated during tea processing in selected sites East and West of the Kenyan Rift Valley and by identifying social impacts caused by the present wastewater treatment technologies to the neighboring society. Grab samples of the wastewater were collected at the inlet, middle and the final retention points from lagoons, trenches and from a trial wastewater treatment system. These samples analyzed for levels of pH, ECw, COD, BOD5, TDS, TSS, Oils & Grease and Colour.

Results: The pH ranged between 6.5 and 7.5 for trenches, 6.5 to 8.0 for lagoons and 6.6 to 7.6 for the trial wastewater treatment plant. These values were within the allowable limits of between 6.5 and 8.5 recommended by NEMA (K) for discharge to the environment. However, all other parameters analyzed were higher than the allowable limits for discharge into an environment.

Conclusions: There was no significant statistical difference between the two methods commonly used by the selected tea factories. The study further showed that the sludge from the facilities was an essential source of cheap manure for the community. However, wastewater from these facilities caused a strong and unpleasant odour which polluted air around these facilities.

Title: Workplace Fires: An Assessment of Fire Safety Measures in Supermarkets within Nairobi Kenya.

Researcher(s): Irene Muya, Joseph Keriko and Charles Mburu.

Background: A workplace fire is one of the critical occupational safety and health risks that require elaborate preventive measures in business premises since consequences are usually very severe. This study was carried to assess the effectiveness of the fire prevention measures being undertaken by supermarkets. The specific objectives were to determine the amount of risk of fire faced by Supermarkets, to evaluate the extent of compliance with the fire risk reduction rules, 2007 by the supermarkets and to establish the level of fire safety awareness of supermarket employees and customers.

Methods: Risk value matrix method of fire risk assessment. Materials used in the study included a fire safety assessment checklist, questionnaires, computer with Statistical Package for the Social Sciences (SPSS) and Ms Excel data software.

Results: The results showed that risk level of fire in supermarkets in Nairobi was significant and ranged from 2 to 20 with a general average level of 11. This is in the "Orange zone" of the risk value matrix method of

fire risk assessment which grades risks on a scale of 1 to 25. The level of fire safety awareness of employees was at average of 44% while that of customers was at 51%. The safety standards failed to meet the threshold of the provisions of the laws and regulations governing fire safety. The results also indicated that there was insufficient training on fire fighting (68%) and evacuation drills (31%) for both employees and the public which imply that the probability of injury in the event of a fire occurring while shopping was high.

Conclusions:

- The average risk level results of 11 indicate that significant improvements were required and that concerted efforts of all occupants within a particular premises or building, a prerequisite of implementation of fire safety measures was lacking.

- Based on the findings of this research, fire safety audits and inspections for the purposes of assessing fire load and the consequent requirements to prevent and protect against fire were not adequate.

- In view of the awareness levels of the employees which were found to be 44%, the effectiveness and quality of training being undertaken was suspect as a big fraction of the employees alleged to be trained yet their awareness levels were below the expectations of the researcher.

Title: Spatial Ambient Air Quality Analysis and its Effects on the Traffic Police Officers within the Central Business District in Nairobi, Kenya.

Researcher(s): Moriango Thomas, Joseph Keriko, Nathan Oyaro

Background: In Kenya, every person is entitled to a clean and healthy environment. Although clean air is a basic requirement for human health and well-being, air pollution continues to pose a significant threat to the health of people worldwide. In Kenya the traffic police officers (TPO's) spend most of their time on the road controlling traffic a condition that exposes them to automobile pollution.

Methods: This study investigated the levels of automobile emissions and determined the health effects of exposure to these toxins. Emissions of carbon monoxide (CO), carbon dioxide (CO_2) and oxides of nitrogen (NOx) from vehicles were therefore sampled at ten selected sites in the Central Business District (CBD) in Nairobi. It was carried out through non-experimental cross sectional survey employing both qualitative and quantitative data collection method. The sampling were carried out in the morning (between 7.00 and 9.00 am), at noon (between 12.00 and 2.00 pm) and evening (between 5.00 and 7.00 pm). A gas aspiration pump AP-20 together with detector tubes were used to determine the levels of NOx, CO emissions while Testo 435 multifunction measuring instrument was used to determine CO_2 levels, wind velocity and temperature at ten purposely selected sites within the CBD.

Results: The results showed that CO_2, CO and NOx sampled had means of 634.80 parts per million (ppm), 12.74 ppm and 2.56 ppm respectively. These results demonstrated that CO_2 were far much below the Occupational Exposure Limits – Control Limit for the gas while CO_2 and NOx levels were found to be above the WHO threshold limits for the gases respectively.

Conclusions: These findings suggest that the TPO's were at risk of being affected by the emissions with continued exposure.

SECTION C: COMPENDIUM OF PUBLICATIONS

1. COLLEGE OF ENGINEERING AND TECHNOLOGY (COETEC)

1.0 DEPARTMENT OF GEOMATIC ENGINEERING AND GEOSPATIAL INFORMATION

Name of Lecturer/Authors: Nguyem Thanh Hoan, Ryutaro Tateishi, Bayan Alsaaideh, Thomas Ngigi, Ilham Alimuddin, Brian Johnson
Title of Publication: Tropical forest mapping using a combination of optical and microwave data of ALOS
Abstract: It is difficult to monitor forests in tropical regions with frequent cloud cover using optical remote-sensing data. Adequate multi-temporal, high-resolution imagery is often not available. Microwave imagery is able to penetrate cloud cover, enabling imagery of the land surface to be recorded more frequently. This study seeks to improve tropical forest mapping by combining optical and microwave imagery, with one of the main objectives being the discrimination of planted and natural forests. First, multi-spectral Advanced Land Observing Satellite (ALOS)/Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2) images were used to create a forest and land-cover classification of the study area. Subsequently, ALOS/Phased Array type L-band Synthetic Aperture Radar (PALSAR) single-polarized and dual-polarized microwave images were used to generate forest and land-cover masks to be used in combination with the ALOS/AVNIR-2 classification. The overall accuracy of the ALOS/AVNIR-2 classification was 77%. When the ALOS/PALSAR masks were used in combination with the ALOS/AVNIR-2 classification, the overall accuracy increased to 88% with higher than 90% accuracy for the main forest classes.
Name of journal / Conference Proceedings /Workshop: International Journal of Remote Sensing, Volume 34 (1).
Year of Publication: 2013

Name of Lecturer/Authors: Kenneth Mubea, Thomas Ngigi and Charles Ndegwa
Title of Publication: Assessing Application of Markov Chain Analysis in Predicting Land Cover Change: A Case Study of Nakuru Municipality.
Name of journal / Conference Proceedings /Workshop: Journal of Agriculture Science and Technology, Volume 12 (2).
Year of Publication: 2010

Name of Lecturer/Authors: T. G. Ngigi, R. Tateishi and M. Gachari
Title of Publication: Global mean values in linear spectral unmixing: double fallacy!
Abstract: Almost all conventional linear spectral unmixing techniques are based on the principle of least squares. The global mean digital number (DN) of an end member is taken as the representative (i.e. contributory) DN for the end-member. This paper sets out to prove that the notion is a fallacy, and will always lead to negative percentages, super-positive percentages and non-100% sum of percentages if the unmixed pixel is not composed of, to within some tolerance, the global mean DNs only. Three sets of spectral end-members (two, three and four spectral end-members) are generated from Landsat ETM+ data. Practical percentages (between 0% and 100% and totalling 100%) of the end-members are returned by pixels in which the local mean DNs of the

spectral end-members do not differ from the global mean DNs by, on average, 4.

Name of journal / Conference Proceedings /Workshop: International Journal of Remote Sensing, Vol. 30, No. 5, pp. 1109 – 1125

Year of Publication: 2009

Name of Lecturer/Authors: Ngigi, T.G.; Tateishi, R.; Al-Bilbisi, H.; Gachari, M; and Waithaka, E

Title of Publication: Applicability of the Mix-unmix Classifier in percent-tree and -soil cover mapping

Abstract: The Mix–Unmix Classifier is a simple novel method developed to address the problem of under-determination in linear spectral unmixing. This paper tests the applicability of the Mix–Unmix Classifier in percentage mapping of tree cover and different soil types from single bands of satellite imagery. Various transformations were executed on African Moderate Resolution Imaging Spectroradiometer (MODIS) data bands 1, 2, 3, 4, 6 and 7. The equatorial rainforest is most distinguishable under skewness. The skewness transformation band is unmixed into two end members: tree (end member of interest) and non-tree (background). The resulting percentage tree cover map was compared with a University of Maryland percentage tree cover map of the continent, giving a correlation coefficient of 0.87. Fraction images of three soil types were generated from Japanese Earth Resources Satellite (JERS) synthetic aperture radar (SAR) L-band data covering a section of Jordan. The soil types considered were hardpan topsoil, Qaa topsoil, and topsoil of herbaceous layer. The correlation coefficients of the Mix–Unmix Classifier-derived fraction images versus reference fraction images for the three soil types were 0.89, 0.87 and 0.89, respectively.

Name of journal / Conference Proceedings /Workshop: International Journal of Remote Sensing, Vol. 30, No. 14, pp. 3637 – 3648

Year of Publication: 2009

Name of Lecturer/Authors: Thomas G. Ngigi, Ryutaro Tateishi, Adel Shalaby, Nehal Soliman and Mohamed Ghar

Title of Publication: Comparison of a new classifier, the Mix–Unmix Classifier, with conventional hard and soft classifiers

Abstract: 'The number of bands must be more than the number of end-members…' is perhaps the most ubiquitous statement in linear spectral unmixing. The Mix–Unmix Classifier overcomes this limitation. Further, the classifier creates a processing environment that allows any pixel to be unmixed without any sort of restrictions (e.g. minimum determinable fraction), impracticalities (e.g. negative fractions), or trade-offs (e.g. either positivity or unity sum). The classifier gives not only the most probable fractions of end-members, but also their most probable contributory DNs. The contributory DNs directly define the qualities, (e.g. the phenological stages) of the end-members.

The classifier is applied as a dual classification method and compared with popular conventional hard and soft classifiers in production of two to eight spectral classes/end-members from Landsat 7 ETM+ data. The classifiers considered are Spectral Angle Mapper, Binary Encoding Classifier, and Maximum Likelihood Classifier for hard classification; and IDRISI Kilimanjaro Probability Guided Option linear unmixing

technique for soft classification. The Mix–Unmix Classifier performs better than the others.

Name of journal / Conference Proceedings /Workshop: International Journal of Remote Sensing, Vol. 29, No. 14, pp. 4111 – 4128

Year of Publication: 2008

Name of Lecturer/Authors: Ngigi, Thomas G. and Tateishi Ryutaro

Title of Publication: Solving under-determined models in linear spectral unmixing of satellite images: Mix-Umix concept (Advance Report)

Abstract: This paper reports on a simple novel concept of addressing the problem of under determination in linear spectral unmixing. Most conventional unmixing techniques fix the number of end-members on the dimensionality of the data, and none of them can derive multiple (2^+) end-members from a single band. The concept overcomes the two limitations. Further, the concept creates a processing environment that allows any pixel to be unmixed without any sort of restrictions (e.g., minimum determinable fraction), impractical/ties (e.g., negative fractions), or trade-offs (e.g., either positivity or unity sum) that may be associated with conventional unmixing techniques. The proposed mix-unmix concept is used to generate fraction images of four spectral classes from Landsat 7 ETM+data (aggregately resampled to 240 m) first principal component only. The correlation coefficients of the mix-unmix image fractions versus reference image fractions of the four end-members are 0.88, 0.80, 0.67, and 0.78.

Name of journal / Conference Proceedings /Workshop: The Journal of imaging science and technology Vol. 51, No. 4, pp. 360 – 367 ISSN 1062-3701

Year of Publication: 2007

Name of Lecturer/Authors: Ngigi, T.G. and Tateishi, R.

Title of Publication: Monitoring deforestation in Kenya

Abstract: Multi-temporal data is used to determine the rate of deforestation between the years 1976, 1987 and 2000. Three Landsat images, for each period, are pre-processed, mosaicked and normalized difference vegetation index (NDVI) values computed. Based on the values, totally non-forested areas are masked out. The forested areas, both partially and wholly, show a very high degree of correlation between all the bands (reflective), thus necessitating an application of principal components transformation. The first two principal components and NDVI values are used in K-means unsupervised classification to distinguish forest from non-forest areas (that appeared as forest at first). Comparison of the resulting thematic maps gives an annual deforestation rate of roughly 15,000 ha or 2% between any two epochs.

Name of Journal/ Conference Proceedings /Workshop: International Journal of Environmental Studies, Vol. 61, No. 3, pp. 281 – 291

Year of Publication: 2004

Name of Lecturer/Authors: Yashon O. Ouma; T. G. Ngigi; R. Tateishi

Title of Publication: On the optimization and selection of wavelet texture for feature extraction from high-resolution satellite imagery with application towards urban-tree delineation

Abstract: Integration of spectral and multi-scale texture is proposed in order to improve the detection and classification of urban-trees from QuickBird imagery. Arguing that spatial-structure semantic information exits at a hierarchy of scales and that texture is a consequence of objects in the hierarchy, multi-scale wavelets decomposition is proposed for the extraction of vertical, horizontal and diagonal texture components. Pre-selection of texture sub-bands is achieved via mean, entropy, variance and second angular moment. The resulting sub-bands are analysed for separability between trees and similarly reflecting features, such as rice-paddy, grass/lawns, open ground and playground, based on Kullback-Leibler (KL) divergence and Battacharyya distance. The results are ranked and classified with *k*-means. In comparison with the field data, KL gave the best results with omission and commission error of 4.4%. The proposed methodology has the ability to capture the increased natural variability in reflectance and improved the accuracy by 23.6%, in comparison with spectral-only.

Name of Journal/ Conference Proceedings /Workshop: International Journal of Environmental Studies, Vol. 27, No. 1, pp. 73 – 104

Year of Publication: 2006

Name of Lecturer/Authors: Patroba Achola Odera, Yoichi Fukuda and Yuki Kuroishi

Title of Publication: A high-resolution gravimetric geoid model for Japan from EGM2008 and local gravity data Abstract: A high-resolution geoid model covering the four main islands of Japan has been developed on a 1 by 1.5 arc-minute grid from EGM2008 and terrestrial gravity data. The Stokes-Helmert scheme in a modified form is applied for the determination of the geoid using an empirically-determined optimal spherical cap, and Kriging is used for gridding the residual gravity anomalies. In comparison with the previous geoid model for Japan (JGEOID2008), there is a slight improvement in the standard deviation from ±8.44 cm to ±8.29 cm. It is noted that although the determined gravimetric geoid model represents the geoid over Japan fairly well, there is still a need for more gravity data especially in the northern parts of Japan. Key words: Geoid model, gravity, Kriging, EGM2008, GPS/levelling.

Name of journal / Conference Proceedings /Workshop: Name of Journal: Earth, Planets and Space (EPS). 64 (5): 361–368

Year of Publication: 2012

Name of Lecturer/Authors: David Kuria, Moses Gachari, Patroba Odera and Rogers Mvuria

Title of Publication: Securing Bank Loans and Mortgages Using Real Estate Information Aided by Geospatial Technologies

Abstract: Due to liberalization within the financial market, there has been increased cash flow in banks. This has resulted in increased competition among banks to secure and increase their customer base, in an effort to remain profitable. Banks are foregoing the multitude of checks that used to be conducted before granting any mortgage facility to customers, in an effort to remain competitive. This has led to a drastic increase in the number of credit card and loan defaulters, leading to increased operation costs and reduction in profit margins. This research proposes an integrated GIS approach enabling banks locate defaulting real estate properties used as collateral. Using data

provided by Kenya Commercial Bank (KCB) for a locality in Kenya, a geodatabase was developed and a custom application developed for the bank loan appraiser to use. This application retrieves property information about a client based on his/her bank account information. Based on a series of spatially driven queries embedded in the solution, the appraiser can prepare a detailed appraisal for the client in a very short time, thereby satisfying the client, while not prejudicing the banks position. Keywords: Banking, GIS; Loan appraisal, Information technology, Mortgage

Name of journal / Conference Proceedings /Workshop: International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies. 4 (2): 129–143.

Year of Publication: 2013.

Name of Lecturer/Authors: Ngigi M.M., and Wangai, L.M.

Title of Publication: GIS in Logistics and Transportation for a Dairy Co-operative Society in Kenya

Abstract

Logistics has gained popularity among many business and production companies as a strategic function to gain competitive advantage. In agri-business such as dairy farming logistics tools are also being applied to their supply chain to address the chain costs and more importantly to improve their business efficiency as a whole. This is especially so in the area of transportation which comprises a large share of the companies' costs. The collection of raw milk is a critical sector of the supply chain that needs to be addressed in order to improve the overall performance of the company. This study was carried out to address milk collection challenges of a local rural dairy company in Kenya. It involved the determination of optimal routes in a milk collection chain involving 10 routes and 40 collection centres. The milk processing factory, collection centres, road network, trading centres were mapped from both primary and secondary data sources. A topologically clean geometrical network dataset of the roads was created, together with vehicular information from the milk company, the most economical and efficient routes were determined through the application of vehicle routing problem (VRP) solution in a GIS environment. A comparison was undertaken to compare the current costs in terms of time and distance with those generated, which revealed a substantial saving in time and distance if the dairy could adopt the VRP solution. This is quite significant in light of the high fuel costs being experienced globally.

Name of journal / Conference Proceedings /Workshop: Proceedings of the Applied Geoinformatics for Society and Environment Conference (AGSE 2012), July 2012, Johor Bahru, Malaysia.

Year of Publication: 2012

Name of Lecturer/Authors: Ngigi M.M., Musiega, D., and Mulefu, F.O.

Title of Publication: Planning and Analysis of Educational Facilities using GIS: A Case Study of Busia County, Kenya.

Abstract: The educational sector in Kenya as in many other third world countries is faced with numerous challenges such as lack of infrastructural and human resources, poor accessibility, imbalance between demand and supply, among others. A spatial analysis on the situation of the sector for a better understanding is essential at various geographical levels in order to evaluate the extent of these challenges. The purpose

of this study was to illustrate how GIS can be used in addressing the educational planning problems through a case study of educational facilities in Busia County. The study involved inventory mapping of all the educational facilities in the County in the backdrop of existing road networks, analysis of the regional distribution of educational facilities, and evaluation of spatial accessibility to the facilities. Demographic data were used in demand analysis for various educational services within the county. Using the demand ratios such as school age population to primary schools, Secondary schools to primary schools, teacher to student ratio and student to toilet facility ratios demand maps and graphs were generated in GIS environment that clearly illustrates the challenges facing parents and other stakeholders as well the disparities in provision of quality education within the County. In addressing the spatial distribution challenges especially in the imbalance in demand and supply, Centres of Excellence are proposed, and suitable public primary schools are identified for expansion to secondary schools, based on certain criteria such as number of facilities, land size the school is located, and topography.

Name of journal / Conference Proceedings /Workshop: Proceedings of the Applied Geoinformatics for Society and Environment Conference (AGSE 2012), July 2012, Johor Bahru, Malaysia.

Year of Publication: 2012

Name of Lecturer/Authors: Kuria D. N., Musiega, D. E., Ngigi, M. M., and Ngugi, S. K.

Title of Publication: An open source Geographic Information System (GIS) approach to water supply management, distribution and billing

Abstract: In this work a comprehensive solution for the Gatanga Water Trust (GWT) has been developed to assist it in managing its water supply and distribution. The solution comprises two subcomponents: a mapping component and a billing component which are tightly coupled together. The proposed system uses stable open source products for the mapping component and the database. At present the GWT uses outdated maps and sketches for design and installation of a new water supply infrastructure. A billing system is in place which is used to manage client accounts, record meter readings, prepare bills and record payments made. This presents a somewhat disjointed approach to management of the water supply and its attendant infrastructure. The database that stores the account information is very different (softcopy) from that storing the spatial information (hardcopy/paper based). In the proposed solution, a single database is used, centralized or distributed. The mapping component provides an interface through which preliminary design of new and planned infrastructure can be done. After installation, these are reflected in the database and the information becomes available as soon as it is stored. The billing component uses the same database to manage account information. Since the information is managed in one system, there is a streamlined and orderly flow from data collection to the final products from the system. The proposed solution leverages advancement in technology by providing two approaches - a desktop application for users within the Trust's intranet and a web mapping application for users utilizing the wider internet.

Name of journal / Conference Proceedings /Workshop: International Journal of Computer Engineering Research Vol. 3(4), pp. 55-62, November 2012

Year of Publication: 2012

1.1 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Name of Lecturer/Authors: Orenge S. R., Kaberere K. K. and Muriithi C. M.

Title of Publication: Impact of Different Wind Generation Technologies on Power System Transient Stability

Abstract: In the last decade, wind generation has been the fastest growing energy source globally. However, higher penetration of wind energy into existing power networks raises concern for power system operators and regulators. In this paper, we investigate the effect of wind farms employing squirrel cage induction generators (SCIG) and doubly-fed induction generators (DFIGs) on the transient stability of power systems. We carried out simulations to demonstrate and compare the transient performance of the IEEE 3-machine 9-bus system with and without wind power integration during a fault. We analyzed the two generator technologies mentioned separately, replacing one synchronous generator in the system. The synchronous generator that was substituted with the wind farm accounts for about 20% of the system installed capacity. We simulated the system using DIgSILENT PowerFactory. Our results show that a better transient performance is achieved with DFIG than with SCIG.

Name of journal / Conference Proceedings /Workshop: KSEEE-JSAEM International Conference

Year of Publication: August 2012

Name of Lecturer/Authors: Orenge R. S., Muriithi C. M. and Kivuva A

Title of Publication: Impacts of Integrating Wind Power Generation on the Transient Stability of the Kenyan Power System

Abstract: In recent years there has been a significant global commitment to develop clean and alternative forms of energy resources. It is envisioned that by 2020, 10% of world energy demand will be supplied from renewable resources. It is expected that this value will grow to 50% by 2050. Among renewable energy resources, wind generation technology has matured considerably. Wind is fairly distributed around the globe and therefore available to everyone in the world. In the last decade, wind generation has been the fastest growing energy source globally. However more penetration of wind energy into existing power networks raises concern for power system operators and regulators. In this paper the impacts of power from DFIG based wind farm to the Kenyan power system transient stability was studied. The proposed Lake Turkana Wind Project (LTWP) located at the Northern part of the country formed the basis of the study. The wind farm aims at generating 300 MW of wind power by the end of 2013. Comparison was made on the behavior of the said system with and without the inclusion of energy from wind. We simulated the system using DIgSILENT PowerFactory. Our results indicate that the inclusion of large quantities of wind power on the Kenyan Power system impacts the system negatively

Name of journal / Conference Proceedings /Workshop: 2013 Sustainable Research and Innovation (SRI) Conference (JKUAT, Dept of Mechanical Engineering)

Year of Publication: April 2013

Name of Lecturer/Authors:	Samuel A. Oketch, C.M.Muriithi, K.K.Kaberere
Title of Publication:	Static voltage Stability Analysis of Nairobi Area Power Distribution network.
Abstract:	The Nairobi Area Power distribution network supplies over 50% of Kenya's national load demand. The increase in load demand in the network, over the years has generated interest to establish the voltage stability status. This paper presents a study to assess the voltage stability status of Nairobi Area Power distribution network. The network power flow problem is solved using Newton Raphson method to determine the base operating voltages and angles, the power flows, and to compute the network Jacobian matrix. The Sensitivity and Modal analyses methods are applied to predict the network proximity to voltage instability. The network weak buses are identified by computing the bus participations to the critical mode. The analysis is performed using peak load conditions of June and July, 2012.
Name of journal / Conference Proceedings /Workshop:	KSEEE & JAEM
Year of Publication:	August, 2012

Name of Lecturer/Authors:	Samuel A. Oketch, C.M.Muriithi, K.K.Kaberere
Title of Publication:	Voltage Stability Analysis of Nairobi Area Power Distribution network Using PV & QV curves
Abstract:	The Nairobi Area Power Distribution Network supplies over 50% of Kenya's National load demand. The increase in load demand over the years has generated interest to the network's voltage stability status. Earlier research shows the network is nearing voltage instability. However, further analysis is needed to establish how far the network is from the collapse point in order to avoid the possibility of system black out. In this paper we assess the network voltage stability margins by analyzing the real and reactive power margins of selected buses considered weak in the Nairobi Area network. Our earlier studies of the bus participations and sensitivities provided the candidate buses for further analysis. We simulated the P-V and Q-V curves using PowerFactory DIgSilent software. The study was conducted to simulate the peak loading conditions of June, 2012.
Name of journal / Conference Proceedings /Workshop:	2013 Sustainable Research and Innovation (SRI) Conference (JKUAT, Dept of Mechanical Engineering)
Year of Publication:	April 2013

Name of Lecturer/Authors:	A. M. Muhia, J. N. Nderu, P.K. Kihato and C. K. Kitur
Title of Publication:	Performance of Magnetostrictive Amorphous Wire Sensor in Motor Speed Measurement
Abstract:	This paper presents the performance analysis of magnetostrictive amorphous wire in motor speed measurement. The principle of the operation of the sensor is based on Large Barkhausen Jump (LBJ), a unique feature of the wire. A dc motor is used due to the linear relationship between applied voltage and speed. The supply voltage of the dc motor is varied and motor speed measured. The frequency of the signal obtained from the magnetostrictive amorphous wire sensor is measured using an oscilloscope and the motor speed calculated from

this frequency. Results obtained from amorphous wire sensor show quite good agreement with that of the digital tachometer.

Name of journal / Conference Proceedings /Workshop: Journal of Innovative Systems Design and Engineering, Vol 3, No. 6, 2012

Year of Publication: 2012

Name of Lecturer/Authors: A.M. Muhia, J. N. Nderu, P.K. Kihato and C. K. Kitur

Title of Publication: Effect of Length and Position Relative to the Rotor of Magnetostrictive Amorphous Wire in Motor Speed Sensing

Abstract: The performance of the magnetostrictive amorphous wire in motor speed sensing has been shown to match that of conventional motor speed sensors. The sensor is based on Large Barkhausen Jump, a unique feature of the wire, which occurs at a given critical length of the wire. A permanent magnet is also used and therefore depending on the strength of the magnet used, the position of the sensor relative to the rotor is expected to influence the results. This paper presents experimental results on the influence of length and position of the magnetostrictive amorphous wire on the performance of the sensor. A close observation on the signal waveforms indicates that there is a critical length and optimal positioning of the wire from the magnet for which the performance of the sensor is satisfactory.

Name of journal / Conference Proceedings /Workshop: Journal of Innovative Systems Design and Engineering, Vol 3, No. 8, 2012

Year of Publication: 2012

Name of Lecturer/Authors: A. O. Onim, P. K. Kihato and S. Musyoki

Title of Publication: Optimization of Base Station Location in 3G Networks Using Fuzzy Clustering and Mesh Adaptive Direct Search

Abstract: The demand for access to mobile networks has been growing steadily over the past decade and is projected to continue rising. This is on account of rising population and new applications that include internet services on mobile phones and wireless devices. Mobile service providers are under pressure to satisfy the subscriber in terms of quality. There is need to increase base stations (BSs) in the network to cater for the increased demand. In this proposal consideration will be given to a geographical area where the network is to be deployed. A set of traffic test points will represent subscribers. A desired Signal-to-interference ratio (SIR) will be targeted for each subscriber. The allocation of a subscriber to a base station will be governed by the mathematical algorithms which will consist of a combination of fuzzy clustering and pattern search algorithm: Mesh Adaptive Direct Search (MADS). Two components of the BS location problem referred to as the site placement problem, and a second component referred to as the site selection problem are considered. The site placement component involves finding the initial optimal BS locations in the area of interest. The site placement problem is achieved using fuzzy clustering and modeled as a constrained optimization problem where a certain signal-to-noise ration must be maintained by the subscribers. The site selection component involves finding the minimum number of BSs from the initial BS locations from the MADS algorithm. Starting

	from the current solutions, MADS finds a better solution in the neighbourhood where the BSs are initially located. It is expected that the algorithms will use the fewest possible number of base stations to maintain a target SIR for each subscriber. Modeling will be done in MATLAB software and tested through simulations.
Name of journal / Conference Proceedings /Workshop:	2013 Mechanical Engineering Annual Conference on Sustainable Research and Innovation ISSN 2076-6226
Year of Publication:	April 2013
Name of Lecturer/Authors:	Robert Macharia Maina, Kibet Langat and P. K. Kihato
Title of Publication:	Adaptive beamforming in a linear antenna array system using particle swarm optimization algorithm
Abstract:	An Adaptive Antenna Array System (AAAS) utilizes beamforming algorithms to optimize radiation patterns in a wireless communication link. Such algorithms are designed and implemented based on particular beamforming approaches. In this paper, adaptive beamforming using the Minimum Mean Square Error (MMSE) approach in a linear antenna array system is studied. The beamforming approach is implemented using Particle Swarm Optimization (PSO) algorithm. The weights of the MMSE based beamformer are synthesized to produce minimum difference between a reference signal highly correlated with the desired signal; and the output of the beamformer. The resultant beam shapes and signal correlation are used as measures of success. A comparative beamforming analysis is done between the developed PSO algorithm and Least Mean Squares (LMS) algorithm. The PSO algorithm is found to be highly effective in implementing the MMSE beamforming approach.
Name of journal / Conference Proceedings /Workshop:	2013 Mechanical Engineering Conference on Sustainable Research and Innovation (SRI)
Year of Publication:	April 2013
Name of Lecturer/Authors:	Robert Macharia Maina, Kibet Langat and P. K. Kihato
Title of Publication:	Optimal beamforming in a circular antenna array system using particle swarm optimization algorithm
Abstract:	Optimal beamforming entails production of a radiation/ reception beam that optimally increases Signal to Interference and Noise Ratio (SINR) in a wireless communication network. In this paper, SINR based beamforming approach in a circular antenna array system is studied. The approach is implemented using Particle Swarm Optimization (PSO) algorithm. The weights of the SINR based beamformer are synthesized to directly produce maximum SINR. The resultant beam shape and QAM constellation plots of the beamformer signal output are used as measures of success. A comparative beamforming analysis is done between Sample Matrix Inversion (SMI) algorithm, and the developed PSO algorithm. The PSO algorithm is found to be highly effective in generating complex weights required in the array reception channels to produce optimal SINR performance.
Name of journal / Conference Proceedings	

/Workshop:	2013 Mechanical Engineering Conference on Sustainable Research and Innovation (SRI)
Year of Publication:	April 2013
Name of Lecturer/Authors:	N. Bett, J.N. Nderu, P.K. Hinga.
Title of Publication:	Neuro-Fuzzy Control Technique in Hybrid Power Filter for Power Quality Improvement in a Three-Phase Three-Wire Power System
Abstract:	Hybrid power filters have proven to play a vital role in harmonic elimination as well as reactive power compensation in power systems concentrated with highly nonlinear loads which has in the last decade increased due to industrial automation and use of power converters based systems in industries and our homes. This paper presents an approach to hybrid shunt active filter for compensating voltage/current harmonics in a three phase three wire system. It is a combination of a shunt C-type high-pass filter in parallel with an active filter controlled by a Neuro-fuzzy controller. The C-type will help to reduce component rating for active filter and suppress the overall filter resonance while active filter compensate for the low order harmonics. A three phase converter supplying highly inductive load has been chosen as a typical nonlinear load for which a shunt hybrid power filter comprising of a shunt C-type high pass passive filter and a shunt active filter is employed to improve the power quality at the source end. Extensive simulation has been carried out and results obtained from the proposed approach gives comparatively better total harmonic distortion (THD) value.
Name of journal / Conference Proceedings /Workshop:	International Institute for Science Technology and Education (IISTE) -Innovative Systems Design and Engineering.Vol3, No 5, pg 41-50.
Year of Publication:	June 2012
Name of Lecturer/Authors:	N. Bett, J.N. Nderu, P.K. Hinga.
Title of Publication:	Adaptive Neuro-fuzzy Inference system based control of three-phase hybrid power filter for harmonic mitigation.
Abstract:	This paper presents a three-phase hybrid power filter based on artificial intelligence control approach. It consists of C-type passive filter in parallel with a shunt active filter that is controlled by an adaptive Neuro-Fuzzy inference system (ANFIS) controller. The active filter is based on a three-phase voltage inverter with six control switches. The AC side of the filter is connected in parallel with the nonlinear load through an interface reactor, while the DC side connected to a DC-link capacitor. The system will estimate harmonic content in the source current, produced by nonlinear load and generate reference waveform for control voltage source inverter. This paper describes circuit topology, control strategy, C-type high-pass filter, compensation current reference estimation and generation of gating signals. ANFIS controlled three-phase hybrid power filter is modeled under MATLAB/ Simulink environment. The results show this kind of filter has a better harmonic compensation in utility current of three-phase three wire system.
Name of journal / Conference Proceedings /Workshop:	International Journal of Emerging Technology and Advanced Engineering (IJETAE), ISSN 2250-2459, Volume 2, Issue 8.
Year of Publication:	August 2012.

1.2 DEPARTMENT OF BIOMECHANICAL AND ENVIRONMENTAL ENGINEERING

Name of Lecturer/Authors: Stephen N. Ondimu

Title of Publication: Possible Approaches to Commercialisable University Research in Kenya

Abstract:

Serving society has become a coherent mission of universities besides the traditional missions of education and research. This involves linking teaching, research and commercialization of research to create an entrepreneurial university. The aim is to make universities major contributors to economic transformation and development of society via research-based entrepreneurship. Unfortunately, the idea of an entrepreneurial university is yet to take off in Kenya. The aim of this paper to propose some approaches which can be adapted to make university research in Kenya commercialisable.

The study was conducted by systematic literature survey. A comprehensive investigation of literature on approaches to commercial utilization of university research found that approaches to commercialisable university research fall into main categories: those which hold a wider view to university as a creator of intellectual and social capital for and in society and those with a narrower view to university as optimizing commercialization of research as fund-raising function. Based on this finding the paper proposes four approaches: - National Project Approach (NPA); Community-University Cooperation Approach (CUCA); Industry-University Cooperation Approach (IUCA) and University Spin-Off Approach (USOA). NPA is based on University-Industry-Government (UIG) triple helix relationship with the government being the principle agent (PA) directing and facilitating university research and research-based entrepreneurship. IUCA is a double helix relationship with industry as the PA facilitating research geared towards innovation or invention in universities. In CUCA the university is the PA identifying community needs and facilitating science/technology based entrepreneurship to meet those needs. In USOA, universities support staff and graduates to engage in commercialisable high end advanced science/technology research to project an image and cut a niche for themselves.

In conclusion, adapting any one of these approaches will ensure strategic, systematic and focused university research geared towards generating sustainable startups, ventures, patents or science/ technology based MSMEs. This will make Kenyan universities get actively involved in the second academic revolution and positively contribute towards knowledge based economic development, vision 2030 and improved well-being of the people of Kenya.

Name of journal / Conference Proceedings /Workshop: 7th JKUAT Scientific, Technology and Industrialization conference 15th - 16th, November 2012; JKUAT, Kenya

Year of Publication: 2012

Name of Lecturer/Authors: Kaluli J.W., Kibe Nganga, P.G.Home, J.M. Gathenya, A.W. Muriuki, A.W. Kihurani

Title of Publication: Effect of Rain Water Harvesting and Drip Irrigation on Crop Performance in an Arid and Semi-Arid Environment

Abstract: Rainwater harvesting and drip irrigation are possible interventions to enhance crop performance in Arid and Semi Arid Lands (ASAL). Work was undertaken to evaluate the feasibility of rainwater harvesting for bean production under an ASAL environment in Kaiti Watershed, Makueni District, Kenya. Treatments comprised two rainwater harvesting methods, Zai pits and contour ridges; bucket-kit drip irrigation and a control. No intervention was made to enhance water availability in the crop root zone in the control. The experiment was arranged in a Randomized Complete Block Design with three replicates. Each of the 12 experimental plots was planted with beans (*Phaseolus vulgaris* L.), variety GLP 2. Soil moisture content and pan evaporation were measured daily for 100 days and runoff after every rainfall event. Crop height was measured once a week and grain and biomass yield were determined at the end of the growing season. Soil moisture content and crop performance were significantly influenced by drip irrigation but not by rainwater harvesting. In drip irrigated plots, grain and biomass yield, were 4 tonnes ha^{-1} and 9 tonnes ha^{-1} respectively compared to 3.5 tonnes ha^{-1} and 7.5 tonnes ha^{-1} respectively, in the control plots. Drip irrigation effectively maintained adequate soil moisture resulting in better crop performance while rain water harvesting methods failed to significantly enhance soil moisture content and crop performance. This study indicated that rainwater harvesting makes a difference in runoff when the 14 Day Antecedent Precipitation (14DAP) exceeds 80 mm. However, the grain yield obtained in all the plots was higher than the national average of 0.36 tonnes Ha^{-1}. It is recommended that further research be done under different rainfall conditions to confirm the conditions under which the benefits of rainwater harvesting using contour ridges and zai pits can be realized in the enhancement of crop performance in ASAL conditions.

Name of journal / Conference Proceedings /Workshop: JAST

Year of Publication: Accepted for publication

Names of authors: Kituu G M, Shitanda D, Kanali C, Mailutha J and John Wainaina J

Title of Publication: Artificial breeding of an optimized solar tunnel dryer using genetic algorithms.

Abstract: Studies were carried out to artificially breed an optimized solar tunnel dryer using genetic algorithms (GAs). The energy harnessed by the dryer was simulated in Visual Basic Script (Microsoft Visual Basic Script 2010TM) and the model was used to optimize the dryer by executing the Goal GA. The optimized dryer was developed and tested for energy harnessing against an existing solar tunnel dryer. The results of the analysis showed an 18–113% increase in plenum chamber temperature for the two dryers. Further, a two-way analysis of variance demonstrated the existence of a highly significant difference between plenum chamber temperatures for the two dryers (F=16.37, Fcrit, 0.99=2.89). Furthermore, regression analysis and Student's t-test established the performance of the optimized dryer to be superior to that of the existing dryer. Finally, this study showed the effectiveness of Goal GA in artificial breeding of an optimized solar tunnel dryer.

Name of journal /

Conference Proceedings /Workshop:	International Journal of Sustainable Energy
Year of Publication:	2012
Name of Lecturer/Authors:	Kituu G, Shitanda D, Kanali C, Mailutha J and Wanaina J
Title of Publication:	Artificial breeding of an optimized solar tunnel dryer using genetic algorithms
Abstract:	Studies were carried out to artificially breed an optimized solar tunnel dryer using genetic algorithms (GAs). The energy harnessed by the dryer was simulated in Visual Basic Script (Microsoft Visual Basic Script 2010™) and the model was used to optimize the dryer by executing the Goal GA. The optimized dryer was developed and tested for energy harnessing against an existing solar tunnel dryer. The results of the analysis showed an 18–113% increase in plenum chamber temperature for the two dryers. Further, a two-way analysis of variance demonstrated the existence of a highly significant difference between plenum chamber temperatures for the two dryers (F = 16.37, $F_{crit, 0.99}$ = 2.89). Furthermore, regression analysis and Student's t-test established the performance of the optimized dryer to be superior to that of the existing dryer. Finally, this study showed the effectiveness of Goal GA in artificial breeding of an optimized solar tunnel dryer.
Name of journal / Conference Proceedings /Workshop:	the 7th international cigr technical symposium "innovating the food value chain" 2nd international conference on postharvest technology and quality management "postharvest africa 2012; 25-28 November 2012, Stellenbosch University, South Africa
Year of Publication:	2012

1.3 DEPARTMENT OF MECHATRONIC ENGINEERING

Name of Lecturer/Authors:	Njiri J. G., Ikua B. W., Nyakoe G. N., Kariuki L.W.
Title of Publication:	Determination of base-line data for ball-end milling of sculptured surfaces
Abstract:	In order to operate the machining process optimally, it is important to have an idea of how the process would behave under certain cutting conditions. This give rise to the need of developing accurate and reliable simulation models for predicting machining process performance. This eliminates the need to carry out experiments which are time consuming and very expensive. This paper outlines the procedure for determining base-line data used to develop a theoretical model for predicting of instantaneous cutting forces for ball-end milling of spherical surfaces. To verify the prediction of the model, a series of experiments were carried out. It has also been demonstrated that the predicted and the measured values of forces show a fairly good agreement.

Name of journal / Conference Proceedings /Workshop:	KSEEE-JSAEM 2012 International Engineering Conference
Year of Publication:	2012
Name of Lecturer/Authors:	Gituku E.W., Ikua B. W., Nyakoe G. N.
Title of Publication:	A study on influence of beam orientation in engraving using a CO2 laser
Abstract:	In recent times, lasers have been adopted in specific areas of machining because of their unique qualities. There has been a lot of research on the factors that affect the laser machining process. However most of this research has been conducted when machining with the beam perpendicular to the work piece while there are cases where a non-vertical beam may be preferred for instance when machining features at oblique angles to the surface. Examples of such features are the cooling holes in certain parts of the aero engine components or in the making of vias. This paper discusses the various uses of lasers in general, and further focuses on challenges in using sealed gas, continuous wave CO2 laser in engraving with a varying beam incidence angle. Experimental results showing the how the kerf width and machined depth vary with a changing beam incidence angle have also been presented.
Name of journal / Conference Proceedings /Workshop:	Sustainable Research and Innovation Conference.
Year of Publication:	2012
Name of Lecturer/Authors:	Gituku E.W., Ikua B. W., Nyakoe G. N., Kagiri C.
Title of Publication:	Study on effect of laser beam parameters on quality attributes in laser machining.
Abstract:	The use of laser micro-machining of polymers is rapidly growing in popularity because of its versatility as a machining method and the substitution of silicon with polymers in the making of micro devices especially micro-fluidics. This research work presents an investigation of the effect of angle of incidence of the beam on the quality attributes of laser machined work. The attributes analyzed are the kerf width and the depth of cut. Results obtained from machining polymethylcrylate (PMMA) with a 60 W, CW, sealed CO2 laser are presented and discussed. It is found that the kerf width increases with increase in the angle of incidence while the depth of cut decreases. Results from two analytical models predicting depth of cut for a changing angle of incidence of the beam are validated against the experimental results.
Name of journal / Conference Proceedings /Workshop:	KSEE-JSAEM 2012 International Engineering Conference.
Year of Publication:	2012

Name of Lecturer/Authors: Gituku E.W., Ikua B. W., Nyakoe G. N., Mulembo T.

Title of Publication: Prediction of width and depth of cut in laser machining of PMMA using a CO2 laser

Abstract:

Lasers are gaining popularity in micro-machining of polymers in the production of micro-devices. Polymer micro-fluidic systems can be produced in several ways, some of which are based on replication from a micro-machined master tool, while others rely on direct machining. The replication methods which include hot embossing and micro-injection moulding are not only relatively complex but also expensive compared to laser micro-machining which may account for the rise in popularity.

Micro-fluidic systems have so far been mostly made using silicon.

As a material, silicon is a good choice when small numbers of long-lasting systems have to be produced. However, especially in clinical applications, single-use systems are desired in order to avoid contamination. Polymers are a good alternative to silicon, since they are cheaper and the commercially available selection of polymers represents a very wide range of physical and chemical properties that for any given application an appropriate polymer is likely to exist.

While factors that affect the quality of laser machined features have been extensively researched, in most of the studies the laser beam has been normal to the work piece. The beam is not always perpendicular to the surface being machined as is the case when working with freeform profiles. Parameters that can be neglected in products of a macro size can significantly affect the functionality of micro-devices and it is important to carefully analyze all factors that may affect their intended functionality.

This paper presents analytical models for the prediction of the width and depth of cut of laser machined polymethlymethacrylate, PMMA, under different angles of incidence of a CO2 laser beam. The validation of the model results with experimental results will be presented at a later publication.

Name of journal / Conference Proceedings /Workshop: KSEE-JSAEM 2012 International Engineering Conference

Year of Publication: 2012.

Name of Lecturer/Authors: Kabini S. K., Murimi E. W., Makenzi M. M.

Title of Publication: Adaptive Neural Fuzzy Inference Systems: A Review.

Abstract:

Non-conventional control techniques such as Adaptive Neural Fuzzy Inference Systems (ANFIS) are increasingly becoming popular in the modern world. This is due to their ability to model or represent vagueness in day to day activities or processes. These systems have the potential to adaptively control processes that present a difficulty to the conventional control techniques due to their ability to predict the likely outcome given a set of conditions or inputs.

This paper looks at ANFIS and which has found wide applications in multidisciplinary fields and more recently has been used in control of machining processes.

Name of journal / Conference Proceedings /Workshop: Proceedings of the KSEEE-JSAEM 2012 International Engineering Conference.

Year of Publication: 2012

Name of Lecturer/Authors: Murimi E. W., Kabini S. K., Makenzi M. M.

Title of Publication: Piezoelectric Energy Scavenging Using Low Energy Sources

Abstract: Energy harvesting has experienced significant attention from researchers over the past few years due to the ever-increasing clean energy demand across the globe. There are various small scale energy harvesting methods available. Among them, the most widely used method vibrational energy harvesting using piezoelectric materials which possess more mechanical energy for conversion into electrical energy than other materials. In addition, they can also withstand large amounts of strain making them very attractive for power harvesting. They therefore use the ambient energy from the environment including body movements, machine vibrations, wind, flowing water, etc. and these energy to mechanical vibrations and later to electrical energy. This paper will review recent progress in the piezoelectric power harvesting using the energy from wind and rain.

Name of journal / Conference Proceedings /Workshop: Proceedings of the KSEEE-JSAEM 2012 International Engineering Conference.

Year of Publication: 2012

Name of Lecturer/Authors: Makenzi M. M., Kabini S. K., Murimi E. W.

Title of Publication: Optimization of EDM Material Removal Rate of Mild Steel Using Permanent-Magnets.

Abstract: The present work investigates the use of neodymium magnets to aid in the dispersion and flushing of eroded debris in the spark gap region. Experiments were performed in a systematic manner using a TOOLCRAFT A25 EDM machine and a newly designed experimental set-up developed to vary magnetic intensity exposed at the machining gap. Machining parameters such as magnetic intensity, peak current and pulse duration were changed to investigate their effects on material removal rate. A four factor, full factorial design was adopted for analyzing the results. Second-order, non-linear mathematical models have been developed for establishing the relationship between the machining parameters. Analysis of variance (ANOVA) has been performed to verify the fit and adequacy of the developed models. It was found that the presence of a unidirectional magnetic field actually aids in the flushing process and consequently improves the material removal rate and tool life.

Name of journal / Conference Proceedings

/Workshop:	Proceedings of the KSEEE-JSAEM 2012 International Engineering Conference.
Year of Publication:	2012
Name of Lecturer/Authors:	Kabini S. K., Ikua B. W., Nyakoe G. N.
Title of Publication:	Recent Trends in Modeling and Control of Chatter Vibration in Cylindrical Plunge Grinding Process
Abstract:	Cylindrical plunge grinding process which is normally a final operation in precision machining is one of the processes that require control. This is because in this process, there is usually occurrence of chatter vibrations which limits the ability of the grinding process to achieve the desired surface finish. It also leads to rapid tool wear, noise and frequent machine tool breakages, which increase the production costs. In this paper, a review of the recent trends in modeling and control of the chatter vibrations common in the process is presented. Both modeling and simulations approaches are presented.
Name of journal / Conference Proceedings /Workshop:	International Journal of Advances in Engineering, Science and Technology (IJAEST), Vol. 2 No. 3 (ISSN: 2249-913X)
Year of Publication:	2012
Name of Lecturer/Authors:	Murimi E., Neubauer M.
Title of Publication:	Piezoelectric energy harvesting; an overview
Abstract:	Energy harvesting has experienced significant attention from researchers over the past few years due to the ever-increasing desire to produce portable and wireless electronics with extended life spans. Piezoelectric materials have been greatly used for this purpose since they possess more mechanical energy for conversion into electrical energy than other materials and can also withstand large amounts of strain making them very attractive for power harvesting. They therefore use the ambient vibrations from the environment. Other sources of harvestable ambient energy including waste heat, electromagnetic waves, wind, flowing water, and solar energy. This paper will review recent progress in the vibrational power harvesting using piezoelectric materials and their applicability in developing self powered devices.
Name of journal / Conference Proceedings /Workshop:	Proceedings of the Sustainable Research and Innovation 2012 Conference
Year of Publication:	2012
Name of Lecturer/Authors:	Owino L. A., Nyakoe G. N.
Title of Publication:	Maximum power tracking in horizontal axis wind turbine using fuzzy logic controller.

Abstract:	To make wind energy a more attractive source of power, the design of a controller based on fuzzy logic is undertaken to facilitate the extraction of maximum power at any given wind speed while at the same time providing a control solution that requires minimal measurements to be taken, thus reducing costs spent on sensor purchase. The controller is applied to a model designed to simulate a horizontal axis wind turbine, and by continually making adjustments to the speed of the wind turbine rotor, it achieves output power greater than what is achievable by a similar wind turbine under experimental conditions.
Name of journal / Conference Proceedings /Workshop:	International Journal of Advances in Engineering, Science, and Technology (IJAEST).
Year of Publication:	2012
Name of Lecturer/Authors:	Macben M.M., Ikua B.W.
Title of Publication:	A Review of Flushing Techniques Used in Electrical Discharge Machining
Abstract:	Flushing is a very important function in any electrical discharge machining (EDM) operation. It not only serves to remove the eroded debris from the spark-gap region but also has various other functions which highly influence the outcome of this machining process. Although the influence of flushing as a wholesome requirement on the efficiency and stability of machining conditions in EDM has been extensively investigated, little has been reported concerning the effects of the various individual flushing techniques that are available in the industry. An examination of the influence of flushing pressure and a review of the various flushing approaches utilized is presented in this paper.
Name of journal / Conference Proceedings /Workshop:	Sustainable Research and Innovation (SRI)
Year of Publication:	2012
Name of Lecturer/Authors:	Wairimu G., Ikua B.W. and Kioni P.N.
Title of Publication:	Effect of CO2 laser beam-material interaction time on depth attainable.
Abstract:	In this paper, we investigate the physical and mechanical behavior of mild steel when machined using a CO2 laser. First, some of the etched mild steel specimens are spray painted and dried. A continuous wave (cw) CO2 laser beam with an estimated power of 35 Watts is then focused on both the painted and unpainted specimens for a wide range of exposure times. The machinability of the painted and unpainted specimens is observed. Both sets of specimens are then checked for any microstructural changes. It was clear that the unpainted specimens had no visible marks or microstructural changes even after the longest exposure of 1000 seconds. However, it was observed that exposure of the material to the beam had effects on the microstructure of the painted specimens even with as little exposure time as 30 seconds.

Name of journal / Conference Proceedings /Workshop: Sustainable Research and Innovation (SRI).

Year of Publication: 2012

Name of Lecturer/Authors: Wairimu G., Ikua B.W. and Kioni P.N.

Title of Publication: Effect of CO2 laser beam-material interaction time on depth attainable.

Abstract: In this paper, we investigate the effect of beam-material interaction time on depth attainable in materials using a CO2 laser. A continuous wave (cw) CO2 laser beam with an estimated power of 35 Watts is then focused on the surfaces of the respective materials for a defined exposure time and the effect of the beam-interaction time on depth of the resulting holes determined by measuring the depth of holes or slots machined. It was observed that an increase in exposure time of the material to the beam resulted in an increase in depth attainable.

Name of journal / Conference Proceedings /Workshop: Sustainable Research and Innovation (SRI).

Year of Publication: 2012

Name of Lecturer/Authors: Oroko J., Ikua B.

Title of Publication: Obstacle Avoidance and Path Planning Schemes for Autonomous Navigation of a Mobile Robot: A Review

Abstract: Autonomous navigation of a mobile robot involves self-steering of a robot from one place to another based on computational resources on-board the robot. There are many different ways to approach mobile robot navigation, with path planning and obstacle avoidance playing a key role. This paper discusses three methods used in obstacle avoidance and path planning i.e., the Bug algorithms, the Potential Field methods and the Vector Field Histogram method which are all active sensor-based methods. A more robust system for use to achieve autonomous navigation in any environment can be developed by fusing technologies or schemes by taking advantage of the merits of the different systems while limiting their drawbacks.

Name of journal / Conference Proceedings /Workshop: Sustainable Research and Innovation Conference

Year of Publication: 2012

2. FACULTY OF SCIENCE

2.0 DEPARTMENT OF CHEMISTRY

Name of Lecturer/Authors: Patrick M. Mwangi

Title of Publication: Studies of chromium removal from tannery wastewater by algae biosorbents, Spirogyra condensata and Rhizoclonium hieroglyphicum.

Abstract: Two manuscripts

1. Physico-chemical and performance characteristics of cashew nut shell liquid (CNSL) and CNSL based coatings and

2. "CNSL": A commodity with great potential for commercial exploitation in Kenya.

Name of Journal/ Conference Proceedings/ Workshop: JAGST

Year of Publication: They were subsequently amended and returned to the publisher (JAGST).

Name of Lecturer/Authors: Omayo, K.E., Chacha, J.S, Okongo, E.R and Ali M.Salim

Title of Publication: Assessment of the Effects of Tobacco Farming on Soil Nutrients in Migori County, Kenya

Abstract: Assessment of heavy metal pollution due to tobacco farming: Cd, Pb, Co, Cu, Cr, Mn, Ni and Zn was conducted in Migori County, Kenya using Atomic Absorption Spectrometry (AAS). Grid sampling was employed in which 50 m2 of land was randomly selected in each of two sampling areas and was divided into ten equally sized grid cells of 5 m2. The study also investigated the effects of these heavy metals on the fertility indices of the soil such as PH, nitrogen, available nitrogen, phosphorous, available phosphorous and organic carbon. Data obtained was subjected to analysis of variance (ANOVA) and correlation analysis using the Pearson moment correlation coefficient technique. The mean concentrations of heavy metals was 14.5 μg/g for Pb, 9.2 μg/g for Cd, 99.7 μg/g for Zn, 33.4 μg/g for Cu, 25.0 μg/g for Cr, 43.6 μg/g for Ni and 14743 μg/g for Mn. The Contamination Factor revealed that the sites were moderately contaminated, the Pollution Load Index showed Mabera to be more contaminated with PLI = 1.15 while Masaba had 1 .05 and finally Geoaccumulation Index showed the two regions to be moderately contaminated. Significantly positive correlation was found to exist between nitrogen, potassium, total organic matter, nitrates and total phosphorus at P = 0.01. Significantly positive correlation was also found to exist between lead and nitrogen; nitrates and copper; chromium and cobalt; potassium and manganese, TOC; nitrogen and nitrates, TOC and total phosphorus. Chromium and zinc; manganese and total phosphorous, TOC; potassium and total phosphorous. The findings in this study will serve to create awareness of the extent of heavy metal pollution to Kenyan policy makers in the mitigation of heavy metal pollution, as it is barely monitored.

Name of Journal/ Conference Proceedings/ Workshop: International Journal of BIochemiphysics, Vol. 20

Year of Publication: 2013

Name of Lecturer/Authors: Osano Aloys Mosima, Okong'o Eric Rangondi, Oyaro Nathan and Kiptoo Jackson

Title of Publication: Compositional and Structural Characterization of indigenous salts in Kenya: A Case Study Of 'Para', 'Magadi' And 'Lebek' Crystalline Salts.

Abstract: Compositional analysis was carried out on three indigenous basic salts from Lake Magadi, Shores of Lake Victoria and the Hot Springs of the Kerio Valley which are different parts of Kenya. All treatments were done in triplicate in complete randomized block design. Fresh and dry weights were recorded at the end of the experiment and analysed for K, Na, Ca, Mg, Co, Fe, Mn, Cu, Pb, Cd, Zn cations and CO_3^{2-}, and HCO_3^- anions. The three different indigenous basic salts are commonly referred as 'magadi', 'Para', and 'Lebek' respectively from the three areas. Quantitative and qualitative analysis was done using Atomic Absorption Spectroscopy, Flame Photometry, FTIR and the wet methods; Gravimetry and titrimetry. A wet digestion procedure was adopted to dissolve the salts. In general, the concentration of heavy metals in the salts followed the order: magadi; Fe > Co > Pb > Cd Mn> Zn > Cu; Para; Fe > Mn > Co > Zn> Pb > Cu>Cd; Lebek; Fe > Mn > Zn > Co> Cu > Pb>Cd. Sodium, Potassium and calcium content was found to be very high in all the samples. Sodium concentration was recorded to be 71.52 mg/g in 'Magadi', Potassium concentration was found to be 2.69 mg/g in 'Para', and calcium concentration was found to be 166.09 mg/g in 'Lebek'. Samples of 'Para' and 'Lebek' contained comparatively higher amounts of Fe as compared to 'magadi'. Lead is present in higher levels in all the samples than minimum levels. The pH values ranged from 9.98±0.01 to 11.26±0.03, an indication of the alkaline nature of these salts.

Name of Journal/ Conference Proceedings/ Workshop: International Journal of BIochemiphysics, Vol. 20

Year of Publication: 2013

Name of Lecturer/Authors: Okong'o E.R. and Oyaro N.M.

Title of Publication: Foundation Physical Chemistry

Abstract: The book offers useful theoretical and practical information in physical chemistry which is a requirement for any aspiring chemist. It gives valuable information required to tackle the traditional subdivisions of chemistry i.e. Organic, Inorganic and Physical Chemistry. It has easy to understand features covering introduction, basic concepts, worked examples and exercises complete with answers in all chapters.

Name of Journal/ Conference Proceedings/ Workshop: Jomo Kenyatta Foundation, ISBN 9966-22-904-3

Year of Publication: 2012.

Name of Lecturer/Authors: Patrick Kareru, Zacchaeus Kipkorir Rotich and Esther Wamaitha Maina.

Title of Publication: Determination of Heavy metals and nutrients in water samples of rivers Naka and Irigu, Chuka, Meru-South District – Kenya using atomic absorption Spectroscopy and UV/Visible Spectrophotometry.

Abstract: Insecticides are toxic substances that are used to kill or control insects. Insects pests affect humans directly by transmitting diseases or indirectly by attacking cultivated plants in farms or in storage, thus affecting food security. It is documented that the use of insecticides by man dates as far back as 1000 B.C, or earlier when burning of stone containing sulfur (brimstone) was used as a fumigant. Substances used to kill or control insect pests can also be referred to as pesticides, though the latter word has a wider scope of application, since other non-insect pests also exist. Insecticides in wide use are mostly synthesized organic compounds, though there are some organic compounds of plant origin referred to as "botanicals", in addition to inorganic compounds of natural and synthetic origin. Certain insecticides of synthetic, organic or inorganic origin function as insect repellents, causing little or no harm at all to the target insects. In most situations insecticides are applied by spraying or dusting onto plants and other surfaces traversed or fed upon by insects. However insecticides/pesticides of chemical origin can affect human health directly or indirectly by disrupting ecological systems that exist in rivers, lakes, oceans, streams, wetlands, forests and fields. Release of chemicals into the environment can have global impacts and there is therefore need to use safer analogues designed with safety in mind. A review of some "safe" insecticides used in Africa is presented. Pesticides in general are toxic chemicals which adversely affect human health when mishandled. Their effects may be direct, for example, during application or when consumed in suicide bids. Also their effects may be indirect when the environment is contaminated either

Name of Journal/ Conference Proceedings/ Workshop: International Journal of Pure and Applied Science, Volume 3, Number 4.

Year of Publication: 2013.

1.2 DEPARTMENT OF PHYSICS

Name of Lecturer/Authors: Gachari, F., Mulati D.M., and Mutuku J.N.

Title of Publication: Impact of Atmospheric tides on Climate Model

Name of Journal/ Conference Proceedings/ Workshop: ARPN Journal of Engineering and Applied Sciences

Year of Publication: 2013

Name of Lecturer/Authors: Gachari, F., Mulati D.M., and Mutuku J.N.

Title of Publication: Sunspot Numbers: Implications on Eastern Africa Rainfall

Name of Journal/ Conference Proceedings/ Workshop: South African Journal of Sciences

Year of Publication: 2013

Name of Lecturer/Authors: Mulati D.M., Francis Gachari

Title of Publication: Statistical rainfall using solar and lunar geometry

Name of Journal/ Conference

Proceedings/ Workshop: Journal of the atmospheric Sciences; American Metrology Society
Year of Publication: 2013
Name of Lecturer/Authors: Mulati D.M., Francis Gachari
Title of Publication: Sunspot Numbers: Implications on Eastern Africa Rainfall
Abstract:
Name of Journal/ Conference
Proceedings/ Workshop: South African Journal of Science
Year of Publication: 2013

Name of Lecturer/Authors: Mulati D.M., Francis Gachari
Title of Publication: Gravitational atmospheric potentials as factors in rainfall modeling
Abstract:
Name of Journal/ Conference
Proceedings/ Workshop: International Journal of Science and Technology U.K
Year of Publication: 2013

1.3 DEPARTMENT OF ZOOLOGY

Name of Lecturer/Author(s): Makonde, H.M., Boga, H.I., Osiemo, Z., Mwirichia, R., Stielow, J.B., Göker, M., and Klenk, H.-P.

Title of Publication: Diversity of Termitomyces associated with fungus-farming termites assessed by cultural and culture-independent methods. PLoS ONE 8(2): e56464. doi:10.1371/journal.pone.0056464

Abstract: Fungus-cultivating termites make use of an obligate mutualism with fungi from the genus Termitomyces, which are acquired through either vertical transmission via reproductive alates or horizontally transmitted during the formation of new mounds. Termitomyces taxonomy, and thus estimating diversity and host specificity of these fungi, is challenging because fruiting bodies are rarely found. Molecular techniques can be applied but need not necessarily yield the same outcome than morphological identification. Culture-dependent and culture-independent methods were used to comprehensively assess host specificity and gut fungal diversity. Termites were identified using mitochondrial cytochrome oxidase II (COII) genes. Twenty-three Termitomyces cultures were isolated from fungal combs. Internal transcribed spacer (ITS) clone libraries were constructed from termite guts. Presence of Termitomyces was confirmed using specific and universal primers. Termitomyces species boundaries were estimated by cross-comparison of macromorphological and sequence features, and ITS clustering parameters accordingly optimized. The overall trends in coverage of Termitomyces diversity and host associations were estimated using Genbank data. Results indicate a monoculture of Termitomyces in the guts as well as the isolation sources (fungal combs). However, cases of more than one Termitomyces strains per mound were observed since

mounds can contain different termite colonies. The newly found cultures, as well as the clustering analysis of GenBank data indicate that there are on average between one and two host genera per Termitomyces species. Saturation does not appear to have been reached, neither for the total number of known Termitomyces species nor for the number of Termitomyces species per host taxon, nor for the number of known hosts per Termitomyces species. Considering the rarity of Termitomyces fruiting bodies, it is suggested to base the future taxonomy of the group mainly on well-characterized and publicly accessible cultures.

Name of Journal/ Conference Proceedings/ Workshop: PLoS ONE 8(2):e56464. doi:10.1371/journal.pone.0056464

Year of Publication: 2013

Name of Lecturer/Author(s): Ng'endo RN, Osiemo ZB, Brandl R.

Title of Publication: DNA barcodes for species identification in the hyperdiverse ant genus Pheidole (Formicidae: Myrmicinae)

Abstract:

DNA sequencing is increasingly being used to assist in species identification in order to overcome taxonomic impediment. However, few studies attempt to compare the results of these molecular studies with a more traditional species delineation approach based on morphological characters. Mitochondrial DNA Cytochrome oxidase subunit 1 (CO1) gene was sequenced, measuring 636 base pairs, from 47 ants of the genus Pheidole (Formicidae: Myrmicinae) collected in the Brazilian Atlantic Forest to test whether the morphology-based assignment of individuals into species is supported by DNA-based species delimitation. Twenty morphospecies were identified, whereas the barcoding analysis identified 19 Molecular Operational Taxonomic Units (MOTUs). Fifteen out of the 19 DNA-based clusters allocated, using sequence divergence thresholds of 2% and 3%, matched with morphospecies. Both thresholds yielded the same number of MOTUs. Only one MOTU was successfully identified to species level using the CO1 sequences of Pheidole species already in the Genbank. The average pairwise sequence divergence for all 47 sequences was 19%, ranging between 0–25%. In some cases, however, morphology and molecular based methods differed in their assignment of individuals to morphospecies or MOTUs. The occurrence of distinct mitochondrial lineages within morphological species highlights groups for further detailed genetic and morphological studies, and therefore a pluralistic approach using several methods to understand the taxonomy of difficult lineages is advocated.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Insect Science 13:17 Available online: http://www.insectscience.org/13.17

Year of Publication: 2013

Name of Lecturer/Author(s): Josiah O. Kuja, Robert R. Jackson, Godfrey O. Sune, Rebbeca N.H Karanja, Zipporah O. Lagat

Title of Publication: Nectar Meals of a Mosquito-Specialist Spider

Abstract:

Evarcha culicivora, an East African jumping spider, is known for feeding indirectly on vertebrate blood by actively choosing blood-carrying mosquitoes as prey. Using cold-anthrone tests to detect fructose, we demonstrate that E. culicivora also feeds on nectar. Field-collected individuals, found on the plant Lantana camara, tested positive for plant sugar (fructose). In the laboratory, E. culicivora tested positive for fructose after being kept with L. camara or one of another ten plant species (Aloe vera, Clerodendron magnifica, Hamelia patens, Lantana montevideo, Leonotis nepetaefolia, Parthenium hysterophorus, Ricinus communis, Senna didymobotrya, Striga asiatica, and Verbena trivernia). Our findings demonstrate that E. culicivora acquires fructose from its natural diet and can ingest fructose directly from plant nectaries. However, experiments in the laboratory also show that E. culicivora can obtain fructose indirectly by feeding on prey that have fed on fructose, implying a need to consider this possibility when field-collected spiders test positive for fructose. In laboratory tests, 53.5% of 1,215 small juveniles, but only 3.4% of 622 adult E. culicivora, left with plants for 24 hours, were positive for fructose. These findings, along with the field data, suggest that fructose is especially important for early-instar juveniles of E. culicivora.

Name of Journal/ Conference Proceedings/ Workshop:

Psche, doi:10.1155/2012/898721

Year of Publication:

2012

Name of Lecturer/Author(s):

Zipporah O., Linus G., Shadrack M., Samuel N., Srinivasan S

Title of Publication:

Influence of mating frequency and parasitoid age on reproductive success of Trichogrammatoidea sp. nr. lutea Girault collected from Plutella xylostella Linnaus in Kenya.

Abstract:

This study was carried out to investigate the reproductive fitness parameters, that is, parasitism, adult progeny production, and sex ratio of a native egg parasitoid Trichogrammatoidea sp. nr. lutea Girault (Hymenoptera: Trichogrammatidae) collected from Plutella xylostella Linnaus (Lepidoptera: Yponomeutidae) in coastal Kenya, reared on Corcyra cephalonica Sainton (Lepidoptera: Pyralidae) in the laboratory. Freshly emerged mated female adults (0-24hr old) with no previous oviposition experience, were placed individually in separate glass vials. Ten replicates (each replicate composed of a single female) were made; each female was offered 40 eggs in an egg card daily. Egg cards were placed in separate vials at constant temperature and humidity to await emergence. The daily and lifetime number of parasitized (blackened) eggs, adults which emerged from the parasitized eggs were counted and recorded, together with the number of females out of the total progeny (number of adults). Percentages for all the tested parameters were also calculated. In another set of experiment, the possibility that the presence of males may bring material benefits to the parasitoid females in terms of enhancing sex ratio and other reproductive fitness parameters was investigated by placing male together with female in same vial throughout its lifetime. Highest progeny production, parasitism and sex ratio (percentage of females) was obtained during the first day of host exposure, decreasing

with parasitoid age. No significant difference (P>0.05) was found in the overall lifetime offspring progeny, parasitism and sex ratio of single mated females and one placed together with male throughout its lifetime. Females of T. sp. nr. lutea received enough sperm from one mating to allocate optimum sex ratio. In order to achieve highest reproductive success of Trichogramma parasitoids during mass production for biological control of Lepidopteran pests, it is important to use younger wasps than old ones. Besides, there is no possibility that the presence of males may bring material benefits to the parasitoid females in terms of enhancing sex ratio and other reproductive fitness parameters.

Name of Journal/ Conference Proceedings/ Workshop: International Journal of AgriScience Vol. 3(2): 114-123, www.inacj.com ISSN: 2228-6322

Year of Publication: 2013

Name of Lecturer/Author(s): Osiemo B. Zipporah, Gitonga L. Muthuri, Maranga R. Orangi and Sithanantham Srinivasan

Title of Publication: Effect of host egg densities on sex ratio and laboratory performance of Trichogrammatoidea sp. nr. Lutea Girault (Trichogrammatidae: Hymenoptera) collected from Plutella xylostella Linnaus in Kenya

Abstract: Four native lines of Trichogrammatoidea sp. nr. lutea Girault collected from Plutella xylostella Linnaus in coastal Kenya were reared on Corcyra cephalonica Sainton (Lepidoptera: Pyralidae) in the laboratory. This experiment was done to explore the possibility for enhancing the potential impact of these native egg parasitoids in terms of favourable sex ratio in the progeny using different host egg densities and competing females during mass production in the laboratory. In addition, other important reproductive parameters such as parasitization success and progeny production were also evaluated. When adult females were placed in-groups of four to oviposit just enough eggs they require to parasitize, the offspring sex ratio was female biased unlike when placed as single females. In group females, host egg patch size (the number of host eggs exposed per adult parasitoid) did not seem to affect the progeny sex ratio, but in test with single females, the offspring sex ratio significantly increased with increasing patch size. Results from this study suggested that placing ovipositing females in groups could be used to maximize percentage of female offspring during mass rearing in the laboratory for field release of T. sp. nr. lutea.

Name of Journal/ Conference Proceedings/ Workshop: Asian Journal of Plant Science and Research, 2012, 2 (6):675-679 online at www.pelagiaresearchlibrary.com

Year of Publication: 2012

Name of Lecturer/Author(s): Ng'endo Rossa, Eunice Kairu, Zipporah Osiemo, & Callistus Ogol

Title of Publication:	Morphological variation of Ridged Frogs of the Taita Hills, Kenya
Abstract:	Comparing of morphological character variation within taxa continues to play an important role in improving species inventories. Using morphometrical and non-meristic morphological adult characters, the diversity of the genus Ptychadena in Taita Hills was studied. Comparative material from elsewhere was not used, and therefore species names were only provisionally allocated to the taxa identified. Available names were discussed on the basis of comparisons with morphological data from other regions. The results revealed that female species are larger in size than males. Two species were identified and for each a standardized diagnosis of 32 characters is provided. Comparison of results with morphological data from related studies done elsewhere reveals that certain characters are of critical importance in differentiating the two Ptychadena species. The power of these morphological characters is discussed, especially for the background of rapid and easy identification of Ptychadena species in the field for conservation purposes.
Name of Journal/ Conference Proceedings/ Workshop:	Acta Herpetologica [Online], 6.2 (2011): 275-288. ISSN 19709498
Year of Publication:	2011
Name of Lecturer/Author(s):	Osiemo Zipporah, Gitonga Linus, Muya Shadrack, Ng'endo Rossa, Baya Joseph and Sithanantham Srinivasan
Title of Publication:	Evaluation of Biological Attributes of a Native Egg Parasitoid, Trichogrammatoidea sp. nr. lutea (Girault), Kenyan Accessions.
Abstract:	This study was carried out to evaluate the biological attributes that is, parasitism, adult progeny production, and sex ratio of 21 strains of a native egg parasitoid Trichogrammatoidea sp. nr. lutea Girault (Hymenoptera: Trichogrammatidae) collected from Plutella xylostella Linnaus (Lepidoptera: Yponomeutidae) in coastal Kenya, reared on Corcyra cephalonica Sainton (Lepidoptera: Pyralidae) in the laboratory. A total of 21 accessions of T. sp. nr. lutea were assembled from the Kenyan coast (Shimba hills and Muhaka sites). Preliminary experiments to select the best performers among the 21 strains, based on biological attributes such as adult longevity, parasitism, emergence, adult progeny produced and progeny sex ratio were conducted under laboratory conditions (temperature of 27±2°C and 65±10% RH). There were significant differences ($P<0.05$) in all biological attributes studied among the strains. The overall mean adult longevity was 9.31 days. Parasitism, emergence and sex ratio per adult female were 20.2%, 75.56% and 37.77% respectively. The wasp age influenced all the attributes tested significantly ($P<0.05$) of T.sp. nr. lutea. Four accessions (SH-1 and 4, MK-1 and 3) were selected and recommended from this experiment based on adult longevity, parasitism, adult progeny produced and sex ratio for further evaluation. The results from this study will be useful for mass rearing purposes as well as for future field release programmes.

Name of Journal/ Conference Proceedings/ Workshop:	Asian Journal of Pharmaceutical and Biological Research, 2012, 2 (3):172-176 e ISSN: 2231-2218
Year of Publication	2012
Name of Lecturer/Author(s):	Zipporah B. Osiemo, Andreas Marten, Manfred Kaib, Linus M. Gitonga, Hamadi I. Boga and Roland Brandl
Title of Publication:	Open relationships in the castles of clay: High diversity and low host specificity of Termitomyces fungi associated with fungus-growing termites in Africa.
Abstract:	In the African and Asian tropics, termites of the subfamily Macrotermitinae play a major role in the decomposition of dead plant material. Their ecological success lies in the obligate mutualism of the termites with fungi of the genus Termitomyces. Before the advent of molecular studies, the interaction with these fungi was poorly understood. Here, we combined available ITS sequence data from West, Central, and South Africa with data of 39 new samples from East Africa to achieve the most comprehensive view of the diversity and host specificity of Termitomyces symbionts across Africa to date. A high amount of sequence divergence in the ITS sequences was found; 11 different Termitomyces lineages in East Africa and [30 lineages across Africa were identified, and the expected diversity is estimated to be about 41 lineages. The fungal lineages belong to four major clades, each almost exclusively associated with one termite host genus. Analysis of molecular variance revealed that 40% of the ITS sequence variation occurred between host genera, indicating close co-evolution at this level. However, within host genera, fungal lineages and haplotypes were frequently shared among host species and sampling localities, except for fungal symbionts of Odontotermes. Horizontal transmission of fungal symbionts may facilitate the transfer of haplotypes and species among hosts. However, at present, we have little understanding of the maintenance of specificity at the genus level. Possible explanations range from substrate specificity of fungi to an active selection of fungi by termites.
Name of Journal/ Conference Proceedings/ Workshop:	Insect Sociaux 57(3):351-363.Published online on 6th April 2010 as DOI 10.1007/s00040-010-0092-3
Year of Publication:	2010
Name of Lecturer/Author(s):	Zipporah B. Osiemo, Andreas Marten, Godfrey H. Kagezi, Johanna P.E.C. Darlington, Manfred Kaib, Linus M. Gitonga, Hamadi I. Boga and Roland Brandl
Title of Publication:	Cryptic termite species diversity in Kakamega Forest, Kenya
Abstract:	Termites are among the keystone species of tropical ecosystems and contribute to ecosystem processes and carbon and nitrogen cycles. The role of termites for soil processes depends strongly on the species composition and their feeding habits. Termite workers are morphologically rather

uniform, and thus exhibit only few traditional taxonomic characters for species identification and yet they dominate in ecological surveys. Therefore, the diversity of termites is poorly understood, especially in tropical forests which are hotspots of biodiversity and threatened by disturbances. Recently, the use of DNA-sequences (barcoding) has become more important for inventory and biodiversity assessment of hyperdiverse taxa and those which are difficult to identify. An approach towards establishing a DNA barcode library for termite species identification and biodiversity assessment using sequences of the mitochondrial COII gene is presented in this study. Kakamega forest is the remnant of the Congo-Guinean Forest reaching Kenya. This isolated forest is a hotspot of biodiversity which is threatened by the increasing human population. Depending on the land use, along a gradient from primary rain forest to farmlands, the species composition among the termites varied greatly, dominated by termite species feeding on wood in the primary forests and by grass feeding termites in farmlands. Hence, to interpret the role of termites in different land-use habitats, the species composition needs to be understood. Here we present termite biodiversity assessment using sequences of the mtCOII gene. 854 sequences of a 681bp fragment of the COII gene of termites were extracted from GenBank and used to define molecular thresholds for termite species delimitation by using means, medians and a threshold method. A threshold value of 0.058 K2P-sequence divergence per site was calculated for termite species delimitation, using COII sequences of termites from GenBank. A family-specific threshold of 0.056 was calculated to delimit the species for termites from Kakamega forest, all belonging to the family Termitidae. Morphological assessment of 240 samples suggested that at least 16 morphospecies occur along the gradient. A sequence-based analysis revealed existence of 22 Molecular Operational Taxonomic Units (MOTUs) using a termite sequence divergence threshold of 0.056. Extrapolation termite species numbers in Kakamega forest using Chao estimates gave higher species numbers (17 and 26 for morphospecies and threshold respectively) than observed numbers. All species assessed were belonging to the family Termitidae (higher termites), and among them the fungus-growing Macrotermitinae were most prevalent with at least eight putative species, which were all cryptic within their three different genera (Microtermes, Pseudacanthotermes and Odontotermes) whereas Promirotermes and Foraminitermes were ranked as less abundant species in the forest. Their abundance in the samples suggests that they play an important ecological role which is completely unstudied also due to the lack of reliable identification means. Our study highlights the advantage that molecular based species delimitation that reveals some morphological cryptic species. Obviously barcoding provides a more comprehensive picture of the diversity of termites. This is a first approach towards establishing a DNA barcode library for termite species identification and biodiversity assessment using sequences of the mitochondrial COII gene.

Name of Journal/ Conference Proceedings/ Workshop:	Proceedings of the XXIIIV International Congress of Entomology, Daegu, Korea, 19th –25th, August, 2012.
Year of Publication:	2012
Name of Lecturer/Author(s):	Zipporah Osiemo, L.M. Gitonga, S. Sithanantham, S.M. Muya, J. Baya & B.K. Muli.
Title of Publication:	Influence of mating frequency and parasitoid age on sex ratio and laboratory performance of the Kenyan accessions of Trichogrammatoidea sp. nr. lutea Girault.
Abstract:	Among several factors which may influence sex ratio in trichogrammatid egg parasitoids include maternal age and the number of times the adult females copulate with the males. We investigated these factors using four native lines of Trichogrammatoidea sp. nr. lutea Girault (Hymenoptera: Trichogrammatidae) collected from Plutella xylostella Linnaus (Lepidoptera: Yponomeutidae) in coastal Kenya, reared on Corcyra cephalonica Sainton (Lepidoptera: Pyralidae) in the laboratory. The wasp age significantly influenced the parasitism, progeny emergence and progeny sex ratio (percentage of females). The sex ratio decreased with aging of the adult female. Thus to achieve highest reproductive success, it is important to use younger wasps for mass production for biological control purposes. The possibility that the presence of males may bring material benefits to the parasitoid females in terms of enhancing sex ratio and other reproductive fitness parameters was investigated by placing male together with female throughout its lifetime. No difference was found in the overall offspring sex ratio and parasitism of single mated females and one placed together with male throughout its lifetime. Females of T. sp. nr. lutea received enough sperm from one mating to allocate optimum sex ratio.
Name of Journal/ Conference Proceedings/ Workshop:	Proceedings of the 13th International Society of Behavioural Ecology (ISBE) Congress held in Perth, Western Australia from 26th to 1st October, 2010
Year of Publication:	2010
Name of Lecturer/Author(s):	Zipporah B. Osiemo, Andreas Marten, Godfrey H. Kagezi, Johanna P.E.C. Darlington, Manfred Kaib, Linus M. Gitonga, Hamadi I. Boga and Roland Brandl
Title of Publication:	DNA Barcoding: A method of assessing termite diversity in Kakamega Forest, Kenya.
Abstract:	Biodiversity studies require species level analyses for its accurate assessment. However, specialized taxonomic knowledge for difficult and hyperdiverse arthropods like the termites, is rarely available for routine identifications. Termites are among the most important decomposers in tropical ecosystems, where they can make up to 95% of the insect biomass in soil. The taxonomy as well as the determination of termites to the species level mostly relies on characters of soldiers. However,

workers are the most frequently sampled caste during ecological surveys. Therefore, the diversity of termites is poorly understood, especially in tropical forests. Recently, the use of DNA-sequences (barcoding) has become more important for inventory and biodiversity assessment of hyperdiverse taxa as well as taxa which are difficult to determine. Termites were sampled across a gradient from primary forests to farmland to assess the regional pool of termite species in Kakamega forest, Kenya. This forest is the most eastern extension of the Congo forest block reaching western Kenya. This isolated forest is a hotspot of biodiversity in Kenya which is threatened by the increasing human population. 854 sequences of a 681bp fragment of the COII gene of termites were extracted from GenBank and used to define molecular thresholds for termite species delimitation by using means, medians and a threshold method. A threshold value of 0.058 K2P-sequence divergence per site was calculated for termite species delimitation, using COII sequences of termites from GenBank. A family-specific threshold of 0.056 was calculated to delimit the species for termites from Kakamega forest, all belonging to the family Termitidae. Morphological assessment of 240 samples suggested that at least 16 morphospecies occur along the gradient. A sequence-based analysis revealed existence of 22 and 18 Molecular Operational Taxonomic Units (MOTUs) using a termite sequence divergence threshold of 0.056 and a mean value of 0.102 respectively. Extrapolation termite species numbers in Kakamega forest using Chao estimates gave higher species numbers (17, 21 and 26 for morphospecies, mean and threshold respectively) than observed numbers. Odontotermes, Pseudacanthocathotermes and Microtermes species were most occurring species whereas Promirotermes and Foraminitermes were ranked as less abundant species in the forest. Termites without sampled soldiers could be assigned to their respective phylogenetic clusters. These results highlight the advantage that molecular based species delimitation reveals some morphological cryptic species. Obviously barcoding provides a more comprehensive picture of the diversity of termites.

Name of Journal/ Conference Proceedings/ Workshop: Proceedings of the 19th World Conference on Ecological Restoration of the SER International, Perth, Australia, 23rd -27th August 2009.

Year of Publication: 2009

Name of Lecturer/Author(s): Zipporah B. Osiemo, Andreas Marten, Manfred Kaib, Linus M. Gitonga, Hamadi I. Boga and Roland Brandl.

Title of Publication: Specificity of symbiotic relationships in fungus-growing termites (Isoptera: Macrotermitinae).

Abstract: Fungus-growing termites of the subfamily Macrotermitinae are abundant in African and Asian tropics where they play a major role in the decomposition of plants. Recent studies based on genetic markers have largely increased our knowledge about the evolutionary history of the symbiosis between fungus-growing termites and their fungi. The obligate mutualism between fungi of the genus Termitomyces and termite species

within Macrotermitinae is as a result of a long co-evolutionary process, with a single phylogenetic origin in African tropical forests during the early Tertiary. Studies focusing on interaction specificity have been conducted elsewhere in Africa but none so far has been done on Eastern Africa despite the high generic richness of host termites in this area. The aim of this study was to investigate the interaction specificity and diversity of Termitomyces and their termite hosts in Eastern Africa. The main focus was laid on the species-rich genus Macrotermes, which is believed to have been under-represented in previous studies. To achieve this, Termitomyces from 40 colonies were sampled across three termite genera and at least seven species from geographically diverse regions in Kenya. The ITS region of the fungi was sequenced and additional ITS sequences of African were obtained from the GenBank to reconstruct phylogenies. Afterwards, a randomization approach was used to test for the distribution of host genera and host species across the phylogenetic trees of the fungi. The fungal sequences represented four well supported major clades with strong sequence divergence in between. Each clade was almost exclusively associated with one host genus, showing that specific symbionts have coevolved with termites at the genus level. However, within the clade associated with the host genus Macrotermes, fungi lineages occurred in several species indicating low host specificity. Furthermore, same lineages occurred across steep environmental gradients. Therefore, the association of the fungal lineages with several host species is not the result of an allopatric distribution of fungi among climatic regions.

Name of Journal/ Conference Proceedings/ Workshop: Proceedings of the XXIII International Congress of Entomology, Durban, South Africa, 4th – 11th July, 2008.

Year of Publication: 2008

Name of Lecturer/Author(s): Marete I.K., Osiemo-Lagat Z.,Simba J.M., Obala A.I.,Marithi A.I.,Chumba J.C., and Mutugi M.

Title of Publication: Utilization of laboratory services in management of febrile children at a referral hospital in Kenya. A clinical View.

Abstract: To describe the perception of and the extent of the utilization of the laboratory services to establish cause of fever in outpatient setting at a national referral facility in Kenya. A cross-sectional survey involving administration of a questionnaire to the clinicians between July 2010 and February 2011. Fifty four clinicians systematically sampled over the study period filled this questionnaire which captured data on the perception, utilization and reliability of the laboratory services to support outpatient treatment of the febrile children in outpatient settling. There was a high prevalence of presumptive diagnosis with 98.2% clinicians commencing antimalarial treatment without blood smears, 86.7% treating sepsis without blood culture, and 83.3% treating tuberculosis without AFB results. Most clinicians thought that the laboratory tests were reliable (72.3%) and accurate (83.3%). There were variations in the availability of the laboratory tests with malaria test being the

commonest (83.4%) and blood culture being the least available (11%). The perceptions of the availability of these tests did not determine the frequency to which they were utilized to support diagnosis and treatment. However, only half of them (50%) perceived them to influence their clinical decision. It is clear that clinicians treat their patients at MTRH based on presumptive diagnosis despite availability of laboratory services that were prescribed to be accurate. Further research is needed to establish the difference between practice and perceptions of laboratory services by clinicians.

Name of Journal/ Conference Proceedings/ Workshop: KJHS Vol.2 pp12-17

Year of Publication: 2012

Name of Lecturer/Author(s): Humphrey Mazigo, RebeccaWaihenya , Nicholas Lwambo, Ladislaus Laurent, Aneth Mahande , Jeremiah Seni , Anthony Kapesa ,Eliningaya Kweka, Stephen Mshana , Gerald Mkoji.

Title of Publication: Co-infectionsofPlasmodium*falciparum,Schistosomamansoni*, and intestinal helminthes among school children in endemic areas of north western Tanzania.

Abstract:

Malaria, schistosomiasis and intestinal helminth infections are causes of high morbidity in most tropical parts of the world. Even though these infections often co-exist, most studies focus on individual diseases. In the present study, we investigated the prevalence of Plasmodium falciparum-malaria, intestinal schistosomiasis, soiltransmittedhelminth infections, and the respective co-infections, among schoolchildren in northwest Tanzania. A cross sectional study was conducted among schoolchildren living in villages located close to the shores of Lake Victoria. The Kato Katz technique was employed to screen faecal samples for S. mansoniand soil-transmitted helminth eggs. Giemsa stained thick and thin blood smears were analysed for the presence of malaria parasites. Of the 400 children included in the study, 218 (54.5%) were infected with a single parasite species, 116 (29%) with two or more species, and 66 (16.5%) had no infection. The prevalence of P. falciparum and S. mansoniwere 13.5% (95% CI, 10.2-16.8), and 64.3% (95% CI, 59.6-68.9) respectively. Prevalence of hookworm infection was 38% (95% CI, 33.2-42.8). A. lumbricoidesand T. trichiurawere not detected. Of the children 26.5% (95% CI, 21.9-30.6) that harbored two parasite species, combination of S. mansoniand hookworm co-infections was the most common (69%). Prevalence of S. mansoni- P. falciparum co-infections was 22.6% (95%CI, 15.3-31.3) and that of hookworm - P. falciparum co-infections 5.7% (95%CI, 2.6-12.8). Prevalence of co-infection of P. falciparum, S. mansoniand hookworm was 2.8% (95%CI, 1.15-4.4). Multiple parasitic infections are common among schoolchildren in rural northwest Tanzania. These findings can be used for the design and implementation of sound intervention strategies to mitigate morbidity and co-morbidity.

Name of Journal/ Conference Proceedings/ Workshop: Parasites and Vectors 3:44.

Year of Publication: (2010)

Name of Lecturer/Author(s): Humphrey Mazigo, Rebecca Waihenya, Nicholas Lwambo, Ladislaus Laurent and Gerald Mkoji.

Title of Publication: Anaemia and Organomegally associated with parasitic infections among schoolchildren in Sengerema District, North Western.

Abstract:

Anaemia and organomegaly are among the health problems affecting schoolchildren in Tanzania and their causes are multifactorial. The objective of this study was to determine the prevalence of anaemia and organomegaly and their relationship with single and multiple parasitic infections among schoolchildren in Sengerema District in north-west Tanzania. This cross sectional study involved 400 schoolchildren. Anaemia and organomegaly were determined using HemoCue photometer and clinical palpation, respectively. A Kato-Katz technique was employed to screen faecal samples for Schistosomamansoniand other intestinal helminths. Giemsa stained thick and thin blood smears were examined for malaria parasites. The prevalence of anaemia was 19.5% (<11g/dl) and majority of the children had mild (22.8%) to moderate (36.6%) anaemia. Organomegaly (palpable spleen and liver) was detected in 41% of the children and hepatomegaly was the most common (53.7%). The prevalence of S. mansoni, hookworm and P. falciparum were 64.3%, 38% and 13.5% respectively. No significant relationship was observed between single and multiple parasitic infections with anaemia and organomegaly. Logistic regression analysis revealed that increased infections intensity of S. mansoniwas significantly associated with an increased likelihood of hookworm concomitant infections (P<0.002). In conclusion, the data confirm that malaria, intestinal schistosomiasis and hookworm are common among school children but are not associated with anaemia and organomegaly. Further longitudinal studies are recommended to establish any such association. The prevalence of parasitic co-infections among schoolchildren calls for an integrated control approach to reduce the burden of these infections.

Name of Journal/ Conference Proceedings/ Workshop: Tanzania Journal of Health Sciences 12, (2) 1-12.

Year of Publication: 2012

Name of Lecturer/Author(s): F.B. KainguKibor, A. C. Shivairo R. Kutima H., Waihenya R. and Kahl A. K.

Title of Publication: Prevalence of Gastro- Intestinal Helminthes and Coccidia in Indigenous Chicken from different districts in Kenya.

Abstract:

A study on the prevalence of gastro-intestinal endoparasites in indigenous chicken was carried out in three regions in Kenya. The objective of the study was to determine the species and their prevalence rates. A total of 710 adult free-ranging local chickens were sampled from six districts, Kakamega (162),

Bondo (81), Narok (81), Bomet (150), Turkana (70) and West Pokot (166). Qualitative and quantitative microscopic parasitological examinations were used for faecal examination. The survey showed that 192 (27.04%) was infected with Coccidialoocysts, 182 (25.63%) with Ascaridiagalli, 10 (1.41%) with Heterakisgallinarum, 2 (0.3%) with Syngamus trachea, 37 (5.21%) with Capillariaretunsa, 8.45% with Capillariaannulata, 21 (2.96%) with Raillietinatetragona, 94 (13.24%), while 112 (15.8%) were negative, with no helminthes infestation. The findings suggested that endoparasites are a common health problem in free range indigenous chicken in Kenya and agro-climate significantly influenced the distribution of endoparasites.

Name of Journal/ Conference Proceedings/ Workshop: African Journal of Agricultural Research Vol 5(6) 458-462.

Year of Publication: 2010

Name of Lecturer/Author(s): Humphrey D. Mazigo, Rebecca Waihenya, Gerald M. Mkoji, Maria Zinga, Emmanuela E. Ambrose, Ola F. Jahanpour, Emmanuel Bahemana, Ladslaus L. Mnyon, Eliningaya J. Kweka, and Nicholas J.S. Lwambo.

Title of Publication: Intestinal Schistosomiasis: Prevalence, Knowledge, Attitude and

Practices among school children in an endemic area of North Western Tanzania

Abstract: Knowledge, attitudes and preventative practices of risk groups for neglected tropical diseases such as intestinal schistosomiasis are important aspects for their control. This study aimed to determine the prevalence of Schistosomamansoni, knowledge,

Perceptions and preventative practices of school children towards schistosomiasis in the Sengerema district, Tanzania. We conducted a cross-sectional study using 400 randomly selected school children. Single faecal specimens were obtained from children and screened for S. mansoni using Kato Katz technique. Amongst those children who submitted faecal specimen, 200 randomly selected children responded to a structured questionnaire. The prevalence of Schistosomamansoni was 64.3% (257/400; 95% confidence interval (CI) =59.3, 69.0).Less than 50% of the interviewed children demonstrated an understanding of control measures and transmission of schistosomiasis.About87.5% (175/200; 95% CI = 82.1, 91.7) of the respondents reported to have heard of schistosomiasis and the main source of information were schools (34.5 %). 84% of the children reported going to the lake and 68% reported to participate in paddy cultivation. About 40.5% of the respondents associated schistosomiasis with water contact and 39.5% accurately quoted symptoms associated with schistosomiasis. Knowledge about transmission increased with age (p=0.005). The control measures mentioned by 34.5% of the respondents were in line with the World Health Organization's control strategies against schistosomiasis. Most of respondents (96.5%) reported the use of toilets. A majority (82%) of the respondents reported that they had participated in previous mass drug administration. Conclusion: The prevalence

of schistosomiasis was high despite repeated previous mass drug administration campaigns. There is a need to incorporate practical public health education in the school curriculum for the purpose of increasing knowledge and promoting behavioral changes in school children to improve disease control.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Rural and Tropical Public Health 9, 53-60.

Year of Publication: 2010.

Name of Lecturer/Author(s): Humphrey D. Mazigo, Benson R. Kidenya, Emmanuela E. Ambrose, Maria Zingaand, Rebecca Waihenya.

Title of the publication: Association of intestinal helminths and P. falciparum infections in co-infected school children in northwest Tanzania.

Abstract:

Plasmodium falciparum malaria and intestinal helminth infections are among the most common infections in the tropics and they share the same spatial distribution. The objective of this study was to explore the association between infections with intestinal helminths and P. falciparum infection as single helminth infections or co-infections among school children. A cross-sectional study was conducted among 400 school children in Nyamtongo, Sengerema District in Tanzania. The study involved examination of single stool and finger prick blood samples for intestinal helminths and malaria parasites. A Kato-Katz technique was employed to screen for intestinal helminths and Giemsa stained thin and thick blood smears were used to screen for malaria parasites. The results of logistic regression model adjusted for age and sex indicated no association between P. falciparum and S. mansoni (OR= 0.749, 95%CI 0.418-1.344), P. falciparum and hookworm (OR= 0.885, 95%CI 0.489-1.605) and P. falciparum and co-infection of S. mansoni and hookworm (OR=0.859, 95%CI 0.422-1.745). Using multinomial regression model adjusted for age and sex, no association was observed between P. falciparum with Schistosomamansoni [Ratio of Relative Risk (RRR) = 0.651, 95% Confidence Interval (CI) 0.331-1.363] and hookworm (RRR=0712, CI 0.280-1.765). Similarly, no association was observed between co-infections of S. mansoni + hookworm (RRR=0.635, CI 0.268-1.504) with P. falciparum infection. Co-infections of S. mansoni, hookworm and P. falciparum among school children is common in the Nyamatongo ward, Sengerema District. We recommend prospective longitudinal studies to elucidate the interactions of malaria and helminths and its health impact in risk groups.

Name of Journal/ Conference Proceedings/ Workshop: Tanzania Journal of Health Sciences 12, (4) 1-4.

Year of Publication: 2010

Name of Lecturer/Author(s): F.O. Wamonje, R. Waihenya, Z. Ng'ang'a and J.N.N. Ngeranwa

Title of Publication: Mouse Cytokine Profile Skewed Towards Th2 In Pregnancy During Infection with BrucellaAbortus S19 Vaccine Strain.

Abstract:

The two classes of cytokines Th1 and Th2 determine the type of immune response elicited. The Th2 immune response is associated with successful pregnancy. Brucellosis is an intracellular bacterium that elicits the Th1 response and is known to cause spontaneous abortion in mammalian species. This study sought to determine if Brucella infection causes spontaneous abortion by causing the circulating cytokine profile be Th1 dominant during pregnancy. Forty eight Swiss white mice were used in this murine model and the S19 strain of Brucellaabortus was used in as the infective agent. Pregnant mice in the test group were injected intraperitoneally with 105-8 CFU of Brucella and cytokine profile and evaluated over the three trimesters of pregnancy. Pregnant mice in the control group were left to go through normal pregnancy and their cytokine profile evaluated over the three trimesters of pregnancy. Cytokines in serum samples were analyzed by Cytometric Bead Array. The data was analyzed using the Paired T- test and $p<0.05$ was considered significant. IFN-γ and TNF-α represented the Th1 cytokines while IL-4 and IL-5represented the Th2 cytokines. None of the mice in the test group had spontaneous abortion. IFN-γ and TNF-α had no significant differences between cytokine levels for infected and uninfected groups in all 3 trimesters of pregnancy. IL-4 levels had significant differences in all three trimesters of pregnancy (t=13, P=0.036, 0.0071 and 0.0277). IL-5 levels had significant differences second trimester (t=14, P=0.0075). The cytokine profile was robustly Th2. In conclusion, Brucellaabortus cannot cause spontaneous abortion by altering the mouse cytokine profile towards ThI in pregnancy. Elevated IL-4 levels with corresponding suppression of IFN-γcan be used as a marker for successful pregnancy in Brucellosis.

Name of Journal/ Conference Proceedings/ Workshop:

Tanzania Journal of Health Research Volume 13, Number 2,

Year of Publication:

2011.

Name of Lecturer/Author(s):

A.K. Nyamache, R. Waihenya, Z. W. Nganga, A. W. Muigai and S. Khamandi.

Title of Publication:

Extent of drug resistance mutations among HIV--1 positive drug—naïve patients in Kenya

Abstract:

Reverse transcriptase inhibitors drug mutations in drug-naïve HIV type 1 positive Kenyan individuals. Development of resistance to antiretroviral medication can occur in persons on antiretroviral therapy, acquisition of already resistant strain in persons who have never taken medication or by natural polymorphism of the virus in vivo. This leads to treatment failure hence complicating management of HIV patients. The main objective of this study was to determine the extent of HIV-1 drug resistance mutations in HIV-1 positive drug naïve persons in Kenyan population. HIV-1 positive plasma samples from seventy-eight (78) drug naive subjects were collected from Health Centers in five provinces in Kenya. HIV-1 viral RNA was extracted from plasma samples using Qiagen® RNA isolation kit and a portion of the HIV-1 reverse transcriptase (RT)

gene amplified by nested PCR using a set of specific primers targeting a region where mutations conferring resistance to antiretroviral medication are prone to occur. The amplified products were analyzed by gel electrophoresis and visualized under UV light. The successfully amplified products were then sequenced using the Big Dye® sequence terminator technology (Applied Biosystems®). A portion of the RT gene (697bp in size) was successfully sequenced for 78 samples. From analysis of the sequences, it was determined that NNRTI associated resistance mutations were present at sites G98A (2.56%) of the amino acid codon; K103E (1.3%) mutation and mutation L100F (3.57%) prevalences. From the 78 samples successfully analyzed, only one sample had a significant mutation that could confer resistance to ARVs, specifically Nevirapine (1.3%). Drug resistance associated mutations detected confer resistance to Nevaripine and low resistance to Delavirdine, etravirine and enfuvirtide. This indicates in general, that drug resistance among HIV-1 positive drug naïve persons is at low thresholds but the problem could be more serious than reported here.

Name of Journal/ Conference Proceedings/ Workshop: East African Medical Journal Vol. 88 no.1pg 4-8.

Year of Publication: 2011.

Name of Lecturer/Author(s): Penina Njoki Muchirah, Dorcas Yole, Hellen Kutima, Rebecca Waihenya, Kennedy Muna Kuria and Mokua John.

Title of Publication: Determination of effective praziquantel dose in different mouse strains: BALB/c and Swiss mice in treatment of Schistosomamansoni.

Abstract: Schistosomiasis is a parasitic disease, second to malaria, affecting human's tropics and sub-tropics. The disease condition varies in severity depending on parasite species and strain, organ system infected, geographical region, genetic constitution of the individual and nutritional status. The drug praziquantel has been the choice of drug for the treatment of schistosomisias; however, the effective dose, 450 mg/kg body weight, which is currently being used, is not able to clear the worms completely. This work sought to determine the effective dose of praziquantel in different mouse strains of which the results can be applied in human treatment. Experimental groups comprising of twelve mice and eighteen for the infected control groups were designed for both BALB/c and Swiss mice. At four weeks post infection, mice were treated with varying dosages of praziquantel namely PZQ 1350, PZQ 900, PZQ 450 mg/kg body weight. At week 6, all mice were perfused to recover adult worms. Gross pathology and histopathology of the liver tissue were examined. Serum samples were collected to determine immunological responses in all the groups at week 4 and 6. Schistosomule soluble protein (SSP) and schistosomule warm antigen preparation (SWAP) specific antibody ELISA were done. Results indicated that in the experimental groups PZQ 1350 mg/kg body weight had few numbers of worms recovered in BALB/c and Swiss mice i.e. 30.30 and 34.08%, respectively, and a high worm reduction i.e. 69.70 and 65.92% respectively. The SSP and SWAP specific

IgG responses were high due to synergistic effect between the drug and immune responses. Granuloma formation was greatly reduced in PZQ 1350 mg/kg body weight group in comparison to other treatments. The findings of this study imply that the higher the dosage of praziquantel, the more the protection against Schistosomamansoniinfection, since PZQ 1350 indicated better responses in worm recovery, worm reduction, immunological response and pathology compared to other dosages. These results may be incorporated into the design of a more effective dose; however, the toxicity of the high dose should be investigated. The findings also indicate that Swiss mouse was a better permissive host than BALB/c, as it allowed more parasites to mature instead of destroying them. Hence, it is a better model in schistosomiasis experimental studies.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Clinical Immnunology and Immunopathology Research Vol. 4(2), pp. 12–21.

Year of Publication: 2012.

Name of Lecturer/Author(s): Kennedy M. Kuria, Rebecca Waihenya, Hellen Kutima, Peninnah Njoki and Dorcas S. Yole

Title of Publication: Cellular responses against Schistosomamansoniin immunized Balb/c mice with soluble proteins from intermediate host, Biomphalariapfeifferi

Abstract:

Scores of millions of people around the world are infected by Schistosomamansoni causing considerable morbidity, mortality and loss of productivity. Safe chemotherapeutic agents have been used though there are challenges of re- infection due to resistance. Both epidemiological and experimental data suggest that acquired cell mediated immunity play significant roles in regulating the intensity of S. mansoniinfection as well as its patho-physiologic sequelae.

Improved control of thistrematode parasite may be obtained with immunization to enhance the resistance of individuals to risk of infection. This study investigated the cellular responses of mice immunized with soluble proteins from foot and digestive gland of the vector snail and challenged with S. mansoni. The proteins were used to immunize the experimental groups then challenged with the S. mansoni. The experimental groups were FT (immunized with foot protein) and DG (immunized with digestive gland). The parameters, which were analyzed to demonstrate protection, included; the worm counts and cellular (IFN-γ, IL-5 cytokines) responses. It was observed that, the experimental groups showed significant protection in terms of worm reduction and immune responses. The group vaccinated with foot protein showed higher protection (87.5%) as compared to the group vaccinated with the digestive gland (50%) in terms of worm reduction. Cytokines (IFN-γ and IL-5) production was present in different levels during the assay time points which showed an aspect of protection. The Foot protein of the vector showed more immunizing power than the digestive gland. Research towards utilizing the two proteins as feasible vaccine candidates is encouraged.

Name of Journal/ Conference

Proceedings/ Workshop: Tanzanian Health Research Volume 14, Number 4, pg1-13.

Year of Publication: 2012.

Name of Lecturer/Author(s): Mokua John Mose, Helen Kutima, Rebecca Waihenya, and Dorcas Yole

Title of Publication: Evaluating the Antischistosomal Activity of Crude Extracts of Carica Papaya against SchistosomaMansoni: the Interplay of Cellular and

Humoral Immunity

Abstract: Carica papaya is widely used in different parts of Kenya for the treatment of intestinal helminthes. The present study was designed to evaluate the anti-schistosomal effect of a methanolic and aqueous extract of Carica papaya seeds in schistosoma infected mice. Laboratory mice were infected with a single dose of Schistosomamansonicercariae. The extracts were administered orally at a dose of 300 mg/kg body weight in 200µl suspension to infected mice two days apart. Praziquantel was the reference drug used in the experiments. Two weeks post-treatment; all animals were sacrificed to evaluate the efficacy of Carica papaya in treatment of the infection. Significant effect of the extracts was observed against schistosomal infected mice. Carica papaya methanol extract was found more effective against schistosomes recording more less recovery while Carica papaya aqueous extract recorded more recovery. Detectable levels of cytokines were also recorded during infection and after treatment with a marked rise in SWAP specific IL5. These data support the use of Carica papaya based medicines as antischistosomal agents where access to commercial drugs is restricted. These findings provide solid scientific evidence to support the traditional medicinal uses of these extracts and indicate a promising potential of this plant for medicinal purposes. There is also need for detailed scientific study of traditional medicinal practices to ensure that valuable therapeutic knowledge of this plant is preserved and also to provide scientific evidence for their efficacy.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Biomedical and Pharmaceutical Research (2) 1; 33-43

Year of Publication: 2013

Name of Lecturer/Author(s): Fredrick Kaingu, Alfred Kibor, Rebecca Waihenya, Robert Shivairo and Lewis Mungai.

Title of Publication: Efficacy of Aloe secundiflora Crude Extracts on Ascaridiagalli in Vitro.

Abstract: Aloe secundifloraSynonym: Aloe floramaculata, Aloe marsabitensis, Aloe engleribelongs to the familyAsphodelaceae. Aloe leaf gel and Aloe exudates are the main components. The gel is derived fromparenchytomous cells while exudates are derived from the inner epidermal layers. The gel consists of mainly polysaccharides while the exudates consists of a mixture of phenolic compounds mainly athrones, chromones

and phenyl pyrones. Leaf components of Aloe have been credited for antibacterial, antifungal and antiviral and anthelmintic medicinal properties. The effectiveness of Aloe secundifloraextracts on the most prevalent nematode of chicken Ascaridiagalliwas conducted in vitro. The results of this study indicate that Hexane, Ethylacetate, Acetone, Methanol and chloroform extracts were found active in hindering the development of Ascaridiagallieggs to larval stage three (L3), and this was dependent on the concentration of the crude extract. The lowest concentration of the various extracts (5 mg/ml) had an inhibition percent (IP), 75.52%, 79.60%, 87.21%, 86.13% and 43.6% respectively. The highest concentration of the extracts was (50 mg/ml); at this level the inhibition percent was found higher than in the lowest extracts concentrations i.e., 91.84%, 97.55%, 100%, 99.46% and 91.29% respectively. Aloe secundifloraextracts therefore have inhibitory effects on the Ascaridiagallilarval development in vitro. Phytochemical tests on the extracts revealed the presence of various chemical compounds.

Name of Journal/ Conference Proceedings/ Workshop: Sustainable Agriculture Research; Vol. 2, No. 2; 49-53

Year of Publication: 2013

Name of Lecturer/Author(s): Humphrey D. Mazigo, Fred Nuwaha, Shona Wilson, Safari M. Kinung'hi, Domenica Morona, Rebecca Waihenya, JorgHeukelbach, David W. Dunne.

Title of Publication: Epidemiology and interactions of Human Immunodeficiency Virus – 1 and Schistosomamansoni in sub-Saharan Africa.

Abstract: Human Immunodeficiency Virus-1/AIDS and Schistosomamansoni are widespread in rica and co-infection occurs commonly. Since the early 1990s, it has been suggested that the two infections may interact and potentiate the effects of each other within co-infected human hosts. Indeed, S. mansoni infection has been suggested to be a risk factor for HIV transmission and progression in Africa. If so, it would follow that mass deworming could have beneficial effects on HIV-1 transmission dynamics. The epidemiology of HIV in African countries is changing, shifting from urban to rural areas where the prevalence of Schistosomamansoni is high and public health services are deficient. On the other side, the consequent pathogenesis of HIV-1/S. mansoni co-infection remains unknown. Here we give an account of the epidemiology of HIV-1 and S. mansoni, discuss co-infection and possible biological causal relationships between the two infections, and the potential impact of praziquantel treatment on HIV-1 viral loads, CD4+ counts and CD4+/CD8+ ratio. Our review of the available literature indicates that there is evidence to support the hypothesis that S. mansoni infections can influence the replication of the HIV-1, cell-to-cell transmission, as well as increase HIV progression as measured by reduced CD4+ T lymphocytes counts. If so, then deworming of HIV positive individuals living in endemic areas may impact on HIV-1 viral loads and CD4+ T lymphocyte counts.

Name of Journal/ Conference Proceedings/ Workshop: Infectious Diseases of poverty 2:2-11

Year of Publication: 2013

Name of Lecturer/Author(s): Koskey S, Okoth F and Waihenya Rebecca.

Title of Publication: Monitoring of CD4+ T_cell counts in HIV infected patients on Arthrospiraplatensis supplement in Kisumu, Kenya.

Abstract:

Consumption of natural products with high nutritional value can improve nutritional and immune status of HIV patients. Arthrospiraplatensis is an alga that grows naturally in some tropical lakes. It is rich in nutritional contents and anti_oxidants. This study investigated whether use of Arthrospiraplatensis by HIV positive adults affected their CD4+ T_cell counts. This was a prospective paired study design with two independent groups: the study group and a control

group. The findings of individual patients before and after intervention were also paired. Patients with CD4+ T_cell counts above 250 cells/1l were enrolled in Nyanza Provincial Hospital, Kenya. Patients in the study group used A. platensis while those in the control group used the standard multi_vitamin supplements. Fifty_eight patients completed the study [28 in A. platensis (study) group and 30 in multivitamin (control) group]. The mean CD4+ T_cell counts among patients in the study group increased from 485 ± 163to 516 ± 181 cells/1l (p = 0.110) while in the multivitamin group they declined from 555 ± 221 to 472 ± 174cells/1l (p = 0.001). It was concluded that A. platensis increased CD4+ T_cell counts in HIV infected adults and it was well tolerated at a maximum dry dose of 2g/ day when used for 1_6 months.

Name of Journal/ Conference Proceedings/ Workshop: African Journal of Health Sciences, (1) 24, 1-8

Year of Publication: 2013

Name of Lecturer/Author(s): Mugweru Julius, Waihenya Rebecca, Kimani Francis, Ng'ang'a Zipporah, Matiru Viviene and Francis W. Muregi.

Title of Publication: Cytokine levels associated with experimental malaria pathology during Plasmodium bergheiANKA infection in a mouse model

Abstract:

Successful recovery from malaria involves striking a balance between counteracting cytokines. The cytokine imbalance contributes to pathological features, but their exact levels have not been elucidated. This study aimed at investigating the role played by circulating cytokines in pathophysiology of cerebral malaria using experimental cerebral malaria (ECM) model by profiling four serum cytokines using cytometric bead array. 72 BALB/c mice were intraperitoneally inoculated with 0.2 ml 1×104 parasitized red blood cells at day 0 and randomized into six groups (six mice/group). The mice were sacrificed at day 4, 6, 8, 11 and 20 post-infection. Significantly higher systemic levels ($P<0.05$) of interferon-gamma (IFN-γ) were observed between day 8 and 20 post inoculation (p.i), while tumor necrosis factor-alpha (TNF-α) levels were significant at days 4, 8 11, 14

and 20, respectively in BALB/c mice that survived until day 20 post-infection with a higher parasitemia (up to 52.6%±0.8). Significant concentrations ($P<0.05$) of interleukin-4 (IL-4) were observed between day 4 and 8. IL-5 levels had significant differences at days 11 and 20 p.i. T-cell pathology was revealed by fragmentation of whole genomic DNA during the infection which coincided with elevated IFN-γ and TNF-α responses further accelerating the severity of cerebral malaria (CM). This study has demonstrated the correlation between T-lymphocyte pathology and elevated levels of T-helper 1 (Th1) cytokines concentrations in the brain and spleen.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Clinical Immunology and Immunopathology Research 5:1-8

Year of Publication: 2013

Name of Lecturer/Author(s): Shadrack Muvui Muya, Abel Kamweya, Apollo Kariuki, Anne W-T. Muigai and Shadrack M. Ngene

Title of Publication: Using range condition assessment to optimize wildlife stocking in Tindress Wildlife Sanctuary, Nakuru District, Kenya.

Abstract: Over 70% of the Kenya's wildlife resources occur outside protected areas, where land use practices are not necessary in conformity wildlife conservation. Ensuring that land-use practices in these areas accommodate wildlife conservation is vital in effectively conserving wildlife in this country. Tindress Farm in Rift Valley offers a good example where economic activities and wildlife conservation can work harmoniously. The farm has set up a 320 hectares Wildlife Sanctuary in the hilly parts of the property to provide a haven for wildlife displaced by human settlements in the surrounding environs. The Tindress Farm management needed to know the diversity and optimum number of wildlife species that the sanctuary could accommodate. This study set out to: 1) outline a set of models for objectively calculating wildlife stocking levels; and 2) demonstrate the practical use of these models in estimating of optimum stocking levels for a specific wildlife sanctuary. After comparing Forage Inventory Methods (FIMs) models and Utilization-based Methods (UMs) models, we opted to use UMs models because of their focus on ecological energetics. This study established that the range condition in TWS varied from poor to good (29 - 69%) and recommended a total stocking density of 158.9 grazer units (GU) and 201.4 browser units (BU) shared out by the various herbivore species. These estimates remain a best-case scenario. The effects of rainfall, range condition, and condition of the animals should be monitored continuously to allow for adjustments through active adaptive management.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Rangeland Ecology and Management doi: http://dx.doi.org/10.2111/REM-D-12-00075.1

Year of Publication 2013

Name of Lecturer/Author(s): Kamweya, A.M., Ngene, S.M. and Muya, S.M.

Title of Publication: Occurrence and Level of damage to farms adjacent to Mount Kenya Forests: Impacts or conservation.

Abstract: Incidences of elephant's crop raids in Mount Kenya area have escalated in the recent past causing considerable damage to the fragile local economy that is mainly peasant farming. Studies on crop-raiding predisposing factors, nature and extent of the damage in this region are scanty. Thus, this was the aim of this study. Data was obtained from questionnaires and occurrence books at Kenya Wildlife Service between 1997 – 2000. Elephant movements were mapped in relationship to watering points and salt licks. It was found that crop-raiding incidences by elephants were widely spread over the study area (80%, n = 487). Crop damage severity was about 16.8 % of the expected yields. Levels of crop damage were positively correlated to crop occurrence (r = 0.982, P = 0.01). Thus, damage levels were substantive. Elephant's crop-raids should stop. Fencing off elephant from farmland will solve crop-raiding problems and enhance their conservation. Keywords: Elephants crop-raiding, human-wildlife conflict, forest fragmentation, conservation area barriers

Name of Journal/ Conference Proceedings/ Workshop: The journal of Biology, Agriculture and Healthcare ISSN 2222-1719 (PAPER) ISSN 222-2863 (ONLINE) VOLX. NO, X, 2010

Year of Publication: 2012

Name of Lecturer/Author(s): Kamweya, A.M and Mwangi, E.M. and Njonge, F.K.

Title of Publication: Attitudes of the people towards elephants and implications for management around Thegu-Forest Reserve, Mount Kenya

Abstract: Rapid human population growth has drastically reduced elephant range by reducing habitats and blocking traditional migration routes over the last several decades. Attempts to reopen migration routes have been met with mixed, albeit strong, reactions. A wider study to analyse human-elephant interactions in the area also sought the attitudes of local people towards re-opening migration between Mt Kenya forests and the nearby Sangare ranch.

The route commonly traversed by elephants was mapped using Global Positioning Systems (GPS) and Geographical Information Systems (GIS) techniques. Two elephant sightings, footprints, dung and residents' accounts confirmed this as the only route currently used by elephants out of Mt Kenya forests. The footprints and dung were observed within a 4 -10 m wide strip along the entire 7 km stretch between Mt Kenya and Sangare.

A questionnaire was administered to collect data on demography and impacts of elephants on adjacent farms, while the dung pile count technique was used to estimate elephant distribution and densities. Results showed that 33% of the community resented elephants, which was strongly associated with alleged levels of damage to lives and property ($X2= 0.797$, $df =4$, $P < 0.01$).

This caused unwillingness to provide passage through their land, with only 2.6% of the respondents indicating they would let elephants on their property. About 42% of those against the corridor attributed this to damages and losses caused by elephants whereas 10.5 % did not give reasons. A majority of the respondents were aware of importance of elephants in tourism, as agents of seed dispersal, sources of bush meat and ivory, and in revenue generation, but only a 3% admitted having gained in any way. The corridor seemed unviable under the prevailing land uses and negative public attitudes towards elephants. Key words: Human-wildlife conflict, habitat fragmentation, migration

Name of Journal/ Conference Proceedings/ Workshop: Journal of Agriculture Science and technology

Year of Publication: 2012

Name of Lecturer/Author(s): Kamweya, A.M., Ngene, S.M. and Muya, S.M.

Title of Publication: Occurrence and Level of damage to farms adjacent to Mount Kenya Forests: Impacts or conservation.

Abstract: Incidences of elephant's crop raids in Mount Kenya area have escalated in the recent past causing considerable damage to the fragile local economy that is mainly peasant farming. Studies on crop-raiding predisposing factors, nature and extent of the damage in this region are scanty. Thus, this was the aim of this study. Data was obtained from questionnaires and occurrence books at Kenya Wildlife Service between 1997 – 2000. Elephant movements were mapped in relationship to watering points and salt licks. It was found that crop-raiding incidences by elephants were widely spread over the study area (80%, n = 487). Crop damage severity was about 16.8 % of the expected yields. Levels of crop damage were positively correlated to crop occurrence (r = 0.982, P = 0.01). Thus, damage levels were substantive. Elephant's crop-raids should stop. Fencing off elephant from farmland will solve crop-raiding problems and enhance their conservation. Keywords: Elephants crop-raiding, human-wildlife conflict, forest fragmentation, conservation area barriers

Name of Journal/ Conference Proceedings/ Workshop: The Journal of Biology, Agriculture and Healthcare ISSN 2222-1719 (PAPER) ISSN 222-2863 (ONLINE) VOLX. NO, X, 2010

Year of Publication: 2012

Name of Lecturer/Author(s): Shadrack Muvui Muya, Abel Kamweya, Apollo Kariuki, Anne W-T. Muigai and Shadrack M. Ngene

Title of Publication: Using range condition assessment to optimize wildlife stocking in Tindress Wildlife Sanctuary, Nakuru District, Kenya.

Abstract: Over 70% of the Kenya's wildlife resources occur outside protected areas, where land use practices are not necessary in conformity wildlife conservation. Ensuring that land-use practices in these areas accommodate wildlife conservation is vital in effectively conserving wildlife in this country. Tindress

Farm in Rift Valley offers a good example where economic activities and wildlife conservation can work harmoniously. The farm has set up a 320 hectares Wildlife Sanctuary in the hilly parts of the property to provide a haven for wildlife displaced by human settlements in the surrounding environs. The Tindress Farm management needed to know the diversity and optimum number of wildlife species that the sanctuary could accommodate. This study set out to: 1) outline a set of models for objectively calculating wildlife stocking levels; and 2) demonstrate the practical use of these models in estimating of optimum stocking levels for a specific wildlife sanctuary. After comparing Forage Inventory Methods (FIMs) models and Utilization-based Methods (UMs) models, we opted to use UMs models because of their focus on ecological energetics. This study established that the range condition in TWS varied from poor to good (29 - 69%) and recommended a total stocking density of 158.9 grazer units (GU) and 201.4 browser units (BU) shared out by the various herbivore species. These estimates remain a best-case scenario. The effects of rainfall, range condition and condition of the animals should be monitored continuously to allow for adjustments through active adaptive management.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Rangeland Ecology and Management

doi: http://dx.doi.org/10.2111/REM-D-12-00075.1

Year of Publication: 2013

Name of Lecturer/Author(s): Abel M. Kamweya, Shadrack M. Ngene, Shadrack M. Muya

Title of Publication: Occurrence and Level of Elephant Damage to Farms Adjacent to Mount Kenya Forests: Implications for Conservation

Abstract: Incidences of elephant's crop raids in Mount Kenya area have escalated in the recent past causing considerable damage to the fragile local economy that is mainly peasant farming. Studies on crop-raiding predisposing factors, nature and extent of the damage in this region are scanty. Thus, this was the aim of this study. Data was obtained from questionnaires and occurrence books at Kenya Wildlife Service between 1997 – 2000. Elephant movements were mapped in relationship to watering points and salt licks. It was found that crop-raiding incidences by elephants were widely spread over the study area (80%, n = 487). Crop damage severity was about 16.8 % of the expected yields. Levels of crop damage were positively correlated to crop occurrence ($r = 0.982$, $P = 0.01$). Thus, damage levels were substantive. Elephant's crop-raids should stop. Fencing off elephant from farmland will solve crop-raiding problems and enhance their conservation.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Biology, Agriculture and Healthcare, Vol 2, No 5 (2012)

Year of Publication: 2013

Name of Lecturer/Author(s): Osiemo Zipporah, Gitonga Linus, Muya Shadrack, Ng'endo Rossa, Baya Joseph, Sithanantham Srinivasan

Title of Publication: Evaluation of biological attributes of a native egg parasitoid, Trichogrammatoidea sp. nr. lutea (girault), Kenyan accessions

Abstract:

Objective: This study was carried out to evaluate the biological attributes that is, parasitism, adult progeny production, and sex ratio of 21 strains of a native egg parasitoid Trichogrammatoidea sp. nr. luteaGirault (Hymenoptera: Trichogrammatidae) collected from PlutellaxylostellaLinnaus (Lepidoptera: Yponomeutidae) in coastal Kenya, reared on Corcyra cephalonicaSainton (Lepidoptera: Pyralidae) in the laboratory. Methods: A total of 21 accessions of T. sp. nr. lutea Muhaka sites). Preliminary experiments to select the best performers among the 21 strains, based on biological attributes such as adult longevity, parasitism, emergence, adult progeny produced and progeny sex ratio were conducted under laboratory conditions (temperature of 27±2°C and 65±10% RH). Results: There were significant differences ($P<0.05$) in all biological attributes studied among the strains. The overall mean adult longevity was 9.31 days. Parasitism, emergence and sex ratio per adult female were 20.2%, 75.56% and 37.77% respectively. The wasp age influenced all the attributes tested significantly ($P<0.05$) of T.sp. nr. lutea. Conclusion: Four accessions (SH-1 and 4, MK-1 and 3) were selected and recommended from this experiment based on adult longevity, parasitism, adult progeny produced and sex ratio for further evaluation. The results from this study will be useful for mass rearing purposes as well as for future field release programmes

Name of Journal/ Conference Proceedings/ Workshop: Asian J Phar Biol Res. 2(3): 172-176

Year of Publication: 2012

Name of Lecturer/Author(s): Zipporah Osiemo, Linus Gitonga, Shadrack Muya, Samuel M, Sithanantham Srinivasan

Title of Publication: Influence of mating frequency and parasitoid age on reproductive success of Trichogrammatoideasp. nr. luteaGirault collected from PlutellaxylostellaLinnaus in Kenya

Abstract:

This study was carried out to investigate the reproductive fitness parameters, that is, parasitism, adult progeny production, and sex ratio of a native egg parasitoid Trichogrammatoidea sp. nr. luteaGirault (Hymenoptera: Trichogrammatidae) collected from PlutellaxylostellaLinnaus (Lepidoptera: Yponomeutidae) in coastal Kenya, reared on Corcyra cephalonicaSainton (Lepidoptera: Pyralidae) in the laboratory. Freshly emerged mated female adults (0-24hr old) with no previous oviposition experience, were placed individually in separate glass vials. Ten replicates (each replicate composed of a single female) were made; each female was offered 40 eggs in an egg card daily. Egg cards were placed in separate vials at constant temperature and humidity to await emergence. The daily and lifetime number of parasitized (blackened) eggs, adults which emerged from the parasitized eggs were counted and recorded, together with the number of females out of the total progeny (number of adults).

Percentages for all the tested parameters were also calculated. In another set of experiment, the possibility that the presence of males may bring material benefits to the parasitoid females in terms of enhancing sex ratio and other reproductive fitness parameters was investigated by placing male together with female in same vial throughout its lifetime. Highest progeny production, parasitism and sex ratio (percentage of females) was obtained during the first day of host exposure, decreasing with parasitoid age. No significant difference (P>0.05) was found in the overall lifetime offspring progeny, parasitism and sex ratio of single mated females and one placed together with male throughout its lifetime. Females of T. sp. nr. lutea received enough sperm from one mating to allocate optimum sex ratio. In order to achieve highest reproductive success of Trichogramma parasitoids during mass production for biological control of Lepidopteran pests, it is important to use younger wasps than old ones. Besides, there is no possibility that the presence of males may bring material benefits to the parasitoid females in terms of enhancing sex ratio and other reproductive fitness parameters.

Name of Journal/ Conference Proceedings/ Workshop: International Journal of AgriScience Vol. 3(2): 114-123

Year of Publication: 2013

Name of Lecturer/Author(s): S. M. Muya, M. W. Bruford, A. W.-T. Muigai, Z. B. Osiemo, E. Mwachiro, B. Okita-Ouma, B. Goossens

Title of Publication: Substantial molecular variation and low genetic structure in Kenya's black rhinoceros: implications for conservation

Abstract:

Abstract Kenya's black rhinoceros population declined by more than 98% from 20,000 individuals in the 1970s to around 400 individuals in 1990 due to the effects of poaching, at which time the surviving individuals were isolated in a series of demographically inviable subpopulations. An initial management exercise translocated the survivors into four high security sanctuaries to control poaching and enhance breeding, and this measure successfully arrested the decline. Subsequently, new sanctuaries were established and the metapopulation size reached 650 animals by 2008. However, translocations and the current management strategy that partitions the metapopulation into 'montane' and 'lowland' rhinoceros may have substantial consequences at the population level and their impact on population genetic diversity has not been investigated. In this study, 12 of the 16 extant subpopulations were analysed using 408 bp of mitochondrial control region sequence (n = 170) and nine microsatellite loci (n = 145). Both markers detected moderate to high genetic diversity (h = 0.78 ± 0.027, n = 170; HO = 0.70 ± 0.087, n = 145) consistent with previous studies on Dicerosbicornismichaeli. However, mtDNA and nDNA diversity varied substantially between subpopulations. The results suggest that the Masai Mara is more differentiated, inbred and isolated than other subpopulations. It also suggests that there are neither distinct montane and lowland groups nor other detectable historical barriers to gene flow. Instead

	the large majority of genetic diversity was partitioned at the level of individuals; highlighting the need to conserve as many individuals as possible. Future translocations should consider the genetic profile of individuals and the demographic history of both the donor and recipient subpopulations
Name of Journal/ Conference Proceedings/ Workshop:	Journal of Conservation Genetics - DOI 10.1007/s10592-011-0256-3
Year of Publication:	2011
Name of Lecturer/Author(s):	Elizabeth Syombua Michael, Dorcas Yole, Mutie Fredick Musila, Hellen Kutima and Patrick Kareru
Title of Publication:	Assessment of Molluscicidal, Cercericidal and Miracicidal Activities of Crude Extracts of Azadirachta indica and Entada leptostachya
Abstract:	Schistosomiasis infections in humans depend absolutely on the presence of intermediate host. Control of the intermediate host disrupts the cycle of schistosomes stopping transmission of schistosomiasis. Synthetic molluscicides used today are expensive and non-target organisms would be a key in controlling schistosomiasis. This study was done to determine if plant extracts of Entada leptostachya and Biomphalaria pfeifferi adult snails and juveniles, study. Groups of uninfected snails were exposed to different concentrations of water, methanol and ecrude extracts obtained from the two plants. Controls were also set; positive control (Niclosamide) and negative control (Distilled water). Miracidia and cerceriae were exposed to the most active plant extract on juvenile and adult snails. Data analysis was done using Finney probit analysis to estimate the LD and LT50values of the crude extracts on cerceriae and miracidia. Only methanol extract of to exhibit the highest molluscicidal activity on juveniles and adults with a LD respectively ($P \leq 0.05$). Methanol extract of leptostachya were nontoxic to both adult and juvenile snails. On the other hand, methanol extract of were found to have cercericidal and miracicidal activity. The LT 4.25 minutes respectively at a conce extracts and ethyl acetate extracts of tannins, alkaloids, triterpenes and sterols. Results suggest molluscicidal activity against Biomphalaria pfeifferi. E. leptostachya have cercaricidal and miracicidal activity against the schistosome larval
	Keywords: Azadirachta indica, Entada leptostachya screening, Molluscicidal activity, Cercericidal activity and Miracicidal activity
Name of Journal/ Conference Proceedings/ Workshop:	Journal of Biology, Agriculture and Healthcare ISSN 2224-3208 (Paper) ISSN 2225. Vol.3 (5), 2013 http://www.iiste.org
Year of Publication:	2013
Name of Lecturer/Author(s):	Mokua John Mose, Helen Kutima, Rebecca Waihenya, and Dorcas Yole

Title of Publication: Evaluating the Antischistosomal Activity of Crude Extracts of Carica Papaya against Schistosoma Mansoni: the Interplay of Cellular and Humoral Immunity

Abstract: Carica papaya is widely used in different parts of Kenya for the treatment of intestinal helminthes. The present study was designed to evaluate the anti-schistosomal effect of a methanolic and aqueous extract of Carica papaya seeds in schistosoma infected mice. Laboratory mice were infected with a single dose of Schistosoma mansoni cercariae. The extracts were administered orally at a dose of 300 mg/kg body weight in 200µl suspension to infected mice two days apart. Praziquantel was the reference drug used in the experiments. Two weeks post-treatment; all animals were sacrificed to evaluate the efficacy of Carica papaya in treatment of the infection. Significant effect of the extracts was observed against schistosomal infected mice. Carica papaya methanol extract was found more effective against schistosomes recording more less recovery while Carica papaya aqueous extract recorded more recovery. Detectable levels of cytokines were also recorded during infection and after treatment with a marked rise in SWAP specific IL5. These data support the use of Carica papaya based medicines as antischistosomal agents where access to commercial drugs is restricted. These findings provide solid scientific evidence to support the traditional medicinal uses of these extracts and indicate a promising potential of this plant for medicinal purposes. There is also need for detailed scientific study of traditional medicinal practices to ensure that valuable therapeutic knowledge of this plant is preserved and also to provide scientific evidence for their efficacy.

KEY WORDS: Plant extract, Antischstosomal activity, Schistosoma mansoni, Carica papaya

Name of Journal/ Conference Proceedings/ Workshop: Journal of Biomedical and Pharmaceutical Research 2 (1) 2013, 33-41 ISSN: 2279 - 0594

Year of Publication: 2013

Name of Lecturer/Author(s): Kennedy M. Kuria, Rebecca Waihenya, Hellen Kutima, Peninnah Njoki and Dorcas Yole

Title of Publication: Cellular responses against Schistosoma mansoni in immunized Balb/c mice with soluble proteins from intermediate host, Biomphalaria pfeifferi. Tanzania

Abstract: Scores of millions of people around the world are infected by Schistosoma mansoni causing considerable morbidity, mortality and loss of productivity. Safe chemotherapeutic agents have been used though there are challenges of re-infection due to resistance. Both epidemiological and experimental data suggest that acquired cell mediated immunity play significant roles in regulating the intensity of S. mansoni infection as well as its patho-physiologic sequelae. Improved control of this trematode parasite may be obtained with immunization to enhance the resistance of individuals to risk of infection. This study investigated the cellular responses of mice immunized with soluble proteins from foot and digestive gland of the vector

snail and challenged with S. mansoni. The proteins were used to immunize the experimental groups then challenged with the S. mansoni. The experimental groups were FT (immunized with foot protein) and DG (immunized with digestive gland). The parameters, which were analyzed to demonstrate protection, included; the worm counts and cellular (IFN-γ, IL-5 cytokines) responses. It was observed that, the experimental groups showed significant protection in terms of worm reduction and immune responses. The group vaccinated with foot protein showed higher protection (87.5%) as compared to the group vaccinated with the digestive gland (50%) in terms of worm reduction. Cytokines (IFN-γ and IL-5) production was present in different levels during the assay time points which showed an aspect of protection. The Foot protein of the vector showed more immunizing power than the digestive gland. Research towards utilizing the two proteins as feasible vaccine candidates is encouraged.

Keywords: Schistosoma mansoni, Biomphalaria pfeifferi, IFN-γ, IL-5 cytokines, mice

Name of Journal/ Conference Proceedings/ Workshop: Journal of Health Research, Volume 14(4) October, 2012.Pg1-13. DOI:http://dx.doi.org/10.4314/thrb.v14i4.7

Year of Publication: 2012

Name of Lecturer/Author(s): D.N. Sagwe, Z. Ng'ang'a and H. Kutima

Title of Publication: Neglect of elderly sexuality – a risk factor for HIV and other sexually transmitted infections in Kenya and beyond

Abstract:

Currently, there is a global trend in increased longevity in Kenya and beyond compared to any other period in history. This has culminated in continued social life including sexual activity with ageing. However, there is little information in the scientific literature concerning HIV and other sexually transmitted infections (STIs) that is specific to those aged 50 years and above. People in this age-group are often excluded from studies as researchers and policy makers focus on young people. Consequently, assumptions are made on the epidemiology as well as sexual behavior of those aged 50 years and above. The exclusion of older people from national programs is on the assumption that older people are sexually inactive, resulting in their omission from major STI policy initiatives despite the physiological changes that occur with age. Thus, policy makers and stakeholders need to address socio-demographic factors that are associated with the prevalence of HIV and STIs in the elderly and to promote further research on this subject in this segment of the population for evidence-based decision making for improved health in the population.

Key words: Elderly, sexuality, HIV, sexually transmitted infections, Kenya

Name of Journal/ Conference Proceedings/ Workshop: A review. JAGST Vol.14 (1) 2012, 127-141. ISSN: 1561-7645

Year of Publication: 2012

Name of Lecturer/Author(s): Penina Njoki Muchirah, Dorcas Yole, Hellen Kutima, Rebecca Waihenya, Kennedy Muna Kuria and Mokua John

Title of Publication: Determination of effective Praziquantel dose in different mouse strains: BALB/c and Swiss mice in treatment of Schistosoma mansoni.

Abstract: Schistosomiasis is a parasitic disease, second to malaria, affecting human's tropics and sub-tropics. The disease condition varies in severity depending on parasite species and strain, organ system infected, geographical region, genetic constitution of the individual and nutritional status. The drug praziquantel has been the choice of drug for the treatment of schistosomisias; however, the effective dose, 450 mg/kg body weight, which is currently being used, is not able to clear the worms completely. This work sought to determine the effective dose of praziquantel in different mouse strains of which the results can be applied in human treatment. Experimental groups comprising of twelve mice and eighteen for the infected control groups were designed for both BALB/c and Swiss mice. At four weeks post infection, mice were treated with varying dosages of praziquantel namely PZQ 1350, PZQ 900, PZQ 450 mg/kg body weight. At week 6, all mice were perfused to recover adult worms. Gross pathology and histopathology of the liver tissue were examined. Serum samples were collected to determine immunological responses in all the groups at week 4 and 6. Schistosomule soluble protein (SSP) and schistosomule warm antigen preparation (SWAP) specific antibody ELISA were done. Results indicated that in the experimental groups PZQ 1350 mg/kg body weight had few numbers of worms recovered in BALB/c and Swiss mice i.e. 30.30 and 34.08%, respectively, and a high worm reduction i.e. 69.70 and 65.92% respectively. The SSP and SWAP specific IgG responses were high due to synergistic effect between the drug and immune responses. Granuloma formation was greatly reduced in PZQ 1350 mg/kg body weight group in comparison to other treatments. The findings of this study imply that the higher the dosage of praziquantel, the more the protection against Schistosoma mansoni infection, since PZQ 1350 indicated better responses in worm recovery, worm reduction, immunological response and pathology compared to other dosages. These results may be incorporated into the design of a more effective dose; however, the toxicity of the high dose should be investigated. The findings also indicate that Swiss mouse was a better permissive host than BALB/c, as it allowed more parasites to mature instead of destroying them. Hence, it is a better model in schistosomiasis experimental studies.

Key words: Schistosomiasis, praziquantel, mice, pathology.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Clinical Immnunology and Immunopathology Research Vol. 4(2), pp. 12–21, March. Available online at http://www.academicjournals.org/JCIIR DOI: 10.5897/JCIIR12.004. ISSN 2141-2219 ©2012 Academic Journals

Year of Publication: 2012

Name of Lecturer/Author(s): John Mokua Mose, Helen Lydia Kutima, Susy Muchika, Rebecca Waihenya and Dorcas S. Yole.

Title of Publication: The evaluation of the effect of an aqueous and methanol extracts of Solanum incanum on Schistosoma mansoni infected mice.

Abstract:

Interest in medicinal plants as a re-emerging health aid has been fuelled by increasing concern about the development of parasite resistance and the rising costs of prescription drugs in the maintenance of personal health and well-being, and the bioprospecting of new plant-derived drugs. Some plant extracts have been used worldwide in traditional medicine for the treatment of human helminthes but not all have been screened for activity against adult Schistosoma sp. The objective of this study was to evaluate the biological effects of crude extracts prepared from dried roots of Solanum incanum using experimental mice infected with Schistosoma mansoni, assessing the worm recovery and immunological responses after treatment. The mice were infected with a single dose of 250 Schistosoma mansoni cercariae and treated with the aqueous and methanol crude extracts at a specific time point. Evaluation on the number of worms recovered and the humoral and cellular immune responses was made. The results obtained showed a 16.7 % maturation of penetrant cercariae. The Solanum incanum aqueous group recorded the highest worm reduction of 46.3% compared to control infected animals with 53.7% worm recovery observed. Cytokine levels peaked during the acute infection and declined to detectable levels after treatment. There was a marked rise in SWAP specific Interleukin-5 and also a rise in 0-3hr and SWAP specific IgG regardless of the time point after treatment. IL-5 production was significantly greater in the infected control and the treatment groups ($p<0.05$). 0-3hr and SWAP induced gamma interferon production however did not increase after treatment.

Keywords: Schistosoma mansoni, Solanum incanum, Granuloma, Interleukin (IL), Interferon (IFN)

Name of Journal/ Conference Proceedings/ Workshop: Asian Journal of Pharmaceutical and Health Sciences, Vol 2, issue 1 pp.278-282

Year of Publication 2012

Name of Lecturer/Author(s): Andrew A Obala, Helen L Kutima, Henry DN Nyamogoba, Anne W Mwangi, Chrispinus J. Simiyu, Gideon N Magak, Barasa O Khwa-Otsyula and John H Ouma

Title of Publication: Anopheles gambiae and Anopheles arabiensis population densities and infectivity in Kopere village, western Kenya

Abstract:

Introduction: This study was conducted in a sugar belt region of western Kenya interfacing epidemic and endemic malaria transmission. We investigated Anopheles gambiae sensu stricto (ss) and Anopheles arabiensis species compositions and densities, human host choice, and infectivity.

Methodology: Mosquitoes were captured using pyrethrum spray catch technique and first identified based on morphology; species were confirmed by PCR. Blood meal preference and

sporozoite rates were determined by ELISA. Parity rates and entomological inoculation rates (EIR) were determined. Seasonal densities were compared against environmental temperatures, relative humidity and rainfall.

Results: In total 2,426 An. gambiae were collected. Out of 1,687 female blood-fed mosquitoes, 272 were randomly selected for entomological tests. An. gambiae ss and An. arabiensis comprised 75% (205/272) and 25% (68/272) of the selection, respectively. An. gambiae ss had higher preference for human blood (97%; n=263/272) compared with An. arabiensis, which mostly fed on bovines (88%; n=239/272). The sporozoite and parity rates were 6% (16/272) and 66% (179/272) for An. gambiae ss and 2% (4/272) and 53% (144/272) for An. arabiensis respectively, while EIR was 0.78 infective bites/person/night. Climate (ANOVA; F=14.2; DF=23) and temperature alone (r=0.626; t=3.75; p=0.001) were significantly correlated with vector densities.

Conclusion: An. gambiae ss are the most efficient malaria vector mosquito species in Kopere village. Because An. gambiae ss largely rests and feeds indoors, use of indoor residual spray and insecticide-treated nets is likely the most suitable approach to malaria vector control in Kopere village and other parts of Kenya where this species is abundant.

Key words: malaria; anopheles; climate; infectivity; transmission

Name of Journal/ Conference Proceedings/ Workshop: Journal of Infection in Developing Countries 2012; 6(8):637-643.

Year of Publication: 2012

Name of Lecturer/Author(s): Joseph Macharia, Linnaus Gitonga and Hellen Kutima.

Title of Publication: Status and Prospectus of stingless Bee-keeping in Kenya

Abstract:

Uganda is one of the world's least developed countries. Its populationdepends on agriculture as a major source of livelihood; however, agricultural production has been negatively affected by civil war in the north of the country. The impact of this war was severe on women and yet they are the major participants in the agricultural industry. HIV/AIDS and structural adjustment programmes have further increased the poverty level. With over two decades of civil war raging in northern Uganda, and rebels having resorted to abducting children to fight in their battle, girl children became targets of devastating abuse. Girls were often given as 'wives' to rebel soldiers, destining them to a life as a sex slave. Many girls become pregnant and gave birth

in the bush to what are called 'bush babies' (babies born as a result of rape by Lord's Resistance Army rebel soldiers). This is a significant percentage of the much needed agricultural labour force. However, some managed to escape and need to be supported during this period of resettlement and rehabilitation. Child mothers are the quiet strength, and desperately need others to join hands and support them towards restoration.

An initiative was made by Women Empowerment for Rural Development (WEFORD) to boost agricultural production and marketing opportunities for the rural women, using information and communication technologies (ICTs) as one of the avenues of its contribution to the post-war rehabilitation process. The major objectives of this project are: to build the capacity of rural women to use ICTs for marketing their products, to facilitate value addition on agricultural products for income generation, and to integrate agro forestry with crop production for improved yields and environmental management.

Keywords: marketing, sensitization, rehabilitation, farmers, empowerment

Name of Journal/ Conference Proceedings/ Workshop: Agricultural Innovations for sustainable development, 2011; 1(1)97-103

Year of Publication: 2011

Name of Lecturer/Author(s): Paulin Nana, Nguya K. Maniania, Rosebella O. Maranga, Hamadi I. Boga, Helen L. Kutima and Jacobus N. Eloff,

Title of Publication: Compatibility between Calpurnia aurea leaf extract, attraction aggregation, and attachment pheromone and entomopathogenic fungus Metarhizium anisopliae on viability, growth, and virulence of the pathogen.

Abstract:

Metarhizium anisopliae sensu stricto (ss) (Metsch.) Sorok. isolate ICIPE 07 is being developed as biopesticide for the control of ticks. In addition, leaf extracts of Calpurnia aurea Benth, and the attraction aggregation and attachment pheromone (AAAP) are being used as ticks' attractant. The three agents are being considered for use in combination in an auto dissemination approach, whereby ticks that are attracted to semiochemicals are infected with the inoculum. Experiments were therefore conducted to evaluate in vitro the compatibility between C. aurea, AAAP, and the M. anisopliae on vegetative growth, conidial production, and spore viability. Calpurnia aurea leaf extract was compatible with the fungus at all the concentrations tested, whereas AAAP inhibited all the fungal growth parameters. The virulence of M. anisopliae formulated in emulsifiable extracts of C. aurea was also tested against different developmental stages of Rhipicephalus appendiculatus in laboratory bioassays. No significant differences in virulence were observed between M. anisopliae applied alone and M. anisopliae formulated in different concentrations of C. aurea leaf extracts. These results suggest that C. aurea leaf extracts is compatible with M. anisopliae and could be mixed together for "spot-spray" treatments as low-cost and environmental-friendly technology to control ticks in grazing field, while AAAP should be used separately.

Keywords Compatibility, Biocontrol agents Metarhizium anisopliae, Calpurnia aurea, Rhipicephalus appendiculatus

Name of Journal/ Conference Proceedings/ Workshop: J Pest Sci. DOI 10.1007/s10340-011-0399-5.

Year of Publication: 2011

Name of Lecturer/Author(s): Muchika Susy, Kutima Helen Lydia and Yole Dorcas Syokui

Title of Publication: Antischistosomal effects of Solanum incanum and Carica papaya crude extracts on the parasite Schistosoma mansoni in vivo and in vitro

Abstract: In schistosomiasis infection, the disease is managed by exposing the definitive host to a dose of Praziquantel. However, Praziquantelis still not reaching the majority of those who most need it due to its high cost and there is possibility of drug resistance, hence need for alternatives. Antischistosomal effects of crude Solanum incanum and Carica papaya extracts were studied. Patterns on immune response, worm recovery, gross pathology in vivo and cercaricidal killing in vitro of Schistosoma mansoni was observed. In vivo S. mansoni infections were treated with two doses of 150 mg/kg of Solanum incanum or Carica papaya (methanol or aqueous) extracts and a treatment control of 450 mg/kg of Praziquantel. Various concentrations of plant extracts were used in cercaricidal assay. Carica papaya, showed highly reduced pathology, elevated immune responses and least time in destroying cercariae. On the other hand, S. incanum had the highest reduction in worm counts, similar to Praziquantel. Further studies are required to isolate the active compound(s) and determine mechanism(s) of their action.

Keywords: Plant extracts, antischistosomal, worm count, IgG, granuloma

Name of Journal/ Conference Proceedings/ Workshop: The Internet Journal of Tropical Medicine ISSN: 1540-2681 2011 Volume 7 Number 2

Year of Publication: 2011

Name of Lecturer/Author(s): Muriuki SJN, Gitonga LM, Waturu CN, and Kutima HL

Title of Publication: Effect of Chlorpyrifos application frequency on infestation levels of Mango Seed Weevil Sternochetus mangiferae (f).

Abstract: Field studies were carried out in three sites in Mbeere district to determine the effect of frequency of chlorpyrifos band application on mango fruit infestation levels by the mango seed weevil Sternochetus mangiferae (F). The objective was to assess the impact of chlorpyrifos band application frequency on the infestation levels of the Mango Seed Weevil (MSW) on mango fruits. Four application levels namely once per month, once every two months, once every three months and once per fruiting season were studied. Orchard sanitation was combined with these treatments. Chlorpyrifos applied once every month performed the best in all sites and differed significantly from all the other treatments. This performance was consistent in all months. Effectiveness of chlorpyrifos in reducing mango fruit infestation levels is partly dependent on frequency of application. A closely spaced application regime results in a higher reduction of the infestation levels. A monthly application of this product in the manner tested appears to give a significant population reduction resulting in higher yields of marketable fruits. This regime is recommended for incorporation to the mango farming practices.

	Key words: Band application, Chlorpyrifos, Mango Seed Weevil, Sternochetus mangiferae
Name of Journal/ Conference Proceedings/ Workshop:	Afr. J. Hort. Sci. (2011) 4:66-71
Year of Publication:	2011
Name of Lecturer/Author(s):	Andrew A Obala, Helen L Kutima, Fabian O Esamai and John H Ouma
Title of Publication:	Sulfadoxine-Pyrimethamine in Treatment of Malaria in Fringe Transmission Buffer Between Endemic and Epidemic Malaria in Western Kenya
Abstract:	This study was conducted in Songhor-West sub-location, Nyando District of western Kenya. This area lies at the interface between endemic and epidemic malaria from where reservoir build-up occurs to cause epidemics in the neighbourhood highland districts. Cross-sectional design was used to conduct the study. Two stage sampling techniques were used to identify homesteads for the study. Retrospective malaria and weather data of between 1992 and 2001 were analyzed to determine critical weather components responsible for malaria epidemics. Indoor-resting mosquitoes were captured between December 2001 and November 2003, and sub-samples investigated for species composition, human blood index (HBI), parity and sporozoite rates. The EIR was also determined. Malaria prevalence, parasites densities and gametocytaemia were determined using finger-prick blood obtained from volunteers. All malaria positive cases were treated with SP, and repeat BS done to detect SP resistance. Quarterly malaria incidences were plotted using GIS to demonstrate spatial, temporal and residual transmission. The malaria parasites SP resistance of 29.2% obtained is higher than 25% resistance allowed (WHO 1962). The SP sensitivity technique used here is consistent with WHO policy which recommends treatment doses for prophylaxis/IPT to restrict emergence of resistant strains in endemic regions (WHO, 1962)
Name of Journal/ Conference Proceedings/ Workshop:	Kenya Journal of Health Sciences, Vol 1, Feb. ISSN 222-2110 (Website site: www.kjhs.ke)
Year of Publication:	2011
Name of Lecturer/Author(s):	P. Nana, N.K. Maniania, R.O. Maranga, H.L. Kutima, H.I. Boga, F.Nchu and J.N. Eloff
Title of Publication:	Attraction response of adult Rhipicephalus appendiculatus and Rhipicephalus pulchelus (Acari: ixodidae) ticks to extracts from Calpurnia aurea (Fabaceae)
Abstract:	Experiments were carried out to investigate the response of two tick species Rhipicephalus pulchellus Gerstaker, 1873 and Rhipicephalus appendiculatus Neumann, 1901 to three different extracts (acetone, aqueous and oil) of the dried leaves

of Calpurnia aurea (Aiton) Benth in both an inverted glass tube and a dual choice T-olfactometer. The oil extract at 50 and 100 mg/ml attracted 46.7% and 65.9% of R. appendiculatus, respectively, in the inverted glass tube assay, which was comparable to 47.8% of the attraction-aggregation attachment pheromone (AAAP) used as positive control. At a dose of 100 mg/ml the oil extract attracted 52.4% of R. pulchellus in the T-olfactometer bioassay. The relative attraction of both tick species to plant extract was also tested in semi-field plot experiments using a trap baited with different concentrations of emulsifiable extract of C. aurea. A dose of 100 mg/ml attracted 52.2% of R. pulchellus and 44.4% of R. appendiculatus from a distance of 1m while 14.4% of R. pulchellus and 12.2% of R. appendiculatus were attracted from 5m

distance at the same dose. Addition of CO2 to the plant extract-baited-trap at the dose of 100 mg/ml increased the range of attraction of adult R. pulchellus (44.4% from 5mdistance) and up to 33.3% of adult R. appendiculatus tick from a distance of 4m. The results of this study suggest that extracts from C. aurea can potentially be used as baits in a trap for the control of ticks in the field.

Keywords: Rhipicephalus appendiculatus Rhipicephalus pulchellus Attraction Pheromone/kairomone Plant extract Calpurnia aurea

Name of Journal/ Conference Proceedings/ Workshop:

Veterinary Parasitology, 174(2010)124-130 www.elsevier.com/locate/vetpar.

Year of Publication:

2010

Name of Lecturer/Author(s):

Sichangi Kasili, Philip M. Ngumbi, Hellen Koka, Francis G. Ngere, Elizabeth Kioko, Nicholas Odemba & Helen L. Kutima.

Title of Publication:

Comparative performance of light trap types, lunar influence and sandfly abundance in Baringo district, Kenya.

Abstract:

Phlebotomine sandflies are vectors of leishmaniases and viral infections as well as being a biting nuisance. In Kenya, Leishmania donovani is transmitted by Phlebotomus martini (Diptera: Psychodidae) whereas vectors of L. major, L. tropica and L. ethiopica are P. duboscqi, P. pedifer and P. guggisbergi respectively. Baringo district has an arid to semi-arid climate and is a home to a wide range of sandfly species. It boasts of 11–17 sandfly species. Historically, robust capture sites have been found in the vicinity of the town of Marigat where sandfly habitats include human habitations, pit-latrines, animal sheds, termite hills, animal burrows and tree holes4,5. Termite mounds have been found to harbour greater numbers of man biting sandflies than other resting places and have been shown to be a habitat of importance to the epidemiology of visceral leishmaniasis (VL). The lunar cycle is known to influence adult flight behaviour of many insects including those of the order Diptera, particularly Culicidae6. In one study, few sandflies were attracted to light traps during full moon. Limited studies have been carried out in Kenya to demonstrate an influence of the lunar cycle on phlebotomine sandfly abundance. Although

sandflies have great medical significance besides being biting nuisances, few studies have focused on determining the most efficient trapping strategies. One study involved comparing a CDC light trap, two types of updraft traps that were designed for trapping sandflies in the field and a sticky trap near Marigat animal burrows9. Results indicated that one of the updraft traps collected relatively more sandflies and both updraft traps were more consistent in terms of sandflies caught than other traps. The more improved blacklight (UV) updraft and downdraft light traps are thought to attract more sandflies than white incandescent light but they have not been widely tested on Kenyan sandfly species.

The current paper presents data on sandfly abundance in Marigat in three different locations and two lunar phases as well as relative performance of the CDC miniature light trap, updraft blacklight and downdraft blacklight traps. The study was conducted in Marigat area that is located within Marigat administrative division of Baringo district, Rift valley province, Kenya. Trap catches were used to characterize each of the three sites with respect to sandfly species and density.

Sandflies were then put in cryo-vials (labelled according to collection date, trap type and location), stored on dry ice and transported to the laboratory for further processing.

A total of 9889 female sandflies falling into 11 species were collected over the whole year. Of this number P. martini and P. duboscqi contributed 0.5 and 3.3% respectively. Overall, S. schwezi (36.6%) and S. clydei (30%) were the most abundant with their numbers being highest in Perkerra. The numbers for Phlebotomus species remained <50 each month. Sergentomyia species with numbers <50 were classified under one group of 'others'. They included S.adleri, S. africanus, S. graingeri and S. inermis. There were no differences in the numbers of P. duboscqi, S. clydei, S. bedfordi among the three sites; Loboi, Perkerra and Rabai ($p > 0.05$). There were differences however when P. martini ($\square 2 = 20.802$, $p < 0.0001$) and S. swchetzi were compared ($\square 2 = 9.770$, $p = 0.0076$). Significantly more P. martini sandflies were collected in Rabai than in both Perkerra ($z = -3.912$, $p = 0.0001$) and Loboi ($z = -3.704$, $p = 0.0002$). There was no difference in the numbers of P. martini collected in Loboi and Perkerra ($z = 1.630$, $p = 0.1032$). The numbers of S. schwetzi were higher in Perkerra than in Rabai and Loboi ($p < 0.05$). per night are shown in Fig. 2.

On the other hand, there was a significant difference in the number of Phlebotomus sandfly species collected by the three traps ($\square 2 = 12.424$, $p < 0.05$). CDC miniature light traps collected significantly more Phlebotomus sandfly species than downdraft ($z = -3.259$, $p < 0.05$) and updraft ($z = 2.759$, $p < 0.05$) trap types.

Key words Kenya; light traps; lunar periodicity; sandfly

Name of Journal/ Conference Proceedings/ Workshop: Journal of Vector Borne Diseases 47, June 2010, pp. 108-112

Year of Publication: 2010

Name of Lecturer/Author(s): F.B.Kaingu, A.C.Kibor, R.Shivairo, H. Kutima, T.O.Okeno, R.Waihenya and A.K. Kahi

Title of Publication: Prevalence of gastro-intestinal helminthes and Coccidia in indigenous chicken from different agro climatic zones in Kenya.

Abstract:

A study on the prevalence of gastro-intestinal endoparasites in indigenous chicken was carried out in three regions in Kenya. The objective of the study was to determine the species and their prevalence rates. A total of 710 adult free-ranging local chickens were sampled from six districts, Kakamega (162), Bondo (81), Narok (81), Bomet (150), Turkana (70) and West Pokot (166). Qualitative and quantitative microscopic parasitological examinations were used for faecal examination. The survey showed that 192 (27.04%) was infected with Coccidial oocysts, 182 (25.63%) with Ascaridia galli, 10 (1.41%) with Heterakis gallinarum, 2 (0.3%) with Syngamus trachea, 37 (5.21%) with Capillaria retunsa, 8.45% with Capillaria annulata, 21 (2.96%) with Raillietina tetragona, 94 (13.24%), while 112 (15.8%) were negative, with no helminthes infestation. The findings suggested that endoparasites are a common health problem in free range indigenous chicken in Kenya and agro-climate significantly influenced the distribution of endoparasites.

Key words: Prevalence, endoparasites, indigenous chicken.

Name of Journal/ Conference Proceedings/ Workshop: African Journal of Agricultural Research Vol. 5 (4), pp. 458-462, 18 March 2010 Available online at http://www.academicjournals.org/AJAR ISSN 1991-637X © 2010 Academic Journal

Year of Publication: 2010

Name of Lecturer/Author(s): Sichangi, K., Kutima, H.L., Mwandawiro, C.S. Ngumbi, P.M. and Anjili, C.O.

Title of Publication: Laboratory and semi-field evaluation of long-lasting insecticidal nets against leishmaniasis vector, Phlebotomus (Phlebotomus) duboscqi in Kenya

Abstract:

Background & objectives: Phlebotomine sandflies are vectors of leishmaniases and other diseases. Long-lasting insecticidal nets (LLINs) as possible tools for control have not been widely tested against them. The objective of this study was to determine the efficacy of Olyset® Net and PermaNet® LLINs alongside a local brand, K-O Tab® treated net (Supanet) against Phlebotomus duboscqi female and flies.

Methods: Four replicates of unwashed and 20x washed Olyset Nets and PermaNets, K-O Tabtreated and untreated Supanet and 'no net' treatments were evaluated against sandflies within the laboratory by tunnel tests and in semi-field conditions in the greenhouse model for their efficacy.

Results: All bed nets allowed entry of P. duboscqi sandflies and subsequent blood-feeding. Olyset net's blood feeding inhibition was significantly higher than that of Supanet in the laboratory but not in semi-field condition. Of the LLINs, only Olyset net had sandflies that could not feed significantly more than those of Supanet. Additionally, no significant efficacy difference was

observed between LLINs washed 20x and unwashed ones. The only significant difference noted in number of sandflies that were found dead or paralyzed within bed nets in the semi-field condition was between Olyset and K-O Tab treated Supanet. In the laboratory, unwashed Olyset had a significantly higher number of sandflies killed than all other bed net treatments.

Conclusion: Olyset net use in areas where sandflies are nuisance biters and/or disease vectors could be more beneficial in preventing sandfly bites than other tested bed nets. It is recommended that mesh sizes of LLINs should be smaller for control of sandflies than those used for control of mosquitoes.

Key words Blood-feeding inhibition; Olyset® Net; PermaNet®; Phlebotomus duboscqi; Supanet®

Name of Journal/ Conference Proceedings/ Workshop: Journal of Vector Borne Diseases 47, pp. 1–10

Year of Publication: 2010

Name of Lecturer/Author(s): Sichangi Kasili, Nicholas Odemba, Francis G. Ngere, John B. Kamanza, Alexander M. Muema & Helen L. Kutima

Title of Publication: Entomological assessment of the potential for malaria transmission in Kibera slum of Nairobi, Kenya

Abstract:

Background & objectives: Malaria in urban and highland areas is emerging as a significant public health threat in Kenya which has seen a dramatic increase in malaria transmission in low risk highland areas. The objectives of the study were to find and incriminate potential vectors of malaria in Kibera, Nairobi.

Methods: One hundred and twenty houses within Lindi area of the southern central section of Kibera slum in Nairobi were chosen randomly and global positioning system (GPS) mapped. Day resting indoor mosquitoes were collected from January 2001 to December 2003. Larvae were collected between 2002 and 2004 and reared in the insectary to adults.

Results: A total of 176,993 mosquitoes were collected. Out of this, 176,910 were Culex fatigans and 83 were Anopheles gambiae s.l. Mosquito population peaked during the long rains in April to May and the short rains in November and December. Blood meal analysis of An. gambiae s.l. female mosquitoes revealed 0.97 human blood index. No mosquito was found positive for Plasmodium falciparum sporozoites. Anopheles gambiae s.l. mosquitoes were found breeding in polluted water and 95% of the larvae were identified as An. arabiensis.

Interpretation & conclusion: Anopheles gambiae s.l., malaria vector is present in Nairobi and it breeds in polluted water. Anopheles arabiensis is predominantly preferring humans as blood meal source, thus, showing ecological flexibility within the species.

Key words Anopheles arabiensis – Anopheles gambiae – Kenya – malaria transmission – urban area

Name of Journal/ Conference Proceedings/ Workshop:	Journal of Vector Borne Diseases, December 2009, pp. 273–279.
Year of Publication:	2009
Name of Lecturer/Author(s):	Sichangi, K., Kutima, H.L., Mwandawiro, C.S. Ngumbi, P.M. and Anjili, C.O.
Title of Publication:	Comparative attractiveness of CO2 baited CDC light trap and animal baits to Phlebotomus duboscqi sandflies
Abstract:	Background & objectives: In order to understand sandfly bionomics, vector species identification, and to develop methods for sandfly control, there is a need to sample sandflies in any particular habitat. This survey was aimed at determining the best method of sampling Phlebotomus (Phlebotomus) duboscqi (Diptera: Psychodidae) in the field. Methods: Different animal baits and CO2-baited CDC light traps were used to attract sandflies released in an insect-proof screen-house located in the sandfly's natural habitat in Marigat, Baringo district of Kenya. Results: Attraction of hungry P. duboscqi female sandflies by the goat (Capra hircis) was significantly higher than that of hamster (Mesocricetus auretus), Nile grass rat (Arvicanthis niloticus), gerbil (Tatera robusta) and chicken (Gallus domestica). However, two rodent species, A. niloticus and T. robusta did not differ significantly. A linear regression analysis of weights of animal baits and number of sandflies attracted revealed an insignificant result. The fluorescent dyes used to distinguish sandflies of different day experiments seemed not to influence the sandfly numbers in relation to the studied sandfly behaviour. Interpretation & conclusion: The similar attraction pattern of P. duboscqi in semi-field environment by CO2-baited CDC light trap and the goat provides hope for solution to the problem of fast dissipating dry ice (CO2 source) in the field. Goats can, therefore, also be utilized as deflectors of vectors of cutaneous leishmaniasis from humans in zooprophylaxis in Leishmania major endemic areas where the sandfly is found. Key words Animal baits – CO2-baited light traps – Phlebotomus duboscqi
Name of Journal/ Conference Proceedings/ Workshop:	Journal of Vector Borne Diseases 46, September 2009, pp. 191-196
Year of Publication:	2009
Name of Lecturer/Author(s):	Muli B.K, Fritz Schulthess, Maranga, R.O., Kutima H.L and Nanqing
Title of Publication:	Jiang Interspecific competition between Xanthopimpla stemmator Thunberger and Dentichsmias busseolae Heinrich

	(Lepidoptera: Ichneumonidae), pupal parasitoids attacking Chilo partellus (Lepidoptera: Crambidae) in East Africa
Abstract:	
Name of Journal/ Conference Proceedings/ Workshop:	Journal of Biological Control 36: 163-170.
Year of Publication:	2006

2.3 DEPARTMENT OF BOTANY

Name of Lecturer/Author(s):	Johnstone Neondo, Joseph Machua, Anne Muigai1, Aggrey B. Nyende1, Moses Munjuga, Ramni Jamnadass and Alice Muchugi
Title of Publication:	Micropropagation of *Allanblackia stuhlmannii:* Amenability to tissue culture technique
Abstract:	*Allanblackia stuhlmannii* is an endangered forest tree valued for its edible nut oil. Its limited regenerative potential in the wild hinders the sustainable utilization of its products. To achieve mass production of A. stuhlmannii, its amenability to micropropagation technique was examined. Explants were best surface sterilized at 8% sodium hypochlorite for 10 min and rinsed using sterile distilled water. Of eight basal nutrient media tested, Lloyd and McCown Woody plant medium (WPM) was the most suitable (88.89% explants survival). Microshoots were induced from apical meristems cultured on WPM supplemented with different concentrations of 6-benzyladenine (BAP), kinetin (KN), Dichlorophenoacetic acid (2, 4 - D), Naphthalene acetic acid (NAA) and Thidiazuron (TDZ), ($P < 0.05$). All responding explants produced a single microshoot irrespective of the type and concentration of PGRs used. 1.2 mg/lBAP and 1.2 mg/lKIN exhibited the most rapid and consistent shoot length increase ($P < 0.05$). Prolonged culture or sub culturing did not promote further shoot proliferation. Callus was induced from leaf explants cultured on WPM fortified with Gamborg's vitamins, 3% sucrose, 1 mg/lKIN combined with 1.2 mg/l 2, 4 - D. No somatic embryos emerged from the callus. The success in explant sterilization and induction of microshoot and callus in this study is a milestone step in the regeneration of A. stuhlmannii.
Name of Journal/ Conference Proceedings/ Workshop:	International Journal for Biotechnology and Molecular Biology Research Vol. 2(11), pp. 185-194
Year of Publication:	November 2011
Name of Lecturer/Author(s):	Chen Ling-Yun, Chen Jin-Ming, Robert Wahiti Gituru, Wang Qing-Feng
Title of Publication:	Generic phylogeny, historical biogeography and character evolution of the cosmopolitan aquatic plant family Hydrocharitaceae.

Abstract:

Hydrocharitaceae is a fully aquatic monocot family, consists of 18 genera with approximately 120 species. The family includes both fresh and marine aquatics and exhibits great diversity in form and habit including annual and perennial life histories; submersed, partially submersed and floating leaf habits and linear to orbicular leaf shapes. The family has a cosmopolitan distribution and is well represented in the Tertiary fossil record in Europe. At present, the historical biogeography of the family is not well understood and the generic relationships remain controversial. In this study we investigated the phylogeny and biogeography of Hydrocharitaceae by integrating fossils and DNA sequences from eight genes. We also conducted ancestral state reconstruction for three morphological characters. RESULTS: Phylogenetic analyses produced a phylogeny with most branches strongly supported by bootstrap values greater than 95 and Bayesian posterior probability values of 1.0. Stratiotes is the first diverging lineage with the remaining genera in two clades, one clade consists of Lagarosiphon, Ottelia, Blyxa, Apalanthe, Elodea and Egeria; and the other consists of Hydrocharis-Limnobium, Thalassia, Enhalus, Halophila, Najas, Hydrilla, Vallisneria, Nechamandra and Maidenia. Biogeographic analyses (DIVA, Mesquite) and divergence time estimates (BEAST) resolved the most recent common ancestor of Hydrocharitaceae as being in Asia during the Late Cretaceous and Palaeocene (54.7-72.6 Ma). Dispersals (including long-distance dispersal and migrations through Tethys seaway and land bridges) probably played major roles in the intercontinental distribution of this family. Ancestral state reconstruction suggested that in Hydrocharitaceae evolution of dioecy is bidirectional, viz., from dioecy to hermaphroditism, and from hermaphroditism to dioecy, and that the aerial-submerged leaf habit and short-linear leaf shape are the ancestral states. CONCLUSIONS: Our study has shed light on the previously controversial generic phylogeny of Hydrocharitaceae. The study has resolved the historical biogeography of this family and supported dispersal as the most likely explanation for the intercontinental distribution. We have also provided valuable information for understanding the evolution of breeding system and leaf phenotype in aquatic monocots.

Name of Journal/ Conference Proceedings/ Workshop: BMC Evol Biol. 2012 Mar 10;12 (1):30 22404786

Year of Publication: 2012

Name of Lecturer/Author(s): Ling-Yun Chen, Jin-Ming Chen, Robert Wahiti Gituru, Tamru Demsis Temam, Qing-Feng Wang

Title of Publication: Generic phylogeny and historical biogeography of Alismataceae, inferred from multiple DNA sequences.

Abstract:

Key Laboratory of Aquatic Botany and Watershed Ecology, The Chinese Academy of Sciences, Wuhan 430074, Hubei, PR China; Wuhan Botanical Garden, The Chinese Academy of Sciences, Wuhan 430074, Hubei, PR China; Graduate University of Chinese Academy of Sciences, Beijing 100049, PR China. Alismataceae is an aquatic or semi-aquatic herb family with a subcosmopolitan distribution. The family is one of the

oldest lineages within monocots and plays an important role in the systematics, biogeography and evolutionary processes of flowering plants. However, the generic relationships of the family are still a subject of debate, and its historical biogeography is less studied. In the present study, we carried out a comprehensive phylogenetic analysis based on multiple DNA sequences (nuclear: ITS; chloroplast: psbA, rbcL, matK, rpoB, rpoC1, trnK 5' intron and trnK 3' intron; mitochondria: cob and atp1). The result supports merging Limnocharitaceae into Alismataceae as one family. Two well-supported clades were obtained based on the combined ITS, psbA, rbcL and matK dataset. Clade B consists of Luronium, Damasonium, Baldellia and Alisma; and clade A consists of the remaining genera of Alismataceae as well as Limnocharitaceae. Biogeographic analysis and Bayesian molecular dating suggested that Alismataceae originated in West Palearctic or Afrotropical area during the Late Cretaceous, and subsequently split into two clades. Clade A and clade B diversified in Afrotropical area and West Palearctic area, respectively. The intercontinental distribution of this family mainly resulted from dispersals involving migration across land bridges and long-distance dispersal.

Name of Journal/ Conference Proceedings/ Workshop: Mol Phylogenet Evol. 2012 Feb 4;: 22327014

Year of Publication: 2012

Name of Lecturer/Author(s): Korir R, Kimani C, Gathirwa J., Wambura M, and Bii C

Title of Publication: In-vitro Antimicrobial Properties of Methanol extracts of three Medicinal Plants from Kilifi District – Kenya

Abstract:

Multidrug resistant microbes are a health management challenge in immunocopromised individuals. The study aimed to evaluate antimicrobial potential and toxicity of the methanol extracts of Hosludia opposita, Rhus natalensis and Combretum illairii. The plants were collected from Kilifi District and authenticated at East African Herbarium. Samples collected were extracted in methanol. Quantitative bioassay was done using disc diffusion method; minimum inhibition concentration was done using broth dilution methods. The isolates used for bioactivity testing were Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Candida albicans and Trichophyton mentarophyte. Phytochemical screening was done using thin layer chromatograpy and cell toxicity was done using human embryonic lung cells. The H. opposita and C. illairii had terpenoids, flavonoids and anthaquinones. All the extracts were safe to the mammalian cells. Combretum illairii plant extracts had good activity against S. aureus and P. aeruginosa with inhibition zones diameters of 15.60 mm and 17.00 mm respectively. Rhus natalensis had an MIC of 6.25mg/ against both S. aureus and P. aeruginosa. The plant extracts were active against both bacteria and fungi. The result indicates that's the plants extracts have potential for managing infections caused by the tested microbes. Isolation of compounds present and determination of their bioactivity should be done together with conservation initiatives.

Name of Journal/ Conference Proceedings/ Workshop: African Journal of Health Sciences, Volume 20, Number 1-2

Year of Publication: 2012

Name of Lecturer/Author(s): William O. Nyakundi and Wambura Mwangi

Title of Publication: Isolation and Characterization of Pathogenic Bacteria and Fungi from *Leptoptilos Crumeniferus* (Marabou Stork) Droppings

Abstract: The aim of the study was to isolate, characterize and identify pathogenic bacteria and fungi from Leptoptilos crumeniferus (marabou stork) droppings in James Gichuru secondary, Dandora secondary and Wangu primary school play fields of Kenya. One gram of droppings was mixed in 10mL of normal saline. The samples were mixed respectively per school. Aliquot (1mL) was transferred into the next test tube and diluted serially. From the dilution of 10-4 of dropping sample, 0.1mL aliquot was transferred aseptically onto nutrient agar plates, spread and incubated at 370C for 24 hours. Biochemical tests were carried out on pure isolates after subsequent sub cultures. Bacteria isolated were Bacillus, Enterobacter, Enterococcus, Proteus, Providencia, E. coli, Shigella, Salmonella, Citrobacter, Staphylococcus, Klebsiella, Morganella. For fungi, potato dextrose agar was prepared and poured to plates aseptically. One gram of droppings was sprinkled on the media and incubated at 280C for five days. Macroscopic and microscopic observations were carried out on pure isolates. Fungi isolated were Aspergilus, Rhizopus, Penicilium, Mucor and Fusarium species. It was concluded that marabou stork faeces is a potential human health hazard. Accumulation of bird droppings poses a public health risk and cause illness.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Applied Technology in Environmental Sanitation, Volume 1, Number 1:93 – 106

Year of Publication: July, 2011

3. FACULTY OF AGRICULTURE

3.0 DEPARTMENT OF HORTICULTURE

Name of Lecturer/Authors: Abang, M. M., Kihurani A. W. and. Srinivasan, R.

Title of Publication: Managing Diseases and Pests of Indigenous Vegetables for Good Agricultural Practices (GAP) Compliance in Sub-Saharan Africa

Abstract: Underutilized vegetables play a key role in human nutrition, food security and poverty reduction for the growing populations of rural and urban poor in Sub-Saharan Africa. Increasing demand for vegetables such as amaranth, African nightshade and Ethiopian mustard coupled with finite agricultural resources are threatening the sustainability and profitability of production. Within this framework, pests and diseases reduce yields, and harmful pesticide regimes pose major risks to human and environmental health. In spite of their importance, little is known about the diagnosis, epidemiology, and sustainable management of major pests of underutilized vegetables due to research neglect. Nevertheless, progress has been made recently in germplasm enhancement, improved soil health and water quality, reduced microbial contamination of vegetables and integrated pest management. AVRDC-The World Vegetable Center, in collaboration with private and public sector partners, is leading efforts to reduce malnutrition and poverty in the region through the development of good agricultural practice (GAP)-compliant technologies that contribute to the production of safe and nutritious vegetables. Strategies for addressing this problem include improved knowledge of the diseases and insect pests affecting underutilized vegetables, the utilization of varieties resistant to major pests and diseases, and their cultivation using practicing that reduce indiscriminate and excessive use of fertilizers and pesticides. This paper reviews our current understanding of the nature and management of diseases and pests of underutilized vegetables and highlights opportunities with biological alternatives that reduce harmful pesticide regimes, protect the production environment and the produce, remove barriers to trade, and improve human health in Sub-Saharan Africa.

Name of journal / Conference Proceedings /Workshop: Scripta Horticulturae (15): 191-232

Year of Publication: 2012

Name of Lecturer/Authors: Mounde, L.G., Ateka, E. M and Kihurani A.W.

Title of Publication: Morphological characterization and identification of *Phytophthora* species causing citrus gummosis in Kenya.

Abstract: Work was carried out to identify the causal agent of *Phytophthora* gummosis, a major disease of citrus trees in Kenya. Some 59 plant and soil samples obtained from symptomatic trees and the rhizosphere were evaluated by direct isolation and baiting,

respectively, using *Phytophthora* semi-selective media. Based on their morphological, cultural and physiological profiles, three *Phytophthora* species, *P. citrophthora, P. nicotianae (syn. P. parasitica) and P. syringae* were isolated. Virulence tests on lemon fruits and stem-inoculation studies on lemon seedlings confirmed pathogenicity of the pathogens as the causal agents of *Phytophthora* gummosis in Kenya. Molecular characterization of the pathogens was recommended to confirm true genetic identity to facilitate practical control strategies and clear scientific communication. Key words: *Phytophthora*, morphological, characterization, virulence, pathogenicity

Name of journal / Conference Proceedings /Workshop: African Journal of Food, Agriculture, Nutrition and Development (AJFAND) 12 (7): 7072-7087

Year of Publication: 2012

Name of Lecturer/Authors: Muriithi C.W., Mugai E. N. and Kihurani A.W.

Title of Publication: Effect of nitrogen and silicon on management of rice blast (*Pyricularia oryzae*) in Mwea Irrigation Scheme of Kenya.

Abstract:

Plant health is an important factor for plant growth and development. Nitrogen is essential and is usually required in large quantities by plants. However, many studies have shown that high nitrogen concentration in plant increases the severity of disease infection by plants pathogen. On the other hand, Silicon though regarded as non essential element, has several benefits in crop growth. Its application to the rice plant has been shown resistance to increase resistance to rice blast *Pyriularia oryzae* as well as increased crop yield. This study aimed to establish an effective level of nitrogen and silicon in the management of the rice blast disease. The experiment was carried out at Mwea Irrigation Agricultural Development (MIAD) research station in Kirinyaga district. Seedlings were raised in the nursery before culturing in vertisol filled pots with various treatment combinations of nitrogen (40, 80 and 120kgN ha^{-1}) and silicon (0,500, 1000 and 1500kgSi ha^{-1}) in Split plots and in completely randomized design (CRD). Plants were inoculated after two weeks with the *Pyricularia oryzae* spore after transplanting and disease assessed in a scale of (0-9) according to IRRI standard. Higher rice blast was realized at 120KgN and 0kgSi ha^{-1} and in the plots that had neither nitrogen nor silicon. The organic husk ash at 2ton^{-1} before burning and 0.7ton^{-1} was shown to be good source of silicon and gave results equivalent to those of 120KgN and 1000KgSi. combination.The study established that interaction of nitrogen and silicon at 80kgN ha^{-1} and 1000kgSi ha^{-1} was the optimal rate for management of the rice blast disease. Key words: Silicon, Nitrogen, Rice blast, rice, hush ash

Name of journal / Conference Proceedings /Workshop: Journal of Agriculture, Science and Technology (JAGST)

Year of Publication: In press

Name of Lecturer/Authors: Gatambia, E. K.; Kihurani, A. W., Wanzala, F. K. R. And Waiganjo, M.M

Title of Publication: *In-vitro* meristem culture for rapid regeneration of papaya plantlets in a liquid media

Abstract: Papaya (*Carica papaya* L.), an important fruit crop in Kenya for local and export market, is a dioecious plant that is mainly propagated through seeds. It is difficult to differentiate between sexes, yet farmers require a ratio of 1 male to 13 females to optimize production. Work was conducted to develop an *in vitro* method that ensures production of known sex seedlings. Meristems were harvested from 30 cm tall seedlings of three popular papaya lines and cultured in Murashige and Skoog basal media supplemented with 30g/l sucrose in liquid medium. They were then mounted on an orbital shaker to initiate rapid shoot development. Treatments comprised 5 levels (0, 0.05, 0.1, 0.15, 0.2 mg^{-1}) of 2 Chloro 4 Pyridy – N Phenyl-urea (CPPU) in liquid/semisolid double layer combination. For callus and root initiation, 4 levels of Indole-3-butyric acid (IBA) (0, 2.0, 2.5 and 3.0 mg^{-1}) were used. The experiment was laid out in a completely randomized design with 3 replicates. Shoot number, length, and survival rate and leaf number were recorded every 2 weeks for 8 weeks. The data was subjected to analysis of variance (ANOVA) using SAS v 9.1 and significant means separated by Duncan multiple range test (DMRT). The highest shoot length (1.7cm), shoot number (10.2) and leaf number (10.2) were recorded in the liquid/semisolid double layer combination with CPPU at 0.15 mg^{-1}. The highest callus tissue and root initiation (70%) was at 3.0 mg^{-1} of IBA. Results indicated that liquid medium could be used for rapid for regeneration of papaya plantlets of known sex. Further work is recommended on optimization of media for shoot elongation and rooting. Key words*: Carica papaya*, meristem, micro propagation, indole -3-butyric acid (IBA)

Name of journal / Conference Proceedings /Workshop: 7th JKUAT Annual Scientific Conference. AICAD, Nairobi. 15-16 Nov., 2012

Year of Publication: In press

Name of Lecturer/Authors: Muriithi, C. W., Mugai, E. N and Kihurani, A.W.

Title of Publication: Efficacy of Selected Fungicides in Management of Rice Blast Diseases

Abstract: Rice (*Oryza sativa* L.) is a staple food of nearly one-half of world's population, contributing to over 20% of the total calorie intake to humans. In Kenya, it ranks third after maize and wheat among the food crops grown. However, rice blast caused by *Pyricularia oryzae* causes a reasonable yield loss warranting the need to control the disease for sustainable food security. There are various strategies used to manage the disease. Chemical control is one of the strategies that are undertaken in various countries. The efficacy of four fungicides namely Azoxystrobin, Thiophanatemethyl, Hexaconazole and

	Carbendazim were evaluated for the control of rice blast disease. The fungicides were incorporated in malt extract agar (MEA) at three different concentration (1, 1.5 and.2.0). The mixture was poured in the 90mm Petri-dish and measurement of the colony diameter expansion recorded. The experiment was laid in Complete randomised design (CRD) replicated four times. The experiment aimed to investigate the efficacy of the fungicides in management of the *Pyricularia oryzae*. The *Pyricularia oryzae* was found to be either being sensitive or intermediately or insensitive at all. Carbendazim and Thiophanate Methyl 50% w/v were found to effectively control rice blast at (2 and 3mls/lit). The *Pyricularia oryzae* was sensitive to the fungicides and therefore inhibited the mycelia growth. Hexacanazole was also effective but required a higher rate of (18.75mls/lit) than the carbendazim and Thiophanate Azoxystrobin 50G/L was not effective in the management of rice blast in the two experiment carried at in-vitro stages. Keywords: Pyricularia oryzae, Oryza sativa L. Fungicides
Name of journal / Conference Proceedings /Workshop:	13th KARI Biennial Scientific Conference and Exhibition of Innovations. KARI Headquarters Complex, Nairobi. 22-26 October, 2012
Year of Publication:	In press
Name of Lecturer/Authors:	Gatambia E. K., Kihurani A.W., Rimberia, F. K. and Waiganjo, M.M.
Title of Publication:	Micro-propagation of selected Kenyan papaya (Carica papaya L.) lines
Abstract:	This study was an attempt to determine rapid micro-propagation methods for regeneration of papaya plantlets *in vitro* using liquid media. Different concentrations and combinations of growth regulators in liquid MS namely BAP (0-2 mgl^{-1}) and NAA (0-1 mgl^{-1}), CPPU (0-2 mgl^{-1}), and IBA (0-3 mgl^{-1}) were used in the experiments. Results showed that 0.2 mgl^{-1} BAP, 0.5mgl CPPU were best in shoot multiplication, while 3.0 mg l^{-1} of IBA in root initiation. Shoot proliferation, root induction reported in this study is an indicator that liquid medium could be a rapid method of papaya regeneration. Key words*:* *Carica papaya*, efficient regeneration, micro propagation, plant growth regulators.
Name of journal / Conference Proceedings /Workshop:	3rd RUFORUM Biennial Conference, Imperial Resort Beach Hotel, Entebbe., Uganda. 24-28 September 2012.
Year of Publication:	In press
Name of Lecturer/Authors:	Ngubia J. N., Ateka, E. M., Kihurani A.W., Amata, R. L., Ndolo, P. and Karuru, H.W.
Title of Publication:	Field resistance of sweet potato genotypes to sweet potato virus disease

Abstract:

Twenty genotypes previously reported to have SPVD severity ratings of between 1.0 and 1.5 in the screen house were challenged with SPVD at two field trials in Western Kenya. Disease severity was scored after every month for a period of five months using a scale of 1-5, where; 1 = no visible symptoms whereas 5 = very severe symptoms. The genotypes exhibited highly significant differences ($P \leq 0.001$) in disease severity in both trials. The genotypes KKFS 56682-03-1, Marooko-3, YS Sopalla and YS Kemb 10 showed high levels of SPVD resistance with SPVD severity scores below 2 in both trials. KKFS 56682-03-1 was the least susceptible to SPVD with a severity score of 1.04 and 1.0 in trial one and two respectively while Katumani -2 was the most susceptible with severity scores 4.93 in trial one and 5 in trial two. Eleven genotypes had mild symptoms (2-3) of SPVD. The susceptible control Ejumula had severity scores 4.70 and 5 in trial one and two respectively. The results indicate that Kenyan sweetpotato gene pool contains SPVD resistance traits which can be integrated into genotypes with desirable agronomic traits but with low levels of resistance.

Name of journal / Conference Proceedings /Workshop:

13th KARI Biennial Scientific Conference and Exhibition of Innovations. KARI Headquarters complex, Nairobi. 22-26 October, 2012

Year of Publication:

In press

Name of Lecturer/Authors:

Mumo N N., Rimberia, F. K., Mamati, E. G. and Kihurani A.W.

Title of Publication:

Mass propagation of selected Kenyan papaya planting materials through shoot tip culture

Abstract:

Papaya is an important crop in Kenya for both the local and export market. Micro propagation of papaya is a reasonable method to ensure mass production of clean planting materials. In order to develop an efficient plantlet regeneration system of planting materials, culture conditions for shoot tips, of three Kenyan papaya lines excised from 3 months old seedlings established in a greenhouse were investigated. The shoot tips were cultured on Murashige and Skoog (MS) basal medium supplemented with 12 different concentrations of 6-benzylaminopurine (BAP) (0.1, 0.3, 0.5 & 0.7mg/L) combined with naphthalene acetic acid (NAA) (0.05, 0.1 & 0.2mg/L). The experiment was arranged in a completely randomized design and each treatment was replicated 4 times. The initial cultures were subcultured after 21 days and the procedure repeated every other 3 weeks. The highest rate of shoot multiplication was recorded in 0.5mg/L BAP combined with 0.1 mg/L NAA. On the other hand, 0.1mg/L BAP combined with 0.05mg/L NAA produced the longest shoots in the three papaya lines. The rate of shoot growth in length was highest in the initial cultures. However, growth rate decreased with the increase in the number of subculturing. The regenerated shoots were then rooted on solid MS basal medium with 2.5mg/L indole Butyric Acid (IBA) for one week in darkness before transferring to half strength liquid MS combined with vermiculite for further root development. Rooted plantlets were transferred onto vermiculite for acclimatization in the greenhouse. An efficient

plantlet regeneration system for Kenyan papaya through shoot tip culture was successfully developed. Key words: *Carica papaya*s, plantlet regeneration, micropropagation, shoot multiplication

Name of journal / Conference Proceedings /Workshop: 7th JKUAT Annual Scientific Conference. AICAD, Nairobi. 15-16 Nov. 2012

Year of Publication: In press

Name of Lecturer/Authors: Ngubia J. N., Ateka, E. M., Kihurani A.W. and Amata, R. L.

Title of Publication: Transmission of sweet potato mild mottle virus.

Abstract: To determine the vector for sweet potato mild mottle virus (SPMMV), white flies (*Bemisia tabaci*) were allowed varying periods of time to feed on virus infected *Ipomoea setosa* plants in order to acquire the virus. Six access acquisition periods (AAP) of 0, 6, 12, 24, 48 and 72 hours were tested. After each AAP whiteflies were allowed to inoculate healthy *I. setosa* by feeding on them for a uniform inoculation access period (IAP) of 48 hours. The experiment was arranged in completely randomized design (CRD) and treatments replicated 8 times. After six weeks, leaves were removed from the previously healthy plants and evaluated for presence of SPMMV using an Enzyme Linked Immunosorbent Assay on Nitro cellulose membrane (NCM-ELISA) diagnostic kit. The rate of virus transmission at each AAP was expressed as the percentage of infected *I. setosa* plants out of the total number inoculated. Data was subjected to analysis of variance (ANOVA) using genstat statistical package, version 12 and significant means separated by LSD at 95% confidence interval. Rates of virus transmission at different AAP showed significant differences ($P<0.05$) the highest being 50% at 72 hour AAP, followed by 31.3% at 48 hour AAP. Virus transmission was not detected at the lower AAP, 24 hours, 12 hours, 6 hours and 0 hours. It was concluded that SPMMV is transmissible by *B. tabaci* at 48 hour IAP and AAP longer than 24 hours. Further studies at different IAP were recommended to provide further insight in the mode of virus transmission involved. Key words: *Ipomoea batatas, Ipomoea setosa*, Whitefly, NCM-ELISA

Name of journal / Conference Proceedings /Workshop: 7th JKUAT Annual Scientific Conference. AICAD, Nairobi. 15-16 Nov. 2012

Year of Publication: In press

Name of Lecturer/Authors: Mumo, N N, Rimberia, F. K., Mamati, E. G. and Kihurani A.W.

Title of Publication: Optimization of media conditions for mass regeneration of Kenyan papaya (Carica papaya L.) plantlets through shoot tip culture

Abstract: The objective of this study was to optimise media conditions in order to develop an efficient plantlet regeneration system

of planting materials. Twelve different concentrations of 6-benzylaminopurine (BAP) (0.1, 0.3, 0.5 & 0.7mg/L) combined with naphthalene acetic acid (NAA) (0.05, 0.1 & 0.2mg/L) were used. This was after preliminary findings. The highest rate of shoot multiplication was recorded in 0.5mg/L BAP combined with 0.1 mg/L NAA. On the other hand, 0.1mg/L BAP combined with 0.05mg/L NAA produced the longest shoots in the three papaya varieties. The regenerated shoots were then rooted on solid MS basal medium with 2.5mg/L indole Butyric Acid (IBA) for one week in darkness before transferring to half strength liquid MS combined with vermiculite for further root development. Rooted plantlets were transferred onto vermiculite for acclimatization in the greenhouse. An efficient plantlet regeneration system for Kenyan papaya through shoot tip culture was successfully developed. Key words: Carica papayas, micropropagation, plantlet regeneration, shoot multiplication.

Name of journal / Conference Proceedings /Workshop: 3rd RUFORUM Biennial Conference, Imperial Resort Beach Hotel, Entebbe, Uganda. 24-28 September 2012

Year of Publication: In press

Name of Lecturer/Authors: C. Muriithi, E. Mugai, A.W. Kihurani, C.J. Nafuma, and S. Amboga

Title of Publication: Evaluation of silicon from rice by-products and chemical sources for Rice blast disease management in Kenya.

☐*Abstract:* Rice (Oryza sativa) is an important cereal food crop in Kenya. It ranks third after wheat and maize contributing and accounts for over 20% of the total calorie intake. The most commonly grown rice varieties in Kenya are ITA 330, IR2793-80-1, BW 196 and Basmati/Pishori 370. The latter variety is the most popular and it attracts premium prices due to its superior taste. Hence it occupies over 80% of the land set aside for rice production. Despite its popularity, Basmati/Pishori 370 is susceptible to rice blast disease caused by the fungus *Pyricularia oryzae*. This is the most important diseases of rice in Kenya, causing yield losses of 70-80% and thereby threatening food security, income generation and employment creation. The objective of this study was to evaluate different sources of silicon, rice by-products and chemical control rice blast management approaches using different.

Name of journal / Conference Proceedings /Workshop: East African Agriculture and Forestry Journal (EAAFRO) 76(*2*). 75-80

Year of Publication: 2010

Name of Lecturer/Authors: C W.Muriithi, E.N. Mugai and A.W. Kihurani

☐*Title of Publication:* Effect of nitrogen and silicon on management of rice blast (Pyricularia oryzae) in Mwea irrigation scheme of Kenya

Abstract: Plant health is an important factor for plant growth and development. Nitrogen is essential and is usually required in large quantities by plants. However, many studies have shown that high nitrogen concentration in plant increases the severity of disease infection by plants pathogen. On the other hand, Silicon though regarded as non essential element, has several benefits in crop growth. Its application to the rice plant has been shown resistance to increase resistance to rice blast *Pyriularia oryzae* as well as increased crop yield. This study aimed to establish an effective level of nitrogen and silicon in the management of the rice blast disease. The experiment was carried out at Mwea Irrigation Agricultural Development (MIAD) research station in Kirinyaga district. Seedlings were raised in the nursery before culturing in vertisol filled pots with various treatment combinations of nitrogen (40, 80 and 120kgN ha^{-1}) and silicon (0,500, 1000 and 1500kgSi ha^{-1}) in Split plots and in completely randomized design (CRD). Plants were inoculated after two weeks with the *Pyricularia oryzae* spore after transplanting and disease assessed in a scale of (0-9) according to IRRI standard. Higher rice blast was realized at 120KgN and 0kgSi ha^{-1} and in the plots that had neither nitrogen nor silicon. The organic husk ash at $2ton^{-1}$ before burning and $0.7ton^{-1}$ was shown to be good source of silicon and gave results equivalent to those of 120KgN and 1000KgSi. combination.The study established that interaction of nitrogen and silicon at 80kgN ha^{-1} and 1000kgSi ha^{-1} was the optimal rate for management of the rice blast disease. Key words: Silicon, Nitrogen, Rice blast, rice, hush ash

Name of journal / Conference Proceedings /Workshop: Journal of Agriculture Science and Technology (JAGST)

Year of Publication: In Press

Name of Lecturer/Authors: Asudi GO, Ombwara FK, Rimberia FK, Nyende AB, Ateka E.M and L.S Wamocho.

Title of Publication: Evaluating diversity among Kenyan papaya germplasm using simple sequence repeat markers.

Abstract: Papaya is an important fruit crop, produced in Kenya for local consumption and export. Despite a history of varietal introductions, no attempts concerned on developing varieties suited to Kenyan conditions have been documented. The objective of this study was to provide information on the diversity of germplasm available in Kenya, as a precursor to systematic plant breeding program. Forty two papaya accessions were collected from farmers' fields located in Coast, Rift Valley, Western, Nyanza, Central and Eastern provinces. Genetic diversity was determined using seven simple sequence repeat (SSR) markers, computing allelic richness and frequency, expected heterozygosity and cluster analysis. Results indicated that the markers were highly polymorphic among the accessions, with polymorphic information content (PIC) varying from 0.75 to 0.852 with an average of 0.81. The genetic similarity among the 42 papaya accessions ranged from 0.764 to 0.932 with an average of 0.844 showing that

most papaya accessions used in this study were closely related. About 96.9% of the pair-wise comparisons among papaya accessions exhibited genetic similarity greater than 0.802, while less than 4% (3.1%) showed genetic similarity lower than 0.802. The phylogenetic analysis grouped the 42 accessions into two main clusters A and B. Cluster A had four sub-clusters while cluster B had one cluster. Accessions from Coast, and some from Rift Valley Provinces, presented the highest variation, being scattered throughout the tree, with little or no differentiation from most accessions, whereas some accessions from Coast regrouped in clusters A (iv) and B. The genetic differences among the accessions revealed by the formation of distinct clusters suggest significant genetic variability emanation from varying sources of the papaya germplasm in Kenya. Although the level of genetic diversity revealed by SSR markers in this study is sufficient to distinguish between breeding lines for varietal protection, the rather narrow genetic diversity demonstrated indicates the need to introduce new germplasm or use other techniques such as mutation and genetic engineering to provide breeding materials for the future improvement of papaya in Kenya.

Name of journal / Conference Proceedings /Workshop: African Journal of Food, Agriculture, Nutrition and Development 13: 7307-7324.

Year of Publication: 2013.

Name of Lecturer/Authors: C. Niyongere, T. Losenge, E. M. Ateka, N. Ntukamazina, P. Ndayiragije, A. Simbare, P. Cimpaye, P. Nintije, P. Lepoint and G. Blomme.

Title of Publication: Understanding banana bunchy top disease epidemiology in Burundi for an enhanced and integrated management approach.

Abstract:

This study on the epidemiology of banana bunchy top disease (BBTD) was carried out in the context of small-scale farms in Burundi for an integrated management approach. Banana trials were established in farmers' fields comparing different plot locations, while spatial and seasonal occurrence of aphid vectors was evaluated at three different altitudes. In addition, serological tests were performed on banana leaf samples to confirm the presence and titre of the virus. The results showed that BBTD incidence varied among banana cultivars and locations. Nine months after plot establishment, BBTD incidence ranged from 21.8% to 56.4% in plots within affected fields, while a range of 0–12.3%was reported in plots located between 5 and 30 m away from affected banana fields. Aphid numbers were highest in the dry season. These aphids were able to acquire and transmit the virus irrespective of altitude. A mean incubation period of 21 and 84 days was observed at low (780 m a.s.l.) and high (2090 m a.s.l.) altitude, respectively. Thus, a holistic approach, taking into account banana cultivar, plot location, disease-free planting material and regular field sanitation, should be promoted for long-term BBTD management.

Name of journal / Conference Proceedings /Workshop: Plant Pathology

Year of Publication: 2012

Name of Lecturer/Authors: Célestin Niyongere, Turoop Losenge, Elijah Miinda Ateka, Désiré Nkezabahizi, Guy Blomme, Pascale Lepoint.

Title of Publication: Occurrence and Distribution of Banana Bunchy Top Disease in the Great Lakes Region of Africa.

Abstract: Banana bunchy top disease (BBTD) was first reported in 1958 in sub-Saharan Africa at the INEAC Yangambi research station in the Democratic Republic of Congo (DR Congo). Cases were reported in 1987 in the Rusizi valley encompassing the borders of Burundi, DR Congo and Rwanda. Since then, no study about BBTD had been carried out in this region. A survey was conducted from September to October, 2008 in three provinces (Bujumbura rural, Cibitoke and Bururi) of Burundi, two districts (Kamanyola and Nyangezi) in South Kivu, DR Congo and the Rusizi district in the Western province of Rwanda. A total of 7,830 banana mats, 30 randomly selected per plot, were assessed on 261 farms. A structured questionnaire was used to assess, cultivar diversity, BBTD incidence and severity, presence and occurrence of the aphid vector (Pentalonia nigronervosa Coquerel) and farmers' awareness about BBTD management. Leaf samples were randomly collected on symptomatic plants for further PCR analysis to confirm the disease. PCR results of samples collected in the three countries confirmed the presence of BBTV. Similar banana varieties are grown across the three countries, indicating the cross-border movement of planting materials which may have influenced disease spread over the past decennia. The regional average of BBTD incidence and aphid occurrence was 25% and 46%, respectively. However, no significant relationship between aphid occurrence and BBTD incidence (R=0.3, P= 0.623) was observed. Among the interviewed farmers, 90% were able to recognize advanced BBTD symptoms; while 95% of farmers were unaware of disease management options and stated that no locally cultivar is resistant to the disease. This pinpoints the need for farmers' awareness raising and that tolerant cultivars should be part of control option packages.

Name of journal / Conference Proceedings /Workshop: Tree and Forestry. Science and Biotechnology 6 (1): 102-107. ISSN 1752-3753

Year of Publication: 2012

Name of Lecturer/Authors: Niyongere, C., Ateka, E., Losenge, T., Blomme, G. and Lepoint, P.

Title of Publication: Screening Musa Genotypes for Banana Bunchy Top Disease Resistance in Burundi.

Abstract: Banana bunchy top disease (BBTD), caused by the Banana bunchy top virus (BBTV), is reported as one of the most

devastating diseases affecting banana and plantain cultivation worldwide. In order to identify putative sources of resistance, a cultivar screening trial comprising 40 Musa genotypes was established in March 2007 at the ISABU Mparambo research station in northwestern Burundi (893 m a.s.l.). Dessert bananas (AAA group), East African highland bananas (AAA, EAHB), plantains (AAB), cooking bananas (ABB), a tetraploid hybrid and wild diploid bananas (Musa acuminata and Musa balbisiana) were assessed. Ten plants per genotype were planted in a completely randomised design with border rows consisting of BBTV-infected 'Yangambi Km 5' (AAA) plants. Colonies of Pentalonia nigronervosa collected in BBTV-infected fields were released in the plot to enhance disease spread. Twenty-eight months after trial establishment, 32 genotypes have shown typical banana bunchy top symptoms. The first symptoms appeared 80 days after trial establishment on 'Yangambi Km 5'. Twenty-eight months after trial establishment, only eight genotypes [Musa balbisiana type Tani (BB), 'Kayinja' (ABB), 'FHIA-03' (AABB), 'Prata' (AAB), 'Gisandugu' (ABB), 'Pisang Awak' (ABB), 'Saba' (ABB) and 'Highgate' (AAA, Gros Michel subgroup)] have not manifested typical disease symptoms on any of the ten plants per genotype. Plant samples taken from these visibly healthy cultivars and analysed at a molecular level [at the Faculté Universitaire des Sciences Agronomiques de Gembloux (FUSAGx) in Belgium] indicated the presence of the virus in 'Pisang Awak', 'Saba' and 'Highgate'. These genotypes can be considered as BBTD tolerant. They could potentially act as a reservoir for the virus. Further diagnostic tests will be carried out on the five BBTV-free genotypes to confirm the extent of latent infections. Preliminary results indicate that genotypes with one or two B genomes tend to be more tolerant to BBTD.

Name of journal / Conference Proceedings /Workshop: Acta Hort. (ISHS) 897:439-447.

Year of Publication: 2012

Name of Lecturer/Authors: Makelo, M.N., R. Melis, & M. Githiri.

Title of Publication: Stability of cytoplasmic male-genic sterility in pigeon pea (Cajanus cajan (L.) Millsp.) under different environmental conditions in Kenya.

Abstract:

In pigeon pea (Cajanus cajan (L) Millsp.), a stable cytoplasmic-genic male sterile system (CMS) of A4 cytoplasm derived from a cross between cultivated and wild relative was developed that opened up the possibility of production of commercial hybrids. Promising stable CMS lines have been developed in India and the hybrids produced with these lines have high heterosis. The use of highly stable CMS will reduce the cost of hybrid seed production by eliminating the task of emasculation. The aim of this study was to investigate the stability of pollen sterility and morphological characteristics of several CMS lines under Kenyan conditions. Three sites; Katumani (1°35'S, 37°14'E; 1,600 m), Kiboko (2°15'S, 37°45E; 960 m), and Leldet-Nakuru (0°31'E, 0°, 09'S; 1,275 m) were selected for evaluation. Six

CMS lines, with over 96% cytoplasmic male sterility, and their maintainers were sourced from ICRISAT India and evaluated for two seasons in 2009 in a screen house at Katumani and Kiboko and in an isolated field at Leldet Nakuru. Two CMS lines, ICPA2043 and ICPA2039 were the most stable across sites with 100 and 99% pollen sterility, respectively. Days to flower showed 2 to 11-day variations between the A- and B-lines, but were not significantly different. Performance of the two promising CMS lines under Kenyan conditions for pollen sterility was comparable to the results obtained in India and can, therefore, be used in commercial hybrid breeding.

Name of journal / Conference Proceedings /Workshop: International Journal of Agricultural Policy and Research Vol.1 (1):11-18

Year of Publication: 2013.

Name of Lecturer/Authors: Nzuve, F., S. Githiri, D.M. Mukunya & J. Gethi.

Title of Publication: Combining abilities of maize inbred lines for grey leaf spot (GLS), grain yield and selected agronomic traits in Kenya.

Abstract:

The genetics of resistance to grey leaf spot (GLS) disease, grain yield and selected agronomic traits was studied in 42 F1 progenies from a full diallel cross among seven maize inbred lines. These 42 F1 progenies and seven parents were evaluated at three locations; Kenya Agricultural Research Institute (KARI), Kiboko, KARI Kakamega and University of Nairobi (Field station) during the period June 2006 to April 2008. The experiments were laid out in a randomized complete block design with three replicates. Combining ability analyses were conducted on the across site data of grey leaf spot disease, grain yield and selected agronomic traits using Griffing's method one, model one in the SAS program. Additive gene action played a greater role than non-additive gene action in the inheritance of resistance to grey leaf spot disease whereas the non additive effects were more important in the inheritance of grain yield. Reciprocal effects were not significant for GLS disease resistance and grain yield indicating absence of maternal effects for these traits. The inbred lines, CML 384 and CML 373 were the best combiners for grain yield with general combining ability (GCA) effects of 0.79 and 0.56 respectively while TZMI 711 and CML 373 were the best combiners for GLS resistance with highest negative values for GCA of -0.51 and -0.398, respectively. The local maize breeders could now incorporate the genes for GLS resistance in CML 373 and TZMI 711 and the grain yield genes in CML 384 into elite lines using recurrent and backcross methods, respectively in order to increase maize production and productivity in Kenya.

Name of journal / Conference Proceedings /Workshop: Journal of Plant Breeding and Crop Science Vol. 5(3): 41-47

Year of Publication: 2013

Name of Lecturer/Authors: Mwimali, M., J. Danson, S. Mugo, S. M. Githiri & B. Wanjala.

Title of Publication: Quantification of Bt δ-endotoxins in leaf tissues of tropical Bt maize populations.

Abstract: In Kenya, stem borers destroy an estimated 13.5% of farmers' annual maize harvest. Maize transformed using Bacillus thuringiensis (Bt) derived genes controls stem borers without negative effects to humans, livestock or the environment. The effectiveness and sustainability of Bt transgenic technology in the control of stem borers depends on the levels of concentration of the Bt δ-endotoxins in plant tissues. Kenya introduced Bt maize events to test the efficacy of Bt maize in controlling stem borers, and to develop high-yielding and locally adapted Bt maize germplasm for farmers. The objective of this study was to assess under greenhouse conditions the concentration levels of Bt δ-endotoxins in the leaf tissues of the parents, the F1, and the F2:3 populations of tropical maize, as a measure of stability and sustainability. Kenya introduced Bt maize events to test the efficacy of Bt maize in controlling stem borers, and to develop high-yielding and locally adapted Bt maize germplasm for farmers. The objective of this study was to assess under greenhouse conditions the concentration levels of Bt δ-endotoxins in the leaf tissues of the parents, the F1, and the F2:3 populations of tropical maize, as a measure of stability and sustainability. Two public Bt maize lines (Event 216 and Event 223) containing the cry1Ab::ubi gene were crossed with two non-Bt maize inbred lines, CML144 and CML159, to assess how the concentrations of Bt δ-endotoxins are transmitted from parents to F1 and to F2 generations. The mean concentration of Bt δ-endotoxins (μg/g) was 4.93 and 4.63 in Events 216 and 223 respectively. As expected, F1 generations of all the crosses had similar concentrations of Bt δ-endotoxins. However, the F2 generations showed a spread of concentrations. These findings may imply that genotypes with a higher mean concentration of Bt δ-endotoxins also have a lower level of plant damage traits expressed. In addition, these observations indicate that the cry1Ab gene was dominant and was inherited following the Mendelian segregation and that Events 216 and 223 could be utilized as reliable sources of resistance to stem borers in maize breeding programmes.

Name of journal / Conference Proceedings /Workshop: African Journal of Biotechnology Vol. 11(51), pp. 11181-11186.

Year of Publication: 2012

Name of Lecturer/Authors: Ngaboyisonga, C., K. Njoroge, D. Kirubi & S.M. Githiri.

Title of Publication: Quality protein maize under low N and drought environments: Endosperm modification, protein and tryptophan concentration in grain.

Abstract: Maize (Zea mays L.) is worldwide used as food and feed, supplying carbohydrates and proteins. However, it is deficient in two essential amino acids namely, lysine and tryptophan. Quality Protein Maize (QPM) has about twice the amount of lysine and tryptophan of normal maize and can be used to correct this deficiency in protein quality. It was developed by

combining the genetic systems of the mutant opaque-2 (O2) gene and O2-endosperm modifiers. Current efforts are to expand QPM cultivation in regions experiencing malnutrition. In those regions, maize is produced under stresses among which low N and drought are the most prevalent. However, the effects of those two stresses on QPM characteristics are not known. To study how N and drought affect major characteristics of QPM, 14 QPM inbred lines were received from CIMMYT-Kenya and used to produce 41 single cross hybrids (SCHs). The 41 SCHs and one normal check were evaluated at Kiboko in 2005 and 3006 under optimum, low nitrogen and drought environments and at Rubona in Rwanda in 2005 under optimum and low N environments. Observations were performed on endosperm modification, protein and tryptophan concentrations in grain. The results showed that low N partially reduced the action of O2-endosperm modifiers making QPM endosperm partially soft and opaque. Drought suppressed or reduced significantly the action of o2-endosperm modifiers making QPM endosperm chalky, opaque and soft. Low N and drought reduced significantly protein concentration in grain of genotypes including the non-QPM check whereas they increased the levels of tryptophan except for the non-QPM check. It appeared therefore that nitrogen particularly water played vital roles in modification of O-2maize endosperm. Moreover, QPM genotypes did not lose their nutritional advantages in stressed environments. The adverse effects of low N particularly drought on endosperm modification may have negative impact on adoption of QPM in areas prone to the two stresses and where maize is the major source of food because harvested grain will be inappropriate for human consumption. However because of important genetic variability among genotypes, it is possible to select genotypes less susceptible to low N and drought by using optimum and stressed environments.

Name of journal / Conference Proceedings /Workshop: Agricultural Journal 7 (5): 327-338

Year of Publication: 2012.

Name of Lecturer/Authors: M.N. Makelo, R. Melis, M. Githiri, & J. Sibiya.

Title of Publication: Response of pigeon pea genotypes to different races of Fusarium udum and the mode of gene action responsible for disease inheritance.

Abstract: To develop high yielding Fusarium wilt resistant varieties, it is essential to identify new sources of resistance that can withstand multiple races of the pathogen. The aim of this study was to identify [Fusarium udum (L.) Millsp.] races occurring in the study fields determine reaction of pigeon pea hybrids to the different isolates and establish the mode of gene action responsible for Fusarium wilt inheritance. Field and pot experiments were conducted during 2009 and 2010. A root-dip inoculation and transplantation technique in pots and sowing in a wilt-sick field were used for studying the reactions of 54 pigeon pea genotypes to F. udum isolates. Field evaluation was done in the infested plot in a 9 x 6 alpha lattice design with two

replications. Purification of the isolates on potato dextrose agar identified three isolates and were designated as ISO-A, ISO-B, and ISO-C. The isolates produced whitish to light pink or orange mycelia. Purple was predominant on the substrate, but whitish to light pink were also identified. Pot inoculation trials with the three isolates identified seven genotypes (ICPB2043, ICP12012, ICP13092, ICPA2039xICP13092, ICPA2043xICP12012, ICPA2043xICP13092, and ICPA2043xICP9135) resistant to all the isolates. Under field evaluation, seven genotypes (ICPA2039xICP13092,ICPA2039xAsha,ICPA2043xICP12012, ICPA2043xICP13092, ICPA2043xICEAP557, ICPB2043, and Maruti) were moderately resistant. The cytoplasmic male sterile (A) line, A2043, showed resistance to the three isolates. The resistant hybrid, ICPA2943xICP12012 had the highest negative SCA that was highly significant for all the isolates in the field.

Name of journal / Conference Proceedings /Workshop: Journal of Tropical Microbiology &.Biotechnology 8:9-19.

Year of Publication: 2012

Name of Lecturer/Authors: Murungi, L.K. Kirwa, H and Torto, B.

Title of Publication: Within plant variation in essential oil composition of Solanum sarrachoides and its effects on oviposition of the tomato spider mite (Tetranychus evansi).

Abstract:

Essential oils from leaves and berries of Solanum sarrachoides were obtained by hydro-distillation, analyzed by GC–MS and tested for oviposition deterrence against Tetranychus evansi. Plant oils comprised mainly of monoterpenes and fatty acids, but differed in terms of their relative abundance. The leaf oil contained mainly camphor (34.1%), limonene (8%), decanoic acid (9.3%) and hexadecanoic acid (7.3%). The berry oil contained mainly fatty acids (>20%) including hexadecanoic acid (9.8%) and dodecanoic acid (5.9%), hydrocarbons (>10%) and (E)-ß-linalool (3.1%). In oviposition deterrence assays, the leaf essential oil and individual major monoterpenes compared favorably with the two positive controls, neem oil and cinnamaldehyde at varying concentrations [incidence ratio (IR) < 1]. Compared to the fatty acid blend, the monoterpene blend exhibited strong oviposition deterrence (IR < 1) across all concentrations. Our results show that essential oils of S. sarrachoides and their monoterpene constituents play a role in regulating oviposition in T. evansi.

Name of journal / Conference Proceedings /Workshop: Industrial Crops and Products 46:73-79

Year of Publication: 2013

Name of Lecturer/Authors: Murungi, L.K. Knapp, M. Wesonga, J. Masinde, P. Nyende, A. and Torto, B.

Title of Publication: Differential effects of various African nightshade species

on fecundity and movement of Tetranychus evansi (Acari: Tetranychidae).

Abstract: The tomato red spider mite Tetranychus evansi Baker & Pritchard is a serious pest of solanaceous plants worldwide. Management of this oligophagous pest in African nightshades has been a challenge to smallholder African farmers due to its high reproductive rate and rapid development of resistance to synthetic pesticides. The aim of the present study was to determine the influence of leaf trichomes on T. evansi by comparing its fecundity and movement on the leaf surfaces of five African nightshade species, namely Solanum sarrachoides Sendter, S. villosum Miller, S. tarderemotum Bitter, S. americanum Miller and S. scabrum Miller. Data were recorded in the laboratory at 23 ± 1° C, 50–70% relative humidity and a 12 h light: 12 h dark photoperiod for the effect of trichome type and density of the abaxial leaf surface on mite fecundity. Distances travelled by mites on the leaf surface from the edge of a thumbtack pin inserted on the leaf were also recorded. Different trichomes, glandular and non-glandular types, were identified. There was a significant negative correlation of fecundity and distance walked by mites with the density of glandular trichomes. Significantly fewer eggs were laid on S. sarrachoides in comparison with the other Solanum species. The distance walked by mites was also significantly shorter in this species, indicating that higher densities of glandular trichomes interfere with mite movements. These results suggest that African nightshade genotypes differ in their levels of resistance to T. evansi, which is partially associated with differences in trichome types and their densities.

Name of journal / Conference Proceedings /Workshop: International Journal of Tropical Insect Science 31: 269-276

Year of Publication: 2011.

Name of Lecturer/Authors: A.M. Kavoo- Mwangi, E.M. Kahangi, E. Ateka, J. Onguso, R.W. Mukhongo, E.K. Mwangi, J.M. Jefwa.

Title of Publication: Growth effects of microorganisms based commercial products inoculated to tissue cultured banana cultivated in three different soils in Kenya.

Abstract: The effect of inoculation of microorganisms-based commercial products on post-flask management and field establishment of tissue cultured (TC) banana plantlets was investigated. TC banana cv. Gros Michel plantlets were inoculated with Bacillus, mycorrhizal and Trichoderma based products in a Vertisol, Humic Nitisol, Rhodic Ferralsol and conventional nursery media. Initial inoculation of plants with products was done at the acclimatization phase and subsequently at the potting phase. Survival of inoculated plantlets was recorded at the end of the acclimatization phase, 8 weeks after deflasking. Effect of products on growth was evaluated as ability to enhance height and girth of pseudostem, leaf length, leaf width, number of functional leaves and root and shoot biomass yield. The efficacy of products on survival of plants at hardening was variable and

dependent on soil type. Inoculation with Bacillus enhanced survival of plants in the Vertisol, mycorrhiza and Trichoderma inoculation in the Rhodic Ferralsol and mycorrhiza in the Humic Nitisol and conventional media. Performance of inoculated plants was dependent on soil type. Application of Bacillus based products significantly increased plant growth (leaf length, leaf width, plant height, shoot dry weights) in the Vertisol and Rhodic Ferralsol in the nursery phase. Application of multiple species mycorrhiza and Trichoderma under field conditions significantly increased plant growth (apparent volume and leaf surface area) in the Vertisol by over 100% and 25% compared to the control and conventional practice respectively. Mycorrhizal colonization was not significantly affected by product inoculation. However, higher percentages of colonization were observed with Bacillus inoculation in the Vertisol and by mycorrhizae and Trichoderma in the Rhodic Ferralsol compared to the non-inoculated controls. Results demonstrate that tissue cultured bananas can benefit from application of arbuscular mycorrhizal fungi, Trichoderma and Bacillus to improve survival and growth during the nursery phase as well as enhance plant performance under field conditions. The effect of microorganisms-based commercial inoculants is however dependent on soil type and the stage of plant development.

Name of journal / Conference Proceedings /Workshop: Applied Soil Ecology 64: 152–162

Year of Publication: 2013

3.1 DEPARTMENT OF FOOD SCIENCE

Name of Lecturer/Authors: Onyango Christine Akoth, Ochanda, Simon Oduor, Mwasaru Mwanjala Alfred, Ochieng Joy Kagwiria, and Mathooko Francis Mutiso

Title of Publication: Development of instant breakfast cereals from optimized flours of pearl millet, red and white sorghum

Abstract:

Objective: This was to develop instant breakfast cereals from optimized flours of red and white sorghum and pearl millet.

Methodology and results: Breakfast cereals were developed from optimally treated flours of red sorghum, white sorghum and pearl millet. Legume complementation was done using pigeon peas. Other ingredients included pigeon peas, wheat, sugar, salt, water and fat. Control products contained the same ingredients but with untreated flours and without the pigeon peas. The most preferred breakfast cereal was determined through sensory evaluation. A comparison of the most preferred product with two breakfast cereals in the market and shelf life analysis was also done. Conclusion and application: The developed breakfast cereals from optimized fours of sorghum and millet were generally acceptable to the consumer with their nutritive values being as high as that of similar products

in the market. This technology can be adopted, further refined and up scaled to be used by interested entrepreneurs to process sorghum and millet based breakfast cereals for commercial purposes. In this way these orphaned crops can be revived and the technologies developed to detoxify the antinutrients associated with them adopted in their utilization.

Name of journal / Conference Proceedings /Workshop: Journal of Applied Biosciences 51: 3559– 3566

Year of Publication: 2012

Name of Lecturer/Authors: Mburu, M.W., Gikonyo, N.K., Kenji, G.M. and Mwasaru, M.A.

Title of Publication: Nutritional and functional properties of a complementary food based on Kenyan amaranth grain (Amaranthus cruentus)

Abstract:

The objective of this study was to determine the nutritional and functional properties of Amaranthus cruentus grain grown in Kenya for preparation of a ready-to-eat product that can be recommended as infant complementary food. Amaranth grains were subjected to steeping and steam pre-gelatinization to produce a ready-to-eat nutritious product with improved solubility during reconstitution. The effect of processing on the functional and nutritional properties of amaranth grain was analyzed. Two blends were prepared from raw and processed amaranth grains. Standard procedures of Association of Official Analytical Chemists (AOAC) were used to determine the proximate chemical composition. High Performance Liquid Chromatography (HPLC) was used quantify amino acid, water soluble vitamins, α- tocopherols and phytates, while Atomic Absorption Flame Emission spectrophotometry was used to determine the mineral element composition. Fatty acid composition was determined using Gas Liquid Chromatography (GLC). Tannin composition was determined using vanillin hydrochloric acid method. The overall results indicated that processing amaranth grain did not significantly affect its nutritional and physicochemical properties. Amaranth grain product was rich in protein with 0.5 g/10g of lysine, a limiting amino acid in cereals, and methionine, a limiting amino acid in pulses. The product had good amount 44.4 mg/100g of α- tocopherols important for infant development. The product was also rich in oleic acid (36.3%) and linoleic acid (35.9%) with some amounts of linolenic acid (3.4%) that are important for infant growth. It also had good amounts of minerals of importance such as potassium (324.4 mg/100g), phosphorous (322.8 mg/100g), calcium 189.1 (mg/100g), magnesium (219.5 mg/100g), iron (13.0 mg/100g) and zinc (4.8 mg/100g). Considering amaranth grain product fed to infant three times a day, at a reconstitution of 15% product, the levels of magnesium, manganese and tocopherols were far above the recommended intakes, while protein, phosphorous, iron, zinc, riboflavin and niacin were above the average requirements. Therefore, reconstituting the product with milk would enrich the deficient nutrients, especially for iron and zinc which are crucial nutrients for infants. The processing method is a practical approach aimed at combating the problem of

malnutrition among infants and young children in Kenya and other developing countries. The product developed in this study would also be appropriate for use in geriatrics care and also in immuno-compromised individuals. The technique in this study can be easily adopted at both household and village levels to produce high protein-energy weaning food to help enhance the nutritional status of Kenyans.

Name of journal / Conference Proceedings /Workshop: AJFAND-ONLINE 12(2):5959-5977

Year of Publication: 2012

Name of Lecturer/Authors: Arnold N. Onyango

Title of Publication: Small reactive carbonyl compounds as tissue lipid oxidation products; and the mechanism of their formation thereby.

Abstract: Small reactive carbonyl compounds (RCCs) such as formaldehyde, acetaldehyde, acrolein, crotonaldehyde, glyoxal, methylglyoxal, glycolaldehyde, glycidaldehyde, and 2-butene-1, 4-dial are involved in carbonyl and oxidative stress-related physiological disorders. While some evidence indicates that lipid oxidation could be an important source of these compounds in vivo, this has sometimes been doubted because the mechanisms of their formation thereby are poorly understood. Here, representative literatures supporting the significant formation of these compounds during lipid oxidation under physiologically relevant conditions are highlighted, and the strengths and weaknesses of previously proposed mechanisms of their formation thereby are considered. In addition, based on the current understanding of lipid oxidation chemistry, some new pathways of their formation are suggested. The suggested pathways also generate 4-hydroxy-2-butenal, a precursor of the carcinogen furan, whose endogenous formation in tissues has hitherto not been seriously considered.

Name of journal / Conference Proceedings /Workshop: Chemistry and physics of Lipids 165 (7): 777-786

Year of Publication: 2012

Name of Lecturer/Authors: Samuel M. Imathiu, Simon G. Edwards, Rumiana V. Ray and Matthew A. Back

Title of Publication: *Fusarium langsethiae* – a HT-2 and T-2 Toxins Producer that Needs More Attention

Abstract: *Fusarium langsethiae* is a toxigenic fungus that was formally described as a new species in 2004. This fungus was first detailed in the 1990s but was initially referred to as 'powdery *Fusarium poae*' having a spore morphology similar to *F. poae* but a mycotoxin profile like that of *Fusarium sporotrichioides*. The species has been isolated from infected oat, wheat and barley grains but has been reported as more problematic in the former crop rather than the latter two. Whilst the epidemiology of *F. langsethiae* remains unclear, the fungus has been shown

to produce high levels of type- A trichothecenes HT-2 and T-2 toxins in small-grain cereals. HT-2 and T-2 toxins are two of the most potent trichothecenes capable of inhibiting protein synthesis in eukaryotes. In this regard, mycotoxin contamination caused by *F. langsethiae* is clearly a food and feed safety hazard. With the European Commission considering legislation of HT-2 and T-2 toxins, more information is required not only on the producer and conditions favouring mycotoxin production, but also on reliable methods of pathogen detection and reduction of cereal contamination. This review describes recent research concerning the known epidemiology of *F. langsethiae* and suggestions of what needs to be known about the fungus in order to be able to understand and employ measures for preventing its infection and contamination of cereals with HT-2 and T-2 toxins.

Name of journal / Conference Proceedings /Workshop: Journal of Phytopathology Vol 161, pp 1-10

Year of Publication: 2013

Name of Lecturer/Authors: Simon G. Edwards, Samuel M. Imathiu, Rumiana V. Ray, Matthew Back, Martin C. Hare

Title of Publication: Molecular studies to identify the *Fusarium* species responsible for HT-2 and T-2 mycotoxins in UK oats

Abstract:

High levels of *Fusarium* mycotoxins HT-2 and T-2 have been detected in UK oats since surveys started in 2002. *Fusarium langsethiae* and the closely related species *F. sporotrichioides* have previously been associated with the contamination of cereals with type A trichothecenes HT-2 and T-2 in Nordic countries. Preliminary microbiological analysis of UK oat samples with high concentrations of HT-2 and T-2 detected and isolated *F. langsethiae* and *F. poae* but not the other type A trichothecene producing species *F. sporotrichioides*, *F. sibiricum* and *F. armeniacum*. Two hundred and forty oat flour samples with a known mycotoxin profile were selected from a previous four year study (2002–2005) to cover the full concentration range from below the limit of quantification (<20 μg/kg) to 9990 μg/kg HT-2+T-2 combined. All samples were analysed for the DNA of *F. langsethiae, F. poae* and *F. sporotrichioides* based on previously published PCR assays. *F. langsethiae* was detectable in nearly all samples; *F. poae* was detected in 90% of samples whereas *F. sporotrichioides* was not detected in any sample. A real-time PCR assay was developed to quantify *F. langsethiae* DNA in plant material. The assay could quantify as low as 10−4 ng *F. langsethiae* DNA/μl. Based on this assay and a previously published assay for *F. poae*, both species were quantified in the oat flour samples with known HT-2+T-2 content. Results showed a good regression ($P<0.001$, $r^2=0.60$) between *F. langsethiae* DNA and HT-2+T 2 concentration. *F. poae* DNA concentration was not correlated to HT2+T2 concentration ($P=0.448$) but was weakly correlated to nivalenol concentration ($P<0.001$, $r^2=0.09$). Multiple regression with *F. langsethiae* and *F. poae* DNA as

explanatory variates identified that both *F. langsethiae* and *F. poae* DNA were highly significant (P<0.001) but *F. poae* DNA only accounted for an additional 4% of the variance and the estimate was negative, indicating that higher concentrations of *F. poae* DNA were correlated with slightly lower concentrations of HT2+T2 detected. A stronger regression (P<0.001, r^2=0.77) between *F. langsethiae* DNA and HT-2+T-2 was obtained after extraction and quantification of DNA and mycotoxins from individual oat grains. The results from this study provide strong evidence that *F. langsethiae* is the primary, if not sole, fungus responsible for high HT-2 and T-2 in UK oats.

Name of journal / Conference Proceedings /Workshop: International Journal of Food Microbilogy Vol. 156, pp. 168-175

Year of Publication: 2012

Name of Lecturer/Authors: M.A. Ayieko, J.N. Kinyuru, M.F. Ndong'a and G.M. Kenji

Title of Publication: Nutritional value and consumption of black ants (C*arebara vidua S*mith) from the Lake Victoria region in Kenya

Abstract:

The edible insects of the Lake Victoria region which provided food and medicine, have suffered the effects of mismanaged environment. Our case study of *Carebara vidua* Smith (black ant) which is an endangered insect currently threatened with extinction due to human's activities, have provided unique source of protein and medicinal value. *C. vidua* is an endangered species of Heminoptera. This paper discusses the nutritional value and medicinal potential of the black ant. It is one of the most sought after edible insects because of its nutritional and medicinal value. The samples were collected from Kisumu and Siaya counties along the Lake Victoria region. Standard nutrient analysis methods were used to determine the nutritional value. The insect has between 39.79 to 44.64% protein and about 42.07 to 49.77% fat content depending on the body part. The insect is also rich in iron, zinc, magnesium, potassium and phosphorus. From the fatty acid profile, the edible insects recorded high content of Palmitic, Oleic and Linoleic acids. No Linolenic acid was found in the samples analysed. The elderly Luos of Kenya collect and consume the black ants to manage several body ailments probably due to the essential nutrients found in the insect. *C. vidua* Smith is fairly similar to Polyrhachis vicina Roger in China which has been processed and commercialised as medicinal to manage several chronic diseases. Further research is needed to highlight the potential medicinal value of *C. vidua* Smith in Kenya and to save the insect from total disappearance.

Name of journal / Conference Proceedings /Workshop: Advance Journal of Food Science and Technology 4(1): 39-45

Year of Publication: 2012

Name of Lecturer/Authors: John N. Kinyuru, Silvenus O. Konyole, Glaston M. Kenji, Christine A. Onyango, Victor O. Owino, Bethwell O. Owuor, Benson B. Estambale, Henrik Friis and Nanna Roos

Title of Publication: Identification of traditional foods with public health potential for complementary feeding in Western Kenya

Abstract: The diversity of traditional foods in Kisumu West District of Western Kenya was assessed with an aim to identify the foods with a potential for complementary feeding. Leaves were the most consumed plant part amongst vegetables, while a few fruits were consumed together with their seeds. *Amaranthus cruentus* L. was found to be consumed as a leafy vegetable while another variety, *Amaranthus hybridus* L. was found to be consumed as a grain. Four species of winged termites, a grasshopper, black ant and *dagaa* fish were also identified. Twelve of the traditional foods were found to be associated with nutritional and health benefits as perceived by the locals. Traditional food processing methods such as boiling, fermentation and sun drying were identified. Thus exploitation of the species possessing nutrient, health and processing benefits needs to be explored in complementary feeding.

Name of journal / Conference Proceedings /Workshop: Journal of Food Research 1(2): 148-158

Year of Publication: 2012

Name of Lecturer/Authors: Silvenus O. Konyole, John N. Kinyuru, Bethwell O. Owuor, Glaston M. Kenji, Christine A. Onyango, Benson B. Estambale, Henrik Friis, Nanna Roos and Victor O. Owino

Title of Publication: Acceptability of amaranth grain-based nutritious complementary foods with *dagaa* fish *(Rastrineobola argentea)* and edible termites *(Macrotermes subhylanus)* compared to corn soy blend plus among young children/ mothers dyads in Western Kenya

Abstract: We assessed acceptability of two flours and porridges of complementary foods based on germinated grain amaranth and maize with or without edible termites and *dagaa* small fish named "Winfood Classic" (WFC) and "Winfood Lite" (WFL), respectively, compared to Corn Soy Blend Plus (CSB+) among mothers and young children. A total of 57 children consumed each of the three foods on separate days with one-day washout between foods. Each food was considered acceptable if the child consumed at least 75% of the serving. Most mothers preferred WFL flour and porridge (63.2% and 70.2%, respectively) compared to WFC (24.4% and 10.5%) and CSB+ (12.3% and 19.3%). Children consuming at least 75% of served porridge were 43%, 19.6% and 21% for WFL, WFC and CSB+, respectively. No adverse effects were observed for all the foods throughout the study period and follow up lasting 4 weeks. All foods were acceptable and can be further developed and be tested for efficacy.

Name of journal / Conference Proceedings /Workshop:	Journal of Food Research 1(3): 111-120
Year of Publication:	2012
Name of Lecturer/Authors:	C. A. Onyango, S. O. Ochanda, M. A. Mwasaru, J. K Ochieng, F. M. Mathooko, and J. N. Kinyuru
Title of Publication:	Effects of malting and fermentation on anti-nutrient reduction and protein digestibility of red sorghum, white sorghum and pearl millet
Abstract:	Sorghum and millet and their products require specialized treatment in order to improve their nutritive value, organoleptic properties and shelf-life. They contain anti-nutrients which are the major phytochemicals which negatively affects their nutritive values. The phytochemicals of concern include tannins and phytates, which interfere with mineral absorption, palatability and protein digestibility. Malting and fermentation treatments were applied to reduce the anti-nutrients, improve protein digestibility, and acidity to increase the products shelf life. The effects of malting and fermentation on the cereals nutritive value and anti-nutrient reduction were studied and evaluated for a period of 8 days. A treatment combining malting for 3 days and fermentation for 2 days respectively both at room temperatures (25°C) was employed. Tannins and phytates were significantly reduced ($p = 0.05$) by malting and fermentation. Protein digestibility was significantly ($p = 0.05$) improved by malting and fermentation treatments; malted cereals digestibility ranged between 34.5-68.1% while the fermented flours protein digestibility range was 97.4-98.3%. The pH values were lowered to below 4.0, a level at which they could effectively inhibit spoilage microorganisms at the end of the fermentation period. A combination of optimum time treatments of malting and fermentation for 3 days and 2 days respectively were effective in reducing tannins and phytates and improving protein digestibility of the cereals.
Name of journal / Conference Proceedings /Workshop:	Journal of Food Research 2(1): 41-49
Year of Publication:	2012
Name of Lecturer/Authors:	John N. Kinyuru, Silvenus O. Konyole, Glaston M. Kenji, Christine A. Onyango, Victor O. Owino, Bethwell O. Owuor, Benson B. Estambale, Henrik Friis and Nanna Roos
Title of Publication:	In-vitro iron bioavailability in amaranth grain-based complementary foods processed with edible termites and effects of germinating amaranth grain on phytate/mineral molar ratios
Abstract:	Low mineral bioavailability is regarded as one of the confounding factors responsible for low mineral absorption and utilisation as a result of dietary components. This study aims at investigating the effect of animal source foods on in-

vitro iron availability when included as ingredients in three amaranth grain-based complementary foods. The effect of germinating Amaranthus cruentus grain on predicted mineral bioavailability was also evaluated. In-vitro iron availability was measured as Fe(II) dialysability/availability obtained by a method combining in vitro protein digestion and dialysis (IVPD-dialysis). Aliquots were collected following digestion with pepsin or pepsin+pancreatin and investigated for their effects on Fe(II) dialysability imitating the conditions in the duodenum and the proximal jejunum. Grains were steeped for 5 hours, germinated for 72 hours and phytic acid, iron, zinc and calcium analysed at intervals. Available minerals were predicted in germinated grains by using phytate/mineral molar ratio. The results showed high phytic acid levels as well as low Fe(II) availability in the foods (<5%). There was a significant increase in available Fe(II) with increase in edible insects' content after pepsin+pancreatin digestion though the increase after pepsin digestion was not significant ($p>0.05$). Fe(II) availability between pepsin and pepsin+pancreatin digestion on all the foods was not different significantly ($p>0.05$). Phytate reduction on the grains was significant after 24 hours of germination followed by significant reduction of molar ratios ($p>0.05$). Edible insects may constitute a valuable animal source food component in enhancing mineral bioavailability though it has to be coupled with reduction of inhibitors.

Name of journal / Conference Proceedings /Workshop: 16th IUFoST World Congress of Food Science and Technology Foz do Iguassu, Brazil

Year of Publication: 5th -9th August 2012

Name of Lecturer/Authors: Okoth Judith Kanensi, Sophie Ochola, Nicholas. K. Gikonyo and Anselimo Makokha

Title of Publication: Optimization of the Period of Steeping and Germination for Amaranth Grain

Abstract:

According to Kenya Demographic Health Survey, 7% of children less than five years were wasted with 16% of them being underweight probably an indication of poor and inappropriate feeding practices. The children suffer from protein energy malnutrition (PEM) and micro-nutrient deficiencies which may lead tophysical, mental and motor development retardation. Children are most at risk of PEM during the introduction of complementary foods usually thin porridge prepared predominantly from cereals and starchy tubers. Such porridge is low in energy and nutrient density, and may be high in anti-nutrients, despite the fact that infants at this stage of rapid development have high requirements of energy and nutrients per unit body weight. There is need therefore to develop appropriate nutrient-dense complementary foods that could be used by low income families. Amaranth grain has high biological value proteins and a better amino acid profile than nearly all cereals. It is also rich in essential fatty acids. However it is not commonly used as a complementary food in Kenya. The main objective was to determine the optimum steeping and

germination time for amaranth grains. The grains were steeped and germinated for various time periods. The dry matter loss, proximate composition and some antinutrient levels were determined. Dry matter loss was least in amaranth grains steeped for 5 hours and germinated for 24 hours. At $p<0.05$, there were no significant differences in ash, fat and protein contents with respect to steeping and germination time. The crude fiber content and the invitro protein digestibility varied with different steeping and germination time. The tannin and phytate contents could not be detected after steeping and germination. Based on dry matter loss and reduction in antinutrient levels, steeping amaranth grains for 5 hours and germinating for 24 hours were the optimums processing times.

Name of journal / Conference Proceedings /Workshop: Journal of Agriculture and Food Technology1 (6) 101-105.

Year of Publication: 2011

Name of Lecturer/Authors: Kathurima C. W., Kenji G. M., Muhoho S. M**.,** Boulanger R. Gichimu B. M. and Gichuru E. K.

Title of Publication: Genetic diversity among commercial coffee varieties, advanced selections and museum collections in Kenya using molecular markers

Abstract: Molecular markers have effectively been applied to study genetic diversity and as markers of particular traits. This study assessed the diversity of twenty four (24) coffee genotypes using 10 Random Amplified Polymorphic DNA (RAPD) primers and 2 microsatellites (M24 and Sat 235). A total of 35 polymorphic bands were generated by the RAPD primers. The bands were scored for presence (1) and absence (0) of amplified products. The data was subjected to cluster analysis using R statistical software and a dendrogram constructed using Unweighted Pair Group Method with Arithmetic Average (UPGMA). The genotypes separated into three main clusters. *C. eugenioides* clustered alone in the first cluster while un-introgressed Arabica genotypes dominated the second cluster. The third cluster comprised of *Coffea canephora* (Robusta) and introgressed genotypes, Ruiru 11, Hibrido de Timor and Catimor. Robusta and *C. eugenioides* were the most distantly related and generated most of the diversity observed. The similarities observed among un-introgressed Arabica genotypes attest to the narrow genetic diversity within *Coffea arabica*. The divergence observed among introgressed genotypes could be utilized in future breeding programmes.

Name of journal / Conference Proceedings /Workshop: International Journal of Biodiversity and Conservation Vol. 4(2), pp. 39-46.

Year of Publication: 2012

Name of Lecturer/Authors: Mbae KM, Kiiyukia C and GM Kenji

Title of Publication: In vitro production of trichothecenes and zearalenone by

fusarium isiolates from equatorial barley (*Hordeum Vulgare* L) grown in Kenya

Abstract: *Fusarium* head blight (scab) is a devastating disease of wheat and barley throughout the world. The disease has been reported worldwide wherever cereals are grown, cutting across diverse ecological and geographical distribution. In addition to being pathogenic to plants, which may cause severe crop yield reduction, many *Fusarium* species are also capable of producing mycotoxins deleterious to human health as secondary metabolites. *Fusarium* toxins are commonly detected in wheat, barley, maize, rice and beer. Traditionally malted barley (*Hordeum vulgare* L.) is the principal ingredient in clear beer and *Fusarium* toxins incidences are of major concern. Moreover, the spent grain from the brewing industry is used as feed and presence of mycotoxins can lead to harmful effects on domestic animals and also find a way into the human food chain. Studies carried out in Kenya have revealed presence of various *Fusarium* species with ability to produce mycotoxins and presence of *Fusarium* toxins in wheat and maize and beer. Based on the ubiquitous nature of *Fusarium* mold and the fact that barley production takes place in maize and wheat growing areas, this study set out to investigate the occurrence of *Fusarium* molds in Equatorial barley grown in Kenya and the ability of the isolates to produce selected mycotoxins. Grain samples were obtained from newly delivered barley lots originating from two regions and stored grain awaiting malting after break of dormancy from Kenya Maltings Ltd., Nairobi. The *Fusarium* isolates were identified to species level based on cultural and morphological characteristics. Additionally, they were screened *in-vitro* on rice cultures for their ability to produce Type A trichothecenes (T–2 toxin, HT–2 toxin, Diacetoxyscirpenol), Type B trichothecenes (deoxynivalenol and nivalenol) and Zearalenone. Samples from all sources were contaminated with *Fusarium*, but at varying magnitudes - 50%, 33.3% and 25% for barley kernels originating from Timau, Olchoro and in-storage grain with no common history of origin, respectively. The distribution of the species showed some regional specificity. *F. graminearum* and *F. poae* predominated in kernels sourced from Olchoro region. All strains of *F. graminearum* produced both deoxynivalenol and zearalenone. *F. poae* strains *and F. chlamydosporum* did not produce detectable amounts of the screened mycotoxins. However, two inconclusively identified isolates of *Fusarium spp*. isolated from Timau samples produced deoxynivalenol only. The study revealed that a number of toxigenic *Fusarium spp*. do occur in Equatorial barley grown in Kenya.

Name of journal / Conference Proceedings /Workshop: AJFAND Vol 12 No 5

Year of Publication: 2012

Name of Lecturer/Authors: Glaston Mwangi Kenji and Richard Wanzala Wamalwa

Title of Publication: Improvement of testing laboratories competency for economic

and social growth

Abstract:

Consumers everywhere expect consistent provision of quality products that they purchase. They need constant assurance that products procured exhibit little or no variation and are safe for use. These expectations can be satisfied when there is conformity, especially in measurements made during the manufacturing processes. To ensure this conformity, the testing laboratories must provide accurate analytical results, manned by well trained staff with well calibrated equipments so as to be able to reduce costs due to reduce wastage and health risks. Laboratory accreditation and profiency testing (PT) yield correct results that enable better technical and socio-economic decisions to be made and thus enhance efficiency of our businesses. We have about 300 testing laboratories in Kenya out of which only less than 10 are accredited. The accredited laboratories are required to periodically participate in PT. In the Second Round EAC PT in 2007, 25 and 33 laboratories in EA region paticipated in chemical composition for drinking water and wheat flour PT respectively. The z-scores were used as a basis for proficiency assessment for analytes for each respective determinant. The result from the participating laboratories in the wheat flour PT was: 53% (13) produced satisfactory results; 28% (7) did not produce reliable results with 9% (2) as questionable results and 19% (5) as unsatisfactory results; 19% (5) did not submit the results of their tests. The results for chemical composition for drinking water PT was: 60% (20) produced satisfactory results; 24% (8) did not produce reliable results; 16% (5) did not submit the results of their tests. These inconsistent results from different laboratories after analysing the same sample demonstrate that the quality of data obtained from some of our laboratory is questionable. This paper therefore proposes that our testing laboratories should aggressively seek to be *competent by getting accreditation by recognized accrediting bodies.*

Name of journal / Conference Proceedings /Workshop:

International Journal of Arts and Commerce Vol 1 No 4.

Year of Publication:

2012

Name of Lecturer/Authors:

Gyu-Sung Cho; Melanie Huch; Julius Maina Mathara; Marco J. van Belkum; Charles M.A.P. Franz.

Title of Publication:

Characterization of pMRI 5.2, a rolling-circle-type plasmid from *Lactobacillus plantarum* BFE 5092 which harbours two different replication initiation genes

Abstract:

Plasmid pMRI 5.2 from *Lactobacillus plantarum* BFE 5092 was sequenced and analysed. The sequence consists of 5206 bp with a mol% G+C content of 35.8%. Nine putative open reading frames were identified. A typical pC194 family double strand origin (*dso*) and a putative single strand origin (*sso*) were predicted upstream of a *rep* gene. This *rep* gene encoded a replication protein of 314 amino acids exhibiting 98% amino acid sequence identity to the Rep protein of plasmid pLAB1000 from *Lactobacillus hilgardii*. A *mob* gene encoding

a mobilization protein was also identified and this protein showed high amino acid similarity to Mob proteins from various *Lactobacillus plantarum* plasmids. Downstream of the *mob* gene, a second putative replication region was identified that is similar to the pMV158 family of plasmids. It contains a *dso* as well as a putative *sso*, and encodes the 52 amino acid repressor-like protein RepA, the replication initiation protein RepB of 215 amino acids, and the 48 amino acid RepC that is similar to ORFD of the lactococcal plasmid pWVO1. RT-PCR and qRT-PCR expression analyses of the *rep* and *repB* genes showed that the *repB* gene was expressed at a higher level. To confirm that the plasmid replicated by the rolling-circle-type mechanism, the presence of a characteristic single strand intermediate DNA was shown to be produced during replication. Plasmid copy number was ca. 30 per equivalent chromosome copy number based on qRT-PCR analyses. The plasmid also encodes four additional putative proteins of unknown function. The unusual feature of a rolling-circle plasmid having two different plasmid-encoded replication initiation proteins from different replicon families suggests that the genes for these may have originated from different plasmids.

Name of journal / Conference Proceedings /Workshop: Plasmid 69 (2013) 160–171

Year of Publication: 2013

3.2 DEPARTMENT OF LAND RESOURCE PLANNING AND MANAGEMENT

Name of Lecturer/Authors: Mburu David Mwehia and Kigomo Mathew Kiura

Title of Publication: Effect of Land Use Change on Agroecosystems in Kijabe-Longonot Area, Kenya

Abstract: Changes in land use and land cover (LULC) affect ecosystems, biodiversity and goods and services they provide to society. The magnitude of change varies with time as well as the agroecological zone. A study was done at Longonot-Kijabe area which is classified as semi-arid. The objective of the study was to assess land use and land cover change and the effect on agroecology. Aerial photographs and satellite images of between 1970 and 2000 were interpreted and LULC classified for ten year intervals. Geographical information system (GIS) was used to compare the diverse data sets and the area under different land use systems. The results show a general trend of decrease in forest cover and increase in the area under settlement and farms. As the high rate of deforestation continues, soil erosion by wind and rainwater is expected to increase in the escarpment and other sloping land. Corrective measures can be initiated by re-forestation and soil and water conservation interventions.

Name of journal / Conference Proceedings /Workshop:	7th Esri Eastern Africa User Conference 3 – 5 October, 2012 | Lake Naivasha Sopa Lodge, Naivasha, Kenya
Year of Publication:	2012
Name of Lecturer/Authors:	Kigomo Mathew Kiura and Mburu David Mwehia
Title of Publication:	Assessment of Potential Landslide Areas in the Upper Tana-Athi Watershed, Kenya
Abstract:	Landslides are natural disasters that occur frequently in Kenya and other parts of East African Region. Although landslides may occur naturally, their occurrence is mostly triggered by interaction between natural factors (geomorphology, lithology, slope, rainfall) and human activities on the landscape (agriculture, mining, construction). These interactions cause change in stress condition of natural slopes resulting in slope instability. In 2002, landslides affected over 2000 people in Meru, Murang'a, Nyeri and Nandi counties in Kenya. Apart from historical perspectives, landslides in Kenya are not yet fully studied. Investigation of the potential landslide areas will help to mitigate and minimize their effects. One of the methods of identifying and determining the landslide hazard areas and distribution is by application of weighted overlay analysis in geographic information system (GIS). Overlaying slope, elevation, lithology, land cover/land use, and rainfall data will result in production of landslide hazard map that can be used in making land management decisions including mitigation and control of landslides. This paper gives practical application of GIS in assessment of landslide hazard areas based on documented evidence of past events in the Upper Tana-Athi watershed.
Name of journal / Conference Proceedings /Workshop:	7th Esri Eastern Africa User Conference 3 – 5 October, 2012 | Lake Naivasha Sopa Lodge, Naivasha, Kenya
Year of Publication:	2012
Name of Lecturer/Authors:	Serem, EK, Mburu, J., Mdachi R., Korir, S., Kibugu, J., Kagira, J. and Ngure, R.
Title of Publication:	Effects of crude extracts of Solanum nigrum on the Liver pathology and Survival time in Trypanosoma brucei rhodesiense infected mice
Abstract:	Tissue inflammatory damage during trypanosomosis significantly affects the treatment and prognosis. The current study investigated the effects of water extracts of Solanum nigrum (SNE) on the liver pathology and survival of Swiss white mice infected with Trypanosoma brucei rhodesiense. Trypanosome infected mice treated with SNE had significantly ($P<0.05$) increased and dose dependent survival time and liver pathology. Mice treated with higher concentrations of SNE had minimal liver pathology with minimal infiltration by

inflammatory cells compared with the dexamethasone treated and untreated mice which had massive infiltration suggesting that SNE could be superior to dexamethasone in reducing trypanosome mediated liver pathology. Therefore, SNE could be a better anti-inflammatory adjunct in the treatment of Human African trypanosomosis (HAT) and other inflammatory conditions such as hepatitis.

Name of journal / Conference Proceedings /Workshop: Science Journal of Microbiology

Year of Publication: 2013

Name of Lecturer/Authors: Edwin Ogendi, Naomi Maina, John Kagira, Maina Ngotho, Gabriel Mbugua, Simon Karanja

Title of Publication: Questionnaire Survey on the Occurrence of Risk factors for Toxoplasma gondii infection amongst Farmers in Thika District, Kenya

Abstract:

A survey was conducted to determine the occurrence of risk factors for Toxoplasma gondii infection amongst farmers in Thika District, Kenya. Interviews were conducted in a total of 385 households using a structured questionnaire. The water consumed at household level originated from taps (74.3%), rivers or streams (15.1%), wells (5.4%) and boreholes (5.2%). A number of households (46.8%) consumed water without boiling or applying any form of treatment. All respondents washed vegetables before cooking, whilst 99.0% washed fruits before eating. Boiled milk was preferred by 99.5% of the farmers. The majority (85.2%) consumed beef more often, whilst 1.6% consumed pork. The majority (98.7%) consumed thoroughly cooked meat. Meat was preserved by 17% of farmers. Only four farmers (1.2%) who practised mixed farming used gloves when handling livestock manure. Five farmers (1.6%) reported the occurrence of abortion in ruminants and pigs on their farms within the last two years before the study. Almost half (44.9%) of the households owned cats, which were kept mainly as pets (79.8%) and for deterring rodents (20.2%). The majority of households (91.3%) fed the cats on leftovers, whilst 8.1% fed cats with raw offal. Sixteen households (9.2%) provided housing for cats. Only five households (2.8%) had litter boxes, but none of the households with litter boxes used gloves when cleaning them out. Disposal of cat faeces was done mainly by women (55.5%). Only one farmer (0.3%) had some knowledge about toxoplasmosis, but was not aware of the transmission mechanism. The study highlights the need for public health education to raise awareness of risk factors for toxoplasmosis.

Name of journal / Conference Proceedings /Workshop: Journal of South Africa Veterinary Association

Year of Publication: 13

Name of Lecturer/Authors: Nasimolo J, Kiama S, Makanya A, Gathumbi P, Kagira J

Title of Publication: Trypanosome Migration to the Brain

Abstract:	The migration of trypanosomes into the brain parenchyma is still not well understood, considering the presence of a blood brain barrier. We examined the second stage of trypanosomiasis that occurs in the brain using a mice model. Swiss white mice were infected intraperitonealy with 1x104 T. brucei brucei and parasitaemia monitored from the third day up to 28 days post infection. Diminazine aceturate was given intraperitonealy 21 days post infection. One animal was sacrificed at day 21 post infection to establish whether the parasites had reached the brain. We established the presence of trypanosomes in the brain from day 21 onwards. Scanning electron microscopy showed trypanosomes in the ventricles and some crossing the choroid plexus, while transmission electron microscopy demonstrated the parasites in brain parenchyma. The results indicate a possible route of invasion of trypanosomes into brain parenchyma, shedding some light on the mechanism of this migration.
Name of journal / Conference Proceedings /Workshop:	2nd East Africa Neuroscience Conference, 2012
Year of Publication:	2012
Name of Lecturer/Authors:	Paul W.N. Kanyari, John M. Kagira, Jumanne R.L. Mhoma, Peter Omemo
Title of Publication:	Parasitic causes of liver and heart condemnation and their economic effects in the Lake Victoria Basin: a retrospective abattoir survey in Kisumu Municipality, Kenya
Abstract:	Malnutrition is a major cause of human mortality in Sub-Saharan Africa and every effort must be made to conserve the available sources of protein for human use. Animals and especially livestock are a major source of the proteins but livestock production is hampered by such constraints as inadequate feed and various diseases. Parasitic diseases constitute a major impediment to livestock production owing to the direct and indirect losses they cause. For example, in Kenya fasciolosis leads to estimated losses at £7 million annually. However, these are conservative estimates since there are only a few studies on the epidemiology and economic importance of these parasites in Kenya. This study was undertaken to determine the causes of liver condemnation between 2003 and2008 and subsequent economic losses from fasciolosis using slaughter house data in Kisumu Municipality for the year 2007-2008. The role of muscular cysticercosis produced by larval forms of Taenia saginata as a cause of heart condemnation among slaughtered cattle was also included in this study. During 2003-2008, the percentage of cattle that had Fasciola infections ranged from 3% in 2003 to 7.13% in 2006. An average of 5.15% cattle was diagnosed with liver fluke infections every year. The proportion of livers condemned for liver flukes ranged from 39.2% in 2005 to 52.4% in 2004 with an average of 46.9% over the six year period. Other parasitic infections encountered in the liver were cystic echinococcosis, Stilesia hepatica and other parasitic cysts. In 2007 and 2008, the total monetary loss from liver fluke infections was USD 12,034 and USD 13,413 respectively.

Losses from heart condemnations appeared relatively low compared to those of the liver but Muscular cysticercosis in cattle leads often to whole carcass condemnation. These losses can make a difference in the Lake Victoria Basin communities where malnutrition is prevalent and income per capita is low.

Name of journal / Conference Proceedings /Workshop: Scientia Parasitologica

Year of Publication: 2012

Name of Lecturer/Authors: John K. Thuita, Michael Z. Wang, John M. Kagira, Cathrine L. Denton et al.,

Title of Publication: Pharmacology of DB844, an Orally Active aza Analogue of Pafuramidine, in a Monkey Model of Second Stage Human African Trypanosomiasis

Abstract:

Novel drugs to treat human African trypanosomiasis (HAT) are still urgently needed despite the recent addition of nifurtimox-eflornithine combination therapy (NECT) to WHO Model Lists of Essential Medicines against second stage HAT, where parasites have invaded the central nervous system (CNS). The pharmacology of a potential orally available lead compound, N-methoxy-6-{5-[4-(N-methoxyamidino) phenyl]-furan-2-yl}-nicotinamidine (DB844), was evaluated in a vervet monkey model of second stage HAT, following promising results in mice. DB844 was administered orally to vervet monkeys, beginning 28 days post infection (DPI) with Trypanosoma brucei rhodesiense KETRI 2537. DB844 was absorbed and converted to the active metabolite 6-[5-(4-phenylamidinophenyl)-furanyl-2-yl]-nicotinamide (DB820), exhibiting plasma Cmax values of 430 and 190 nM for DB844 and DB820, respectively, after the 14th dose at 6 mg/kg qd. A 100-fold reduction in blood trypanosome counts was observed within 24 h of the third dose and, at the end of treatment evaluation performed four days post the last drug dose, trypanosomes were not detected in the blood or cerebrospinal fluid of any monkey. However, some animals relapsed during the 300 days of post treatment monitoring, resulting in a cure rate of 3/8 (37.5%) and 3/7 (42.9%) for the 5 mg/kg610 days and the 6 mg/kg614 days dose regimens respectively. These DB844 efficacy data were an improvement compared with pentamidine and pafuramidine both of which were previously shown to be non-curative in this model of CNS stage HAT. These data show that synthesis of novel diamidines with improved activity against CNS-stage HAT was possible.

Name of journal / Conference Proceedings /Workshop: PLoS Neglected Tropical Diseases

Year of Publication: 2012

Name of Lecturer/Authors: Maribel Funes-Huacca, Alyson Wu, Eszter Szepesvari, Pavithra Rajendran, Nicholas Kwan-Wong, Andrew Razgulin, Yi Shen, John Kagira, Robert Campbell and Ratmir Derda

Title of Publication:	Portable self-contained cultures for phage and bacteria made of paper and tape
Abstract:	In this paper, we demonstrate that a functional, portable device for the growth of bacteria or amplification of bacteriophage can be created using simple materials. These devices are comprised of packing tape, sheets of paper patterned by hydrophobic printer ink, and a polydimethyl siloxane (PDMS) membrane, which is selectively permeable to oxygen but non-permeable to water. These devices supply bacteria with oxygen and prevent the evaporation of media for a period over 48 h. The division time of E. coli and the amplification of the phage M13 in this device are similar to the rates measured on agar plates and in shaking cultures. The growth of bacteria with a fluorescent mCherry reporter can be quantified using a flatbed scanner or a cell phone camera. Permeating devices with commercial viability dye (PrestoBlue) can be used to detect low copy number of E. coli (1–10 CFU in 100 mL) and visualize microorganisms in environmental samples. The platform, equipped with bacteria that carry inducible mCherry reporter could also be used to quantify the concentration of the inducer (here, arabinose). Identical culture platforms can, potentially, be used to quantify the induction of gene expression by an engineered phage or by synthetic transcriptional regulators that respond to clinically relevant molecules. The majority of measurement and fabrication procedures presented in this report have been replicated by low-skilled personnel (high-school students) in a low resource environment (high-school classroom). The fabrication and performance of the device have also been tested in a low-resource laboratory setting by researchers in Nairobi, Kenya. Accordingly, this platform can be used as both an educational tool and as a diagnostic tool in low-resource environments worldwide
Name of journal / Conference Proceedings /Workshop:	Lab on a Chip
Year of Publication:	2012
Name of Lecturer/Authors:	Maina N, Kagira JM, Achila O, Karanja SM, Ngotho M.
Title of Publication:	Herbal Medicines in Kenya: A Review of the Toxicity and Quality Control Issues
Abstract:	In sub-Saharan Africa, it is estimated that 80% of the population depends on indigenous medicines for primary health-care. These herbs often contain highly active pharmacological compounds whose pharmacotherapeutic and toxicity profiles have not been well characterized. Toxicity may be related to several intrinsic and extrinsic factors. Most of the available reports related to the toxic effects of herbal medicines cite hepatoxicity as the most frequently experienced toxicity. However, noxious effects involving kidneys, the nervous system, skin, blood, the cardiovascular system, mutagenicity and carcinogenicity have also been published. This article presents a systematic review on safety and toxicity of herbal medicines used in Kenya.
Name of journal /	

Conference Proceedings /Workshop:	African Journal of Health Sciences
Year of Publication:	2013
Name of Lecturer/Authors:	Mathew G. Gicheha; Grant, R. Edwards; Stephen, T. Bell and Anthony C. Bywater
Title of Publication:	Embedded Risk Management in Dryland Sheep Systems I. Field Results and Development of a Destocking Algorithm
Abstract:	This paper presents part of a study evaluating alternative management strategies to address effects of climatic variability on productivity and profitability in dryland sheep farming in New Zealand. The study included a field trial and the development and use of quantitative models of sheep grazing systems. Field research carried out to investigate and demonstrate key aspects of high performance sheep systems in dryland environments is briefly described and a summary of results presented. These demonstrate that it is possible to maintain high pasture quality throughout the growing season with a relatively high stocking rate, leading to rapid lamb growth and sale. Flexibility to change feed demand quickly when conditions dry may reduce the variability of income between years (i.e. reduce risk) in comparison to the average farm in the region represented by a regional monitor farm model. To explore effects of different flexibility options and embedded climate risk responses over a number of years, a de-stocking and marketing algorithm has been developed. This combines information on current and projected feed supply and demand, and the probability of rain from long range weather forecasts into a 'severity index' which affects how aggressively a farmer might react to a change in climate conditions. Soil moisture level in the top 25 cm of soil (SML25) is suggested as a 'trigger' variable to prompt a response in terms of sale of trading stock (lambs and cattle) or capital stock (breeding ewes and cows). The algorithm may be used as a stand-alone decision aid, in which case the farmer needs to enter a sale or disposal priority list of stock classes (which may change during the season), the current stock on hand and current feed supply (expressed as the number of days grazing available). The algorithm is designed to be used iteratively to manage stock sales and utilisation of feed to the end of the season. The algorithm has also been included in a sheep farm simulation model. Implementation and testing within the Lincfarm model, set up for a hypothetical farm, shows that the algorithm generates appropriate sales profiles for scenarios involving different feed supply situations. This illustrates that it is possible to simulate the complex interactions between animals, pastures and management components in dryland grazing systems to investigate tactical adjustments in risk management strategies. Long term impacts of alternative policy: risk response combinations are described in a subsequent paper. Key words: Dryland farming, Sheep, Cattle, Climate risk
Name of journal / Conference Proceedings	

/Workshop:	Agricultural System (accepted for publication)
Year of Publication:	2012/2013
Name lecturer/Authors:	Mathew G. Gicheha; Grant, R. Edwards; Stephen, T. Bell; Elizabeth, S. Burtt and Anthony C. Bywater
Title of publication:	Embedded Risk Management in Dryland Sheep Systems II. Risk Analysis
Abstract:	Climatic variability is a major constraint to improved productivity and profitability in dryland grazing systems. This paper reports the physical and economic benefits obtained from incorporating tactical responses in risk management strategies for dryland sheep production systems constrained by climatic variability. A total of 112 potential risk management strategy: response combinations were evaluated using the simulation model LincFarm. The strategies differed in stocking rate (SR; stock units (SU) ha-1), pasture type (legume or grass-based system), and stock classes. All strategies were evaluated at 10, 12, 14 or 16 SR, first without tactical responses and then with responses triggered when soil moisture levels fell to 10.0%, 12.5% or 15.0% in the top 25 cm soil. The results show that all strategies including tactical adjustments to management and marketing were economically superior to those that did not vary tactically. The difference in average returns between the best strategy with tactical responses and the best without is $336.04 ha-1 year-1, an increase of 40%. The value of including tactical responses in corresponding strategies ranged between 2.98% and 37.32%. This was in addition to tactical responses decreasing the variability of returns by between 19.74% and 67.38%. The combination of risk and return defines a risk-efficient frontier on which any individual farmer should find an optimal strategy which reflects their risk attitude. By including tactical adjustments additional strategies become risk-efficient and the number on the frontier increased from 5 to 11. Comparing the two sets of strategies showed that failure to incorporate tactical adjustments may result in sub-optimal risk management strategies being chosen whereas failure to accommodate risk attitude may change the strategy chosen, but not necessarily to one that is sub-optimal. The results suggest conventional ryegrass: clover pastures are risk efficient when management is aggressive (high stocking rate and later climate response) and that either conventional pasture systems or those with high nutritive value species are superior when management is more conservative. In all cases, retaining a proportion of flexible stock classes such as 2 year old cattle or a mob of older ewes is essential. The results also emphasise the importance of maintaining high pasture quality to ensure fast lamb growth rates and early drafting. Key words: Dryland farming; embedded risk; risk-efficient systems
Name of journal / Conference Proceedings /Workshop:	Agricultural System (accepted for publication)
Year of Publication:	2012/2013

Name of Lecturer/Authors:	Mathew G. Gicheha; Grant, R. Edwards; Stephen, T. Bell; Elizabeth, S. Burtt and Anthony C. Bywater
Title of Publication:	Modelling Alternative Dryland Sheep Systems
Abstract:	On the east coast of New Zealand, sheep and beef cattle are increasingly confined to dry hills and un-irrigated flat land as land suitable for irrigation is converted to other uses. Dryland farming is subject to variability in temperature and particularly rainfall between and within years with the most important risk being the point at which soils dry out and pasture production ceases in late spring/summer. Improving pasture and animal performance and, n particular, the consistency of productivity and profitability the face of a highly variable climate is complicated. The challenge is to utilise the 3-5 month window of opportunity for production between August and the end of the year to best advantage and without compromising the ability to feed ewes well in late summer/autumn prior to mating. Key variables in this context are high lamb growth rates in order to finish as many lambs as possible before the risk of dry conditions becomes too high, and flexibility to respond to the growing conditions as they unfold. The objective of this research were to investigate, and demonstrate, opportunities for improving dryland sheep systems through increased lamb output, high pasture quality and utilisation, and flexibility to respond to climate and feed conditions.
Name of journal / Conference Proceedings /Workshop:	Agricultural Economics Research Unit (AERU; Report No. 330), Lincoln University. Available at: http://www.lincoln.ac.nz/Research-at-Lincoln/Research-centres/Agribusiness-and-Economics-Research-Unit/AERU-publications/#669
Year of Publication:	2012/2013
Name of Lecturer/Authors:	Mathew G. Gicheha; Teo, E.S.; Rugoho, I.; Zhang S.J.; Cheng L.
Title of Publication:	Intercontinental Research Partnership in Food Sciences
Abstract:	Food around the world is prepared and eaten in various ways. However, health and safety plays a major concern regardless of how the food is processed and eaten. Food safety standards and codings give reassurance in food imports and exports. Food imports and exports partnership could influence the tendency of between countries collaboration in food science and/or nutritional researches. The behaviour of between countries collaboration is hypothesised to be related with the continents economic status. Online survey was conducted to analyse the differing levels of research partnership between countries by categorising the countries into six main continents – Africa, Asia, Australiasia, Europe, North America and South America with the economic status of the country being divided into either high, medium or low. The majority of the articles represented research done through partnerships of countries come from same income level. The least-utilised partnership was that among countries from different income levels. The findings obtained from the current study indicate limited cooperation

	in global food science research. Therefore there is need to explore ways of increasing such research collaborations.
Name of journal / Conference Proceedings /Workshop:	Journal of Agricultural Biosciences, 2: 4-7
Year of Publication:	2012/2013
Name of Lecturer/Authors:	Aggrey D.M. Thuo
Title of Publication:	Urbanisation in Nairobi's peri-urban areas, Kenya: Exploring how subaltern actions and do-it-yourself (DIY) strategies are evolving and creating order in new urbanization areas.
Abstract:	This paper explores land development issues in Nairobi rural-urban fringe. It is based on qualitative research approach and used Town Council of Karuri as a case study. This paper appreciates that land developments in an urbanising context such as in peri-urban areas need be understood at different scales, that's site or situational. Separating land development pressures is not easy and any attempt to classify them in this paper does not in any way show that they are independent of each other. The paper concludes that land use changes are contingent upon many factors, primary of which is population increase through natural growth and immigration. Population growth is thus a necessary pre- and continuing-condition for the land conversion. The process that produces population growth is however a subset of the structuration processes that produces land use changes in the peri-urban areas.
Name of journal / Conference Proceedings /Workshop:	International Journal of Education and Research
Year of Publication:	2013
Name of Lecturer/Authors:	Aggrey D.M. Thuo
Title of Publication:	Place of positionality, values, ethics and reflexivity in qualitative urban field work research.
Abstract:	This paper details my field work experiences during my doctoral research in Nairobi rural-urban fringe, Kenya. The field work was conducted before, during and after a period of election related violence. The paper details the choice of my methodology and also enumerates various decisions that I had to take during the field work when the situation was visibly bleak. The paper provides lessons and insights on how to negotiate different fields and positions in situations of instability and uncertainty during field work
Name of journal / Conference Proceedings /Workshop:	Journal Human and Social Science Research
Year of Publication:	2013

4. SCHOOL OF ARCHITECTURE AND BUILDING SCIENCES (SABS)

4.0 DEPARTMENT OF LANDSCAPE ARCHITECTURE

Name of Lecturer/Author(s): Carolyne W. Nthiwa and Mugwima B. Njuguna

Title of Publication: Designing for Sustainability in Cultural Landscapes: The Kaya Kinondo Forest of the Mijikenda Community, Kenya

Abstract:

Along the southern coast of Kenya, the sacred Kaya forests of the Mijikenda community are a living legacy of the people's history, culture and religion. In recent decades the Kaya forests have been shrinking in number and size. This research focuses on the traditional religious practices carried out among the Digo of the Mijikenda community. This investigation includes sacred natural sites, is limited to sacred forests and groves, and focuses particularly on how these practices have contributed to the conservation of the natural landscape. The research relied heavily on interviews and observations. Data was collected by use of interview schedules, photographs and sketches. Graphs were used to present the collected data for better comparison and understanding, while tables were used to depict the data collected from the interviews. The research established that traditional religious practices have greatly influenced the appearance of these sacred natural landscapes, enhancing their survival. It recommends development of an exhibition shrine in Kinondo to form part of the sacred Kaya Kinondo forest. This will ensure optimum input by all stakeholders under a coordinated program that realises a sustainable conservation agenda for traditional religious practices and the natural landscapes in which they take place.

Name of Journal/ Conference Proceedings/Workshop: Sustainable Futures: Architecture and urbanism in the global south. International Conference Kampala, Uganda June 27th – 30th 2012.

Year of Publication: 2012

5.0 INSTITUTE OF BIOTECHNOLOGY AND RESEARCH (IBR)

Name of Lecturer/Authors: S. Agili, A.B. Nyende, K Ngamau and P. Masinde.

Title of Publication: Selection, yield evaluation, drought tolerance indices of orange fleshed sweet potato hybrid clone.

Abstract:

Orange-Fleshed Sweet Potato (OFSP) varieties have high pro-vitamin A and medium amounts of iron and zinc. Drought susceptibility is perceived as one of the major drawbacks of this crop type and currently available varieties do not allow sustainable and enduring production in drought affected regions. Screening and selection for OFSP for drought tolerance could have a positive impact on the livelihood and health of vitamin A deficient people in Sub-Saharan Afica (SSA). In this study 18 OFSP genotypes from Lima, Peru and two Kenyan check cultivars, Marooko (drought tolerant) and K566632 (susceptible) were screened for drought tolerance at Kiboko (Latitude 010 15' S; Longitude 360 44' E; Altitude 975 masl) and Marigat (Latitude 0° 38, 0" N; Longitude 36° 5, 0" E; Altitude 970 masl) during the years 2008-2009. A split-plot

design was used with two levels of treatment, non-irrigated and irrigated as the main factor and the genotypes as the sub-factor. All the treatments were laid out in a randomized complete block design. Stress tolerance index was used to identify genotypes with high stress tolerance and high yield potential. In both site genotypes 194573.9, 420014, 440286, 189135.9, 187017.1 and 441725 showed high stress tolerance and yield potential compared with the check by registering higher stress index that ranged between 0.37- 0.96 and very low susceptibility index. The multidimensional preference analysis of the bi-plot distinguished the same genotypes as high yielding in both treatments imposed. Correlation analysis revealed that Yield potential (Yp) and Stress yield (Ys) had highly significant positive correlation coefficients with Stress Tolerance Index (STI), Mean Productivity (MP) and Geometric Mean Productivity (GMP) and they can be used as the most desirable indices for screening drought tolerance genotypes.

Name of Journal/ Conference Proceedings/ Workshop: Journal of nutrition and food sciences Vol 2-3.open access
Year of Publication: 2012

Name of Lecturer/Authors: Gichimu B.M., Gichuru E.K., Mamati G.E. and Nyende A.B.
Title of Publication: Selection of Ruiru 11 Hybrid Sibs based on Raw Coffee Quality.
Abstract: The economic value of Arabica coffee (Coffea arabica L.) is determined mainly by the yield potential, the size and shape of raw beans and beverage quality. Bean quality reportedly differs depending on the variety, environmental conditions and management practices. This study aimed at genetically improving raw bean quality of C. arabica cultivar Ruiru 11 through selection within the cultivar. The study also intended to measure the extent to which raw bean quality of Ruiru 11 is affected by the environment. Thirty four Ruiru 11 full-sibs grown in three locations in Kenya exhibiting strong edaphic and climatic differences were used for the study. The three sites were Mariene in Meru, Kisii and Koru. Rainfall amounts during various phases of berry development were used to explain the differences observed in discriminating abilities of the locations for raw bean quality traits. The results showed that beans of desirable AA and AB grades were obtained from Mariene where moderate moisture supply was received during berry expansion and bean filling stages rather than in high rainfall conditions. The best overall Ruiru 11 sibs were identified as R11-121, R11-93, R11-142, R11-52 and R11-71.

Name of Journal/ Conference Proceedings/ Workshop: African journal of Horticultural sciences 6: 72-82.
Year of Publication: 2012

Name of Lecturer/Authors: Gichimu B.M., Gichuru E.K., Mamati G.E. and Nyende A.B.
Title of Publication: Selection within Coffee Arabica cv. Ruiru 11 for high cup quality.
Abstract: In recent years, consumer awareness about the quality of different coffees has increased and therefore production and supply of coffee with excellent quality attach more significance. As a result, many coffee producing countries include coffee quality assessment in their coffee variety development programmes. The present study was undertaken to evaluate the variation of cup quality traits and determine their associations

with each other and with overall cup quality among the sibs of Coffea arabica L. cultivar Ruiru 11. In addition, the study targeted to select specific Ruiru 11 sibs with superior cup quality and wide adaptability based on assessment of 7 traits including fragrance, flavor, aftertaste, acidity, body, balance, preference and their total score. Thirty four full-sib families representing this hybrid cultivar grown in three different agro climatic zones of Kenya were used for the study. Rainfall amounts during various phases of berry development were used to explain the differences observed in the discriminating abilities of the locations for cup quality traits. The results showed that Ruiru 11 sibs were highly variable in all the cup quality traits except body. Site variations were also highly significant and the sibs were best differentiated in the sites where moderate moisture stress occurred during bean expansion and filling stages. Genotype by environment (G × E) interactions, were observed for all the traits except body. A highly significant positive correlation was registered between all traits. The study also demonstrated the existence of a high variation in cup quality among Ruiru 11 sibs. The most widely adapted Ruiru 11 sibs were identified to be R11-52, R11-117, R11-131, R11-107, R11-121, R11-11, R11-137 and R11-22.

Name of Journal/ Conference Proceedings/ Workshop: African journal of food sciences. Vol. 6 (18) pp 456-464.
Year of Publication: 2012

Name of Lecturer/Authors: Njeru MJ, Mugai EN, Njoroge G, and Nyende A.B.
Title of Publication: The impact of liming on biodiversity in Embu tea zones landscapes: A case study of Kavutiri area.

Abstract:

Biodiversity in agro-ecological zone UM1 on southern slopes of Mt. Kenya commonly termed as tea zones has been declining due to many factors among them soil acidification. In Embu tea zone specifically Kavutiri area, acidification has been increased by intensive agriculture without proper soil management. Soils have developed high acidity level ranging between pH 4.2 – pH 4.6. Whereas lime has been used in the past to reduce the soil acidity in many parts of the world, it has not been experimented for flora and fauna diversity in Kenyan acid soils. This research was conducted to test the effect of soil liming on biodi-versity in the acidic soils of Kavutiri area of Embu County. A randomized complete block design with four blocks and four treatment plots per block was laid out. The treatments comprised rates of lime which were broadcasted on plots as follows; 0 (L0), 2.4t/ha (L1), 6t/ha (L2), 8t/ha (L3). Soil, flora and fauna data were sampled 9 months after liming. Soil parameters that increased with increase in liming from L0 to L3 were pH, BS%, available phosphorus and exchangeable bases (Ca2+, Mg2+, K+ and Na+). However, ECEC, extractable Al and Mn decreased from L0 to L3. Flora characteristics within the treatment plots differed with particular species. Fauna diversity increased with increase in flora diversity. Limed plots had significantly ($p<0.05$) more benefits to biodiversity than the control plots. Liming level L2 gave the most recommendable results.

Name of Journal/ Conference Proceedings/ Workshop: African journal of Horticultural sciences 6: 61-71.
Year of Publication: 2012

Name of Lecturer/Authors: Gichimu B.M., Gichuru E.K., Mamati G.E. and Nyende A.B.
Title of Publication: Yield Selection within Coffea arabica cv. Ruiru 11. 2013.
Abstract:

Aims: This study was aimed at identifying high yielding Ruiru 11 sibs in varying growing conditions. The study also intended to measure the extent to which cherry yields of Ruiru 11 are affected by the environment. Study Design: Randomized Complete Block Design with three replications. Place and Duration of Study: The study was conducted in three different agro-ecological zones in Kenya namely Mariene in Meru County, Kisii near Kisii town in Kisii county and Koru in Kericho County between November 2008 and September 2011. Methodology: Thirty four (34) Ruiru 11 sibs, all of which are resistant to Coffee Berry Disease and Coffee Leaf Rust, were evaluated in this study alongside two entries of SL28,a cultivar susceptible to the two diseases. One entry of SL28 was sprayed with copper fungicides to control, while the other SL28 entry was not sprayed with any fungicides. Planted at a spacing of 2m by 2m, each entry had 12 trees per plot per rep, giving a total of 1296 plants per experiment per site. Cherry yield recording was done during the peak harvesting period of May to July at Mariene and July to September at Koru and Kisii. The data was subjected to Analysis of Variance (ANOVA) using XLSTAT version 2012 statistical software and effects declared significant at 5% level. Significant (P = .05) yield differences among Ruiru 11 sibs were obtained in all years of evaluation at Koru but only in 2011 at Kisii and Mariene. There was a greater discrimination between sibs at Koru, followed by Kisii and then Mariene. Year effect was highly significant (P < .001) and equally distinguished in all sites but year x sib interactions were significant (P = .05) only at Kisii. Combined analysis for all environmental combinations showed highly significant (P < .001) differences between sibs, environments and their interaction. Environments made a greater contribution (42.6%) to the variation compared to sibs (7%). The interaction term also made a significant contribution (18.7%). The best sibs per site and those adapted to contrasting environments were identified. The expression of high yield variation among Ruiru 11 sibs is a sign of high potential of intra-selection within the cultivar for yield improvement. Identified sibs can be recommended to farmers and also exploited in future breeding programmes for improvement of Ruiru 11 productivity and agronomic adaptability. The occurrence of significant sib by environment (G x E) interactions was an indication that the best improvement strategy should be a multi-site selection.

Name of Journal/ Conference Proceedings/ Workshop: American Journal of Experimental Agriculture 3(1): 76-88.
Year of Publication: 2012

Name of Lecturer/Authors: Asudi G., F. K. Ombwara, F. Wanzala, E.M. Ateka, A.B. Nyende, L.S. Wamocho.
Title of Publication: Evaluating diversity among Kenyan papaya germplasm using simple sequence repeat markers.
Abstract:

Papaya is an important fruit crop, produced in Kenya for local consumption and export. Despite a history of varietal introductions, no attempts concerned on developing varieties suited to Kenyan conditions have been documented. The objective of this study was to provide information on the

diversity of germplasm available in Kenya, as a precursor to systematic plant breeding program. Forty two papaya accessions were collected from farmers' fields located in Coast, Rift Valley, Western, Nyanza, Central and Eastern provinces. Genetic diversity was determined using seven simple sequence repeat (SSR) markers, computing allelic richness and frequency, expected heterozygosity and cluster analysis. Results indicated that the markers were highly polymorphic among the accessions, with polymorphic information content (PIC) varying from 0.75 to 0.852 with an average of 0.81. The genetic similarity among the 42 papaya accessions ranged from 0.764 to 0.932 with an average of 0.844 showing that most papaya accessions used in this study were closely related. About 96.9% of the pair-wise comparisons among papaya accessions exhibited genetic similarity greater than 0.802, while less than 4% (3.1%) showed genetic similarity lower than 0.802. The phylogenetic analysis grouped the 42 accessions into two main clusters A and B. Cluster A had four sub-clusters while cluster B had one cluster. Accessions from Coast, and some from Rift Valley Provinces, presented the highest variation, being scattered throughout the tree, with little or no differentiation from most accessions, whereas some accessions from Coast regrouped in clusters A (iv) and B. The genetic differences among the accessions revealed by the formation of distinct clusters suggest significant genetic variability emanation from varying sources of the papaya germplasm in Kenya. Although the level of genetic diversity revealed by SSR markers in this study is sufficient to distinguish between breeding lines for varietal protection, the rather narrow genetic diversity demonstrated indicates the need to introduce new germplasm or use other techniques such as mutation and genetic engineering to provide breeding materials for the future improvement of papaya in Kenya.

Name of Journal/ Conference Proceedings/ Workshop: African journal of food, agriculture, nutrition and development Vol. 13.no.1: 2013.

Year of Publication: 2013

Name of Lecturer/Authors: Tesfamichael A., A. B. Nyende, S. M. Githiri, R.W. Kasili. , W. Araia.

Title of Publication: Documentation of Sorghum (Sorghum bicolor L Moench) Landraces: Production, Utilization and Challenges in Eritrea.

Abstract: Grain Sorghum (Sorghum bicolor (L.) Moench) is the most important staple food crop in Eritrea. A study conducted in four sub regions (Hamelmalo, Segeneyti, Tesseney and Goluj) of Eritrea to determined farmers' perceptions on sorghum diversity, utilization, post harvest and production problems and their management practices using a semi-structured questionnaire and focused group discussions. A total of 190 sorghum growing farmers were randomly selected for this study. Results from the study showed that about 22 sorghum landraces were in active cultivation in the four sub regions, though there is a possible duplication in the naming of landraces. The naming of landraces was based on maturity dates, grain color, plant height and uses. Grain sorghum was used for home consumption in the form of injera (90%), bread (5%) porridge

(5%) and local alcoholic beverages (13%). Varieties with white and red grains were used mainly for injera and porridge while those with brown grains were used for local alcoholic beverages. Storage pests were the leading post harvest constraint in all the sub regions. Farmers reported various traditional pest management options which included treatment with ash and herbs; washing with water, sun dry and winnowing methods. Low yields (less than 1.0 t ha-1) were reported by farmers in all the sub regions. Drought was reported to be the leading production constraint (71%) followed by striga and diseases (17.9 %) and access to labour (3.2 %). Post flowering drought was the key yield reducing factor on farmers' field. The use of early maturing landraces and good adaptation to marginal areas coupled with some agronomic practices are the main options used by the farmers to mitigate drought. The results also indicated that 85.8 % of the farmers used their own saved sorghum seed for planting. The main criteria for seed selection were panicle and seed size, grain color and maturity dates. The panicles to be used as seed were selected when the sorghum plants reached physiological maturity.

Name of Journal/ Conference Proceedings/ Workshop: Journal of Agricultural and Biological Sciences.

Year of Publication: 2013

Name of Lecturer/Authors: Johnstone Neondo, Cecilia Mweu, Peter Njenga and Catherine Muthuri

Title of Publication: Phytochemical characterization, antibacterial screening and toxicity evaluation of Dichrostachys cinerea.

Abstract:

To provide scientific rationale to the traditional use of Dichrostachys cinerea as medicinal plant in Kenya, phytochemical analysis, antimicrobial screening and evaluation of toxic concentration levels of D. cinerea extracts were done. Qualitative assessment of phytochemicals, in vitro antimicrobial (selected bacteria and fungus) and brine shrimp toxicity assays were done. Explants (leaves, bark of stems and roots) were collected from D. cinerea trees growing in Jomo Kenyatta University of Agriculture and Technology (JKUAT) fallow land behind Botany laboratory. They were washed and then air dried under light exposure (27°C – 30°C for 14 days). A portion of each extracts was used for phytochemical screening. Sensitivity of different bacterial strains to various extracts was measured in terms of zone of inhibition using disc diffusion assay. Brine shrimps lethality test (BST) was used to predict the presence of bioactive compounds in the extracts. Methanol extracts contained all the tested phytochemicals while hot water extracts lacked steroids. Methanol and hot water extracts had no significant difference in terms of antibacterial screening. The LC50 value was found to be 2000ppm (parts per million). The results suggest that extracts of D. cinerea contain potential antibacterial and antifungal agents.

Name of journal / Conference Proceedings /Workshop: International Journal of Medicinal Plant Research Vol. 1 (4), pp. 032-037, September, 2012. Available online at www.internationalscholarsjournals.org © International Scholars Journals.

Year of Publication: 2012

6.0 INSTITUTE OF ENERGY AND ENVIRONMENTAL TECHNOLOGY (IEET)

Name of Lecturer/Author(s): P.M Njeru, J.T. Mailutha, E. Gatebe and C. Mburu

Title of Publication: Evaluation of safety culture maturity levels of the universities in Kenya.

Abstract:

Safety culture is shared and accepted attitudes, beliefs and practices supported by documented policies and procedures in an organization which influences employees' perceptions and behaviours within a workplace. Consequently, analysis of safety culture is vital in institutions in order to identify potential areas of improvement. The objective of this study was to evaluate safety culture maturity levels in universities in Kenya. Data was collected from seven universities where descriptive research design was utilized using simple and stratified random sampling methods. The tools used for data collection included questionnaires, observations and interviews. Similarly, secondary data was collected from universities strategic plans, policies and statutes. The data was subjected to statistical analysis using SPSS 16.0 and excel statistical packages. The results showed that six universities were in the emerging level (level 1) and one was in the managing level (level 2). The sampled universities recorded low average satisfaction levels ranging from 17.2% to 34.8%. The employees' perceptions were varied. The means of the key dimensions ranged from 1.90 to 3.68 with the average mean scores ranging from 2.42 to 3.49. Low safety perception on safety management in the universities was established. This was found to be as a result of the identified gaps in safety management systems which included invisible and weak top management commitment, unclear communication procedures, lack of adequate safety training and non-existence of safety rewarding systems. Based on these results, the study recommends an improvement on the identified weak safety management by the universities' management thus improving the employees' safety perception and satisfaction leading to an enhancement of safety culture maturity level. The role of universities top management and leadership in safety culture development in the universities in Kenya should be researched on to identify the weaknesses hampering their poor response. Key words: universities, safety culture, safety management systems, perception.

Name of Journal/ Conference Proceedings/Workshop: JKUAT Scientific Conference.

Year of Publication: 2012.

Name of Lecturer/Author(s): P.M. Njogu, J.J. Kitetu, R. N. Wanjau and M. Keriko

Title of Publication: Application of the perperst model in the prediction of environmental risks of endosulfan on oreochromis leocostictus. A case study of Lake Naivasha, Kenya.

Abstract:

The occurrence, concentration and spatial distributions of Endosulfan (6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepine-3-oxide) and endosulfan sulphate were studied in the Lake Naivasha basin during the months of May to December 2010. The aim of the study was to determine the concentration of endosulfan in the watercourse. Endosulfan sulphate was the most predominant with a range of 16.2 – 345 ng/L and a mean of 131 ± 110.2 ng/L, followed by endosulfan II 41.7 – 92.8 ng/L and a mean of 60.6 ± 20.3 ng/L,

and endosulfan | 20.1 – 57.9 ng/L and a mean of 34.3 ± 14.7 ng/L respectively. The measured exposure concentrations were translated into environmental risks factors using the PERPEST model Version 3.0. the model was calibrated using laboratory experimental data on exposure of O. Leocostictus to endosulfan in aquariums simulating Lake Naivasha. The environmental risks posed predicted as total endosulfan (∑Endosulfan). ∑Endosulfan ranged from 80.9 – 450 ng/L within the basin with a mean of 225.8 ± 129.1 ng/L. Results of the prediction were compared those obtained from microcosm laboratory experiments simulating the Lake Naivasha ecosystem to assess the accuracy of the model. The study shows that though the insecticide is not targeted to kill fish it has an adverse effect on the population of O. Leocostictus. The measured exposure concentrations can cause reduction in population of O. Leocostictus by between 0 – 6% in O. Leocostictus. Comparison of the results of the prediction that there is no significant difference between the results of obtained from the microcosm experiment at p = 0.05. The study shows that the model can be applied in environmental and toxicity studies of chemicals without the use of laboratory specimens. The study also explains the variability of aquatic organisms' populations in the lake can explain the current decline in populations of aquatic life in Lake Naivasha. Increased monitoring is thus recommended to detect inflow of toxic chemicals to safeguard aquatic life.

Name of Journal/ Conference Proceedings/Workshop: JKUAT Scientific Conference
Year of Publication: 2012.

Name of Lecturer/Author(s): Jalab Janmohamed Ashraph, Robert Kinyua, Fred Mugambi, Ahmed Kalebi

Title of Publication: Health effects of lead exposure among Jua Kali (informal sector) workers in Mombasa, Kenya: A case study of the "Express" Jua Kali workers

Abstract:

The objective of this study is to analyze the effects of lead exposure among the Jua Kali workers. Correlation study: relationship between lead exposure and its effects on blood lead levels (BLL), kidney function and haemoglobin levels between the lead-exposed versus the lead un-exposed workers. 162 adult Jua Kali workers participated. Out of 119 exposed workers, 8 (6.72%) were aware of lead while only 3 of them (2.5%) used protective equipment. The highest BLL in the test group was 32 µg/dl with 16 of them (13.45%) having BLL above 10 µg/dl. The mean BLL in this group was 6.76 ± 5.96. In the control group, the highest BLL was 9 µg/dl with none having BLL above10 µg/dl. The mean BLL was 2.58 ± 1.69. The spearman's correlation coefficient was 0.272 significant at 0.05 levels. 14 out of 119 (13.45%) exposed workers had impaired glomerular filtration rates (GFR). The mean GFR in the exposed workers was 104.85 ± 16.485. In the un-exposed workers, 1 out of 43 (2.4%) had impaired GFR. The mean GFR was 109.98 ± 15.408. The spearman's correlation coefficient was -0.113, not statistically significant. 21 out of 119 (17.6%) lead-exposed workers had haemoglobin (HB) less than 13 g/dl with mean HB of 14.12 ± 1.600. 1 out 43 (2.3%) in the control group had an HB of less than 13 g/dl with the mean HB of 14.37 ± 1.34. Spearman's correlation coefficient of negative 0.321 ($P<0.05$) implying significant inverse relationship. Recommendations: education on lead and its effects, provision of protective equipments, medical facilities to diagnose and manage lead and other heavy metal toxicity.

Name of Journal/ Conference Proceedings/Workshop: International Journal of Medicine and Medical Sciences Vol. 5 (1), pp. 24-29

Year of Publication: January 2013.

Name of Lecturer/Author(s): Benson H.K. Karanja, Rafael Ziegler, Christian Dietsche

Title of Publication: Toilet Monuments: An investigation of innovation for Human Development.

Abstract:

The article reviews the role of capability innovations, defined as the carrying out of new combinations of capabilities, in human development. Drawing on a recognized social innovation in sanitation – the ikotoilets of Kenya's Ecotact – the article makes a threefold argument. Firstly, indirect conversion factors are an important element in the success or failure of an innovation. In our sanitation case study, these factors help to explain why the public toilets in urban centres are a success story and those in the slums a story of difficulty. Secondly, not to take into account direct and indirect conversion factors is to commit explanatory commodity fetishism. Goods are taken as given. However, they are the product of human design, including options for capability impact, and this accordingly needs to be taken into account. Thirdly, applying the capabilities approach to innovation suggests that it is fruitful to distinguish analytically two different scaling strategies regarding the replication of capability innovations, which the article calls 'the lab' and 'the family' strategies.

Name of Journal/ Conference Proceedings/Workshop: Journal of Human Development and Capabilities.

Year of Publication: 2012.

SECTION E: APPENDICES

Table 1: A Total Number of Research Activities and Publications in 2011/2012 Academic Year

S/N	Faculty/ Institute/ School	Department	On-going Research	Completed Research	Publications	Total Research Activities and Publications
1.	*Science*	Statistics and Actuarial Sciences	4	1	2	***7***
		Pure and Applied Mathematics	13	0	0	***13***
		Chemistry	1	0	8	***9***
		Biochemistry	4	1	1	***6***
		Botany	0	0	0	***0***
		Physics	23	1	4	***25***
		Zoology	5	0	0	***0***
			50	***3***	***15***	**68**
2.	*Engineering*	Electrical and	15	6	28	***49***
		Mechanical	0	0	8	***8***
		Mechatronics	9	2	12	***23***
		Telecommunication	0	0	0	***0***
		Geomatic	0	0	0	***0***
		Civil	0	0		***5***
		BEED	8	1		***9***
			32	***9***	***48***	**89**
3.	*Agriculture*	Horticulture	0	1	0	***0***
		Food Science	2	7	0	***9***
			2	***8***	***0***	**0**
4.	*SHRD*	CES	1	2	2	***5***
		EPD	0	1	4	***5***
		Social Sciences	0	0	0	***0***
			1	***3***	***6***	**0**
5.	*ITROMID*	MLS	0	0	0	**0**
6.	*SABS*	Architecture	0	0	0	***0***
		Land Architecture	0	0	0	***0***
		Construction Management	0	0	0	***0***
			0	***0***	***1***	**1**
7.	*ICSIT*	Computing	0	0	0	***0***
		IT	0	0	0	***0***
			0	***0***	***0***	**0**
8.	*IBR*	N/A	0	0	0	**0**
9.	*Nairobi Campus*	N/A	0	0	0	**0**
10.	*Sports and Games*	*Sports and Games*	0	0	0	**0**
11.	*RPE*	N/A	0	0	1	**1**
Grand Total			***85***	***23***	***70***	***178***

Table 2: A Total Number of Research Activities and Publications in 2012/2013 Academic Year

S/N	Faculty/ Institute/ School	Department	On-going Research	Completed Research	Publications	Total Research Activities and Publications
1.	*Science*	Statistics and Actuarial Sciences	0	0	0	***0***
		Pure and Applied Mathematics	0	0	0	***0***
		Chemistry	1	0	5	***6***
		Botany	0	2	5	***7***
		Physics	3	0	5	***8***
		Zoology	50	15	55	***120***
			78	***19***	***65***	***141***
2.	*Engineering*	Electrical & Electronic	18	5	11	***34***
		Mechanical	0	0	0	***0***
		Mechatronics	9	1	14	***24***
		Telecommunication	0	0	0	***0***
		GEGIS	10	3	13	***26***
		Civil	0	0	0	***0***
		BEED	15	1	4	***20***
			52	***10***	***42***	***104***
3.	*Agriculture*	Horticulture	6	2	24	***32***
		Food Science	8	2	15	***25***
		Land Resource	9	1	15	***25***
			23	***5***	***54***	***82***
4.	*SHRD*	CES	0	0	0	***0***
		EPD	0	0	0	***0***
		Social Sciences	0	0	0	***0***
			0	***0***	***0***	***0***
5.	*COHES*	Biochemistry	24	4	0	**28**
			24	***4***	***0***	***28***
6.	*SABS*	Architecture	0	0	0	***0***
		Land Architecture	5	4	1	***10***
		Construction Management	0	0	0	***0***
			5	***4***	***1***	***10***
7.	*ICSIT*	Computing	0	0	0	***0***
		IT	0	0	0	***0***
			0	***0***	***0***	***0***
8.	*IBR*	N/A	**11**	**4**	**8**	***23***
9.	*IEET*	N/A	**10**	**3**	**4**	***17***
10.	*Nairobi Campus*	N/A	0	0	0	***0***
11.	*Sports and Games*	*Sports and Games*	0	0	0	***0***
12.	*RPE*	N/A	0	0	0	***0***
Grand Total			***179***	***45***	***174***	***405***

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