



**University of Nairobi**  
**College of Agriculture and Veterinary Sciences**

**Faculty of Veterinary Medicine**  
**8th Biennial Scientific Conference**  
**and**

**The 46th Kenya Veterinary Association Annual Scientific Conference**  
**and**

**The 12th World Veterinary Day Celebrations**

# **Programme and Abstracts**

**THEME:**

**Evolving the veterinary profession towards  
safeguarding the human well-being  
in a dynamic environment**

**25 - 27 April, 2012**  
**Safari Park Hotel, Nairobi-Kenya**

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Time	EVENT/PRESENTATION	
<b>DAY 1: WEDNESDAY 25TH APRIL 2012.</b>		
8.00	Registration	
	<b>Plenary session A. Chair : Prof. Mulei</b>	
8.30	Welcome address <i>Chairman, scientific committee</i>	
8.45	The role of veterinary Training in achieving vision 2030 <i>Njenga munene</i>	
9.15	Key note address: The role of research in achieving vision 2030. <i>Gituro Wainana</i>	
9.45	Challenges to animal resources industry in Africa <i>Ahmed –El- Sawalhy, AU IBAR.</i>	
10.15	One health and climate change <i>Bernard Vallat, OIE.</i>	
10.45	Discussion	
11.00	<b>Opening Ceremony.</b> <b>Master of ceremonies: Prof Susan Mbugua</b> Chairman, organizing committee- Prof. Peter K. Gathumbi Chairman Kenya Veterinary Association- Dr. Elizabeth Ouko Chairman Kenya Veterinary Board - Dr. Joseph Omega Director Veterinary Services - Dr. Peter Ithondeka Acting Dean, Faculty of Veterinary Medicine - Prof. Charles Mulei Principal, College of Agriculture and Veterinary Services - Prof. Agnes Mwangombe Deputy Vice-Chancellor, RPE- Prof. Lucy. Irungu Vice- Chancellor Guest of Honour: Minister for Higher Education- Prof. Margaret Kamar	
11.45	<b>Tea break and poster session</b>	
	<b>Session 1: Climate change.</b> <b>Chair: Dr. Mande</b>	<b>Session 2:</b> <b>Drugs and ethnomedicine.</b> <b>Chair: Prof. Gareth Bath</b>
12.15	Importance of camels in adapting to climate change in ASAL areas of Kenya <i>Machuchu D.M., Onyango D.A., Chuchu S.M., Namatsi J.O., Gluecks I. V. and Maloo S. H.</i>	The invitro ascaricidal efficacy of <i>erythrina abyssinica</i> extracts <i>Lagu C.</i>
12.30	Climate change vulnerability, adaptation and mitigation of livestock systems in Kenya <i>Nanyingi M. O., Kiama S. G., Thumbi S. M. and Muchemi G. M.</i>	Anti-microbial activity and biochemical constituents of <i>Pycnoporus sanguineus</i> , a medicinal mushroom of Mid-Western Uganda <i>Nakalembe, I.</i>

12.45	Perspectives on the veiled potential of the one-humped camel ( <i>Camelus dromedaries</i> ), and its perceived future role in mitigating the devastating effects of climate change and in enhancing ASAL livelihoods in Kenya <i>Wamwere Njoroge, G.J.</i>	Cytotoxicity of antimalarial plant extracts from Kenyan biodiversity to the Brine Shrimp, <i>Artemia salina</i> L. (Artemiidae) <i>Nguta, J.M., J.M.Mbaria, D.W.Gakuya, P.K.Gathumbi, J.D.Kabasa, S.G.Kiama.</i>
13.00	Discussions	Possible effects of distribution conditions on efficacy of veterinary drugs, chemicals and biologicals in Uganda <i>Okello, S. and Ekou, J</i>
13.15		Antibacterial sensitivity of water and ethanol extraction of some herbal plant remedies used by the Gabra community of Marsabit District, Kenya <i>Wamwere Njoroge, G.J. Gathuma, J.M, Njeruh, F.M. and2 Katala, P.M.</i>
13.30		An evaluation of marketed anthelmintic products and user information in central and north rift regions of Kenya <i>Nginyi, J.M., Mugambi, J.M., Ogali, I.N., Njanja, J.C .and Lumumba, P.L.</i>
13.45		Discussions
15.00	<b>Lunch break and poster session</b>	
	<b>Session 3. Food safety and security.</b> <b>Chair: Dr. Allan Asegele</b>	<b>Session 4. Animal welfare.</b> <b>Chair: Dr Kimwele</b>
16.00	The properties of potential camel lactobacilli cultures for yoghurt production. <i>Akweya B. Kamau. Gitao C.G.</i>	Animal welfare challenges in Africa and mitigating measures <i>Nick De Souza</i>
16.15	Challenges and opportunities for clean milk production in the arid and semi-arid areas (ASALs) of Kenya <i>Gitao C.G., Ngeiwa K. and Wanjohi M.</i>	Recent developments on effective anthelmintic use in sheep and goats <i>Bath G.F</i>
16.30	An analysis of indigenous chicken value chain (ICVC) in Makueni <i>Kabuage et al.</i>	Challenges in the Smallholder (zero-grazing) Production Systems of Nairobi and its Environs: A Welfare Perspective <i>Aleri, J.W. J.M. Nguhiu., E.M. Mogoia and C.M. Mulei.</i>
16.45	Enhancing the Milk Market Supply Chain in the Wajir County <i>Owuor G.A</i>	The challenges of balancing between productivity and claw health of dairy cows in modernized husbandry in smallholder farming units <i>Nguihu-Mwangi, J., Mbithi, P.M.F., Wabacha, J.K., Mbuthia, P.G.</i>

17.00	Effective use of rice fields for wider variety of food production. <i>Nyunja, C.</i>	Combating animal disasters through veterinary response units: a UoN initiative” <i>Mutembei HM and Mulei CM</i>
17.15	Influence of agricultural knowledge on drought-flood disaster preparedness through strategic crop production in Budalang’i, Kenya <b>Barasa J.K. and Wangia S.M.</b>	Wildlife welfare: Can the care of individual animals be good animal welfare compatible with the ‘one health’ approach, and also with the wider conservation goals. <i>Ian Robinson</i>
17.30	Discussion	Discussion
17.45	<b>Tea break and poster session</b>	
<b>DAY 2: THURSDAY 26TH APRIL</b>		
	Plenary D. <b>Chair: Prof Njenga Munene</b>	
8.30	One health concept: Challenges to livestock industry in developing countries. <i>Rweyemamu</i>	
9.30	Key note address- changing technologies in research <i>Njenga Kariuki</i>	
10.00	Contribution of animal resources to food security - FAO	
10.30	Effect of climate change on animal production - <i>DG ILRI</i>	
11.00	Current Status on HIV AIDS Vaccine development <i>Thumbi Ndung’u</i>	
11.30	Discussion	
11.45	Sponsor’s presentation- Assia Bimeda	
12.00	Tea break and poster session	
	<b>Session 5: Animal production, and management. Chair: Prof. Lucy Kabuage</b>	<b>Session 6: Parasitology. Chair: Dr Njagi Obadiah</b>
12.30	The potential use of moringa oleifera Lam. As poultry feed supplement in Kenya <i>Gakuya D.W., S.G. Kiama, J.M. Mbaria, P.N. Mbugua , P.K. Gathumbi, M. Mathiu.</i>	Occurrence and lesions associated with Echinostoma Revolutum in free-range indigenous chickens in Kenya <i>Kyalo, M.M. P.G. Mbuthia,. Maingi, P.n. Nyaga, L.W. Njagi, et al.</i>
12.45	M. Effects of management practices and Economic stimulus program on fish production in Mwea Division of Kirinyaga County <i>Maina, J.G., Mbuthia, P.G., Ngugi, J. N., Karuri, E.G. et al.</i>	Prevalence of haemoparasites in free-range local ducks <i>Mavuti, S.K.2P.G.Mbuthia, R.M.Waruiru, L.W.Njagi, et al.</i>

13..00	Integration of camel research and development in the veterinary profession in Kenya and future <i>Ngeiywa K J and Njanja J C.</i>	Prevalence, intensity and pathological lesions associated with contraecum species infection in farmed and wild catfish in the upper Tana River basin, Kenya <i>Mathenge, CG, P.G Mbuthia., RM Waruiru, TA Ngatia, et al.</i>
13.15	Spermiogenesis and sperm ultrastructure of lake magadi tilapia <i>Alcolapia grahami</i> (teleostei, perciformes, cichlidae). <i>Papah, M.B., Seth M. Kisia, Rodi O. Ojoo, Andrew N. Makanya, Daniel W. Onyango.</i>	Prevalence and pathology of echidnophaga gallinacea in free-range local ducks <i>Mavuti, S.K., P.G.Mbuthia, R.M.Waruiru., L.W.Njagi et al.</i>
13.30	Good and bad co-infections; impact on growth and survival of zebu cattle under one year <i>Thumbi SM2, Poole J, Kiara H, Jennings A, et al.</i>	
13.45	East African Zebu as a dairy cow <i>Mburu JN and Mbuku SM.</i>	Discussions
14.00	Discussions	Sponsor's presentation
14.15	Lunch break and poster session	
15.15	KVA Annual general meeting , Excursions/Tours	
<b>Day 3: FRIDAY 27TH APRIL</b>		
	<b>Session 7: One health.</b> <b>Chair: Prof Njenga Kariuki</b>	<b>Session 8: Veterinary education and policy.</b> <b>Chair: Sam Oketch.</b>
8.30	A Temperature Resistant Needle Free Vaccine against Tetanus <i>Amuguni, H. Sangun Lee, S., Brown,D., Keusch,G., Onensheinand, A., and Tzipori, S.</i>	Teaching and learning approaches that promote the achievement of vision 2030 for the agriculture sector <i>Maina, J.G., Ambuko, J. L., Lopokoyit, M. and Cheminingwa,G.N.</i>
8.45	Association between virulence and specific genomic characteristics of predominant <i>Mycobacterium tuberculosis</i> Uganda genotypes <i>Muzoora Saphan.</i>	A model for good veterinary governance: Overview of draft veterinary policy <i>Karugu, D.K.</i>
9.00	Environmental impact of traditional gold mining in Tigray province, Ethiopia: Some effects on health of animals and human beings <i>Gebresilassie S.</i>	CPD for veterinarians working in Africa <i>Darbon C. J. and Ojigo D.O.</i>

9.15	A one health approach to infectious disease outbreak investigation and response: an overview of the USAID/RESPOND project <i>Amuguni, H.</i>	“Veterinary forensic medicine: an emerging and important discipline” <i>Cooper, J.E., Coop M.E., Nyaga, P.N., Gathumbi, P.K., Mbuthia, P.G., Njagi, L.W. and Githigia S.M.</i>
9.30	One health East and Central Africa: current status. <i>Thaiyah, A.G., Mwanthi, M.A. and Koskei, P.</i>	
9.45	Combination adjuvants: The next generation of adjuvants? <i>Mutwiri, G., Sylvia van Drunen Littel-van den Hurk and Volker Gerds.</i>	
11.00	Discussions	
11.15	Tea break and poster session	
	<b>Session 9 Wildlife and wildlife diseases.</b> <b>Chair: Dr. Gakuya F.</b>	<b>Session 10: Animal health.</b> <b>Chair: Dr Varma VJ</b>
11.45	The African Green Monkey ( <i>Cercopithecus Aethiops</i> ) As a non-human primate model for infections with <i>Cyclospora Cayetanensis</i> <i>Nguhii P. N.</i>	The risk factors associated with FMD and CBPP outbreaks in Uganda’s cattle corridor <i>Angubua, S.</i>
12.00	Factors associated with morbidity and mortality in selected ungulate species in Al Ain wildlife park and resort, United Arab Emirates <i>Chege S. M, Muchemi, G and Kitala, P.</i>	How to treat osteoarthritis medically in the horse – A review. <i>Marais J.</i>
12.15	Historical perspectives of lesser flamingo mortalities in Kenya <i>Manyibe, T.N and Gathumbi, P.K Ngati, T.A, Bebora, L., Muchemi, G.</i>	Experimental infection of PPR in Goats in Kenya <i>Gitao C.G., Kihu S., and Maina S. M.</i>
12.30	Application of GPS/GSM/satellite collars for monitoring elephant ( <i>Loxodonta africana</i> ) populations in Kenya. <i>Mijele D., Gakuya, F., Lekool, I. Omondi, P. and Kiamb, S.</i>	Integrating Mobile Tools for Surveillance, Reporting and Information Management by Veterinary Services in Kenya <i>Ojigo D.O and Daborn C.J.</i>
12.45	Unusual mortalities of Eastern Black Rhinoceros ( <i>Diceros bicornis michaeli</i> ) due to Clostridial Enterotoxaemia in Ol Jogi Pyramid Sanctuary, Kenya <i>Ndeereh, D.</i>	Management of Bovine Papillomatosis using an Autogenous Vaccine: A Case Study in Bukura Agricultural College, Western Kenya <i>Lubembe D. M., Githigia S. M., Chogo P., Athumani H. M. and Kitaa J. M.</i>



13.00	Human wildlife conflict in Samburu County: One Health approach to an integrative ecosystem study <i>Ogara, W.O. Nduhiu, G.</i>	Evaluation of Abattoir Surveillance System for Zoonoses in Western Province, Kenya <i>Nelima, K., Osoro, E., Mutonga, D., Omolo, J, Monday, B., Jared, M., Mbaabu, M., Kariuki, N., Monica, M., and Ohuabunwo, C</i>
13.15	Conservation medicine in the African context <i>Manyibe T.N Muriuki S and Gathumbi, P.K.</i>	Discussions Sponsor's presentations
13.30	Discussions	Sponsor's presentations
13.45	Lunch Break	
	Plenary session C. <b>Chair: Dr. Paul Rwambo</b>	
14.45.	Financing and global policy <i>Peter Sturesson-EU</i>	
15.00	African challenges in resourcing agriculture for the development of livestock sector <i>Gabriel Nagatu</i>	
15.15	KVB presentation <i>Chairman KVB</i>	
15.30	Discussions	
15.45	Sponsors session	
16.00	Annual welfare and equine UoN prize presentation. - <i>Donkey sanctuary.</i> <i>Chair: Dean FVM</i>	
16.15	Kenya Veterinary Board awards <i>Chair: KVB</i>	
16.30	<b>Closing ceremony</b> <b>Master of ceremonies: Dr. Christopher Wanga</b>  Chairman, organizing committee - Prof. Peter K. Gathumbi Acting Dean, Faculty Veterinary Medicine - Prof. Charles M. Mulei Kenya Veterinary Association Chairman - Dr. Elizabeth Ouko Director of Veterinary Services - Dr. Peter Ithondeka Guest of Honour - Mugo Kibati Vote thanks - Dr Sebensa Wekesa	

<b>DAY 4: SATURDAY 29TH APRIL 2012</b>	
	<b>World Veterinary Day Celebrations Mwalimu Farm, Njiru, Nairobi County</b>
7:00	Departure from Kabete
8:00 - 9:00	Arrival and registration of participants at Mwalimu Farm, Njiru
9:00 – 12:00	<p style="text-align: center;"><b>Public viewing of thematic displays from</b></p> <ol style="list-style-type: none"> <li>1. Government Departments</li> <li>2. Non-Government Organizations</li> <li>3. Pharmaceutical Industry</li> <li>4. Livestock Marketing</li> <li>5. Kenya Veterinary Association</li> <li>6. University of Nairobi</li> <li>7. Livestock Products</li> <li>8. Extension Services</li> <li>9. Herd Health</li> <li>10. Cultural Focus</li> </ol>
10:30 - 12:00	<p>Arrival of the Guest of Honor  <b>GUEST OF HONOUR:</b> Hon. Dr. Mohammed Kutu EGH, MP  Minister for Livestock Development</p> <p><b>Accompanied by:</b>  Dr. Peter Ithondeka, Director of Veterinary Services  Dr. Elizabeth Ouko, Kenya Veterinary Association  Provincial Director of Veterinary Services, Nairobi  Dr. Christopher Wanga, Africa Veterinary Association  Dr. Joseph Omega, Kenya Veterinary Board  Prof. Charles Mulei, Acting Dean - FVM, University of Nairobi  District Veterinary Officer</p> <ul style="list-style-type: none"> <li>• All Public &amp; Participants seated</li> <li>• Entertainment</li> <li>• Tour of the Display Tents</li> </ul>
12:00 – 14:00	Refreshments Speeches Vote of thanks
<b>14:30 – 17:00</b>	<b>Departure</b>

### Rappoteurs

Dr Mande-chief rapporteur  
Dr. Sangula  
Dr. Onyango Diana  
Dr. Caroline Muneri

Dr. Mugambi J.M-deputy rapporteur  
Dr Sambuni Alex  
Ngeiwa kisa Juma

## Poster presentations

**P01. Impact of Participatory Integrated Community Development (PICD) tools in pastoral research and development.**

*Wamwere Njoroge G.J.*

Community Development Officer, GoK/ADB ASAL Based Livestock and Rural Livelihoods Support Project (ALLPRO), Ministry of Livestock Development, P.O. Box 34188, 00100, Nairobi, Kenya. : E-mail; [gwjnjoroge@yahoo.com](mailto:gwjnjoroge@yahoo.com)

**P02. Using research outputs for sustainable community development: Lessons learnt in camel milk studies in Kenya.**

*Wamwere Njoroge G.J.*

Community Development Officer, GoK/ADB ASAL Based Livestock and Rural Livelihoods Support Project (ALLPRO), Ministry of Livestock Development, P.O. Box 34188, 00100 Nairobi, Kenya. E-mail; [gwjnjoroge@yahoo.com](mailto:gwjnjoroge@yahoo.com)

**P03. Tick species on cattle and African buffaloes in the Tsavo Conservation Area, Kenya**

*Edward K. Kariuki<sup>1</sup>, 2, Banie L Penzhorn<sup>2</sup>, Ivan G. Horak<sup>2</sup>*

**P04. Dimorphic yeast fungi infections in beef cattle.**

*Kuria JKN and Gathogo S.M.*

**P05. Dairy goat health problems affecting milk production in Meru, Nyeri and Embu counties.**

*Mbindyo C. Toroitich K.C., and Gitao C.G*

**P06. Camel health problems affecting milk production in Garissa.**

*Toroitich K.C. Mbindyo C. and Gitao C.G.*

**P07. The possible effects of camel milk on management of diabetes type I.**

*Gitao C.G., Toroitich K.C. and Mbindyo C.*

**P08. Experiences of camel health management in Botswana.**

*Gitao C.G. and Field C.*

**P09. Veterinary surgeons and veterinary paraprofessionals act 2011: its impact on meat hygiene, quality control and marketing.**

*Ogara, W.O. and Ngethe, E.*

**P10. Foot and Mouth disease manifestation from a ‘cattle boma’ in South Sudan**

*Gitao C.G. and Chepkwony E.C.*

**P11 Gastrointestinal parasites and other endoparasites of indigenous chickens traded in Nairobi, Kenya. Maina,**

*A.N. R.M. Waruiru, T.A. Ngatia, P.G. Muthia and W.K. Munyua.*

**P12 Effects of medicated urea-molasses block supplementation on productivity and gastrointestinal nematode infections of sheep in Nyandarua District, Kenya**

*R.M. Waruiru\*, W.K. Munyua, R.O. Otieno, M.N. Mutune, V.M. Gichohi and R.N. Gitari*

**P13. Effects of copper oxide wire particles for the control of gastrointestinal nematode infections in indigenous goats**

*R.M. Waruiru\*, J.C. Nganga, W.K. Munyua, M.N. Mutune and R.O. Otieno*

## ORAL PRESENTATIONS

### CLIMATE CHANGE

#### **01. Importance of camels in adapting to climate change in ASAL areas of Kenya**

*Machuchu D.M., Onyango D.A., Chuchu S.M., Namatsi J.O., Gluecks I. V. and Maloo S. H.*  
Vétérinaires sans Frontières Switzerland (VSF-Suisse), P.O. Box 25656 – 00603, Nairobi, Kenya

##### **Abstracts**

Over 70% of Kenya's land mass consists of arid and semi-arid lands (ASALs). Camels are well adapted to the arid conditions of the ASALs and are reared in various pastoral communities in Northern Kenya. The dromedary is an important part of their livelihood, essential to their subsistence economy. Through camels, income to the household is generated through the sales of milk, meat, hides, animals, transport services and the camel represents a saving bank. Furthermore, camel milk and meat are available for household food consumption. Milk is the most important product of the camel, and contributes between 50 – 60 % of the nutrient intake of some of the pastoralist communities. Recently with move of ethnic communities towards urban centers, more camel milk is in demand in cities and towns hence creating an issue on public health and hygiene matters. Furthermore with the occurrence of frequent droughts, many traditional cattle keeping communities find it difficult to cope with the changing climatic conditions and tend to diversify their herd composition by adopting camels. VSF-Suisse is currently supporting camel keeping communities with issues related to health, husbandry, products and marketing – even the introduction of camels into non-traditional camel keeping communities as means of coping strategy. This paper discusses the methodology, interventions, preliminary results, share experiences and lessons learnt as well as recommendations which focus on using the camels to mitigate against drought and for the pastoralists to adapt to climate change effects in the Arid and Semi- arid lands of Kenya.

#### **02. Climate change vulnerability, adaptation and mitigation of livestock systems in Kenya**

*Nanyingi M.O\*<sup>1,3,4</sup>, Kiama S.G<sup>2</sup>, Thumbi S.M<sup>5</sup> and Muchemi G.M<sup>3</sup>.*

<sup>1</sup>Ministry of Livestock and Development, District Veterinary Office, PO BOX 60 -50135, Khwisero, Kenya, <sup>2</sup> Wangari Maathai Institute for Environmental Studies and Peace, College of Agriculture and Veterinary Science, University of Nairobi PO BOX 30197 Nairobi, Kenya, <sup>3</sup> Department of Public Health, Pharmacology and Toxicology, Faculty of Veterinary Medicine, University of Nairobi PO BOX, 30197 Nairobi, Kenya, <sup>4</sup> Colorado State University Fort Collins, <sup>5</sup> Centre for Immunity, Infection and Evolution, University of Edinburgh.

##### **Abstracts**

In Kenya, global circulation models predict that, by the year 2100, climate change will increase temperatures by about 4°C leading to massive crop failure, reduced availability of forage and water, livestock mortality and loss of livelihoods. Consequently vast economic impacts are expected, because of higher vulnerability and the exceeding magnitude of future hazards to the adaptive capacity of vulnerable communities. Historically livestock keepers have developed adaptive measures that include traditional early warning systems, use of emergency fodders, multi-species composition of herds and nomadic mobility to reduce their vulnerability. However, lack of understanding of the drivers of climate change due to inconsistent weather data remains a major challenge causing unreliable and inaccurate prediction of climate change patterns. It is important to identify replicable and cost effective mitigation activities to strengthen the adaptive capacities to climate change of

affected communities. Here we review strategies to bridge the knowledge gap in understanding the present and future impacts of climate change on indigenous livestock production systems and options of adaptation to and climate change mitigation based on the indigenous knowledge. We propose a systematic methodology to study vulnerability in the context of multiple stressors and the potential for utilization of participatory mapping tools, geographic data and predictive models of infectious disease burden for anticipatory and reactive adaptive preparedness. The overall thrust of the review is to improve the ability of vulnerable people and their livestock to be more resilient to current climate variability and their decision-making to climate change.

Key words: Climate change; Livestock; Adaptation; Kenya

### **O3. Perspectives on the veiled potential of the one-humped camel (*Camelus dromedaries*), and its perceived future role in mitigating the devastating effects of climate change and in enhancing ASAL livelihoods in Kenya**

*Wamwere Njoroge, G.J.*

Community Development Officer, GoK/ADB ASAL Based Livestock and Rural Livelihoods Support Project (ALLPRO), Ministry of Livestock Development, P.O. Box 34188, 00100 Nairobi, Kenya, E-mail; [gwjnjoroge@yahoo.com](mailto:gwjnjoroge@yahoo.com)

#### **Abstracts**

This paper gives a synthesis that attempts to lay bare the enormous untapped treasure inherent in the mysterious *C. dromedaries* (alas “Desert Car”), with specific emphasis on ASALs zones of Kenya. Historically, droughts have manifested a well known phenomenon of predictable cyclic occurrence, a character that had enabled ASAL dwellers to develop coping strategies that had served them well for generations. To the contrary, empirical research in the recent years has shown that as a consequence of the adverse effects of climate change and global warming, the droughts will henceforth be marked with the triple character of being more frequent, prolonged and intensive. This coupled with unchecked population increase has led to devastating effect on both national and household food security, especially to the residents of Arid and Semi-arid Lands, who utterly rely on only livestock, hence a mono livelihood source.

Among the domesticated animal species, the camel is the only creature that can stand in the gap and provide a worthy alternative to this grim scenario. It therefore the conclusion of this analysis that due to the demonstrated camel superior traits compared to other livestock species that include: the assured survival and continued productivity even in extreme climatic conditions and proven value of camel milk as healthy food are just some few indicators to the future role of the camel in mitigating the unstoppable negative effects of climate change and in enhancing livelihoods both within and without their traditional areas.

## **DRUGS AND ETHINOMEDICINE**

### **O4. The invitro ascaricidal efficacy of erythrina abyssinica extracts**

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## Abstracts

The antihelminthic efficacy of *Erythrina abyssinica* (Leguminosae) used in the control of worms in indigenous chicken was conducted in the Pharmacology Department of Faculty of Veterinary Medicine, Makerere University. The study hypothesized that Plants with known but undocumented anthelmintic activity exist in the south western agro-ecological zone of (SWAEZ) of Uganda. The efficacy of medicinal plant varies with the location in the SWAEZ. The study aimed to investigate the invitro efficacy of *Erythrina abyssinica* against *Ascaridia galli*. *Ascaridia galli* was used as a model for the in vitro study. The research findings showed that the leaves, root bark and stem bark had activity against *A.galli* ( $P < 0.05$ ). Leaves extracts had comparable efficacy to conventional *piperazine citrate* with minimum dose level of 2.30-9.69 mg/ml to achieve 50% mortality (ED50) compared to stem barks (2.93-13.57mg/ml) and root barks (7.99-24.39 mg/ml). There was statistically insignificant differences ( $p > 0.05$ ) in activity against *Ascaridia galli* by root barks, stem barks and leaves extract across districts in Bushenyi, Mbarara, Ntungamo and Rakai. The study validates the use of *Erythrina abyssinica* by the farmers to control worms in local chicken. The study recommends further study to undertake acute toxicity tests to establish safety of the plant extracts. The use *Erythrina abyssinica* leaves other than root or stem is sustainable way of conserving the plant.

Keywords: Antihelminthic, *Erythrina abyssinica*, *Ascaridia galli*, Effective dose (ED50), Motility

## **O5. Anti-microbial activity and biochemical constituents of *Pycnoporus sanguineus*, a medicinal mushroom of Mid-Western Uganda**

Nakalembe, I.

### Abstracts

As a contribution towards search of alternative medicine against emerging resistant pathogenic strains, this study aimed at exploring the antimicrobial activity and identification of the potential bioactive compounds in the commonly used medicinal mushroom (*Pycnoporus sanguineus*). To achieve this target, the fractions were obtained from methanol and petroleum ether crude extracts and tested in vitro for antimicrobial activities against selected bacterial strains and fungi. The bioactive compounds were identified by GC-MS. Gram positive bacteria were more sensitive to than the gram negative ones. Similarly, methanol fractions had high activity than petroleum ether. Isolated fractions had a MIC value ranging between 12.5  $\mu\text{g mL}^{-1}$  to  $>200 \mu\text{g mL}^{-1}$  for bacteria and 12.5-100  $\mu\text{g mL}^{-1}$  for a fungus. Interestingly, *Pseudomonas aeruginosa* and the multidrug resistant strains of *Staphylococcus aureus*, MD were also sensitive to these fractions as observed by the zones of inhibition. Several bioactive compounds were identified including aliphatic compounds, naphthalene, 2-pentanone, 4-hydroxy-4-methyl- and fatty acids among others. This diversity highlights this mushroom as a good candidate for prospecting for novel bioactive compounds against many emerging multi-resistant strains, particularly those of *S. aureus* and *P. aeruginosa*. Furthermore, the presence of high content of aliphatic hydrocarbons and naphthalene puts this mushroom species on the “myco-diesel” map and a favorable candidate for potent insecticides search, respectively.

**Key words:** Mushroom, fraction, bioactive compounds, bacteria, Uganda

## **O6. Cytotoxicity of antimalarial plant extracts from Kenyan biodiversity to the brine shrimp, *artemia salina* l. (artemiidae)**

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### Abstracts

**Background:** *Artemia salina* (Artemiidae), the brine shrimp larva, is an invertebrate used in the alternative test to determine toxicity of chemicals and natural products. **Design and methods:** In this study the Medium Lethal Concentrations (LC50 values) of 45 antimalarial plant extracts and positive controls, cyclophosphamide and etoposide were determined using *Artemia salina* (Artemiidae). **Results:** Out of the 45 organic extracts screened for activity against *Artemia salina* larvae, 23 (51%) of the crude extracts demonstrated activity at or below 100 µg/ml, and were categorized as having strong cytotoxic activity, 18 (40%) of the crude extracts had LC50 values between 100 µg/ml and 500 µg/ml, and were categorized as having moderate cytotoxicity, 2 (4.5%) of the crude extracts had LC50 values between 500 µg/ml and 1000 µg/ml, and were considered to have weak cytotoxic activity, while 2 (4.5%) of the crude extracts had LC50 values greater than 1000 µg/ml and were considered to be non toxic. Approximately 20% (9) of the aqueous extracts demonstrated activity at or below 100 µg/ml and were considered to have strong cytotoxic activity, 40% (18) of the screened aqueous crude extracts had LC50 values between 100 µg/ml and 500 µg/ml and were considered to be moderately cytotoxic, 16% (7) of the crude extracts had LC50 values between 500 µg/ml and 1000 µg/ml and were considered to have weak cytotoxic activity while 24% (11) of the aqueous extracts had LC50 values greater than 1000 µg/ml and were categorized as non toxic

The positive controls, cyclophosphamide and etoposide exhibited strong cytotoxicity with LC50 values of 95 µg/ml and 6 µg/ml respectively in a 24 hour lethality study, validating their use as anticancer agents. **Conclusions:** In the current study, 95.5% of all the screened organic extracts and 76% of the investigated aqueous extracts demonstrated LC50 values <1000 µg/ml, indicating that these plants could not make safe antimalarial treatments. This calls for dose adjustment amongst the community using the plant extracts for the treatment of malaria and chemical investigation for isolation of bioactive compounds responsible for the observed toxicity. These could make novel ingredients for anticancerous drugs.

**Key words:** Cytotoxicity; *Artemia salina* bioassay; crude extracts; anti-malarial plants; Kenyan biodiversity

### 07. Possible effects of distribution conditions on efficacy of veterinary drugs, chemicals and biologicals in Uganda

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### Abstracts

Effective management of veterinary drugs, chemicals and biologicals is a prerequisite for quality, safe and efficacious livestock health products. Since the introduction of the policy of privatization and liberalization of veterinary service provision in the country, concerns have been mounting over quality and efficacy of veterinary supplies sold on the open markets. Like in most tropical developing countries, livestock production is concentrated in remote locations from the urban centers. Local

variations in ambient temperature, humidity, transportation and handling conditions can adversely affect the final quality of these products at the end markets. A study was therefore undertaken to assess the distribution conditions of animal health products with a view of identifying possible factor that could reduce their efficacy. Five districts were randomly selected from each of the six major regions located away from the capital city of Kampala: the northern, west Nile, north eastern, eastern, southern and south-western regions, respectively. In each district, structured questionnaire were administered at the height of the wet and dry seasons to randomly select veterinary staff, drug suppliers, transporters, drug shop owners, drug inspectors and traffic police officers working in the major towns. Mean ambient temperatures and humidity were recorded during these periods. Data recorded included the means of transport (road, rail, water, air), the type of vessels (open lorry, closed containers, specialized trucks, plastic sheeting), the animal health products (antibiotics, antiparasitics, vaccines), length of single journeys and time of transportation. Higher dry season temperatures (33-37°C) were recorded in the greater compared to the south, where humidity were higher (75-87%) during the rainy seasons. Distributors can be divided into two major categories: the large scale companies employing veterinary staff up only 20% and the small time dealers dominated with 80%. With the exception of the southern region where water transport was predominant (90%), road transport was the most important (96%). Road appear to more preferred due to their less costs and higher speed in absence of well developed air and rail infrastructure. Specialized vans were the main vessels used by distribution companies (80%), while small timers (20%) used open Lorries covered with tents. Antibiotics and antiparasitics were the most common products, while vaccines did not appear on the lists of items. These may be due to difficulty of maintaining the cold chain required for most vaccines. All journeys took less than 24 hours, most during the night when products are less likely to suffer extreme temperatures. Further studies are recommended to assess efficacy of veterinary products sold at open markets.

**Key words:** Animal health products, Uganda, distribution, efficacy

#### **O8. Antibacterial sensitivity of water and ethanol extraction of some herbal plant remedies used by the Gabra community of Marsabit District, Kenya**

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#### **Abstracts**

This study was undertaken to determine the antibacterial activity of water and ethanol extraction of some plant herbal remedies used by the Gabra ethnic group of Marsabit District, Kenya. The data on herbal plants remedies was collected through Participatory Rural Appraisal (PRA) workshops at the “Manyattas”, while selected re-owned LTHs, were used to fine tune the raw data documented during the PRAs and also facilitated collection of herbal plants voucher specimens for sensitivity tests at University of Nairobi laboratories at the College of Agricultural and Veterinary Sciences (CAVS). The herbal plants remedies were botanical identified at the East African Herbarium based at the National Museum of Kenya. In total a taxonomic analysis showed that 15 herbal plant species were cited as medicinal by Gabra pastoralists and they generally belonged to five most common plant families, namely: Burseraceae, Caparidaceae, Euphorbiaceae, Mimosoideae and Solanaceae.

Antibacteria sensitivity screening tests using Muller-Hinton-Agar (MHA) inoculated with *Micrococcus lutea* and *Bacillus cereus*, revealed that *Cucumis dipsaceus* gave the highest inhibition zone (14.0 mm) with *B. cereus* compared to 7.0 mm showed by *M. lutea* after ethanol extraction in well-method while water extraction of *Commiphora flaviflora* gave 10.0 mm and 9.0 mm against *B.cereus* and *M.lutea* respectively.



Basing on the findings of these investigations, this paper concludes that some of the herbal plants used by Gabra community of Marsabit District posses demonstrable antibacterial activity.

#### **O9. An evaluation of marketed anthelmintic products and user information in central and north rift regions of Kenya.**

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##### **Abstracts**

A survey of different types of marketed anthelmintic brands in the main livestock keeping areas in the central and north rift regions of Kenya was carried out in April 2011. The aim of this survey was to obtain baseline data on the different brands of anthelmintics, type of advice given to farmers as well as to sample some products for analyses of active ingredients.

All the three broad-spectrum anthelmintic classes were on sale in 90 drug outlets visited. Majority of the outlets were agro-vets shops, although the anthelmintics were also sold in pharmacies and animal feed stores. Out of a total of 789 anthelmintic samples recorded, 274 (34.7%) were benzimidazoles, 241 (30.5%) were levamisoles while 6 were avermectins (0.8%). A total of eight were in combinations; levamisole/oxyclosanode (seven, 13%) and fenbendazole/rafoxanide (one, 1.8%). The information given to farmers related to dosage, basis of dosage, withdrawal periods for milk and meat, time of the day to administer the drugs and rotation of different classes of anthelmintics. In a majority of cases, the information given was found to be accurate except that some were not informed on the time of the day to deworm, frequency, rotation of different classes and use of other practices to reduce over reliance on anthelmintics. Information from this survey and results of drug assays will form a basis for formulating strategies to manage anthelmintic resistance in different parts of the country.

## **FOOD SAFETY AND SECURITY**

#### **O10. The properties of potential camel lactobacilli cultures for yoghurt production**

*Akweya B. Kamau and Gitao C.G.*

##### **Abstracts**

The production of fermented camel milk offers an opportunity to preserve the nutritive value and keeping quality of milk. Traditionally fermented camel milk is produced by leaving the milk for about 12-24 hours until it become sour. The fermentation is spontaneous and results in a product with varying taste and flavor and often of poor hygienic quality. Use of normal starter cultures derived from cow milk does not produce a high quality product. Proper selection and balance for starter culture is critical for the manufacture of fermented camel milk products of desired texture and flavor. This is especially true for camel milk which is produced in hot areas with ambient temperatures ranging from 25- 40 0 C. It is for this reason that a thermo-stable stable starter culture is underway. Lactobacilli obtained from camel milk were exposed to different sub-lethal stress factors (low pH, high temperature, high salt concentration, combinations of them and starvation). The potential starters will be selected for optimal growth under field conditions and fermented yoghurt produced from them tested by consumers before bulk production. Improved post-harvest processing of camel milk will improve the livelihood of pastoralists and enhance their income

## **O11 Challenges and opportunities for clean milk production in the arid and semi-arid areas (ASALs) of Kenya**

*Gitao C.G., Ngeiywa K. and Wanjohi M*

### **Abstracts**

In Kenya the ASALs form 80% of the country's land mass with nomadic pastoralism as the main activity. North Eastern Province is one of the key ASAL areas where camels are the main milk providers especially during the drought season when other livestock die or become unthrifty. About 1.7 million camels are kept in an area characterized by dusty environment, frequent drought or flooding and a high level of poverty. Although a lot of research has been done on highland milk production, little has been done in ASALs where there are unique challenges to clean milk production. In this study, experiences from training six women groups in clean milk production, is combined with interviews from one hundred pastoralists in Garissa and Wajir from 2008-2010 to reveal constraints and challenges in clean milk production in the ASALs. The key constraint is lack of water and even when water is available it is salty, dirty and brackish. Unawareness on the value of clean milk is another major constraint. Other constraints include conservative culture which believes that camel milk should not be boiled. The opportunities available include the use of traditional knowledge to slowly improve the quality of milk. Use of clean energy like solar power can lead to improvement of milk quality. Continued education of communities on health will lead to improved hygiene.

## **O12 An analysis of indigenous chicken value chain (ICVC) in Makueni**

*Kabuage, L.W. et al,*

Department of Agricultural Resource Management, Kenyatta University

### **Abstracts**

The indigenous chicken (IC) population in Kenya is estimated at 25.8 million birds and constitutes 81% of the total poultry population. The IC sub-sector contributes to food and nutrition security, income and social-cultural roles in majority of resource-poor rural households. These dual-purpose birds are raised under free-range management systems with minimum production inputs. The average productivity for the national flock remains low at about 60 eggs per hen per year. With increasing preference for white meat and quality range chicken, new concerns on biosafety of IC products have emerged. The scavenging system allows IC to access feed from different environments including those polluted with various contaminants. This paper reports on early findings of a project undertaken to evaluate and subsequently enhance the IC value chain (ICVC) in Makueni. In Makueni county a region with 65% poverty level, the ICVC has been identified as a major vehicle for poverty alleviation. Indigenous chicken are the main livelihood enterprise and household bank, and ranked amongst the most desired technologies for drought mitigation in the region. The binding constraints in the ICVC are low productivity, lack of organized market and small flock sizes that curtail the enterprise viability. These challenges limit the opportunities for competitive market participation in a scenario where emerging niche urban markets are experiencing gaps in supply of quality IC. Besides low genetic potential, the major primary factor adversely affecting IC performance is poor feeding where birds scavenge with minimal supplementation. The growth rate of birds is therefore slow, leading to delayed sexual and body size maturity. Products of IC are of low quality with sub-standard carcass and small eggs. The above factors together with poor disease control, limit the expansion of flock sizes. Enhanced value in terms of quantity and quality of IC requires suitable interventions at various levels of the value chain. Data from Makueni indicates that adoption of producer level interventions would enhance flock sizes from the current household average of 15 birds to a range considered viable at 35-50 birds. Establishment of local hatcheries needs to be encouraged for supply of quality

chicks. Availability of cost effective, IC specific feed supplements and suitable bio-security measures would significantly enhance productivity and bio-safety aspects. Proper flock planning and linking producer groups to terminal markets can significantly improve market participation and increase gross margins.

### **O13 Enhancing the Milk Market Supply Chain in the Wajir County**

*Owuor G.A.*

### **014 Effective use of rice fields for wider variety of food production**

*Nyunja, C.*

Faculty of veterinary medicine, Bsc wildlife management

#### **Abstracts**

There is increasing need for food security due to increasing human population pressure. Sustainable and effective production of food is key in a dynamic environment. Rice fields' coverage has increased over the years. There is the need to improve the effectiveness of the rice fields in food production. The basis for this idea is that fish production can be managed concurrently within rice plantations. This would enhance variety of produce per unit coverage of plantation. The mudfish is a species that is most suitable for it thrives in muddy water and tolerates high turbidity levels. Young and mature fish are introduced into the unit field. Observations are noted with regards to behaviour as they grow and develop with time. This fish usually dig into the mud and can therefore live in the rice fields' condition. This behaviour would minimize the disturbance the fish would have on the rice plants. Excretion from the fish is a source of nutrients for the plants. The fish are later harvested once mature. This project is thus viable because of the adaptation to mud water. This would imply that the type and amount of nutrients added to the field should be tolerated by the mudfish. This calls for better harvesting measures of both fish and rice so as not to interfere with the other. This would result in an increase in the amount of food obtained from unit coverage of land hence efficient production.

### **O15. Influence of agricultural knowledge on drought-flood disaster preparedness through strategic crop production in Budalang'i, Kenya**

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#### **Abstracts**

The preparedness and ability to go through drought-flood disaster events by excising appropriate strategic food crop production practices in Budalang'i floods plain is of national and international interest. The growing interest reflects the increased concern over the level of famine caused by the unique drought-flood disaster events due to excessive destruction of food crops. The area suffers from a mixture of disasters threatening livelihoods and by inflicting heavy property and life losses. Kombo (2011), alleges that community preparedness can lessen drought dangers and damages.

This study answers the question, "To what extent does knowledge influence community involvement in strategic food production practices in Budalang'i?" Budalang'i is unique because the floods experienced originate from heavy rains experienced elsewhere. Three hundred (300) randomly selected households were interviewed using structured questionnaires. Data were analyzed to measure community involvement in drought management and level of agricultural knowledge was determined from students using a knowledge test. Evaluative analysis was used to determine the influence of agricultural knowledge on community involvement in drought management. The study developed two drought preparedness models, as critical entry points for further research. The study recommends

additional studies to investigate the factors that may strengthen strategic crop production practices to control further disaster successions.

**Key words;** Drought, Floodplain, Floods, Strategic Food Crop Production, Famine Agricultural Knowledge, Disaster Management.

## **ANIMAL WELFARE**

### **O16 Recent developments on effective anthelmintic use in Sheep and Goats**

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#### **Abstracts**

For half a century worm control in small ruminants relied too heavily on anthelmintics, resulting in widespread and increasing drug resistance in several Helminth species. Currently two highly effective and safe drugs that are unrelated to existing drug groups have been launched onto the international market. Derquatal and Monepantel are not chemically related but face similar risks of anthelmintic resistance if they are abused or used unwisely. A similar strategy is thus required to retain efficacy and prolong their effective lifespans. These recommended practices are listed and briefly dealt with as an integrated package of worm control measures. They comprise reducing the rate and amount of pasture contamination, identifying and protecting the animals most at risk, reducing selection pressure for anthelmintic resistance, practical worm infection monitoring, increasing sheep and goat resistance to worm infections. Relatively recently the only proven practical system of targeted selective treatment, the FAMACHA© system, has been augmented by the FIVE POINT CHECK©, which covers most or all important parasitic Helminth infections.

### **O17 Challenges in the smallholder (zero-grazing) production systems of Nairobi and its environs: A welfare perspective**

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#### **Abstracts**

Animal welfare is defined as the ability of an animal to interact comfortably with its environment through its physiological, psychological and behavioural systems. About 70% of dairy production in Kenya is from the smallholder production systems. These production systems are negatively impacted by a number of factors including poor nutrition, substandard husbandry and management practices, lack of appropriate farm inputs, diseases and low incomes. These factors influence the welfare of dairy cattle, hence their importance for its evaluation. This study was therefore designed with the aim of determining the welfare of dairy cattle in the smallholder production units in Nairobi and its environs. This was achieved through a cross-sectional study carried out in 80 smallholder dairy units purposively selected in Nairobi and its environs, in which 306 dairy cows were examined. The welfare of cattle in these dairy units was evaluated through several methods which included: visual observations for animal- and farm-level factors that indicate poor welfare of cattle; taking measurements of dairy housing unit dimensions such as cubicle, walk-alley, kerb and feeding bunk; and using a structured questionnaire to interview farmers and stockmen on nutritional regimes and other management practices such as removal of slurry, milking techniques, record keeping and disease control. These factors were recorded and later analyzed. Analyses included descriptive statistics, and

simple associations using chi-square at  $p < 0.05$  significance level. Over 80% of these smallholder units had factors that contributed to poor welfare of dairy cattle. These factors included under-size cubicles, small walk-alleys, too high feeding bunks with traumatic edges, too low positioning of neck rails at the feed bunks, sharp objects and edges within the housing units and dilapidated housing structures. The main evidence of poor welfare was injuries on the animals. The body condition score (BCS) of the cows was the main indicator of welfare relating to feeding. The farmers' and stockmen's attitude towards animal welfare was poor as evidenced by negative response and poor perception when interviewed about the five freedoms. This study concludes that poor welfare of dairy cattle exists in all the smallholder units evaluated, which is mainly caused by improper housing and management. Training of farmers and stockmen on animal welfare issues would therefore be a prerequisite to improvement of dairy cattle welfare. Research on the physiological response to poor welfare of dairy cows in the smallholder units needs to be carried out to enhance the understanding of the impact of these risk factors on smallholder dairy animals.

**Keywords:** housing design, body injuries, BCS, indicators

### **O18. The challenges of balancing between productivity and claw health of dairy cows in modernized husbandry in smallholder farming units**

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#### **Abstracts**

Progressive reduction in land holdings has necessitated establishment of smallholder zero-grazing dairy units for livelihood of low income families. Adoption of confined housing in which cattle spend long hours standing on hard floors and supplementation with high levels of concentrates for improved milk production has exacerbated occurrence of claw-horn disorders in dairy cows. A cross-sectional study was carried out in 32 smallholder dairy units in which 300 dairy cows were thoroughly examined for claw lesions through trimming of a thin layer of the claw-horn on weight-bearing surface. The objectives of the study were to determine the prevalence and type of claw lesions as well as their risk factors in these smallholder zero-grazing dairy units. A high prevalence (88%) of claw lesions was found among the 300 dairy cows examined of which 69% were subclinical and 31% clinical. Laminitis had the highest prevalence (70.3%) and the rest of the lesions whose profiles are presented in this paper were laminitis-related. The importance of laminitis is that it has the subtle phase (subclinical laminitis) whose effects are long-standing and devastatingly irreversible. Stepwise logistical regression analysis (screening interactions of all the possible risk factors) revealed that the most significant zero-grazing housing-and management-level contributor to the occurrence of subclinical laminitis was regular concentrate feeding (O.R. = 2.08,  $\chi^2 = 5.5$ ,  $P = 0.0212$ ). Subclinical laminitis subsequently predisposes claws to several other lesions that cause lowered production. Thus high-level feeding and other modernized husbandry practices such as concrete floors can paradoxically indirectly cause lowered production.

**Key words:** Claw health, Production, dairy cow, smallholder, husbandry

### **O19. “Combating Animal Disasters through Veterinary Response Units; a UON Initiative”**

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## **Abstract**

Natural disasters and calamities throw up major challenges for national governments in many countries of the African region. Droughts, floods, epidemics, tsunamis, and landslides are some of the common occurrence in the region, repeatedly taking a heavy toll of life and property. In such serious disaster situations, the major challenge for authorities is the protection of life (human and animal), property, and the vital life-supporting infrastructure necessary for disaster mitigation.

Any delay or laxity in disaster relief could escalate the magnitude of distress for the victims. Disaster management programs could provide a critical support system for disaster management authorities at times of disaster-related crises. Natural disasters inflict severe damage on alm or outreach and provision of community service, the department of Clinical Studies, through external funding (WSPA), has established a disaster management and mitigation project. During the national drought disaster of 2010-2011, this project helped to improve coping status of 20,039 animals in Mwingi. In addition, for the past 3 years, the department has engaged in slum feral dog and cat rabies vaccinations (4,399 cases) and their population control through spay and neuter (815 cases). This has helped mitigate onset and spread of rabies in the slum areas of Nairobi. We have also dewormed dogs and cats (5,317) cases. The intended presentation will highlight the activities of the programs, point out their challenges and stimulate the audience for a sustainable way forward resolution.

## **020. Wildlife Welfare: Can the care of individual wild animals be good animal welfare, compatible with the ‘one health’ approach, and also with wider conservation goals?**

*Robinson I.*

International Fund for Animal Welfare

### **Abstracts**

The International Fund for Animal Welfare (IFAW) cares for individual animals, and also wildlife populations and their habitats. We find solutions to problems that are good for both animals and people. These are the words found in our mission statement and frequently used in published material and online on our website – but can we live up to these lofty ideals and how do we set about achieving them? Can the care of individual animals be compatible with the ‘one health’ approach – or does it create greater risks for the animals themselves, the people who care for them and the populations to which they are returned? There are many who are critical of attempts to rescue, treat and return wildlife to the wild and consider that they are more of a threat to animal welfare, animal and human health, and can jeopardize wild populations. Looking at examples of IFAW’s work around the globe with wildlife rescue, rehabilitation, translocation and reintroduction, it is clear the veterinarian has a key role in ensuring that standards of good animal health, welfare and conservation are met. Examples from both terrestrial and marine environments, involving avian, mammalian and reptilian taxa are considered.

## **ANIMAL PRODUCTION AND MANAGEMENT**

### **021. The potential use of moringa oleifera as poultry feed supplement in Kenya.**

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### **Abstracts**

Poultry industry in Kenya is constrained by inadequate supply of good quality feed and high cost of feed. The industry is faced with poor availability of the raw materials especially the proteins which is a major contributor to the low quality feed and the escalating costs. *Moringa oleifera* Lam. is the best known of 14 species of Moringa tree (family Moringaceae). This rapidly-growing, drought-resistant tree is now widely cultivated and has been naturalized in many locations in the tropics. *Moringa oleifera* has unique nutritive value and it can serve as a good source of protein, essential amino acids, minerals and vitamins that are needed in the poultry industry. Cultivation of *Moringa oleifera* in the rural areas can offer a sustained supply of nutrients to indigenous chicken which are mainly raised on both confinement and scavenging. The plant has been used to combat malnutrition in humans and also it is reported to have antitrypanosomal, antibiotic, anticancer, antispasmodic, antiulcer, anti-inflammatory, hypo-cholesterolemic properties. It is reputed to have considerable efficacy in water purification by flocculation, sedimentation, antibiosis besides its capacity to reduce Schistosome cercariae titer in water. Its integration in the poultry feed industry would go along way in poverty alleviation especially in rural areas by offering alternative enterprise to the communities, besides the environmental benefits that would accrue from its cultivation. The nutritional value of *Moringa oleifera* can benefit both commercial and small holder poultry production by providing a substitute to the raw materials used in the poultry feed and therefore, the need to evaluate its potential as an alternative feed supplement in poultry nutrition.

### **O22 Effects of management practices and economic stimulus program on fish production in Mwea Division of Kirinyaga County.**

<sup>1</sup>Maina, J. G., <sup>1</sup>Mbuthia, P.G., <sup>2</sup>Ngugi, J. N., <sup>1</sup>Karuri, E. G., <sup>3</sup>Owiti, G. O., <sup>4</sup>Omolo, B., <sup>5</sup>Orina, P. and <sup>1</sup>Wangia, S. M.

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### **Abstracts**

Aquaculture contributes about 7 billion shillings to the economy annually (Mbugua, 2006). Furthermore unlike other sources of protein, fish tend to be shared more equitably among households, including women, children and other vulnerable members of societies. Fish farming requires relatively light labour hence does not increase the work-load for burdened rural women. Fish processing, value addition and marketing also provide excellent opportunities for public private partnerships development. Government intervention in aquaculture started in 1921 when the colonial government introduced trout, common carp and black bass into the country. Despite many government initiatives, aquaculture has not been fully integrated with other farming systems and its contribution to the national economy is small. Sustainability and commercialization of fish farming are limited by an inadequate supply of good quality fish seeds, unavailability of good quality and inexpensive feeds, Inadequate data on diseases and parasites that affect farmed fish in Kenya, and challenges in value addition and marketing. A study was done to characterize fish farming practices used by farmers in Mwea Division of Kirinyaga district and to determine the management practices which had the greatest influence on fish yields. Specific objectives of the study were to evaluate the main fish farming practices adopted by fish farmers in the division, determine the main challenges and opportunities that exist in fish

farming, explore gender roles, and responsibilities in fish farming and determine the preliminary effects of the Economic Stimulus program on fish farming in Mwea division. Results showed that over 66% of fish farmers were over 40 years of age, while approximately 60% of them were funded through the Economic Stimulus Program (ESP). 73 % of the farmers had earth ponds, while only 27% used lined ponds. Most of the farmers (55%) stocked tilapia in monoculture and 68% of farmers used organic manures to fertilize their ponds. Manure from ruminants was the most frequently used manure among farmers. Fish were harvested between 9 – 12 months after stocking and the average weights of the harvested fish were low. Most farmers identified marketing, lack of fingerlings and price of commercial feeds as the main challenges they faced in fish farming

### **023. Integration of camel research and development in the veterinary profession in Kenya and future**

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#### **Abstracts**

The camel is uniquely adapted to hot and arid environments. Camels in Kenya are used for food security and as source of livelihoods. Challenges of climate change led to more attention on camel research and development since 1970s. Three major projects on camel research and development in the arid and semi arid lands of Kenya were implemented from the late 70s to early 90s with varying successes and challenges. With increasing aridity of the ranges, camels prevail because they are better adapted than other livestock to water and feed stress. The Kenya Camel Association was founded in 1995 to advocate on camel research and development issues for the betterment of the wellbeing of camel owners. The association works with partners in implementation and advocacy of appropriate policies, addressing the role of camels and the threats of climate change using the annual Kenya Camel Forums as a platform for information sharing. The forum is the trademark of advocacy for camel research and development in Kenya and it will be discussed in details in this paper. The Government of Kenya and partners have goodwill for camel development thus the future of the spread of camel keeping Kenya is promising.

**Key Words:** advocacy, camel, development, Kenya, research

### **024. Spermiogenesis and sperm ultrastructure of Lake Magadi tilapia *alcolapia grahami* (teleostei, perciformes, cichlidae)**

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#### **Abstracts**

Spermiogenesis and sperm ultrastructure are specific and highly conserved characteristics among various taxonomic units of teleosts. To understand these features in *A. grahami*, a cichlid teleost that inhabits the highly alkaline and saline waters of Lake Magadi, light and electron microscopy investigations of its testis were conducted. It was established that the entire process of spermatogenesis in this fish occurs in spermatocysts, suggesting a complete cystic type of spermatogenesis. Spermiogenesis revealed three structurally distinct phases, identified mainly on the basis of morphological characteristics



of chromatin material in the nucleus. This fish exhibited type 1 spermiogenesis characterized by progressive reorganization and condensation of the initially coarse heterogeneous chromatin in the early spermatids to a cluster of electron-dense globules which ultimately filled the head in mature spermatozoa. Concomitant with this process was the growth of the flagellum, diplosome migration, nuclear fossa formation and complete nuclear rotation. Mature spermatozoa had acrosomeless round heads containing electron-dense globules in their nuclei. The midpiece had ten ovoid mitochondria arranged in two rows. The flagellum, containing the typical 9+2 microtubule axoneme penetrated medially in the cytoplasmic canal to project freely distally. These findings are generally consistent with those observed in Cichlidae; suggesting an emerging characteristic that is unique for this Family. However, absence of cytoplasmic sheath on the midpiece and presence of very short lateral fins on the flagellum distal to the midpiece appears to be exceptional for this fish.

KEY WORDS: *Alcolapia grahami*, spermiogenesis, spermatozoa, Cichlidae.

## **O25. Good and bad co-infections; impact on growth and survival of zebu cattle under one year**

Thumbi SM<sup>1, 2</sup>, Poole J<sup>2</sup>, Kiara H<sup>2</sup>, Jennings A<sup>3</sup>, Toye P<sup>3</sup>, Handel P<sup>3</sup>, Bronsvoort MB<sup>3</sup>, Coetzer J<sup>4</sup>, Conradie I<sup>4</sup>, Woolhouse MEJ<sup>1</sup>

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### **Abstracts**

In natural populations, individuals may be infected with multiple pathogens at a time. The direction and strength of co-infecting pathogen interactions are often unknown and dependent on the mechanism of interaction. They may be synergistic (together harming the host more) or antagonistic (together having less adverse effects on the host), compared to single infections. Here we have tested associations of infections and their co-infections with observed variation in growth rates, and survival in zebu cattle part of the IDEAL project cohort study. Complete clinical and infection life history data on 548 animals recruited at birth, examined and sampled every 5 weeks until one year old was used. After controlling for other significant covariates, the results reveal both synergistic interactions (lower growth rates) with *Theileria parva* and *Anaplasma marginale* coinfections, and antagonistic interactions (relatively higher growth rates) with *Theileria parva* and *Theileria mutans* co-infections. Additionally, helminth infections can have a strong negative effect on the growth rates but this is burden-dependent. The all-cause mortality rate was 16.1%, with no significant differences between calf sex or genotype. Helminth infections (strongyle eggs per gram (epg) of faeces) and *Theileria* spp high-intensity infections were associated with higher odds for mortality (OR =1.27,  $p < 0.001$  per 1000 epg increase, and OR = 5.5,  $p < 0.001$ , respectively). East Coast Fever (ECF) was the single most important disease associated with calf mortality accounting for 37.1% of all deaths, followed by Haemonchosis accounting for 11.2%. However, the risk of death due to ECF was itself influenced by helminth burden (OR = 1.41 per 1000 epg increase,  $p < 0.001$ ). These findings present evidence of pathogen interactions affecting host growth and survival, and have important implications on disease control strategies, suggesting benefits of an integrated approach to worm and tick-borne diseases.

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## **O26. East African zebu as a dairy cow**

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### **Abstracts**

The zebu cattle constitute about 80.8% of the total cattle population in Kenya but only contribute 13.2% to the annual total milk production. Conversely the exotic dairy cattle population constitutes about 19.2% of the total population and contributes 74.6% of the total milk produced per annum. The Zebu cattle are mostly found in arid and semi-arid lands (ASAL) which take about 80% of the total landmass. Milk production from this group remains very low and the communities that rear the cattle mostly the subsistence ones remain poor and food insecure. 1957 African farmers were allowed to use A.I to upgrade their E.A Zebu to improve production. However since then indiscriminate crossbreeding with exotic cattle either using AI or natural service has remained a continuous process of erosion of the genetic material in the Zebu population. The small East African zebu cattle germplasm must be conserved to retain the resistance to disease and draught genetic benefit. The small east African zebu remains relatively unfavourable in most of production parameters that are carefully selected for in exotic cattle breeds. The reason is that there has been very little work put on design of proper breeding schemes to upscale the productivity parameters, conduct detailed study on reproductive physiological parameters and conserve the unique germplasm of the EAzebu. Consequently, EAzebu farmers having no direction in breeding apart from crossing with exotic cattle continue to breed their animals indiscriminately giving rise to inbred smaller and low producing cattle. Time has come to focus on the EAzebu cattle taking into account their unique genetic benefit and draw a breeding programme that involves selection of the best individuals in milk production and multiply them using biotechnological techniques like embryo transfer.

## **PARASITOLOGY**

### **O27. Occurrence and lesions associated with echinostoma revolutum in free-range indigenous chickens in Kenya**

<sup>1</sup>M.M. Kyalo, <sup>2</sup>P.G.Mbuthia, <sup>2</sup>N. Maingi, <sup>2</sup>P.N. Nyaga, <sup>2</sup>L.W.Njagi, <sup>2</sup>M. N. Mutune, <sup>2</sup>R.O.Otieno, J.M. Gachoka, <sup>3</sup>P.L.M. Msoffe and <sup>3</sup>D. Bunn,

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### **Abstracts**

The study was carried out between November 2008 and April 2009 to investigate the occurrence and pathology due to *Echinostomum revolutum* in free-range indigenous chickens. One hundred and fifty six (156) indigenous chickens were purchased from various farms (108) and markets (48) in Nairobi, Thika and Kiambu districts using randomised purposive sampling method. The distribution of the 108 birds from the farms was Nairobi (36), Thika (36) and Kiambu (36) birds. Birds were transported alive in cages to University of Nairobi, Department of Veterinary Pathology, Microbiology and Parasitology, Kabete for laboratory examination. A thorough post mortem examination was performed on each bird and the isolated worms from the caeca, large intestines, cloaca and oviduct were identified and quantified. Tissues were collected for histopathology, processed, examined and the severity of the lesions determined. *Echinostoma revolutum* was recovered in the caeca and large

intestines of 3/156 (1.9 %) birds but not in cloaca and oviduct. The affected birds originated from market in Kiambu District. Birds from the other areas did not have *E. revolutum*. The parasites caused haemorrhages and typhlo-enteritis in the affected birds. Other worms observed from these organs were *Ascaridia galli*, *Heterakis gallinarum*, *Heterakis isolonche*, *Heterakis dispar*, *Subulura brumpti*, *Raillietina echinobothrida* and *Hymenolepis contaniana*. The trematodes are reported in Kenya for the first time.

### **O28. Prevalence of haemoparasites in free-range local ducks**

<sup>1</sup>*S.K.Mavuti*, <sup>2</sup>*P.G.Mbuthia*, <sup>2</sup>*R.M.Waruiru*, <sup>2</sup>*L.W.Njagi*, <sup>2</sup>*M.N.Mutune*, <sup>2</sup>*R.O. Otieno* and <sup>3</sup>*P.L.M.Msoffe*.  
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#### **Abstracts**

A study was conducted between November 2008 and March 2009 to determine the prevalence of haemoparasites in different age and sex groups of free-range local ducks in Nairobi and its environs. The ducks were categorized into ducklings (<2 months), growers (2 to 6 months) and adult ducks (>6 months). A total of 47 adults, 50 growers and 48 ducklings comprising 77 females and 68 males were sampled. Two thin blood smears were prepared from each bird, processed and examined for haemoparasites. Data obtained was analyzed as number of ducks of different age and sex groups infected with a particular haemoparasite. Haemoparasites were observed in 70/145 (48.28 %) of the ducks. Four haemoparasites identified were *Aegyptinella pullorum* 59/145 (40.69 %), *Leucocytozoon caulleryi* 10/145 (6.90 %), *Haemoproteus* species 1/145 (0.69 %) and *Eperythrozoon* species 5/145 (3.45 %). Their prevalence was 38.57 % (27/70), 24.29 % (17/70), 20.0 % (14/70) and 17.14 % (12/70) ( $p > 0.05$ ) for Embakasi, Westlands, Kasarani and Thika districts, respectively. Grower ducks had a prevalence of 35.71 % (25/70), adults, 34.29 % (24/70) and ducklings, 30.0 % (21/70) ( $p > 0.05$ ). Male and female ducks had an equal prevalence of 50.0 % (35/70). This study has demonstrated the occurrence of haemoparasites in different sexes and age groups of apparently healthy appearing ducks for the first time in Kenya. Their impact on duck productivity need further investigation and control strategies initiated to improve the industry.

### **O29. Prevalence, intensity and pathological lesions associated with *Contracaecum* species infection in farmed and wild catfish in the upper Tana river basin, Kenya**

*CG Mathenge*.<sup>1\*</sup>, *PG Mbuthia*.<sup>2</sup>, *RM Waruiru*<sup>2</sup>, *TA Ngatia*, *M. N Mutune*<sup>2</sup>, and *RO Otieno*<sup>2</sup>,  
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#### **Abstracts**

A total of 108 randomly selected farmed and wild *Clarias gariepinus* (catfish) obtained from the upper Tana river basin were examined for intestinal helminthes between July 2007 and April 2008. Over fifty nine point three per cent (59.3 %) of the catfish had *Contracaecum* species larval worms in the abdominal and branchial cavities. The prevalence of the parasite in farmed fish was 18.5 %, wild catfish 40.7 % ( $p < 0.05$ ), whereas adult catfish had a prevalence of 37.0 % while young had 22.2 % ( $p < 0.05$ ). There was no significant difference in the *Contracaecum* spp. infection between

males and female catfish ( $p > 0.05$ ). Branchial cavity infection prevalence was 3.7 % while that of the abdominal cavity was 55.6 %. Farmed catfish mean load was 3.5 worms per fish, wild 185.1; female catfish had a mean load of 77.4 while males had 167.8, whereas adult catfish had a mean count of 161.2 while for the young fish was 69.7. The infection varied from mild to severe. There was significant differences in the mean worm load between the farmed and wild, the sexes and the age groups ( $P < 0.05$ ). Gross lesions of peritoneal adhesions with at a mean prevalence of 58.3 % with microscopic lesions of severe infiltration of mononuclear and polymorphonuclear cells as well as fibroblasts into the mesenteries, gastro intestinal tract were also observed. This study reports the occurrence of *Contracaecum* spp. and associated pathology in catfish in Kenya for the first time.

**(Key words:** *Clarias gariepinus*, *Contracaecum* spp., prevalence, intensity, pathology

### **O30. Prevalence and pathology of echidnophaga gallinacea in free-range local ducks**

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#### **Abstracts**

A study was carried out in November 2008 and March 2009 to investigate the pathology, prevalence and intensity associated with *Echidnophaga gallinacea* infestations of free range local ducks. The ducks were categorized into ducklings (<2 months), growers (2 to 6 months) and adult ducks (>6 months). A total of 47 adults, 50 growers and 48 ducklings comprising 77 females and 68 males were sampled. Each duck was subjected to a thorough clinical examination with emphasis on the cutaneous system and observations recorded. Body, head and leg skins were examined and identified parasites quantified. Parts of the skin were collected for histopathology processing, examined and the severity of the lesions determined. The data obtained was entered in Microsoft Excel and analyzed using Chi square ( $\chi^2$ ), t-test and one-way analysis of variance. *Echidnophaga gallinacea* (the stick-tight flea of poultry) was the only ectoparasites observed in 51/145 ducks (35.17 %). Grower ducks had a 47.06 % prevalence which was higher than ducklings (31.37 %) and adult birds (21.57 %). Female ducks had a higher prevalence (58.82 %) than male ducks (41.18 %). Thika Central District had the highest prevalence of *Echidnophaga gallinacea* infestation of 45.09 %, Embakasi (25.49 %), Kasarani (15.69 %) and Westlands (13.73 %). The study documents *Echidnophaga gallinacea* species in different age and sex of ducks for the first time in Kenya. Their control strategy and impact on productivity of ducks need to be investigated.

## **ONE HEALTH**

### **O31. A temperature resistant needle free vaccine against tetanus**

*Hellen Amuguni, Sangun Lee, David Brown, Gerald Keusch, Abraham Sonenshein and Saul Tzipori*

#### **Abstracts**

All human beings and most animal species require vaccination against tetanus. The current tetanus vaccine is injectable and requires cold storage significantly reducing coverage in developing countries. The development of mucosally administered heat-stable vaccines with long shelf life would considerably enhance immunization programs in developing countries by avoiding the need for a cold chain or injections. One of the promising approaches relies on live recombinant vaccine carriers. Engineering *Bacillus subtilis* for use as a non-invasive, heat and environmentally-resistant

antigen delivery system has proven successful. Sublingual (SL) immunization against infectious agents or bacterial toxins is emerging as a novel route for antigen delivery. In this work, we evaluated the efficacy of sublingual immunization with *Bacillus subtilis* engineered to express tetanus toxin fragment C (TTFC) in mice and piglets. Both mice and piglets developed protective IgG antibodies against tetanus. Immunized mice survived challenge with tetanus toxin. Higher IgA levels in saliva, vaginal wash and feces were detected in SL immunized animals compared with other routes. Sera from SL immunized piglets neutralized tetanus toxin in vitro and protected mice against tetanus toxin challenge. In addition, SL immunization promoted a mixed Th1 /Th2 response, based on cytokine analysis (IL-2, IL-4, IL-10 and INF $\gamma$ ). Antigen-stimulated tissues (intestine, spleen, lymph nodes) revealed a dramatic increase of MHC class II+ expressing cells compared to all other groups. We conclude that SL immunization is a promising effective non invasive and safe route for delivery of a temperature-resistant, *B. subtilis* expressing tetanus vaccine, and potentially other immunogens.

### **032. Association between virulence and specific genomic characteristics of predominant *Mycobacterium tuberculosis* Uganda genotypes**

*Muzoora Saphan*

#### **Abstracts**

**Background & Problem Statement:** Recent studies have shown that certain strains of *M. tuberculosis* are more virulent than others because these strains have been isolated from both immuno-competent and immuno-compromised individuals. A recent study done in Uganda showed that Uganda strains were the most prevalent. Genetic variations in these strains have been implicated as the cause of variations in their virulence abilities. However, no definitive case links or specific genomic characteristics regarding these strains have been detected which may have restricted efforts to reduce their transmission.

**Specific objectives:** To define putative genes associated with virulence of Uganda strains and to determine the association between virulence and specific genomic characteristics.

**Methodology:** The bacterial strains are archived isolates of five Uganda strains and three other East African strains. H37Rv and H37Ra are being used as positive and negative controls respectively. The DNA isolation is being done using a standard protocol. PCR is being used to amplify the DNA regions of interest. Definition of putative genes and other genomic characteristics will be done using DNA microarray analysis technique. Scanning of slides will be done in UK.

**Ongoing activities:** Extraction of DNA from the archived isolates and preparation of microarray analysis slides.

**Expected outcomes:** Genomic characteristics responsible for the high virulence of Uganda strains will be determined and the association between virulence and wide spread transmission established.

### **033. Environmental impact of traditional gold mining in Tigray province, Ethiopia: Some effects on health of animals and human beings.**

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#### **Abstracts**

Intensive traditional gold mining activities is ongoing in Tigray province of northern Ethiopia. Such mining works are generating a lot of income for poorly educated unemployed youths of the country and subsidizing the lively hood of poor farmers of the region. In addition to such job creation, it is also generating the much sought hard currency that can be utilized for other development projects of Ethiopia. For example, Ministry of Trade data indicate that out of ~500 million USD Ethiopia

obtained from export of gold in 2010/2011, half of it is from traditional gold mining. However, such economic benefits do not come without the expense of the environment as such mining activities are conducted by uneducated farmers and youths. Usually, the miners arbitrary mine and transport gold rich sediments into a river for panning to recover the gold. By doing so they are inflicting harm to the environment as they are not rehabilitating the mined land back and are also degrading the quality of water, which is used for domestic uses and animal consumption. A research conducted by the authors shows that in most of water samples collected from the mining areas, the concentrations of toxic metals such as As, Sb, Pb, Zn, Fe, Al and F are above WHO permissible levels for drinking. People who use this polluted water for different uses are facing some health problems. In addition, the miners are also deforesting the environment where getting grasses for animal grazing is becoming critical problem. As a result animals are facing food scarcity and metabolic health disturbances. Generally, if the ongoing traditional gold mining in the region is not be properly regulated and monitored as well as a mitigation mechanism of the mined areas is not emplaced, it is likely that it continues to cause unwarranted environmental degradation problems. Therefore, an efficient traditional gold mining system such as reclamation of mined sites and panning of the gold in isolated ponds is warranted so that these gold resources play their own share in sustainable development of the region.

Key words: Traditional gold mining, animal and human health, environmental degradation, Tigray

#### **O34. A one health approach to infectious disease outbreak investigation and response: An overview of the USAID/RESPOND project**

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#### **Abstracts**

Infectious diseases of grave concern to human health are emerging from wildlife and livestock populations in regions of the world where boundaries between human, wildlife and livestock populations are undergoing rapid change. This occurs with greater frequency in tropical regions, areas with limited resources for disease prevention and control. Among recent examples, avian influenza may have posed the greatest threat to public health, but increases in monkey pox in the DRC, Yellow Fever in Uganda, and Nipah virus outbreaks in Southeast Asia are of global importance. Most capacity building efforts to identify, investigate and respond to emerging infectious diseases have focused on supporting public health agencies. However, responding effectively to these diseases requires engagement of and coordination with a diversity of professions and stakeholders in both human and animal health, as well as social and environmental sciences. Moving towards a One Health approach to investigate, respond to, and counter existing and future emerging infectious disease threats is the overarching goal of the USAID's Emerging Pandemics Threat(EPT) Program. The RESPOND project aims to strengthen training, educational programs, and support to governments, universities and civil society with the objective of using One Health tools and approaches to improve worldwide capacity to investigate and respond to emerging infectious diseases. The project reinforces and supports existing public health services by developing the skills of a wide range of professionals with multidisciplinary applied training and experience in animal, human and environmental health threats, while simultaneously strengthening the institutions that can provide the training.

### **O35. One health East and Central Africa: current status**

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#### **Abstracts**

Faced with complex patterns of global change, the inextricable interconnection of humans, pet animals, livestock and wildlife and their social and ecological environment is evident and requires integrated approaches to human and animal health and their respective social and environmental context. One Health represents an interdisciplinary strategy to address health from a holistic integrated perspective rather than a discipline-based fragmented. In East and central Africa, one health is being spearheaded by 14 universities in seven countries which form One Health Central and East Africa. This is part of the emerging pandemic threats program sponsored by USAID-RESPOND. This paper highlights the progress so far achieved in the integration of One Health in the Kenyan and East and Central African context.

### **O36. Combination adjuvants: The next generation of adjuvants?**

*George Mutwiri<sup>1, 2\*</sup>, Sylvia van Drunen Littel-van den Hurk<sup>1,3</sup> and Volker Gerdt<sup>1</sup>*

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#### **Abstracts**

Adjuvants are critical components of many vaccines. The majority of existing vaccines contain only a single adjuvant. Due to their inherent limitations, no single adjuvant is capable of inducing all the protective immune responses required in the many different vaccines. Consequently, investigators are exploring the potential of using multiple adjuvants (“cocktails”) in a vaccine. An emerging paradigm is that careful selection of adjuvant combinations can result in complimentary and even synergistic enhancement of immune responses to vaccines. This approach is promising and presents tremendous opportunities for vaccinologists to tailor immune responses for specific vaccines. Combination adjuvants at different stages of development and their potential in veterinary medicine will be discussed.

## **EDUCATION, TRAINING AND POLICY**

### **037. Teaching and learning approaches that promote the achievement of vision 2030 for the agriculture sector**

*Maina, J.G., Ambuko, J. L., Lopokoyit, M. and Cheminingwa, G.N.*

#### **Abstracts**

Transforming agricultural education in Universities in Kenya is critical to enable them to contribute to the realization of Vision 2030 for the agriculture sector. Since the mid 1980's, faculties of agriculture and veterinary sciences have experienced changes that include reduced government funding, reduced student enrolment, increased competition for students, and changes in the role of government as the traditional employer for graduates of agriculture and veterinary sciences. Universities must therefore

respond to these changes by designing relevant and responsive curricula using appropriate delivery methods responsive to the changing demands of sustainable production systems and market driven economies. Graduates require knowledge, skills, attitudes and professional competencies to enable them effectively engage rural communities in developing innovative solutions to their complex problems. To achieve these objectives there is need to develop student centered learning systems that develop innovative and adaptable graduates. This demands a paradigm shift from dyadic transfer of information to experiential and problem-based learning approaches. A study was done to evaluate teaching-learning strategies used by lecturers in two universities, Nairobi and Egerton. The objectives of the study were to assess the lecturer's perceptions and understanding of experiential learning, determine the instructional methods used, evaluate adequacy of teaching – learning resources, and determine the main challenges that limit the use of experiential and problem based learning approaches at the two universities. A cross sectional research design was used and data was collected using questionnaires and document analysis. Majority of the lecturers had no formal training on teaching methodologies, were not aware of the contents of the ISO 9001:2008 document on teaching standards and had differing understandings of experiential learning. Further, lectures were the main instruction method used, and large classes and inappropriate classroom infrastructure made it difficult to use other instructional methods. There is need to retool and equip staff with the appropriate skills and provide the necessary infrastructure and resources to facilitate lecturers to adapt student centered teaching- learning approaches.

**KEY WORDS:** Experiential learning, Graduates, Teaching, learning, Lecturers

### **O38. A model for good veterinary governance: overview of draft veterinary policy**

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#### **Abstracts**

The new Kenya Constitution 2010 provides revolutionary frameworks in governance and also assures Kenyans of various basic rights. Among the values and principles elaborated are patriotism, human dignity, good governance, integrity, transparent, accountability and participation of the people. These values and principles would henceforth bind Kenyan when enacting and implementing public policy and law. The Constitution assures Kenyans of protection of human health and attainment of the highest attainable standard of health, which includes the access to adequate food of acceptable quality. It assures consumers of goods and services of reasonable quality and access to information necessary for them to gain full benefit for the necessary protection of their health, safety, and economic interests. It promotes social and economic development and the provision of proximate, easily accessible services throughout Kenya. It also protects genetic resources and biological diversity for the benefits of Kenyans and for posterity. The Constitution links Kenya with the rest of the world by upholding international treaties, agreements, conventions and the general rule of international law. The international trade policy including the framework of basic rights of countries to protect life and health of humans, animals and plants while leveling the ground for fairness has been upheld. This has opened the door for Kenya to adopt the best practices which have ingenuity and foundation in international standards. The Constitution caps it all by providing for enactment of Veterinary Policy which would institutionalize these values, principles, rights and best practices and create the path for Kenya to enjoy economic growth, industrialization and good quality of human life as envisaged in the Vision 2030. This Paper will elaborate, under Sub-Theme 1, the provisions of the Draft Veterinary Policy and facilitate interrogation and enrichment of the document by participants in the conference.



### **O39. Continuing Professional Development for Veterinarians Working in Africa**

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#### **Abstracts**

Livestock production in Africa makes a vital contribution to livelihoods, food security, income generation and gross national product. With its enormous forage production potential and current livestock population of more than 191 million cattle, 340 million sheep and goats and 700 million poultry, Africa has a largely under-recognized and grossly under-exploited potential to sustainably supply the rising global demand for livestock products. Livestock service delivery personnel, lead by veterinarians, can play a major role in meeting this demand for increased livestock production by acquiring updated relevant knowledge and extending that knowledge to livestock producers in the form of skilled practice and informed technical advice and to policy makers by way of effective advocacy. To achieve these outputs our current and future generations of veterinarians working in Africa need to update their “knowledge, skills and personnel qualities” by undertaking an appropriate form of Continuing Professional Development [CPD]. This need has been recognized by the Kenya Veterinary Board that requires veterinarians registered to practice in Kenya to undergo formal CPD programmes / activities measured by a points system. Each KVB registered veterinarian must accumulate at least 60 CPD points over three years with a minimum of 15 points per year. This paper describes how the Department of Veterinary Services Kenya, with DFID funding, aims to assist veterinarians meet KVB requirements by providing accessible, affordable and relevant CPD content by way of on-line e-learning.

### **O40. “Veterinary forensic medicine: an emerging and important discipline”**

<sup>1</sup>Cooper, J.E., <sup>2</sup>Cooper M.E., <sup>3</sup>Nyaga, P.N., <sup>3</sup>Gathumbi, P.K., <sup>3</sup>Mbuthia, P.G., <sup>3</sup>Njagi, L.W. and <sup>3</sup>Githigia S.M.

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#### **Abstracts**

“Forensic veterinary medicine” can be defined as “the applied use of veterinary medical knowledge to the purpose of the law.” In recent years, there has been an increase in many parts of the world in lawsuits concerning animals and their products. Factors that have contributed to this include a growing tendency for owners of animals to resort to litigation, the escalating financial value of many animals, the global trade (some of it illegal) in wild species and greater public concern over conservation and environmental issues. The veterinarian of the 21st century cannot afford to be complacent. Whether interested in legal cases or not, s/he is likely to become involved – and certainly must be prepared for - that eventuality. This requires familiarity with the demands of forensic work, in particular the detailed investigations and meticulous record-keeping that are its essential features. Such skills will also prove of value to the veterinarian when dealing with such matters as contested insurance claims and disciplinary proceedings. Although forensic medicine offers exciting challenges, it is, as yet, not a true “bona fide” discipline within the veterinary undergraduate curriculum in most parts of the world. Few opportunities for specialised post-graduate training in the subject are available. This means that veterinarians generally have to rely largely on experience or advice from others, rather than receiving specific teaching. The lack of training opportunities, coupled with relative paucity of literature and baseline data, can hamper the ability of veterinarians to contribute their skills and knowledge to the necessary standard.

In Kenya, veterinarians frequently meet forensic cases and yet they are inadequately prepared with skills, practice and knowledge to document them appropriately and confidently - while they miss others cases for lack of ability to recognise them as forensic. Kenyans have increasingly become aware of both human and animal rights, including animal safety and wellbeing, as well as the ethical requirements that are necessary when conducting research. Veterinarians are required to provide expert evidence for litigation on cases where animals are associated with crime. Insurance for animal losses or compensation for chicks that die due to diseases from mother hens or during disease pandemics pose forensic issues that require Kenyan veterinarians to have specialised training to enable them to correctly recognise, document, preserve and confidently present the data gathered from such forensic case. Dog-bites, cases of poisoning, assaults on animals including bestiality, investigation of causes and time of death and homicides associated with animals including cattle-rustling and ordinary thefts: all would be better resolved by a veterinarian well-skilled in forensic sciences. In addition, there are increasing numbers of cases of wildlife-associated human deaths or crop destruction issues that can only be satisfactorily resolved with a forensic approach. Also, some human crimes could be solved using animal-associated information gathered at the scene of crime which the specially-trained veterinarian would readily provide. However, there is no local training facility offering forensic veterinary sciences nor are there any supporting diagnostic services that are specifically geared to veterinary forensic sciences. In this regard, giving a course in integrated veterinary forensic sciences (incorporating environmental and agricultural issues) would be timely as would the setting-up of a well-equipped forensics laboratory. Both are long overdue in Kenya.

## **WILDLIFE AND WILDLIFE DISEASES**

### **O41. The African green monkey (*cercopithecus aethiops*) as a non-human primate model for infections with *cyclospora cayetanensis***

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#### **Abstracts**

*Cyclospora cayetanensis* is a protozoan parasite causing gastroenteritis in immunocompetent as well as immunocompromised humans worldwide. Clinical epidemiology and pathogenesis of *Cyclospora* species was studied in 64 wild-trapped *Cercopithecus aethiops* at Institute of Primate Research, Nairobi. The monkeys were screened for *Cyclospora* parasites by conventional microscopy, examination of hot safranin stained faecal slide smears, *Cyclospora* specific antibody responses and molecular characterization of DNA following nested PCR amplification. Efficacy of trimethoprim-sulphamethoxazole therapy for *Cyclospora* positive monkeys was evaluated. Experimental *Cyclospora* infections were established by oral inoculations. Oocyst shedding was used to confirm establishment and duration of infection. Gross and histopathological characteristics were described. The animals remained asymptomatic, *Cyclospora* parasites were identified in 41 (64%) of animals with infections mostly in male adults. Incubation period was 14-17 days, the duration of infection one to two months. A PCR product of 294 base pair was visualized, confirming *Cyclospora* species in the natural and experimental infections. *Cyclospora* specific antibody responses were recorded in

positive monkeys. Response to treatment was evaluated by cessation *Cyclospora* oocyst shedding by D17 post-treatment and decreased *Cyclospora* specific antibody levels. Relapse infections occurred in 33% of the treated animals but responded to second TMP-SMX therapy. Pathological findings recorded were moderate haemorrhagic enteritis, parasites vacuoles in the enterocytes, mild lymph node enlargement, lymphocytic infiltrations, focal necrosis and granulomas in the liver. In conclusion, the study demonstrated that African green monkey may offer an appropriate model for study of Cyclosporiasis.

#### **O42. Factors associated with morbidity and mortality in selected ungulate species in al ain wildlife park and resort, united Arab emirates.**

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##### **Abstracts**

Captive populations of endangered species are often viewed as a safeguard against extinction, and in the case of extinction in the wild, a last chance for revival (Tudge, 1992; Rusello and Amato, 2007). Al Ain Wildlife Park and Resort (previously referred to as Al Ain Zoo) is one such collection with captive population of endangered species as per the the International Union For Conservation of Nature Red List of Threatened species. A study was conducted at the Zoo with an aim of investigating causes of morbidity and mortality and their associated risk factors in selected ungulate species within Al Ain Wildlife Park and Resort with a hope to recommending mitigation measures to reverse the trend. The study had the following specific objectives: (1) To estimate the crude and cause-specific morbidity and mortality rates in selected species of ungulates in Al Ain Wildlife Park and Resort (2) To identify risk factors associated with morbidity and mortality in selected ungulate species in Al Ain Wildlife Park and Resort. Historical data from the year 2005 to 2010 were evaluated to estimate crude morbidity and mortality. A follow-up cohort study from January to June 2011 was conducted to estimate the crude morbidity and mortality, cause-specific morbidity and mortality and associated risk factors. High morbidity and mortality (above 10%) was reported. The significant risk factors for morbidity were age and sex ( $p < 0.01$ ), with younger animals (less than 30 days) 6.8 times more likely to become sick and 19.7 times more likely to die as compared to older animals (above 30 days). Males were 2.4 times more likely to get morbid compared to the females. Age was the only significant factor associated with mortality ( $p < 0.001$ ). Trauma was the leading cause of morbidity and mortality. The study recommends; management of antelopes and gazelles considering the natural social structure of a single male and several females (harem) to reduce fights, and the surplus males be managed as bachelor herds but more space to be provided to escape fights. Alternatively, since managing males as bachelor herds is costly, surplus males can be donated to other captive collections. To look for options to reduce the current overcrowding of the ungulates and conducting further studies to establish the extent of inbreeding in the captive collection at Al in Wildlife Park and Resort.

#### **O43. Historical perspectives of lesser flamingo mortalities in Kenya**

*Manyibe, T.N<sup>1</sup> and Gathumbi, P.K<sup>2</sup> Ngati, T.A<sup>2</sup>, Bebora, L.<sup>2</sup> Muchemi, G.<sup>2,1</sup>*

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## Abstracts

The lesser flamingo(LF) (*Phoeniconaias minor*) is the most abundant waterbird species in Kenya and a major attraction for ecotourism in many parts of Africa (Harper 2003; Nasirwa, 2000; Owino et al., 2001; Owino et al., 2002). It is an obligate filter feeder and the main primary consumer of the prolific algae (*Arthrospira fusiformis*) in the saline Rift Valley lakes of East Africa thus making it a key bioindicator species of aquatic ecosystems. It is also a 'flagship' species for the wetlands (Jenkin, 1957; Vareshi, 1978). Mass deaths of LF have become more frequent in eastern Africa over the last two decades and have been recognized as one of the threats to conservation of the species (Koyo and Owino, 2010; Lugomela et al., 2006; Ndetei and Muhandiki, 2005; Beasley et al., 2004; Kock et al., 1999; Motelin et al., 1995; Sileo et al., 1979; Tuite, 1974; Manyibe et al., 2007). Previous investigations have implicated infectious and toxicological diseases, acting in combination with various environmental stressors, as the causes of mortalities. This paper reviews these investigations highlighting their salient features and proposes multidisciplinary approaches for better addressing the problem in the future.

### **O44. Application of GPS/GSM/satellite collars for monitoring elephant (*Loxodonta africana*) populations in Kenya**

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## Abstracts

The use of satellite GPS/GSM-collars for tracking wild animals' movement and distribution has become popular in wildlife conservation particularly for the endangered wildlife species. In Kenya, satellite collars are frequently being used to monitor movements of large mammal species such as elephants (*Loxodonta africana*), lions (*Panthera leo*), grevy zebras (*Equus grevyi*), spotted hyenas (*Crocuta crocuta*) and wildebeests (*Conochaetes taurinus*) among others. We highlight various applications of satellite collars in mapping of elephant ranges and corridors, human-elephant conflict resolution and monitoring of translocated elephants. We captured and collared two adult female elephants in Siyapei and Olooltoto areas of Narok North district in June to July, 2011, to track elephant movements and frequency of crop raids through a special collar website located at ranger security office in the area. Siyapei and Olooltoto areas are known for frequent human elephant conflict and loss of wildlife habitat attributed to increasing human population and rapid conversion of wildlife range land into agriculture. The collars transmitted GPS locations of elephants to the website at an interval of every 4 hours for 2 months. Wardens and rangers were able to monitor the elephant movements from the website and responded to crop raid in time hence minimizing crop damages and reducing vehicle patrol costs. The collar results helped KWS to identify elephant herds for translocation from Siyapei to Masai Mara NR. The translocated elephants were further monitored using satellite collars to ensure that they settled in the new area. We also report various challenges and experiences of using collars for elephant monitoring in Kenya.

**Key words:** Satellite collars, *Loxodonta africana*, Masai Mara, human elephant conflict, monitoring.

#### **O45. Unusual mortalities of eastern black rhinoceros (*Diceros bicornis michaeli*) due to clostridial enterotoxaemia in Ol Jogi pyramid sanctuary, Kenya**

David Ndeereh

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##### **Abstracts**

Nine eastern black rhinoceroses (*Diceros bicornis michaeli*) developed clinical clostridial enterotoxaemia between May and July 2010 in the Pyramid Black Rhino Sanctuary within the Ol Jogi Conservancy, Laikipia, Kenya. The rhinos presented with a peracute syndrome characterised by severe abdominal pain manifested by struggling and rolling on the ground, laboured breathing and died within three hours after being sighted sick. Necropsy and histopathology revealed severe pathology in the gastro-intestinal tract (GIT). Grossly, the small and large intestines were congested and oedematous. All the rhinos had variable amounts of hemorrhagic fluid in the intestines. Microscopically, the most characteristic lesion was severe necrotising-haemorrhagic enteritis. Numerous gram-positive rod-shaped bacterial colonies that were identified to be *Clostridium* spp were occasionally seen in the intestinal mucosa. *Clostridium perfringens* type A was isolated from the stomach contents. *C. perfringens* was postulated as the aetiological agent with the infection triggered probably by change of habitat following a prolonged period of drought that was followed by above normal rainfall.

**Key words:** *Clostridium perfringens*, necrotising-haemorrhagic enteritis

#### **O46. Human wildlife conflict in Samburu County: One health approach to an integrative ecosystem study**

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##### **Abstracts**

One health is the concept of human, animal and environmental ecosystem coexisting in a balance that keeps all of them healthy and living optimally, where the disturbance of one element affects the other components. This phenomenon underpins the desire for the holistic one health study approach in an ecosystem. In Samburu ecosystem humans, domestic animals and wildlife co-exist sharing the same environmental resources, exposed to common risks and in some cases antagonize the lives and existence of one another. Carnivores as well as wild ungulates in the Samburu ecosystem roam into human settlements. Through scat analysis carnivores were shown to predate on both domestic and wild animals. There are a number of records of humans' injuries. The carnivores, most notably the hyena share their denning sites with humans, while the wild ungulates grazed and watered together with domestic animals. This human carnivores and prey base interaction has over time resulted in cross-species pathogens transfer. Samburu herdsmen "morans" were reported to live and trans-night in dens abandoned by carnivores. Disease transmitting vectors namely ticks, were also identified from the same dens, as a result, the pastoralists remain at risk of emerging and re-emerging infections that could be transmitted by both carnivores and wild ungulates. The findings of this study will constitute recommendations to inform future research and policy development.

**Key words:** human, wildlife, carnivores, livestock, conflict, one health

## **O47. Conservation medicine in the African context**

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### **Abstracts**

Medical sciences have evolved from fairly generic to highly specialized fields over the 20th century. Increased specialization has not only brought about the benefits associated with division of labour but also negative side-effects including divergent and separatist approaches, little or no horizontal integration of strategies and weak collaboration between disciplines and sectors in what is popularly referred to as the 'silo culture'. The need for collaboration between the animal and human medical fields was pointed to by Rudolf Virchow (1821-1902) who, over a century ago, stated that "Between animal and human medicine there is no dividing line-nor should there be". Other luminaries like William Osler (1849-1919) and Calvin Schwabe (1927-2006) developed the concept of One Medicine that clearly articulated the necessity for integrated approaches within the life sciences. With the emergence, over the last few decades, of serious global threats including those of pandemic diseases, the global community has been re-awakened to the absolute need for integrative, trans-disciplinary and collaborative approaches in solving the problems that face humanity. Conservation medicine emerged in the mid 1990s as an interdisciplinary field that addresses the broad scope of ecological health taking into consideration the interrelationships between animal and human health and environmental health. More recently, there is a strong global drive towards what is known as the One Health paradigm that can be traced to an international meeting convened in New York in 2004 by the Wildlife Conservation Society (WCS) during which scientists drawn from the global community made a resolution that would be known as the Manhattan Principles of One World, One Health (WCS Registered Trade Mark). Ministers from African countries representing relevant sectors have discussed and adapted the One Health principles during international ministerial meetings held at Sharm El Sheikh, Egypt in 2008. This presentation looks at the relevance of the Conservation Medicine in Africa and how the African continent has responded to the One Health drive.

## **ANIMAL HEALTH**

### **048 The risk factors associated with FMD and CBPP outbreaks in Uganda's cattle corridor**

*Angubua, S.*

### **Abstracts**

Livestock contributes significantly to the world economy. In the rural communities in Africa livestock provide; household source of income, food, manure, draught power, hides and skins, and bride price and a safety net to resource poor farmers and traders along the value chain. FMD and CBPP impact livestock production and trade of livestock and livestock products through production losses, high mortality in calves, food security effects, and hindering improved market access. A three tiered survey to assess the risk factors associated with FMD and CBPP outbreaks in Uganda's cattle corridor was conducted in a value chain context aided by a structured questionnaire. At production level, unrestricted livestock movements (Mean=6.373), communal grazing (Mean=5.456) and sharing watering points (Mean=5.325) were the most important risk factors associated with FMD and CBPP outbreaks in the study areas. At traders level, the most important risk factors associated with FMD and CBPP were mixing cattle from different herds and markets and not following stock routes (Means=6.09), unrestricted livestock movements (Means=5.82) and overcrowding the livestock markets and poor

veterinary inspection in the livestock markets (Means=5.13) and lack of waste management facilities (Mean=6.00) at processing. Unrestricted livestock movements, mixing cattle from different herds and lack of waste management facilities at the slaughter places were the most important risk factors associated with FMD and CBPP outbreaks. Involving stakeholders; farmers, traders, processors, policy makers and neighboring countries in East Africa to control livestock movements is essential if Uganda's efforts to control FMD and CBPP are to bear fruits.

#### **O49 How to treat osteoarthritis medically in the horse – A review.**

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##### **Abstracts**

Osteoarthritis is a very common condition in the horse and the medical treatment of osteoarthritis is therefore one of the most utilized therapeutic regimens in equine practice. The joint is an organ consisting of cartilage, joint capsule, ligaments, synovial fluid and subchondral bone. The therapeutic goals of treating osteoarthritis should be aimed at targeting both the soft tissue supportive structures and cartilage within the joint. The therapeutic goals may differ between one of the following: to decrease inflammation, alleviate pain, lubricate the joint, restore the articular environment to slow progression of disease, or in rare instances to increase cartilage destruction to encourage ankylosis. This review will give an overview of the different classes of drugs used in the treatment of osteoarthritis, their indications and toxicity. In addition to these drugs, various chondroprotective drugs such as glucosamine and chondroitin sulphate that recently became available to the equine practitioner to control inflammation and provide viscosupplementation will also be dealt with briefly.

#### **O50. Experimental infection of PPR in goats in Kenya**

*Gitao C.G., Kihu S., and Maina S. M.*

##### **Abstracts**

Livestock keeping is the main source of livelihood for most pastoral households found in the arid and semi-arid lands (ASAL) of East Africa which are characterized by extreme climatic features of drought, flooding, fragile eco-systems and poverty levels approaching 65%. *Peste de petits ruminants* (PPR) is a contagious viral disease of small stock that causes high mortality (50%) and morbidity rates (80%) especially in naive populations. It continues to spread throughout East Africa despite widespread vaccination and is headed in the South African direction. Small stock comprise the current account for pastoral livelihoods which is depleted and worse the disease negatively affects the local and international trade. Understanding why the disease spreads despite vaccination is therefore very important. In a participatory disease survey of Turkana district, Kenya which has had PPR vaccinations since 2008, five active PPR cases with typical signs of diarrhoea, and oculo-nasal discharges in four month kids was observed. One kid was sacrificed and post mortem followed by histopathology performed. Discharges from these animals were inoculated into two four month old kids. On day six there was fever and coughing, while discharges appeared on day nine which cleared by day 13. Effective vaccination against PPR would require coverage above 60% in susceptible populations. Such coverage is sometimes difficult to achieve in ASALs which also neighbor countries with endemic PPR. There is need to develop accurate diagnostic tools and enhance awareness on clinical signs of PPR among the population.

## **O51. Integrating mobile tools for surveillance, reporting and information management by Veterinary Services in Kenya**

*Ojigo D.O<sup>1</sup>\* and Daborn C.J.<sup>2</sup>*

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### **Abstracts**

A veterinary surveillance system functions to gather, analyse and disseminate information on animal diseases. A number of initiatives have been undertaken to enhance the veterinary surveillance system as deployed in Kenya. These include the PACE project 2003-2006, SPINAP 2008-2009 and SERECU 2010. The surveillance tools used have evolved from pen and paper to desk top / mobile devices and computer based analysis. In 2010 DFID funded the Department for Veterinary Services, Kenya to test innovative approaches involving the use of mobile technology to strengthen the surveillance system and enhancing disease reporting and information management. Mobile tools improved all indicators of an effective surveillance system. Different tools and software have comparative advantages in reporting specific events and the selection of which tool to use for which event and level of reporting were identified. A model for integration of mobile tools in surveillance was generated, a harmonized e-reporting template for district veterinary officers was developed, and the list of notifiable disease in the country was updated. It was noted that the use of mobile technology improved the timeliness of the system by 3 weeks and the cost of the information collection and flow was reduced by over 200%. The best practices and innovations identified can be up-scaled to other counties and used to guide the development of a comprehensive information management system for the veterinary services in the country.

## **O52. Management of bovine papillomatosis using an autogenous vaccine: A case study in Bukura Agricultural College, Western Kenya**

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### **Abstracts**

Bovine Papillomatosis is a papillomavirus infection in cattle characterized by presence of warts of various sizes on the body of the affected animals. The virus usually affects the epithelial cells of the skin causing hyperproliferative lesions. Six types of papillomavirus are involved where BVP-3, BVP-4 and BVP-6 types cause true papillomas. Five cases of bovine papillomatosis were noted on Bukura Agricultural College farm where the diseases presented as dry cauliflower-like warts of varying sizes especially on the neck and shoulder regions. Some smaller warts were also found around the eyes. Diagnosis was based on the clinical signs. An autogenous bovine specific wart vaccine was prepared from the wart samples and administered subcutaneously three times at two weeks interval. The warts started regressing 28 days after the first vaccination (day 0) and disappeared after 10 weeks. Based on the previous studies, this case study confirms that an autogenous bovine papillomavirus specific vaccine is a successful method of controlling bovine papillomatosis.

**Key words;** Bovine Papillomatosis, autogenous vaccine, control.



### **O53. Evaluation of Abattoir Surveillance System for Zoonoses in Western Province, Kenya**

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#### **Abstracts**

Surveillance for zoonoses in abattoirs is essential in public health because it facilitates early detection, monitoring and control of diseases at human- animal interface. Abattoir surveillance can provide critical data for animal diseases of public health and food safety importance. Since the adoption of the meat control act, zoonoses surveillance in abattoirs has remained rudimentary in Kenya. We carried out an evaluation of the abattoir surveillance system to describe the performance, assess the attributes, determine if it meets the set objectives and design a standard surveillance system for zoonoses in abattoirs. We interviewed key stakeholders using an interview guide. Surveillance documents and data collection processes at representative abattoirs were assessed with an observational checklist. Surveillance dataset for 2010 was reviewed and analyzed. The system attributes were assessed using CDC updated guidelines. There were no standard reporting tools and case definitions. Data management and transmission were manual. Information sharing with public health authorities and laboratory support was lacking. Although the annual completeness of reports was 100%, only one district out of 27 reported on time .The duration of delay in monthly report submission ranged between 18.7- 37.3 days with a mean of 28.7 days . The abattoir surveillance system in Western province is not up to standard. Though simple and representative, timeliness, data quality, information sharing and laboratory support are unsatisfactory thereby limiting its usefulness. Provision of standardized surveillance tools and resources combined with laboratory support and animal-human health authorities information sharing will enhance the usefulness of the system.

**Key words:** Surveillance system, Abattoir, Zoonoses, Evaluation, Kenya.

### **POSTER PRESENTATIONS**

#### **P01. Impact of Participatory Integrated Community Development (PICD) tools in pastoral research and development.**

*Wamwere Njoroge G.J.*

#### **Abstracts**

Though it has long been acknowledged that the eventual consumption of research outputs and realization of sustainable development is rooted in the active involvement of beneficiaries along all phases of research and development processes. Making choices on the best approach to ensure participation of all stakeholders, including the community members has been a formidable challenge to researchers and development workers in pastoral production system. This is confounded by low literacy levels that are a common characteristic of such populous. The ASAL Based Livestock and Rural Livelihoods

Support Project (ALLPRO) funded by the Government of Kenya and the African Development Bank (ADB), through the Ministry of Livestock Development adopted PICD techniques and tools as its guiding pillar in all its development endeavors in 22 ASALs Counties/districts in Kenya. The level of participation attained by using selected PICD tools like Venn diagram I and Venn Diagram II, Take-a-step, Daily gender activity calendar, Visioning matrix and Current and Future community maps has been implausible. PICD tools afford the community members, including the illiterate to take lead in the discussions, while the researchers and development workers take a facilitating role. Due to their inherent ability to make the community members, the kin pin of the research and development process, the PICD tools enhances the esteem and the self help capacity of the targeted beneficiaries. This kind empowerment leads to not only ownership of the research findings and development initiatives but also enthusiastic adoption of research recommendations and sustenance of development initiatives embedded with PICD tools. Community Action Plans (CAPs) generated through a PICD process gives communities' shared vision as far as their prioritized development is concerned. As a result the target beneficiaries have been able to use the CAPs to raise development funds within their rank. In addition, CAPs has been used as a bargaining tool for development assistance as well as a Monitoring and Evaluation tool by the community.

## **P02. Using research outputs for sustainable community development: Lessons learnt in camel milk studies in Kenya.**

*Wamwere Njoroge G.J.*

### **Abstracts**

World all over, it has been common practice to chastise animal science research workers (an indeed all researchers) for doing excellent work but only hemming their findings, conclusions and recommendations in well bound reports that are neatly stack in shelves. Consequently, as livestock stakeholders crave for solutions and innovative ways of circumventing the multiple challenges that confront them on daily basis, many cutting edge research outputs are gathering dust somewhere in offices and libraries. In its endeavor to do development unusually, and also in seeking for practical solutions and easily adaptable innovations to the constraints in camel milk marketing, the Ministry of Livestock Development, with assistance from the African Development Bank, designed the ASAL-Based Livestock and Rural Livelihoods Support Project (ALLPRO) with an inbuilt research programme within the project design. This in essence meant that funds were made available not only for camel milk market development purposes, but also for camel milk marketing research activities, that were meant to provide insights into the researchable issues encountered during the implementation of the project. In addition, the implementation framework provided opportunities for continuous upscaling and outscaling the accruing positive lessons learnt from implementation, including making provision for facilitating acquisition of appropriate technologies. To ensure a proactive approach, ALLPRO identified key collaborating institutions, namely: International Livestock research Institute (ILRI), Kenya Agricultural Research Institute (KARI) and Kenya Camel Association (KCA) among others), who brought in their comparative advantages to the project. The combined expertise put in place a formidable team that ensured that research findings were documented and used to design functional training modules for the stakeholders involved in camel milk value chain. Moreover, due to the realism of the ensuing research outputs, this project have been to rally many development agents towards designing the up upcoming Garissa camel milk dairy plant. The outcome of this project is a stunning success, and an example of an innovative and sustainable community development endeavors.

### **P03. Tick species on cattle and African buffaloes in the Tsavo Conservation Area, Kenya**

Edward K. Kariuki<sup>1, 2</sup>, Banie L Penzhorn<sup>2</sup>, Ivan G. Horak<sup>2, 1</sup>

<sup>1</sup> Department of Veterinary and Capture Services, Kenya Wildlife Service Nairobi, Kenya. <sup>2</sup>Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, South Africa.

#### **Abstracts**

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A total of 25 cattle and 62 African buffaloes (*Syncerus caffer*) in the Tsavo Conservation Area in Kenya were sampled for ticks. The ticks that were collected were identified and counted under a stereoscopic microscope. Eight species, namely *Amblyomma gemma*, *Amblyomma lepidum*, *Hyalomma albiparmatum*, *Hyalomma rufipes*, *Hyalomma truncatum*, *Rhipicephalus evertsi evertsi*, *Rhipicephalus pravus* and *Rhipicephalus pulchellus*, were shared by cattle and buffaloes. Three species, namely *Rhipicephalus (Boophilus) sp.*, *Rhipicephalus kochi*, and *Rhipicephalus muelhensi*, were collected only from cattle and three species, *Hyalomma impeltatum*, *Rhipicephalus humeralis* and *Rhipicephalus praetextatus*, were present only on buffaloes, New locality records for *H. impeltatum* and *H. truncatum* were established and the first locality records for *Rhipicephalus praetextatus sensu stricto* in Kenya reported.

**Keywords:** Cattle, African buffaloes, ixodid ticks, Tsavo Conservation Area, Kenya

### **P04. Dimorphic yeast fungi infections in beef cattle. Kuria JKN and Gathogo S.M.**

Kuria JKN<sup>1\*</sup> and Gathogo SM<sup>2</sup>

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#### **Abstracts**

In an investigation primarily to determine the prevalence of bovine tuberculosis in slaughter cattle in Kenya, smears of tuberculous lesions and of cultures in BBL™ MGIT™ Mycobacterium growth indicator tubes were stained by Ziehl-Neelsen procedure and examined microscopically. Sections of formalin- fixed lesions were stained with the periodic acid Schiff reagent and examined for yeast fungi. Of the 176 animals with tuberculous lesions, dimorphic yeast fungi were detected, as acid fast negative cell, in 70 (39.8 %) cases either alone (42, 23.8 %) or concurrent with acid fast bacilli (28, 15.9 %) in lesion smears. Yeast fungi were also detected in some BBL™ MGIT™ culture smears and in some tissue sections. The fungi comprised of *Paracoccidioides brasiliensis* or *Blastomyces dermatitidis* species. The present report documents native *P. brasiliensis* infections outside the endemic region, and *B. dermatitidis* infection in a livestock species of animal. It also speculates infections in other animals, including humans, in the region of origin of the infected animals. The findings emphasize further the importance of including dimorphic yeast fungi infection in the differential diagnosis of bovine tuberculosis during meat inspection in the region.

**Key words:** Dimorphic fungi, infections, cattle

### **P05. Dairy goat health problems affecting milk production in Meru, Nyeri and Embu counties**

Mbindyo C. Toroitich K.C., and Gitao C.G

### **Abstracts**

In Kenya, about 80,000 dairy goats are reared and about eighty percent of these are reared in Mt Kenya Region. They provide a quick source of milk for consumption or sale and are thus of immense value especially to poor households. The fact that they can be reared in small land holdings is especially useful in these highly populated areas. Although there has been a lot of research on problems faced by dairy cattle farmers, there has been little on problems faced by dairy goat farmers. In a cross-sectional survey, one hundred farmers were interviewed on major constraints and 100 milk samples obtained and analyzed. The main problems were lack of market of milk and goats, problems of buck rotation, unavailability of commercial feeds formulated for dairy goats and poor group dynamics. The main health problems are pneumonia, mastitis, stunted growth, and diarrhoea. The main pathogens from milk samples were Gram positive, coagulase positive and negative staphylococcus. Others were streptococcus spp and actinomyces spp. Further investigation is underway but indications are that coping strategies including farmer awareness, treatment and control measures need to be developed in order to enhance the productivity of goats in the region.

### **P06. Camel health problems affecting milk production in Garissa**

*Toroitich K.C. Mbindyo C. and Gitao C.G.*

#### **Abstracts**

A total of about 3 million camels are reared in Kenya about 1.7 of which are reared in Northeastern province. Garissa county alone has a population of 234,683 camels. They provide a source of milk and income for about 2 million pastoralists especially during the droughts when other livestock die or are unthrifty.

Data from Ministry of livestock development (MOLD) (2007) states that camels are the most important dairy animals in Kenya ASALs producing approximately 220 million litres of milk annually. This amount of milk is greatly reduced by mastitis. Camels are adapted to the arid and semi arid lands (ASAL), but their full milking potential is affected by udder infections especially sub-clinical mastitis. A cross-sectional survey of prevalence of camel mastitis was undertaken in Garissa county and 130 pastoralists interviewed and 112 samples collected and analyzed. The purpose of this study is to identify the most common pathogens responsible for clinical and sub-clinical mastitis in camels under traditional management in Garissa County, Northern Kenya. Gram positive cocci (*Staphylococcus* and *Streptococcus* species) were the main pathogens isolated from camel milk samples in addition to environmental coliforms (*Escherichia coli* and *Klebsiella/Enterobacter* species);

The preliminary results of this study showed that subclinical mastitis is prevalent in dromedary camels of Garissa county and that Gram-positive cocci are the dominant mastitis pathogens isolated.

### **P07. The possible effects of camel milk on management of diabetes type I**

*Gitao C.G., Toroitich K.C. and Mbindyo C.*

#### **Abstracts**

In India, camel milk is said to be effective in the management of Diabetes type 1 and the prevalence rate of diabetes there is said to be lower in camel milk consuming communities. In Kenya a similar allegation has been made although no study has been done to validate the allegation. A retrospective study is underway in Garissa county where there are both camel milk consumers and non-consumers. From May 2010-Feb 2012 over 900 patients visited the diabetes clinic in Garissa provincial hospital. About 25 percent were under 40 and had Type 1 diabetes. Most of these had high random blood sugar, and some had had complications like neuropathy. The ages ranged from 5 years to 40 years. The patients are being tracked down to the villages so as to obtain complete family and behavioral history. There are reports from the hospital that some patients abandon conventional treatment and opt for camel milk in the rural areas.

## **P08. Experiences of camel health management in Botswana**

*Gitao C.G. and Field C.*

### **Abstracts**

In Botswana where camels were apparently brought by Cecil Rhodes from Egypt in 20th century and although a few still remain with the police at Tsabong the majority were sold or given away at the turn of the 21st Century with the expectation of using them for eco-tourism. Currently, a total of 134 camels are held by Botswana Tourism Association which contracted Kenya camel Association to work out a management and health programme for the camels in 2010. Early in 2011, the camels were evaluated on health and well being. A few Botswana people were also trained on camel management. The experiences reveal that camels can be exploited for commercial purposes that include tourism which can raise income of the population is a lesson that can be spread through out the region. People who had never tasted camel milk were increasing in number and by now about 50 people regularly take camel milk. One camel was castrated for demonstration purposes. The main health problems encountered included fractured limbs, skin wounds and eye infections. There were relatively few ticks considering that the camels were living in the wild probably because of living outside the tropics. The camel potential in Botswana is high if all production and marketing factors can are considered

## **P09. Veterinary surgeons and veterinary paraprofessionals act 2011: its impact on meat hygiene, quality control and marketing**

*William O Ogara and Esther Ngethe*

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### **Abstracts**

The Veterinary Surgeons and Veterinary Paraprofessionals Act 2011 replaced the Veterinary Surgeons Act Cap 366 on 2<sup>nd</sup> December 2011 vide the legal notice No. 183. The Veterinary Surgeons Act Cap 366 repealed, only regulated the training of Veterinarians and their participation in animal health services, but had no provisions for regulating the Veterinary Paraprofessionals. Safeguarding animal health and Public health concerns in livestock and livestock products for local and international markets require elaborate laws and regulations that control and direct veterinary services at all levels.

Before structural adjustment changes in 1986, Veterinarians and animal health paraprofessionals trained, and were recruited to, serve the Department of Veterinary Services, thereafter, many veterinary professionals joined private sector and Non-governmental organization offering animal health services. This paper examines the spirit, content and context of the newly enacted Veterinary Surgeons and Veterinary Paraprofessionals Act 2011; discusses its impact on training in terms of institution infrastructure and course content, regulation of the practice of veterinary medicine and its contribution to quality control and food safety assurance., national and international trade and its compliance with existing instruments regulating the Veterinary profession.

Key words: Veterinarians, paraprofessionals, regulations, training, practice

## **P10. Foot and Mouth disease manifestation from a “cattle boma’ in South Sudan**

*Gitao C.G. and Chepkwony E.C.*

### **Abstracts**

The South Sudan was recently granted independence from Sudan in 2011 after a period of internal conflict which prevented normal disease control programmes. There has been a rapid increase in the movement of goods and services between South Sudan and Kenya. The need for vaccination in the South Sudan needs to be backed by evidence of the prevalent strains and disease epidemiology of

Foot and Mouth Disease. In this study, a cattle boma with about 100 cattle was visited in the vicinity of Juba in July 2009 and clinical samples and serum obtained for screening against foot and Mouth disease. Actual lesions of foot and mouth were found in 15 cattle that included 5 calves. The lesions included painful inter-digital hoof lesions, tongue erosions, and nostril lesions. Lesions from coronary were all having secondary bacterial infection with thick yellowish discharge which was associated with a painful gait, inability to graze and poor condition. Serum obtained from eleven animals were found sero-positive for Type O (45.5%) and Serotype SAT 2 (54.5 %). A quadrivalent vaccine with type O, A Sat 1 and Sat 2 would be recommended for vaccination

### **P11. Gastrointestinal parasites and other endoparasites of indigenous chickens traded in Nairobi, Kenya**

*A.N. Maina, R.M. Waruiru\*, T.A. Ngatia, P.G. Muthia and W.K. Munyua*

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#### **Abstracts**

A survey of gastrointestinal and other internal parasites was conducted on apparently healthy indigenous chickens of both sexes obtained from open-air markets around Nairobi, Kenya. A total of 131 birds from 9 districts were examined. Worm egg and coccidial oocyst counts were performed on faecal materials from each bird while worms collected from gastrointestinal tracts were quantified and identified. Many chickens had gastrointestinal helminths (90%), but only a few of these (13.9%) had coccidial oocysts. Nematodes were the predominant helminths (89%) followed by cestodes (51.5%), but no trematodes were recovered. The nematodes recovered were: *Heterakis isolonche* (59.5%), *Subulura brumpti* (36.0%) *Tetrameres* spp. (32%), *Ascaridia galli* (19.8%), *Gongylonema ingluvicola* (19.1%), *Acuaria hamulosa* (6.1%), *Heterakis gallinarum* (5.3%) and *Capillaria* spp. (2.3%). The cestodes recovered were: *Raillietina echinobothrida* (37.7%), *Hymenolepis carioca* (33.6%), *Davainea proglottina* (6.9%), *R. tetragona* (6.1%) and *R. cesticillus* (2.3%). Other endoparasites encountered were the air-sac mite, *Cytodite nudus* (15.3 %), *Sacocystis* spp. (5.6 %) and *Syngamus trachea* (4%). The mean caecal worm counts in chickens were significantly different ( $p < 0.05$ ) in various districts. However, there was no significant difference in the overall worm loads between sexes ( $p > 0.05$ ). The results of this study showed that there is heavy parasitism with various endoparasites in apparently healthy traded indigenous chickens in Kenya.

### **P12 Effects of medicated urea-molasses block supplementation on productivity and gastrointestinal nematode infections of sheep in Nyandarua District, Kenya**

*R.M. Waruiru\*, W.K. Munyua , R.O. Otieno, M.N. Mutune, V.M. Gichohi and R.N. Gitari*

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#### **Abstracts**

A 13 months study was undertaken to determine the effects of feeding medicated urea-molasses blocks on production parameters and gastrointestinal (GI) nematode parasitism of sheep under field conditions in Central Kenya. Forty-five Corriedale crossbred female lambs were initially treated subcutaneously with ivermectin (0.2 mg kg<sup>-1</sup> body weight) and randomly assigned into 3 groups: group I were fed fenbendazole incorporated urea-molasses blocks (MUMB), group II were fed urea-molasses blocks (UMB) and group III (control) received no block supplementation (NBS). The feed blocks were given in the evening when the animals returned from grazing and were consumed during

the night at a rate of 30 g head<sup>-1</sup> day<sup>-1</sup>. Parameters measured included faecal egg counts (FEC), worm burdens (WB), live-weight (LW) and greasy wool production. Significant differences ( $p < 0.05$ ) were found in LW changes of the MUMB group compared with the NBS and the UMB groups, respectively. The mean LW responses of the UMB group were significantly ( $p < 0.05$ ) greater than those of the NBS group. Comparing the LWs at the start and end of the study, the MUMB group gained an average of (+ s.d.) 21.9 + 2.4 kg, the UMB group 17.3 + 2.7 while NBS group gained 10.9 + 2.6 kg. Greasy wool production was significantly higher ( $p < 0.05$ ) in the supplemented groups and the rank order of production animal<sup>-1</sup> was 3.6 kg (MUMB), 3.3 kg (UMB) and 2.1 kg (NBS). The estimated monetary gain animal<sup>-1</sup> based on meat and wool production was equivalent to US\$ 47.51, US\$ 37.26 and US\$ 27.59 for the MUMB, UMB and NBS groups, respectively. The FECs for the MUMB group differed significantly ( $p < 0.05$ ) compared to those of the UMB and NBS groups. However, no significant differences ( $p > 0.05$ ) in FECs were found between the UMB and NBS groups. On necropsy, the mean (+ s.d.) group WBs for MUMB was 425 + 76, for UMB 1279 + 240 while that of NBS was 1619 + 402. These results indicate that the MUMBs were effective in reducing and maintaining a low level of GI nematode infection with subsequent improved performance of grazing young sheep.

### **P13. Effects of copper oxide wire particles for the control of gastrointestinal nematode infections of indigenous goats**

*R.M. Waruiru\*, J.C. Nganga, W.K. Munyua, M.N. Mutune and R.O. Otieno*

#### **Abstracts**

Gastrointestinal nematode (GI) parasitism, dominated by haemonchosis, is a major constraint to economic goat production in Kenya. Currently, the conventional method of control is almost based on the use of anthelmintics. Consequently anthelmintic resistance has developed in goat farms in the county. In view of this, there is need for alternative control methods. The use of Copper Oxide Wire Particles (COWP) to help reduce parasite burden is one such alternative. The objective of the present study was to determine the curative and preventive efficacy of COWP in naturally infected goat exhibiting predominant infections with *Haemonchus contortus*, *Trichostrongylus* spp. and *Oesophagostomum venulosum*. The trial was conducted on a farm in Katani area of Kathiani Division, Machakos District, Kenya. Forty five small East African goats were randomly assigned into 3 groups based on faecal egg counts (FEC). Group I were treated orally with COWP boluses (Copinox®, Animal Ltd, UK; 2g), group II were treated with COWP plus Curaflyke® (Fenbendazole and Rafoxanide, 7.5 mg Kg<sup>-1</sup> bodyweight) and group III were the untreated controls. The infection levels were monitored over a period of 98 days by bi-weekly determination of FEC and blood PCV. Serum copper levels were determined before and at the end of the trials. Coproculture was conducted fortnightly to determine relative distribution of infective larvae genera. On days 56 and 98 respectively, 3 goats from each group were randomly selected and necropsied to determine GI nematode burden. The efficacy of COWP was nil against *Trichostrongylus* spp. and *Oesophagostomum venulosum*. In contrast, the efficacy of COWP against *H. contortus* was clearly established in reducing the worm burden by 76.9% for group I and 96.0% for group II goats on day 56 post-treatment. A single dose of either COWP or COWP plus CuraflykeR was effective (group I, 62.8 – 92.1%; group II, 97.0 – 100%) in suppressing faecal egg output up to day 56 post-treatment, and group II FEC remained significantly lower than those of group I up to day 84 post-treatment ( $p < 0.05$ ). There was no difference in PCV between the 3 groups. Copper levels were within normal range before treatment and remained within normal limits at the end of the trial. Results indicates that COWP may represent an alternative to conventional anthelmintics in the control of *H. contortus* infection in goat farms where this parasite is predominant.

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## EXCURSIONS, TOURS AND SAFARIS BY ROAD.

### 1. Nairobi city tour 3hrs (from 9:00AM - 6:00PM)

This is a tour of the whole capital city of Kenya in general which also Includes the following i.e. the National Museum, Snake Park & Railway Museum

2 to 3 pax USD \$ 80 p.p.

4 or more pax USD \$55 p.p.

### 2. Karen Blixen museum & giraffe center 4hrs (from 9:00AM - 6:00PM)

Set at the foothills of Ngong hills, visit the ancient home of the woman who Pioneered planting of coffee in Nairobi. Karen is famous for the Movie “Out of Africa”. Afterwards go to the giraffe manor where you see, play, touch and feed the endangered Rothschild giraffe.

2 to 3 pax USD \$80 p.p.

4 or more pax USD \$55 p.p.

### 3. Bomas of Kenya 4hrs (from 1:30PM - 5:00PM)

A cultural center set in rural environment. Gain sight into village life

& discover different ways of life of the Kenyan people. The Word “Bomas” is a Swahili word meaning homestead.

2 to 3 pax USD \$ 60 P.P

4 or more pax USD \$ 40 P.P

### 4. A. Daphne Shedrick 3hrs (from 11:00AM - 1200noon)

This is a trust fund involved in a myriad of different activities to help conserve Wildlife. Most notable is its work with orphaned baby elephants & rhinos. Play & touch these harmless creatures as you watch them being fed for an hour.

2 to 3 pax USD \$60 p.p.

4 or more pax USD \$50 p.p.

### 4 B. Nairobi National Park & Daphne Shedrick 6hrs (From 6:00AM / 9:00AM)

Enjoy an early morning game drive when you are likely to see the cat family. After the game drive in time for the feeding of the baby Orphaned elephants.

2 to 3 pax USD \$145 p.p.

4 or more pax USD \$120 p.p.

### 5. Paradise Lost 4 hrs (from 9:00AM - 6:00PM)

The largest picnic site in Kenya. 54 acres of pure fun. Enjoy the nature trail, boat ridding, coffee farm tour, explore Stone Age caves, water falls, bird watching, fishing, ostrich feeding, free camel rides. Horse rides is at an extra fee.

2 to 3 pax USD \$80 p.p.

4 or more pax USD \$45 p.p.

### 6. Nairobi National Park 4hrs (from 7:00AM - 6:30PM)

It is about 25 minutes drive from Safari Park Hotel, bordering The south Kapiti plains & Kitengela migration corridor. It is homeTo wildlife including lions, zebras, buffaloes, hippos, rhinos not Forgetting various bird species. Nairobi boasts of being the only “Wildlife capital” globally.

2 to 3 pax USD \$125 p.p.

4 or more pax USD \$100 p.p.



## **7. Tayaina Horse Ridding (from 10:00am- 6:00pm)**

Enjoy horse ridding at the outskirts of the busy capital city. Visit the near by coffee plantation, Karura forest and the Surrounding areas while ridding. For the 1st one hour of horse ridding the cost is as follows

2 to 3 pax USD \$ 80 p.p.

4 or more pax USD \$ 50 p.p.

For every other extra hour the cost is USD \$ 30 per person

The above rates include the following:

- A. Transport to and from in a safari minibus with a pop-up roof.
- B. Park entrance fee.
- C. The tour or game drive.
- D. The services of an English speaking driver/guide.
- E. Minimum two persons. A child pays 50% accompanied by two adults

Except for 4A & B which starts at 6.00AM Or 9.30AM all the others can be organized to start at 2.00pm up to 6PM



**Ministry of Livestock**

