

The UVIMA Project

Uchambuzi wa Viumbe kwa Maendeleo
Taxonomy for Development in East Africa

**BASELINE REVIEW ON TAXONOMIC INFRASTRUCTURE AND CAPACITY ON
PESTS IN KENYA**

DRAFT REPORT

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NATIONAL MUSEUMS OF KENYA

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Executive Summary

The current project aimed at consolidating and mobilizing existing taxonomic information on pests in order to generate tools and products to address the environmental, food and poverty crises in Africa. Visits to various institutions and interviews with various individuals were undertaken to gather important base line information on pest issues in Kenya. In addition, questionnaire was developed and administered to relevant institutions (About 30 key institutions targeted). The survey has made significant steps on various activities that aimed at meeting the objectives of the consultancy. So far there has been a slow response to the questionnaire and this has been a major drawback in trying to gather appropriate information within the set dates. A number of institutions and contact persons have been identified and these will form important collaboration and partners with UVIMA in future undertakings. A number of gaps related to pest issues e.g. specimen collection management, specimen database management have been identified. Our review so far indicates that there is still a lack of expertise in pest taxonomy. Most of the agricultural institutions rely on the National Museums of Kenya for identification. Identification of pest for use in biological control programs requires highly specialised skills to genus or species level which currently is not available in most institutions. Occasionally specimens are sent overseas which takes time before identification. Many local academic institutions offer taxonomic training as a basic course in biological science programs and this has contributed to the low level of professional taxonomist. The few taxonomists can only handle particular groups of organisms. We hence recommend the need for allocation of resources to conduct specialised training in taxonomical work. There's need to invest on specialised identification technologies in the country that will contribute to the objectives of the Global Taxonomic initiatives.

1. Introduction

Kenya's economic growth and development is largely dependent on the agricultural sector which contributes about 25% of the gross domestic product (GDP) and employs about 75% of national labour force. Agriculture is the basic source of livelihood for a majority of the population living in the rural areas (Kinyua 2004, Alila & Atieno 2006). Strategies to increase agricultural production are, therefore, important for food security and poverty reduction leading to the achievement of the number one millennium development goals (MDG). Agricultural pests are a serious production problem in the country. Estimates of crop damage from pest during outbreaks and plagues range from insignificant losses to 100 percent, depending on the year, region and pest species.

This explains why many **global** (FAO, MDGs, IFAD, Rocker feller, UE) **regional** (NEPAD, ASERECA), **national** (Kenya Special Program for Food security, Poverty Reduction Strategy, Kenya Rural Development Strategy, Economic Recovery Strategy for Wealth Creation and Employment) and **sectoral** (Strategy for Revitalizing Agriculture and many Ministerial policies) efforts targeting poverty alleviation and food security have always focused on agriculture. In fact the importance of this sector in the economy is well reflected in the relationship between its performance and key indicators such as GDP and employment. For instance declining trends in growth in agricultural sectors especially in 1990s is well reflected in the drop in GDP and unemployment in Kenya. Concomitantly, the number of absolute poor people around the same period increased from 10 million in 1994 to 13.4 million in 19997 alone.

Despite this huge recognition and many efforts on agriculture, cases of low agricultural production and crop failure leading food insecurity are many. Many factors have been identified to have contributed to the low agricultural production, food insecurity and poverty in general (Strategy for Revitalising Agriculture-Republic of Kenya 2002, Kinyua 2004, Poverty Reduction Strategy-Repub. Of Kenya 2005):

1. Poor access to new technology
2. Inadequate access to credit facilities
3. Inadequate access to land (dwindling land size to agriculture)
4. Poor infrastructure
5. Climate change
6. Inadequate and declining research in agriculture
7. Pest infestation

Each of these problems (factors above) requires different approaches to solve. For instance the first four (1-4) can easily be sorted by the political and intergovernmental cooperation. Factors,5-7 depends on knowledge and information and are their solution depends on research, and information access. For example Hill (1972) contends that a lot of information on agricultural pests exists out there, enough to aid effective management and prevent extensive

losses, but poor access to this information by farmers and extension officer is responsible for widespread crop damages. In agricultural sense, we get concerned when damages done to crops by animals (pests) or plants causes loss in yield or quality resulting to loss of profit and nutritional value by the farmer or consumer respectively. This is because such losses lead to poverty and malnutrition culminating to death, poverty and general economic losses. Conventionally, when a loss in yield reaches a certain proportion, say a minimum 5% (Edward & Heath 1964), then the animal or plant causing the loss is referred to as economic pest.

1.2 Pests

Pests are animals or plants which harm or cause damage to man, his animals, crops or possessions or even just cause him annoyance (Hill 1972). For purposes of scoping this task we have confined ourselves to crop pests.

Crop pests are principal causes of malnutrition and general decline in crop production, besides bad weather and inappropriate technology. Overall pests contribute economic losses leading to hunger, poverty and country economic recession. Economic in this sense is the relation of crop losses to production costs. For instance, due to a pest outbreak a particular crop may be scarce and sell for higher prices which might be good for the farmer but not for the entire country economy.

Scale of pest problems in Kenya

- a. Armyworm infestation is still contributing to significant losses per annum in Kenya
- b. Rodent pests contribute to losses in cereals amounting to thousands of tones per year
- c. Quelea

Rodent problem in farms and stores is an old problem and Aristotle's remarks in way back between 384-322 BC that "The rate of propagation of field mice in country places, and the destruction that they cause are beyond all telling" The all important question that sticks is why an effective management have become elusive.

One of the most important reasons for lack of effective pest management strategy is inadequate knowledge on pests identity and therefore ecological dynamics. Taxonomic information on pests that would lead to proper diagnosis, damage assessment, forecasting and effective control is virtually unavailable to farmers, extension officers and researchers (Singleton et al., 1999).

Taxonomy is the description, naming and classification of organisms (Green 1998) It is fundamental to the comparative study of organismic diversity. Management of any organism either for conservation, propagation or eradication fundamentally relies on knowledge on the identity of the organism. Good

taxonomic knowledge leads to accurate identification which then lead to effective control strategies. Taxonomy therefore, is about communication and information. To conserve, manage or use organisms, or to communicate about them, we need unambiguous nomenclature. Good taxonomy delivers stable classification and unequivocal names both which facilitates communication (UNEP/CBD/SBSTTA4/inf.1). In turn this makes it possible to conserve, manage or use biodiversity more effectively (UNEP/CBD/SBSTTA4/inf.6).

In absence of proper taxonomic information, people tend to confuse two or several species for one often leading to unnecessary and ineffective methods of control. This often culminates into continued loss of crops in farm and in-stores due to pests. This situation can be ameliorated by providing taxonomic information to farmers, extension officers and other users whose contribution would lead to timely and accurate pest control managements.

The United Nations Convention on Biological Diversity (CBD) has identified taxonomy as an impediment to conservation and sustainable use of biological diversity. In other words, lack of taxonomic expertise was the most serious problem to sound in management biodiversity resources. In recognition of the magnitude of this taxonomic impediment, CBD formulated the Global Taxonomy Initiative (GTI) to provide a broad, collaborative and international forum to raise awareness for the importance of taxonomy. GTI is intended to augment the work of the convention by (a) providing access to taxonomic improve management biological diversity, and (b) contribute to infrastructure and capacity building in reference materials, databases, and taxonomic expertise in all regions of the world.

In October 2008, the UVIMA initiative was created at a meeting in Arusha to address the taxonomic impediment in managing pollinators, pest and invasive alien species the east Africa (Kenya, Uganda and Tanzania). The project aims to mobilize existing taxonomic information for generating tools and products relevant to the environmental, food and poverty crises in Africa. The project seeks to improve flow of information from a network of centers of generation to the end users to enhance ecosystem resilience and food security, focusing on three areas: pollinators, invasive alien species and pests. The project will contribute to address some of the priorities identified during the Botanical and Zoological Taxonomic Networks for Eastern Africa (BOZONET). This study was commissioned to obtain national baseline taxonomic information in Kenya useful to pest management to improve food security and help alleviate poverty.

2. Objectives

2.1. Aim

The current project aimed at consolidating and mobilizing existing taxonomic information on pests in order to generate tools and products to address the

environmental, food and poverty crises in Africa. Pests are a constant challenge to agricultural productivity and trade.

The UVIMA project will build on past and ongoing national and regional initiatives and address some of the priorities identified during the GEF PDF B phase of the Botanical and Zoological Networks for Taxonomy in East Africa (BOZONET) Project. While focused on East Africa, UVIMA will also provide a platform for engaging partners, sharing experiences and delivering outcomes at the pan-African level. Our report however presents information on pests that eventually contributes to the general objectives.

2.2. OBJECTIVES

The specific objectives as listed were derived from the Terms of Reference;

- Identify tools/methodologies for review
- Document institutions, projects, experts, initiatives, programmes and databases involved in curation, management and use of pests at national level in Kenya, Uganda and Tanzania; indicate the current status of the collections, their digitisation and associated databases and determine future prospects for growth and use.
- Document the expertise available and make recommendations on capacity needs at national level.
- Identify potential partners, collaborations and linkages regionally and internationally relevant to the UVIMA project working on pests.
- Identify the gaps in handling pests issues and provide recommendations as to how the UVIMA project can contribute to bridging the gaps.
- Document current institutional mandates and sources of funding available, additional opportunities and potential for new funding and strategic partnerships to enhance effective delivery of the broader goals and objectives of the UVIMA project.
- Document and address any other pertinent issues not outlined above, in the broader context of and relevant to the UVIMA project concerning baseline review for pests at national level.

3. Tools/methodologies used in the review

3.1. Methods used

A number of methodologies were employed based on the required end results and specific tasks as stipulated in the Terms of Reference. Approaches involving desktop and literature searches, institutional visits, direct and indirect interviews, consultative stakeholder brainstorming meetings and secondary data/information analysis were employed in this work. Desktop searches consisted of print library searches at various institutions. Internet searches for information on institutional mandates were also consulted. To generate details on taxonomic information stored by various institutions direct and indirect interviews were conducted with persons working in the institutions. Because of time constraints the institutions visited were limited to those within Nairobi. These appeared to be a representative cross section of institutions dealing with pest issues in Kenya.

3.2. Tools used

Questionnaire was prepared and sent to all potential stakeholders to provide additional information that would be required within the objectives of the current project. These groups included research institutions and individuals undertaking taxonomic studies and/or working on related pest issues in Kenya. Pest record information from multiple databases was also searched from the relevant institution. Few of these questionnaires have been returned with others promised. A copy of the questionnaire is attached in annex 2.

A checklist of pest information stakeholders both data holders and end users was developed defining roles and respective information needs. This information was derived from the questionnaires, face interview, focused group discussions and consultations with experts. Herein, we report on existing infrastructure, capacity, end user needs and gaps on pests in Kenya.

4. RESULTS

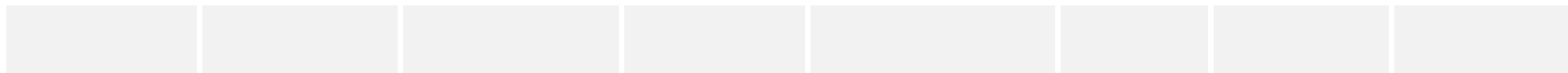
4.1. Existing Resources

(Institutional and personnel documented) in each case defining. Please fill-in the following table: Make sure the information give covers the whole country

CATEGORY /Resources	Source	Where it is developed	Where it is maintained	Where it is Disseminated (or not)	Why developed	Target audience	How - approach/method/design/platform
Collections	National Museums of Kenya	Within various departments	Within various departments	To the public	References, Training	Academic & research institutions	Organised visits to institutions
	University of Nairobi	College of Agriculture and Veterinary Science,	Within the College	University learning	Training	Students, University scientists	Organised visits to institutions
	ICIFE	ICIFE	ICIFE	Farmers, Agricultural Extension Officers, Technicians	Training & Research	Researchers and students	Organised visits to institutions
	KARI	National Agricultural Research	KARI	Relevant stakeholders	Training &	Researchers students	Organised visits to

		Laboratory (NARL)			Research		institutions
	Ministry of Agriculture	Ministry of Agriculture	Crop Protection Division,	Farmers	Training & Workshops	Farmers, extension officers	Farmer open days, workshops
	<i>EAPIC – Regional Plant Pest Database</i>	East Africa Phytosanitary Information Committee (EAPIC)	East Africa Phytosanitary Information Committee (EAPIC)	NPPO member countries, Kenya, Rwanda, Tanzania, Uganda, and Zambia.	Develop pest reporting methods and Internet accessible	NPPO member countries, Kenya, Rwanda, Tanzania, Uganda, and Zambia.	Collaboration with UN-FAO
	<i>PCPB pesticide approval database</i>	<i>PCPB</i>	<i>PCPB</i>	Across the country	To improve the management of pesticide-registration data	Public	Web-Site
	<i>Kenya Phytosanitary Information</i>	KARI and KEPHIS	KARI and KEPHIS	Across the country	Database of pest on specific	Quarantine officers, Researcher	Web base

	<i>Management System (PIMS)</i>				species	s	
Secondary e.g. keys, literature, publications and tertiary	Libraries, Internet	ICIZE, KARI, NMK, Universities, National Polytechniques and Colleges, Ministry of Agriculture Libraries	ICIZE, KARI, NMK, UNIVERSITIES	Public Education	Research, Education and student training	Farmers, Extension Officers, Students and Policy makers	Print Copy, CD-ROMS, Electronic
Communication resources	Agricultural resource centres, Internet	KARI, Universities, Agricultural Colleges	KARI, Universities, Agricultural Colleges	Farmer Field Schools	Farmer Education	Farmers, Extension Officers	Field Guides, Brochures, Pamphlets
Other resources							



4.2. Status of infrastructure for developing the resources

CATEGORY	Institutions Responsible (List all institutions you have come across in your country, including addresses, telephones and contact person(s))	STATUS Rank from 0-10 where 0 = not available and 10 = in good/excellent condition <i>(scale without indicators – given by TZ) Action: go with them??</i>	PROGRESS Description of work undertaken to improve the resource	ISSUES Description of problems encountered; issues that need to be addressed; Decisions /Actions that can be taken
Collections	National Museums of Kenya	6-Good Condition	Collection space expansion Training interns in collection management	<p>1. Human resource development and training with the objective of improving access to formal training courses in taxonomy and biosystematics in the region.</p> <p>2. Development and application of new technologies including acquisition and/or development of biochemical, molecular and computer-based diagnostic systems, including electronic keys.</p>
	Department of Zoological	5-Fair	1. Building up of the	1. The existing specimen

	<p>Sciences, University</p>	<p>Kenyatta</p>	<p>collection is done by individual interests</p> <p>2. Plans are underway to digitise the collection</p>	<p>collection is:</p> <p>a) Managed by one of the Teaching staff as an added responsibility, and assisted by a few Technicians.</p> <p>b) Not properly curated; catalogued nor updated</p> <p>2. The Museum operates on a constrained budget for buying preservatives</p> <p>3. Insufficient specimen display space, storage cabinets, collection vehicles</p> <p>4. Dry specimen attacked by pest leading to disintegration or complete loss</p>
	<p>KARI/NARL</p>	<p>5-Fair</p>	<p>Last national crop pest and disease survey was done in 1982. Since then building up is done by individual interest and projects by visiting scientist or students.</p> <p>There are plans to digitise the collection</p>	<p>1. Specimen sorted to species but few verified by taxonomic authority</p> <p>2. No initiative to do regular curation</p> <p>3. Curation manger not a qualified taxonomist; helped by a few technicians all with hands on experiences.</p> <p>4. No computers, scanners, GPS handsets, etc for digitization work</p> <p>5. No budget for specimens collection, vehicle, preservatives,</p>

				mounting material, etc 6. No internet connection
	International Centre for Insect Physiology and Ecology (ICIPE)	8-Good	Most of the insect collections sorted to species level, and verified by taxonomic authority. Collections are partly digitised, work is on going to complete the process	1. Constrained institutional budget for collection work 2. Collection are mainly from regions and project sites there do not give a national representation
	Crop Protection Division, Ministry of Agriculture	7-Good	Collections build up done on individual interest or brought by farmers	1. Insufficient field guides/manuals for pest identification are lacking
	Desert Locust Control Organization of East Africa (DLCO-EA)	8-Good		
Databases	EAPIC – Regional Plant Pest Database	Under Development	Consultations among experts to come up with complete list is underway	Information is at the administrator stage
	Kenya Phytosanitary Information Management System (PIMS)	Under Development	Information on a few pest available	Problem of data base design Lack of key information for some species
Secondary e.g. keys,	Universities,	5-Fair	Not much is done	Lack of funds to subscribe to

literature, publications and tertiary	Polytechniques, Agricultural Colleges			journals, buy books Most literature are old and probably outdated The modern ones are insufficient and unaffordable to majority of individual researchers and students
Communication resources	Agricultural Resource Centre KARI, Agricultural Technology and Information Response Initiative	7-Good	There is government program to ICT in villages. This can improve internet communications and cross-linkages	Need to stock with more literature and reading material at the regional centres Introduce e-library facility
Other resources				

4.3. *New opportunities where they exist*

CATEGORY	Name List all new opportunities you have come across that do not exist in your country)	Institution List the all institutions that do not exist in your country and show where this new opportunity is	STATUS Rank from 0-10 where 0 = not available and 10 = in good/excellent condition	Detail Details of the institutions including addresses, telephones and contact person(s)
Technologies	Geographical Information System for Pest (database system for gathering pest information)	FAO member states	8 – still under development	Gillian Allard, Forest Officer, Protection and Health, Forest department FAO gillianallard@fao.org
Expertise				
Hardware	Field work Manual for ATBI + M sites (with packages in Applying Taxonomy to conservation)		10	BIONET
Software				
Programmes	Training course in taxonomy	Royal Museum for	10	Royal Museum for Central

	and systematics of African fruitflies	Central Africa in Tervuren (Belgium)		Africa in Tervuren (Belgium)
Projects and partnerships				
Others				

4.4. Current status and future plans of 2, 3 and 4 above

- a) of existing resources
- b) Infrastructure
- c) opportunities

CATEGORY	Current status	Gaps	Future plans
Collections and Databases	<p>Most institutions charged with pest management hold disparate collections and datasets that are not well curated and catalogued.</p> <p>Little measures are taken to protect the collections against hazards such as fire, pest damage, moisture are inadequate</p>	<p>Collections exist in preserved specimen and datasets kept in manual formats, rendering them inaccessible to the end users</p> <p>Most collections representation is limited to pest of interest, field or region</p> <p>Periodic surveys not carried out</p> <p>Incomplete local pest record data</p>	<p>Establish KARI/NARL as the national coordination centre for agricultural specimen and data collection</p> <p>Specimen cataloguing, digitization and electronic data basing to allow on-line access and easy dissemination</p> <p>Revise the current pest status of known pest and the emerging pest species in the event of global warming easy dissemination</p> <p>Explore ways of utilizing manpower resources from higher learning institutions in the Country by collaborating in data collection and mapping of pest distributions</p>

Secondary e.g. keys, literature, publications and tertiary	Taxonomic identification keys are available for e.g. insects, fungi, nematodes, birds and mammals are available Field oriented brochures, Annual reports and Journal publications are available in many pest institutions e.g. ICIPE, KARI, KEPHIS, KEFRI, Universities	Lack of simplified pest identification guides for farmers and agricultural extension Lack of common/local names for some pest species Man	Development of user friendly field identification guide for use by non-scientist e.g. farmers and agricultural extension officers Kenya and EA region Incorporation of indigenous knowledge in pest common agricultural pest guide books
Communication resources	Few networks of researchers exist	Not known by many stakeholders Information channel long hence delays	Strengthen the existing networks between collaborating institutions for ease of data/information sharing Need to give timely information/reports
Other resources			
Technologies	Electronic equipment for example scanners, GPS handsets, internet connection and email services are available but inadequate	Limited financial resources	Provide appropriate electronic equipment, high resolution digital cameras and scanners
Expertise	Limited technical expertise in Taxonomy and Curation	Inadequate trained personnel.e.g. taxonomist, zoologists and plant pathologists	Training in personnel e.g. taxonomist, zoologists and plant pathologists Train curation manager in data management and database design

Hardware	Basic scientific and collecting equipment are available but inadequate in many institutions	Limited financial resources	Secure modern equipment to replace the old technologies
Software	GIS are available	Specialised identification software unavailable	Avail for purchase and renewal of licenses
Programmes	Few available in institutions e.g. Crop Protection at KARI	Lack of trained staff and turnover	More training
Projects and partnerships	There are several operating in the country	Weak coordination structure Depended on individual initiatives Donor driven interest	Strengthen institution linkages Design projects based on national needs
Others			

4.5. Existing communication strategies and dissemination channels (correction by TZ team)

CATEGORY	Name	Institution List the all collaborating Institutions	CONTACTS Give contact details of the Institution and focal person
Networks	International Plant Diagnostic Network – East Africa (IPDN)	IITA, World Vegetable Centre	To be provided
	EAFRINET	NMK, KARI,	Dr. Wanja Kinuthia, National Museums of Kenya Box 40658 GPO-00100, Nairobi. Tel: +254-20-3742131/4 Email:
	Striga Network	African Agricultural Technology Foundation, BASF, CIMMYT and FORMAT, KARI	Canon Savala, P.O. Box 79, The Village Market, Nairobi. Telephone 254-733-972722. Email: format@wananchi.com

	African Crops Network	AATF, FORMAT, CIMMYT, SCODP, STRIGAWAY, ROCKEFELLER FOUNDATION	<p>Dr. Joseph DeVries Deputy Director, Food Security Program The Rockefeller Foundation, Eden Square Complex Chiromo Road, Westlands Block 1, 5th Floor P.O. Box 66773 Westlands 00800, Nairobi, Kenya Telephone: +254 (20) 3750 627 (Pilot) ISDN Line: +254 (20) 3675 000 Fax Line: +254 (20) 3750 653</p> <p>Email: jdevries@rockfound.org</p>
	African Crop Science Society	ROCKEFELLER FOUNDATION, RUFORUM	<p>The President, African Crop Science Society Council, Prof. Kasem Zaki Ahmed, Department of Genetics, Faculty of Agriculture, Minia University, El-Minia, Egypt, ET-61517, (ahmed_kz@yahoo.com) Tel (work): ++ 20 (86) 2 36 23 33 Mobile:++ 20 (12) 10 37 50 4 Fax (work):+ + 20 (86) 2 36 21 82</p>
	International Association for the Plant Protection Sciences (IAPPS)	KEPHIS	<p>E. A. Heinrichs Dept. of Entomology, University of Nebraska Lincoln, NE 68583-0816 Phone: (402) 472-2123 Fax: (402) 472-4687 Email: eheinric@vt.edu</p>

	East Africa Regional Root Crops Research Network (EARRNET)	KARI, IITA, USAID, WB, AMREF	Coordinator, EARRNET. P.O. Box 7878, Kampala. Tel: 256 41 285060. Fax: 256 41 285079 Mob Tel: 25675787815. Email: p.ntawuruhunga@iitaesarc.co.ug
	Kenya Network on Urban and Peri-Urban Agriculture and Livestock (UPALNet-Kenya)	KARI	The Director, KARI P.O.Box 57811, City Square, NAIROBI, 00200, Kenya Fax: +254-020-4183344 Tel No(s): +254-020-4183720, 4183301-20 Email: Resource.center@kari.org
Partnerships	Birdlife Africa Secretariat	Nature Kenya, Nature Uganda, NMK, KWS	
Collaborations	East Africa Phytosanitary Information Committee (EAPIC)	NPPO member countries, Kenya, Rwanda, Tanzania, Uganda, and Zambia, UN – FAO, International Plant Diagnostic Network – East Africa (IPDN)	Esther Kimani, P.O. Box 49592-00100 Nairobi. Tel: 254-020- 3597201/2/3 3536171 3536172 Cell: 0722-516221 / 0723-786779 / 0733-874274 Fax: 254-020- 3536175 Email: kephisinfo@kephis.org

Others			

4.6. Defining specific challenges, constraints, key gaps and opportunities for UVIMA

#	Issue/Category	Specific challenges	Constraints	Key gaps	Opportunities	Proposed Solution
	Taxonomic Knowledge	Low level of use and knowledge of taxonomic information in Kenya	Access to relevant training No institutions offering specialized training in pest taxonomy	Lack specialized in some taxa especially the emerging pest species due to global warming	Collaborations with relevant academic institutions	Provide taxonomic training for staff at various institutions
	Pest databases	Not centralized and institutionalized	inaccessible to stakeholders	Most databases are need driven or project specific	Databases exist and this could be harmonized and organized to suit needs of UVIMA	Collate pest information and existing database and create a clearing house for pest information
	Specimen collections	Not pest specific all mixed up in several collections	Accessibility Very little new collections being added	Lack specialized skills to manage and handle specimens	Collection managers exist in the various institutions	Develop pest collections and special training for staff at various institutions with collections.
	Resources (Funding and logistics) for taxonomic work	Taxonomical work does not attract funding	Many institutions operate on very small budgets	Modern scientific and electronic equipment inadequate in many institutions	Through collaborations its possible to obtain trust funds	Collaborations and partnerships should be able to source funding

				visited		

4.7. Checklist of resources persons in the country with knowledge in Taxonomy including (Pollinators, Pests and Alien Invasive Species)

Full Name	Qualification	Specialization	Institution	Address	Office phone (landline)	Mobile phone	Official e-mail address
Christopher Odhiambo	MSc	Vertebrate Pest Management	National Museums of Kenya	Box 40658 GPO-00100 Nairobi	374216 1/4 ext. 2555	072239 7762	codhiambo@mpala.org
Philista Adhaimbo	MSc	Conservation Biology	National Museums of Kenya	Box 40658 GPO-00100 Nairobi	374216 1/4 ext. 2555		
Bernard Agwanda	MSc	Mammal Taxonomist	NMK Head, Dept of Mammalogy	P. O. Box 40658-00100, NAIROBI	374213 1-4	0722280 995	Ben_risky@yahoo.co.uk
Fabian Haas	PhD	Entomologist	ICIPE	P.O. Box 30772-00100, Nairobi			
Charles M. Warui	PhD	Spiders & Terrestrial Mollusk Taxonomy & Conservation	Invertebrate Zoology Dept. NMK	P. O. Box 40658-00100, NAIROBI	374673 / 374213 1-4 Ext.283	0720764 784	cmwarui@yahoo.com
Emily Kimwomi	PhD	Entomologist	KARI/NARL	Box 14733 NAIROBI		0724648 775	ebousi@yahoo.com
Eunice Kairu	PhD	Ecology, Conservation and Biodiversity	Zoological Sciences Dept., KU	Box 43844-00100 NAIROBI	800901 /19	0722340 733	
J. M. Mueke	PhD	Entomologist	Zoological Sciences Dept., KU	Box 43844-00100 GPO-	800901 /19		

				00100 NAIROBI			
Callistus K.P. Ogol	PhD	Applied Entomology/Bio diversity	Zoological Sciences Dept., KU.	Box 43844- GPO- 00100 NAIROBI	800901 /19		
Nicholas Oguge	PhD	Vertebrate Pest Management, Animal Ecology	Earthwatch Institute		800901 /19	0722297 029	otienoh.o guge@g mail.com
Beatrice Tengecho	PhD	Ecological Entomology	Zoological Sciences Dept., KU.	Box 43844- GPO- 00100 NAIROBI	800901 /19		
Patrick Mbugi	PhD	Agricultural Entomology	Zoological Sciences Dept., KU.	Box 43844- GPO- 00100 NAIROBI	800901 /19		
Jean Nguya Maniana	PhD	IPM	ICIPE				nmaniana@icipe.org
G. Nyamasyo	PhD	Agricultural Entomology	SBS, UoN				
C. Khamala	PhD	Agricultural Entomology	SBS, UoN				
Benson Kanyi		Pest Management Officer	Tree Biotechnology, Kenya				bkanyi@tree-biotech.com
Girma Hailu	PhD	Forest Pest Management	World Agroforestry Centre				g.hailu@cgiar.org
Beatrice Khayota	PhD	Plant Taxonomy, Cites (Scientific Authority)	National Museums of Kenya	P. O. Box 40658- 00100, NAIROBI	374216 1/4 668	0733780	biodiversity@wananchi.com bkhayota@hotmail.com
Desterio Ondieki Nyamongo		Seed Science	KARI	P. O. Box 20412- 00200, NAIROBI Tel	-	0733921 956	dnyamongo@yahoo.co.uk agbk@mwananchi.com

Geoffrey M. Mungai	Bsc	Plant Taxonomy	National Museums of Kenya	P. O. Box 45166-00100, NAIROBI	2743513	0733849071 0721422977	plants@afrikaonline.co.ke
Geoffrey Mwachala	PhD	Systematic Botany	East African Herbarium, NMK	P. O. Box 45166-00100, NAIROBI	3742161	-	plants@afrikaonline.co.ke
John Mutua Mugambi	PhD	Veterinarian/Parasitologist	KARI, MUGUGA	Veterinary Research Centre, P. O. Box 32, KIKUYU	2700640	0721433783	karinvrc@kari.org jmmugambi@hotmail.com
John Kiogora Mworia	PhD	Ecology	School of Biological Sciences	P. O. Box 30197 - 00100, NAIROBI	4449004	0723582552	jmworia@uonbi.ac.ke jmworia@yahoo.com
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Paul Nduati Ndegwa	PhD	Entomologist	SBS-UON	SBS, UON, P. O. Box 30197, NAIROBI	4445763	0723649433	pndegwa@uonbi.ac.ke pndegwa@yahoo.com
Robert Mutugi Chira	PhD	Ecologist	SBS-UON	P. O. Box 30197 - 00100, NAIROBI	444235763	0722822795	jchira@uonbi.ac.ke
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Bioinformatics Conservation	NMK	40658- 00100, NAIROBI	374213 1-4 Ext.28 3	e.co.ke siromasin de@hotmail.com
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4.8. Related Projects

Please report on the status of projects whose objectives are more less similar to UVIMA Project in your country along the lines of your consultancy using the table below

Project Name	Implementing institution	Source of funding	Status (project beginning, mid-term, ending)	Focal person	Contact details
Integrated Pest Management Framework for Kenya Agricultural Productivity and Agribusiness Project (IPMF-KAPAP)	Ministries of (Agriculture, Livestock Development, Fisheries Development, and Co-operative Development), KARI and KENFAP	Kenya Government	Beginning	Permanent Secretary, Ministry of Agriculture	
IPM for cashew nut in Africa	ICIZE	German Federal Ministry for Economic Cooperation and Development	Ongoing	Dr. Jean Nguya Maniania	nmaniania@icize.org
Tackling Liriomyza leaf	ICIZE	German	Ending	Dr.	University of

mining flies, invasive pests of Global Proportions		Federal Ministry for Economic Cooperation and Development		Adenirin Chabi- Ofaye	Hohenheim , Germany
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5. Reference

6. ANNEXES

In each report, please include the following information in the annexes:

- ✓ General photographs illustrating the environment of the Baseline Review
- ✓ Soft copy of thematic reports where available or where they can be got from (institution and focal person)
- ✓ Hard copy of thematic reports where available or where they can be got from (institution and focal person)
- ✓ List and contact details of all persons met and referred to during the consultancy meeting (to build the UVIMA Dbase)
- ✓ Questionnaire used

6.1. Annex 1: Inventory of Outputs/Services (fill in as appropriately as you can)

a) Consultancy meetings

No	Meeting Type	Title	Venue	Dates	Convened by	Organized by	# of Participants	Report issued as doc no	Language	Dated
1.	Consultants' discussions with thematic group leaders	Terms of Reference and payments	NMK	7/05/2009	Mr. Bernard Agwanda, Dr. Emily Wabuyele, Dr. Wanja Kinuthia	Mr. Bernard Agwanda, Dr. Emily Wabuyele,	7	Meeting Notes	English	7/05/2009
2.	Consultative	Brainstorming, exploring research tools & methods	NMK	8/05/2009	Mr. Bernard Agwanda	Mr. Bernard Agwanda	3	Meeting notes	English	8/05/2009
3.	Discussions	Administer Questionnaires	DLCO-EA	15/05/2009	Mr. Chris Odhiamboko	Mr. James Gatimu	4	Answers to Questionnaire Discussion notes	English	15/05/2009
4.	Face Interview	Plant Pathogens	Crop Protection Division, MoA	25/05/2009	Mr. Chris Odhiamboko	Mr. P. N. Nyaga & Teresia Karanja	3	Answers to questionnaire	English	25/05/2009
5.	Focused Group Discussion	Migratory Pest and their control	Crop Protection Division, MoA	26/05/2009	Mr. Chris Odhiamboko	Mr. Roy Kithae	6	Discussion notes	English	26/05/2009

6.	Discussions	Insect taxonomy, collections, databases and research projects	ICIPE	2/06/2009	Mr. Chris Odhiamboko	Dr. Fabian Haas	3	Discussion notes and answers to questionnaire	English	2/06/2009
7.	Face Interviews	Taxonomic assessment of pest in Kenya	Crop Protection Division, MoA	25/05/2009	Mr. Chris Odhiamboko	Mr. P. N. Nyaga & Teresia Karanja	3	Answers to questionnaire	English	25/05/2009
8.	Focused Group Discussion	Migratory Pest and their control	Crop Protection Division, MoA	26/05/2009	Mr. Chris Odhiamboko	Mr. Roy Kithae	6	Discussion notes	English	26/05/2009
9.	Discussion	Pest Taxonomy, Collections, Databases at KARI	KARI/NARL	26/05/2009	Mr. Chris Odhiamboko	Dr. John Kasina & Dr. Emily Kimwomi	2	Discussion notes	English	26/05/2009
10.	Phone Interview	Pest information assessment	KEPHIS	28/05/2009	Philista Malaki	Ms. Philista Malaki	2	Answers to Questionnaire	English	28/05/2009
11.	Consultative	Progress review	NMK	29/05/2009	Mr. Bernard Agwanda	Chris Odhiamboko	2	Meeting Notes and Comments on Draft Report	English	29/05/2009
12.	Face Interview	Pest information assessment	KWS	2/06/2009	Dr. Chege	Ms. Philista Malaki	2	Answers to Questionnaire	English	2/06/2009
	Discussions and Face interviews	Pest Information Assessment	Dept. of Zoological Sciences, KU	3/06/2009	Mr. Chris Odhiamboko	Dr. Eunice Kairu	3	Discussion notes & answers to questionnaires	English	3/06/2009

13	Consultative	Review Progress	NMK	4/06/2009	Mr. Mathias Behangana	Dr. Emily Wabuye	9	Meeting Notes	English	4/06/2009
14	Face Interview	Pest information assessment	KWS	5/06/2009	Mr. Mr. Vincent Obanda	Ms. Philista Malaki	2	Answers to Questionnaire	English	5/06/2009

b) Electronic & Printed Materials

No	Type	Title	Author(s)/Editor(s)	Publisher	Symbol	Publication Date	Where to get it and / or contact person
1.	Print	Alien and invasive species: impacts on forests and forestry. A review.	Moore B	Forestry Department, FAO, Rome	Forest health and Bio-security Working Paper FBS/8 E	2005	Forestry Department FAO, Rome
2.	Print	Contribution of forest insects to food security. The example of caterpillars in central Africa.	FAO	Forestry Department, FAO, Rome	Non-wood Forest Products working paper	2004	Forestry Department FAO, Rome

					No.1		
3.	Print	Bio-security and forests: an introduction-with particular emphasis on forest pests	Cock M	Forestry Department FAO, Rome	Forest health and Bio-security Working Paper FBS/2 E	2003	Forestry Department FAO, Rome
4.	Print	Patterns in a maize cropping system in the Kenyan Rift Valley	Odhiambo C & Oguge NO	ACAIR Publications, Canberra	Conference Proceedings	2003	Chris Odhiambo, National Museums of Kenya codhiambo@mpala.org
5.	Print	An assessment of forest diseases in Kenya with specific emphasis on cedar decline	Anderson, R.L.	Forestry Department, Ministry of Environment and Natural Resources, Nairobi Kenya	FAO Publications	1994	Forestry Department, Ministry of Environment and Natural Resources, Nairobi Kenya
6.	Print	Cypress aphid, a new pest of conifers in eastern and southern africa	Ciesla W.M.	FAO publications	FAO plant protection bulletin	1991	
7.	Print	Exotic aphid pests of	Kenya Forestry	Kenya	Works	1991	Kenya Forestry

		conifers. A crisis in African forestry	Research Institute	Forestry Research Institute, Muguga, Kenya	hop proceedings		Research Institute, Muguga, Kenya
8.	Electronic	Bionet bulletin	Bio-Net	Bio-NET-INTERNATIONAL Secretariat	Bio-NET Bulletin NO. 99	2009	www.bionet.intl.org
9.	Electronic	Integrated Pest Management Training Workshop Report) Scaling up: Training of adult education teachers on general principles of crop husbandry and integrated pest management KARI-Kisii, Kenya	Minja EM, J. Ogecha J, Ampofo JKO & Mziray HA	International Centre for Tropical Agriculture (CIAT)	Published Report	2003	Coordinator CIAT, Selian Agricultural Research Institute Dodoma Road P.O. Box 2704, Arusha-Tanzania. Tel: (+255-27) 2502268/2508557 Fax: (+255-27) 2508557 E-Mail: <ciattz@habari.co.tz>
10.	Electronic	<i>Striga Technology Extension Project</i> Striga Technology Extension Project (STEP) Long Rains 2008 Report.	Woomer PL & Savala CEN	Forum for Organic Resource Management and Agricultural Technologies (FORMA	Published Report	2008	P.O. Box 79, The Village Market, Nairobi, Kenya. Email: format@wananchi.com

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11	Electronic	Improved fallows for western Kenya: an extension guideline	Amadalo B, Jama B, Niang A, Noordin Q, Nyasimi M, Place F, Franzel S, & Beniast J.	Nairobi: World Agroforestry Centre (ICRAF).	Extension Guide	2003	Jan Beniast Jan BeniastWorld Agroforestry Centre PO Box 30677, GPO 00100 Nairobi, Kenya
12	Electronic	Abundance of insect pests and their effects on biomass yields of single vs. multi-species planted fallows	Girma H., Rao, MR; Day R.; & Ogol CKPO	Springer	Research Article	2006	ghailu@cgiar.org
13	Electronic	Distribution, pest status and agro-climatic preferences of lepidopteran stem borers of maize in Kenya	Ong'amo GO, P. Le Ru Bruno, D Stephane, Moyal P, Calatayud P-A & Silvain J-F		Research Article	2006	International Centre of Insect Physiology and Ecology (IRD/ICIPE), P.O. Box 30772, Nairobi, (Kenya Email: bleru@icipe.org

6.2. Annex 2: Major pest and diseases of food crops and livestock in Kenya

NOTE: Please, note that the list in annex 2 is our own compilation from the searches we did in the internet. It is does NOT represent the entire pest organisms in Kenya. KEPHIS and KARI are currently working on a more comprehensive list.

a.) Major pests and diseases of food crops in Kenya

Common Name	Scientific Name	Crops Attacked
Stalk borers	<i>Busseola fusca</i>	Maize
African armyworm	<i>Spodoptera exempta</i>	Maize, Rice, Sorghum, Millet
Seedling weevil	<i>Tanymecus spp.</i>	Maize
Seedling weevil	<i>Mesokeuvus spp.</i>	Maize, Sorghum, Millet
Larger grain borer (LGB)	<i>Prostephanus truncatus</i>	Maize, dry Cassava tubers or chips, Sorghum, Millet
Flour beetle	<i>Tribolium spp.</i>	Maize, Cassava, Sorghum, Millet
Granary weevil	<i>Sitophilus granarius</i>	Maize, Sorghum, Wheat, Rice
Maize weevil	<i>Sitophilus zeamais</i>	Maize, Sorghum, Wheat,
Rice weevil	<i>Sitophilus oryzae</i>	Rice, Paddy
Grey leaf spots (GLS)	<i>Cercospora zeae-maydis</i>	Maize
Maize streak virus (MSV)	<i>Cicadulina mbila</i>	Maize
Leaf rusts	<i>Puccinia sorghi</i>	Maize
Leaf blights	<i>Helminthosparium turcicum and H. maydis</i>	Maize
Common smut	<i>Ustilago maydis</i>	Maize
Storage beetle	<i>Acanthoscelides obtectus, Zabrotes subfasciatus</i>	Maize, sorghum, rice, millet, beans, cow peas
Cowpea pod borer	<i>Maruca vitrata</i>	Cow pea
Simama	<i>Oxygonum sinuatum</i>	Maize
Star grass	<i>Cynodon Spp.</i>	Maize, Millet , Sorghum, Cassava, Potato, Common Bean (Phaseolus)
Wondering jew	<i>Commelina benghalensis L.</i>	Maize
Late weed	<i>Digitaria spp.</i>	Maize
Witch weed	<i>Striga spp.</i>	Maize, Sorghum, Millet
Baboons	<i>Papio spp.</i>	Maize, Sorghum, Banana, Cassava, Sweet Potato, Cotton
Monkeys	<i>Cercopithecus spp., Colobus spp.</i>	Maize, Sorghum, Banana, Sweet Potato, Cotton

Wild pigs	<i>Hylochoeris spp.</i> , <i>Potamocheirus spp.</i>	Maize, Sorghum, Cassava, Sweet Potato
Warthog	<i>Phacoeris aethiopicus</i>	Maize, Cassava, Sweet Potato
Red Billed Quelea	<i>Quelea quelea</i>	Wheat, Barley, Rice, Sorghum, Millet
Weaver Birds	<i>Ploceus spp.</i>	Maize, Sorghum, Millet
Speckled Mousebird	<i>Colius striatus</i>	Papaya, Guavas, Mangoes, Tomatoes, Kales, Cabbages, Capsicum
Multimammate Rat	<i>Mastomys natalensis</i> , <i>M. erythroleucas</i>	Maize, Rice, Sorghum, Millet, Banana, Cassava, Cotton
Hippopotamus	<i>Hippopotomus amphibius</i>	Maize, Rice, Sorghum, Millet
Rats	<i>Rattus rattus</i> , <i>R. norvegicus</i>	Storage pest all products
Stem borers	<i>Chilo partellus</i> , <i>C. orichalcociliellus</i> , <i>Maliarpha separata</i> , <i>Sesamia calamistis</i> , <i>Busseola fusca</i>	Maize, Rice, Sorghum, Millet
Stalk-eyed fly	<i>Diopsis spp.</i>	Rice
African rice gall midge	<i>Orseolia oryzivora</i>	Rice
Small rice grasshoppers	<i>Oxya spp.</i>	Rice
Flea beetles	<i>Chaetocnema varicornis</i>	Rice
Rice hispa	<i>Dicladispa spp.</i>	Rice
Cyperus	<i>Cyperus rotundus</i>	Rice
Witch weed	<i>Striga hemonthica</i>	Maize, Rice, Sorghum
Rice yellow mottle virus (RYMV)	Virus of the genus <i>Sobemovirus</i>	Rice
Rice blast	<i>Pyricularia oryzae</i>	Rice
Brown leaf spot	<i>Helminthosporium spp.</i>	Rice
Sheath rot	<i>Acrocyndrium oryzae</i>	Rice,
Cutworms	<i>Agrotis spp.</i>	Rice, Sorghum, Millet, Common Beans (<i>Phaseolus</i>), Tomatoes, Cabbages, Onions, Cucumbers
Shoot fly	<i>Atherigoma soccata</i>	Sorghum, Millet
Sorghum Grain moulds	<i>Fusarium spp.</i> , <i>Curvularia spp.</i> , <i>Phoma spp.</i>	Sorghum

Grey leaf spot	<i>Cercospora sorghi</i>	Sorghum
Anthraxnose	<i>Colletotrichum graminicola</i>	Sorghum
Sorghum shoot fly	<i>Antherigona soccata</i>	Sorghum
Rust	<i>Puccinia purpurea</i>	Sorghum
Sorghum midge	<i>Stenodiplosis (Cantarina) sorghicola</i>	Sorghum
Leaf blight	<i>Exserohilum turcicum</i>	Sorghum
Ladder leaf spot	<i>Cercospora fusimaculans</i>	Sorghum
Sooty stripe	<i>Ramulispora sorghi</i>	Sorghum
Zonate leaf spot	<i>Gleocercospora sorghi</i>	Sorghum
Rust	<i>Puccinia penniseti</i>	Sorghum
Smut	<i>Moesziomyce bullatus</i>	Millet
Downy mildew	<i>Sclerospora graminicola</i>	Banana
Banana weevil	<i>Cosmopolites sordidus, Temnoschoita delumbrata</i>	Banana
Panama disease/Fusarium wilt	<i>Fusarium oxysporum f.sp. cubense</i>	Banana
Black and yellow sigatoka	<i>Mycosphaerella fijiensis</i>	Banana
Burrowing nematodes	<i>Pratylenchus goodeyi, Radophilus similis, Meloidogyne spp., Helicotylenchus multicintus</i>	Banana
Cassava mealy bugs	<i>Phenacoccus manihot</i>	Cassava
Cassava green mites	<i>Mononychellus tanajaa</i>	Cassava
Cassava root scale	<i>Stictococcus vayssierra</i>	Cassava
Cassava white scale	<i>Aonidomytilus albus</i>	Cassava
Variegated grasshopper	<i>Zonocerus variegates</i>	Cassava
Spiralling whitefly	<i>Aleurodicus dispersus</i>	Cassava
White fly	<i>Bemisia tabaci</i>	Cassava
Cassava mosaic disease (CMD)	Virus of the genus <i>Begomoviruses</i> in the family <i>Geminiviridae</i>	Cassava
Cassava bacterial blight	<i>Xanthomorias ampestris</i>	Cassava
Cassava Anthracnose	<i>Colletotrichum graminicola</i>	Cassava
Cassava brown streak	Virus of genus <i>Ipomovirus</i> in the family	Cassava

disease	Potyviridae	
Cassava root rot disease	<i>Phytophthora, Pithium and Fusarium spp</i>	Cassava
Bean stem maggot	<i>Ophiomyia spp.</i>	Common Beans (<i>Phaseolus</i>)
Bean aphids	<i>Aphis fabae</i>	Common Beans (<i>Phaseolus</i>)
Bean leaf beetle (BFB)	<i>Oothea benningseni</i>	Common Beans (<i>Phaseolus</i>)
Common Bean weevil	<i>Acanthoscelides obtectus</i>	Common Beans (<i>Phaseolus</i>), Maize
Angular leaf spot	<i>Phaeoisariopsis griseola</i>	Common Beans (<i>Phaseolus</i>)
Anthraxnose	<i>Colletotrichum lindemuthianum</i>	Common Beans (<i>Phaseolus</i>)
Bean pod borer	<i>Helicoverpa armigera</i>	Common Beans (<i>Phaseolus</i>)
Rust	<i>Uromyces appendiculatus</i>	Common Beans (<i>Phaseolus</i>)
Haloblight	<i>Pseudomonas spp.</i>	Common Beans (<i>Phaseolus</i>)
Ascochyta	<i>Phoma spp.</i>	Common Beans (<i>Phaseolus</i>)
Bean common mosaic virus (BCMV)	Virus of the genus Potyvirus in the family Potyviridae	Common Beans (<i>Phaseolus</i>)
Common and fuscous bacterial blight	<i>Xanthomona phaseoli</i>	Common Beans (<i>Phaseolus</i>)
Sweet potato weevil	<i>Cylas brunneus</i>	Sweet Potato
Semi-looper	<i>Plusia spp.</i>	Soybean
Rough sweet potato weevil	<i>Blosyrus sp</i>	Sweet Potato
Striped sweet potato weevil	<i>Alcidodes dentipes</i>	Sweet Potato
Sweet potato feathery mottle virus (SPFMV)	Virus of the genus Potyvirus in the family Potyviridae	Sweet Potato
Sweet potato sunken vein virus (SPSVV)	Virus of the genus Crinivirus in the family Closteroviridae	Sweet Potato
Mole rats	<i>Tachyoryctes splendens</i>	Sweet Potato, Cassava
Porcupine	<i>Hystrix cristata</i>	Sweet Potato, Cassava
Coffee leaf rust	<i>Hemileia vastatrix</i>	Coffee
Millipede	<i>Odontopyge vanutellii</i> SILVESTER, O. <i>pardalis</i> GERSTAECKER	Irish Potato, Snow Pea
Coffee wilt	<i>Fusarium spp.</i>	Coffee
Stem borers	<i>Anthores spp.</i>	Coffee

Antestia bugs	<i>Antestiopsis spp.</i>	Coffee
Leaf miners	<i>Leucoptera spp.</i>	Coffee
Coffee berry borer (CBB)	<i>Hypothenemus hampei</i>	Coffee
Mealy bugs	<i>Planococcus kenyae</i>	Coffee
Green scale insects	<i>Coccus viridis</i>	Coffee
Coffee berry disease	<i>Colletotrichum coffeanum</i>	Coffee
Root-knot nematodes	<i>Meliodogyne spp</i>	Coffee
African bollworm	<i>Helicoverpa armigera</i>	Cotton
Jassids	<i>Empoasca spp</i>	Cotton
Aphids	<i>Aphis gossypii</i>	Cotton
Spiny bollworm	<i>Earias insulana and E.biplaga</i>	Cotton
Lygus	<i>Lygus vosseleri</i>	Cotton
Cotton stainers	<i>Dysdercus spp.</i>	Cotton
Blue bugs	<i>Calidea dregii</i>	Cotton
Bacterial blight	<i>Xanthomonas malvacearum</i>	Cotton
Fusarium wilt	<i>Fusarium oxysporum f.sp. vasinfectum</i>	Cotton
Alternaria leafspot	<i>Alternaria macrospora</i>	Cotton
Coreid bugs	<i>Pseudotheraptus wayi</i>	Cashewnuts, Coconuts
Holopeltis bugs	<i>Helopeltis anacardi</i>	Cashewnuts
Cashew mealybugs	<i>Pseudococcus longispinus</i>	Cashewnuts
Thrips	<i>Selenothrips rubrocinctus</i>	Cashewnuts, Onions,
Stem borers, Weevils	<i>Mecocorynus loripes</i>	Cashewnuts
Powdery mildew	<i>Oidium anacardii</i>	Cashewnuts
Anthrachnose	<i>Colletotrichum gloeosporioides</i>	Cashewnuts
Dieback	<i>Phonopsis anacardii</i>	Cashewnuts
African rhinoceros beetle	<i>Orytes monoceros</i>	Coconuts
Coconut mites	<i>Aceria guerreronis</i>	Coconuts
Coconut termites	<i>Macrotermes spp.)</i>	Coconuts
Fruit flies	<i>Ceratitis spp.</i>	Mangoes
Mango weevils (<i>Sternochetus mangifera</i>	Mangoes
Mango anthracnose	<i>Colletratrichum gloesporiodes</i>	Mangoes
Powdery mildew	<i>Oidium spp.</i>	Mangoes

Mealy bugs	<i>Planococcus citri-Risso</i>	Citrus
Aphids	<i>Toxoptera citricidus</i>	Citrus
False codling moth	<i>Cryptophlebia leucotrata</i>	Citrus
Orange dog	<i>Pappilio demodercus</i>	Citrus
The wooly white fly	<i>Aleurothrixus floccosus</i>	Citrus
Black flies	<i>Aleurocanthus spp</i>	Citrus
Giant coreid bug	<i>Anoplenemis curvipes</i>	Citrus
Citrus leaf miner	<i>Phyllocnistis citrella</i>	Citrus
Greening disease	<i>Liberobacter africana</i>	Citrus
Gummosis	<i>Phytophthora spp</i>	Citrus
Green moulds	<i>Pencillium italicum</i>	Citrus
Mealy bugs	<i>Pseudococcus brevipes</i>	Pineapples
Top and root rot	<i>Phytophthora spp</i>	Pineapples
American bollworm	<i>Helicoverpa armigera</i>	Tomatoes
Root knot nematodes	<i>Meloidogyne</i>	Tomatoes
Red spider mites	<i>Tetranychus spp</i>	Tomatoes
Late blight	<i>Phytophthora infestants</i>	Tomatoes
Early blight	<i>Alternaria solani</i>	Tomatoes
Powdery mildew	<i>Oidium lycopersicum</i>	Tomatoes
Bacterial wilt	<i>Pseudomonas solanacearum</i>	Tomatoes
Fusarium wilt	<i>Fusarium oxysporum</i>	Tomatoes
Bacteria spot	<i>Xanthomonas compestris pv. Vesicatoria</i>	Tomatoes
Onion thrips	<i>Thrips tabaci</i>	Onions
Downy mildew	<i>Peronospora destructor</i>	Onions
Purple blotch	<i>Alternaria porri</i>	Onions
Storage rots	<i>Bortytis spp., Erwinia spp., Mucor spp., Fusarium spp.</i>	Onions
Diamondback moth (DBM)	<i>Plutella xylostella</i>	Brassicas (cabbages and kale), Tomatoes, Capsicum
Aphids	<i>Brevicoryne brassicae L., Lipaphis erysimi (Kaltenbach) and Myzus persicae (Sulzer)</i>	Brassicas (cabbages and kale)
Sawfly	<i>Athalia spp.</i>	Brassicas (cabbages and kale)

Cabbage webworms	<i>Crocidolomia binotalis</i> Zeller	Brassicas (cabbages and kale)
Blackrot	<i>Xanthomonas compestris</i>	Brassicas (cabbages and kale)
Downy mildew	<i>Peronospora destructor</i>	Brassicas (cabbages and kale)
Alternaria leaf spot	<i>Alternatira spp.</i>	Brassicas (cabbages and kale)
Cabbage club rot	<i>Plasmodiaphora brassicae</i>	Brassicas (cabbages and kale)
Black rot	<i>Xanthomonos compestris pv. Compestris</i>	Brassicas (cabbages and kale)
Cauliflower mosaic virus (CaMV)		Brassicas (cabbages and kale)
Dumping off	<i>Fusarium Spp, Rhizoctonia spp., Pytium spp and Phytophotra spp</i>	Brassicas (cabbages and kale)
Bacterial soft rot	<i>Erwinia carotovora var. carotovora, Pseudomonas spp.</i>	Brassicas (cabbages and kale)
Melon aphid	<i>Aphis gossypii</i>	Okra
Groundnut hopper,	<i>Hilda patruelis</i>	Crotalaria, Bean, Maize, Cashew and Potato
Butterfly	<i>Amphicallia pactolicus</i>	Improved Fallow plants: <i>Sesbania</i> and <i>Crotalaria</i>
Root-knot nematode	<i>Meloidogyne spp</i>	Improved Fallow trees: <i>Sesbania sesban</i> , <i>Tephrosia vogelii</i> and <i>Tephrosia candida</i> , intercropped with ; bean, carrot, cowpea, maize, eggplant, tobacco and tomato

b.) Major livestock pests and diseases in Kenya

Diease	Causative Agent	Host species
Foot and Mouth Disease	Virus of the genus <i>Aphthovirus</i> in the family Picornaviridae	Cattle, zebus, Sheep, Goats, Swine, Wild ruminants
Rinderpest	Virus of the genus <i>Morbillivirus</i> in the family Paramyxoviridae	Cattle, zebus, Sheep, Goats

Lumpy Skin Disease	Virus of the genus <i>Capripoxvirus</i> in the family Poxviridae	Cattle, <i>Bos taurus</i> , Zebus, domestic buffaloes
Rift Valley Fever	Virus of the genus <i>Phlebovirus</i> in the family Bunyaviridae	Cattle, Sheep, Goats, Dromedaries, Rodents
Sheep and Goat Pox	Virus of the genus <i>Capripoxvirus</i> in the family Poxviridae	Sheep and Goats
Highly Pathogenic Avian Influenza	Virus of the genus <i>Influenzavirus</i> A, B. in the family Orthomyxoviridae	Chickens and Turkeys
Newcastle Disease	Virus of the genus <i>Rubulavirus</i> in the family Paramyxoviridae	Chickens
Nagana (Animal African Trypanosomiasis)	<i>Trypanosoma spp.</i>	Cattle Zebus, Sheep, Horses, Carmels
Peste des Petits Ruminants (PPR) or “Lomoo” in Turkana Northern Kenya	Virus of the genus <i>Morbillivirus</i> in the family Paramyxoviridae	Goats and Sheep
Contagious Bovine Pleuropneumonia (CBPP) or Lung sickness	<i>Mycoplasma mycoides</i> subsp. <i>mycoides</i>	Cattle
Contagious Caprine Pleuropneumonia (CCPP)	<i>Mycoplasma capricolum</i> subsp. <i>capripneumoniae</i>	Goats
Anthrax	<i>Bacillus anthracis</i>	Cattle
Theileriosis or corridor disease	<i>Theileria parva</i> species	Livestock; cattle severely affected
Malignant catarrhal fever	<i>Alcelaphine herpesvirus-1</i>	Cattle

