Vol-2, Issue-2 PP. 388-399 ISSN: 2394-5788

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

Traditional Botanical Based Pesticides for Key Pest Animals Control in Dire Dawa Administration, Eastern Ethiopia

Mohammed Kasso
Department of Zoological Sciences,
Addis Ababa University
P.O. Box 1176, Addis Ababa,
Ethiopia

ABSTRACT
The survey study to gather information on traditional botanical pesticides for the key pest animals was carried in Dire Dawa Administration from March 2010 to September 2010 in the eighteen randomly selected representative villages. Stratified and multistage random sampling techniques were used to sample representative villages and respondents (n=174). Both qualitative and quantitative data were gathered through observation, questionnaire and focal group discussion and interview. The collected data were tabulated, organized and analyzed with appropriate statistical analysis. A total of 35 key pest animals as the group were recorded of which cockroach was the dominant followed by mosquito, bedbug and rats. Traditional botanical pest controlling methods like the use of organic pesticide, poisoned bait, repellents and trapping were used. The dominantly used plant species as organic pesticides or repellents were *Azadirachta indica*, *Capsicu annuum*, *Aloe vera*, *Croton macrostachyus*, *Eucalyptus camaldulensis*, *E. globules*, *Allium sativum*, *Citrus sinensis*, *C. limon*, *Olea europaea*, *Boswellia papyrifera*, *Kleinia spp*., *Vernonia amygdalina*, *Euphorbia spp*., *Calpounia aurea*, *Echinos*, *Nicotiana tabacum* and *Carrissa schimperi*. However, currently their use seems to be underestimated and hence it requires further identification, screening of the cost effective, efficient and environmental friendly and accordingly incorporating them into integrated pest management.

General Terms
Ecology, Pest management

Keywords: Botanical pesticide, indigenous knowledge and techniques, pest animal.

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

1. INTRODUCTION

Traditional knowledge is the local knowledge that is unique to a given culture or society differing from the international knowledge generated by universities and research institutions. It is one of the tools used as cost-effective survival strategy at the local level for decisions related with food security, human health, agriculture and household products protection and natural resources management [1]. These indigenous knowledge and techniques can be categorized as land preparation, soil fertility management, weed control, post-harvest management and pest controlling strategies [2]. From the different pest management strategies one is the use of traditional botanical pesticides [3].

Traditional botanical pest controlling methods are used to protect agricultural and household products as natural, cost effective and easily accessible from nearby source. In addition, due to their biodegradability unlike synthetic chemical pesticides they are environmental friendly and hence favourable to the environmental sustainability and community wellbeing [3].

Today many indigenous knowledge systems are at risk of extinction because of the rapidly changing natural environments and fast pacing economic, political, and cultural changes on a global scale [1]. Many traditional practices are disappearing because of the intrusion of foreign technologies like synthetic chemical pesticides that assure short-term solutions to problems [1]. Despite of killing pests effectively, these chemical pesticides are toxic to human beings and lead to severe environmental degradation if not properly used. Besides this, its fully integration into insect pest management systems is roughly disrupted as a result of the subsistence nature of production and high poverty levels. That is to mean high costs of synthetic pesticides and associated toxicity risks discourage its integration into insect pest management systems [4]. As an alternative option, local community forced to relay on their indigenous knowledge and techniques in order to meet their daily needs which are most relevant to the rural poor and marginalized population. Farmers who use natural control methods obtain satisfactory yields and financially save on production inputs, and no longer forced to get into debt or sell off their livestock in order to repay loans for purchasing of pesticides. They were also able to control pests in a timely fashion using their own resources, rather than worry about how to access pesticides [5].

The use of plant extracts to control destructive insect pests or disease vectors is not new. Rotenone (*Derris* spp.), nicotine and pyrethrins have been used for a considerable time in small-scale subsistence and in commercial agriculture [6]. For instance, the use of poisonous plants which have bio-pesticide properties is found in the Indian Rig Veda (2000 B.C.). More than 1,600 plant species have been reported to possess bio-pesticide properties at different parts of the world [7].

Botanical pesticides are biologically active ingredients that derived from plants and used for the control pest animals. Currently the demand for environmental friendly pest management strategies is showing the tendency increase. Thus, the development and usage of alternative pesticides with minimal or non-ecological hazards like natural pesticides is highly recommended [8]. It also used to maintain biological diversity and reduces environmental contamination and human health hazards. This becomes applicable when science-based approach is well developed to discover and determine their efficacy and attempts to either produce them on a commercial scale [9].

Thus, traditional botanical pesticides which are environmental friendly, cost effective and efficient needs to be recognized, valued, appreciated and it should be preserved, transferred, or adopted and adapted as integrated pest management elsewhere. In viewing of this the present study was carried out to catalogue the current information on the traditional botanical pesticides used for pest management in Dire Dawa Administration.ask that authors follow some simple guidelines. In essence, we ask you to make your paper look exactly like this

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

document. The easiest way to do this is simply to download the template, and replace the content with your own material.

2. MATERIALS AND METHODS

1.1 Study area

The study was conducted in Dire Dawa Administration, Eastern Ethiopia. It approximately lay in between 09° 28.1' – 09°49.1' N of latitude and 41°38.1' – 42°19.1'E of longitude. The administration is 502 km (515 km for Dire Dawa town) away from Addis Ababa in east and 311 kms from Djibouti port in the west directions. Dire Dawa Administration is one of the chartered city administrations in Ethiopia consisting 9 urban and 38 rural Villages (small administrative unit or division).

Its altitude ranges approximately from 950 – 2,000 m above sea level and has arid climate (high temperature and low rain fall). The vegetation of the Administration is dominated by scrubs and sparse vegetation types and most of the area seems to be highly disturbed by anthropogenic and natural factors like overgrazing, deforestation and soil erosion.

Dire Dawa Administration has a total population of 342,827, of which 171,930 were male and 170,897 female accounting 0.5% of total population of Ethiopia [10]. Although the administration has more than 79 ethic groups of the major ethnic groups include the Oromo (46.08%), Somali (24.24%), Amhara (20.09%), Gurage (4.54%), Harari (1.08%); the remaining 3.97% of the population consists of all other ethnic groups. The administration is also a home for many religious although the majority (70.9%) of populations are followers of Islam followed by 25.6% of Orthodox Christians, 2.8% of Protestants, 0.4% of Catholics and 0.3% followers of other religions [10]. The administration is known as source of diversified indigenous knowledge and foreign cultures which is adopted from its commencement. These diversities in indigenous knowledge and culture are happened as the result of a large number of Ethiopian nation, nationalities and peoples and people from various other countries like Greek, Armenia, India and Isreal residing in the town and its surrounding.

1.2 Methods

The study was carried out from March 2010 to September 2010. The preliminary survey was conducted in March and April 2010 to gather all the available and relevant information for easily excursion of the study. Information on the extent of usage of indigenous knowledge and techniques (traditional botanical pest controlling methods) for key pest animal species management and on the location of villages and agro climatic zones of the administration were collected.

A stratified random sampling technique (based local communities settlement either rural or urban) was used to take representative hamlet sample from rural and urban villages. To select a representative hamlets and householders from each stratum a multistage systematic random sampling technique was used. Based on the preliminary survey study result, a total of 18 representative villages (13 villages from rural and five villages from urban) were decided to be selected. The selections of representative villages were based the traditional agro ecological and climatic zones, socio-economic structures and on the extent of application of indigenous knowledge and techniques for pest managements.

Both qualitative and quantitative data were gathered through observation, questionnaire and focus group discussion and interviews. A pre-tested and structured open and close ended questionnaire in four languages (English, Amharic, Afan Oromo and Afi Somali) with similar contents were prepared and given to respondents according to their language of preference and in their area of farming, working or residence. Except for a few respondents who had degree and above level of education all the questionnaires were filled with the guide of

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

principal researcher or assistant researchers. That means after each question on the questionnaire were read for them then the answers of respondent were immediately recorded. Although this method seems to be tedious and difficult to cover a large number of respondents within short time, it greatly solved the problems like unreturned questionnaire papers and wrong answer due to miscommunication.

The collected data from observation, questionnaire and focal group discussions and interviews was tabulated and organized. To analyze the collected data SPSS Version 16.0 statistical program and other appropriate statistical methods such as frequency distribution and percentage and Chi-square test were used. Differences were considered as significant at p-value less than 0.05.

The entire specimens of pest animals listed as key pest animals by households and recorded during study were collected and preserved for further species identification to the species level. Similarly, specimens of individual plant species reported to exhibit pesticide effects on pests was collected and identified to the species level based on the available literatures and consultation with botanical science experts. For plant specimens whose species identification in the field becomes difficult specimens were prepared and preserved for further species identification in National Herbarium Museum of Addis Ababa University.

3. RESULTS AND DISCUSSION

A total of 174 respondents were selected based on the number and distances of hamlets in villages, social factors and probable variation in pest infestation and based on the level of usage of indigenous knowledge and techniques for pest managements.

All respondents' mentioned that their household or agricultural products were dominantly affected by one or more factors connected with climate, pest animals and theft and other problems related to human beings. More than 65% of respondents' household and agricultural products were affected by both climate and pest animals whereas for 22.4% of respondents pest animals alone were considered as major factor for the damage or loss.

In the same way, the studies made in Eastern Ethiopia showed as pest problems were mentioned by tremendous number of the farmers as a major constraint upon their production that followed by drought and others [11]. In particular, from the elements of climate, the rainfalls amount and temporal distribution is the most determinant for fluctuations in national crop production in Ethiopia [12].

A total of 35 key pest animals as the group were recorded in the study area of which 14 were pre-estimated (Table 1) and the rest 21 (porcupine, flea, squirrel, naked mole rat, aphid, varvet monkey, hyena, plant bug, grasshopper, leopard, beetle, fox, hyrax, cattle louse, scorpion, warthog, lesser kudu, aardvark, lizard, bat and snake, in respective order) were listed latter as key pest animals by respondents. However, the number of key pest animals was expected to be higher than these if the group was identified to the species level. For example, in the study area two species of cockroaches and more than five species of ant, five species of fly and more than 8 species of rat and mice, more than two species of mosquito were observed although not presented to the species level in this paper. In the same way, caterpillar which was treated as single key pest animal refers in this paper refers the larvae of many moth and butterfly species.

From pre-estimated key pest animals cockroach was the dominant whereas locust was relatively least perceived pest animals. About 94% of them declared as they face problem related with cockroach infestation. The second dominant pest animal was mosquito affecting 92.5% of respondents and followed by bedbug (89.1%), rats (87.4%) and fly (86.2%). Except ticks and mite and locust all the rest pre-estimated key animal pests affect almost more than 50% of respondents (Table 1). The present result showed as cockroach, mosquito, bedbug, rat,

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

fly, weevil, ant, termite, bird, baboon, caterpillar, tick and mite and locust were the key pest animal in the area although their level of infestation varies. The variation is statistically significant ($\chi^2 = 1.099$, df = 13, $P<0.05$).

The number of respondents listed the additional key pest animals were seems to be relatively lower than the number of respondents listed the pre-estimated pest animals even though loss or damage was comparable.

The majority of pests except scorpion and snake were recorded from rural villages. For instance flea was listed as key pest animals in rural villages but not in urban villages. These showed us, as there was variation in the level and distribution of pest infestation in urban and rural villages.

Table 1: The frequency distribution of pre-estimated key pest animals perceived by respondents

Pest	Frequency (n=174)	Percentage (%)
Cockroach	163	93.7
Mosquito	161	92.5
Bedbug	155	89.1
Rats & mice	152	87.4
Fly	150	86.2
Weevil	112	64.4
Ant	110	63.2
Termite	104	59.8
Birds	96	55.2
Mongoose	94	54.0
Baboon	89	51.2
Caterpillar	87	50.0
Ticks and mite	85	48.9
Locust	83	47.7

From the latter mentioned key pest animal, porcupine was foremost and snake was least cited by respondents. The frequency in which the pest animals listed by respondents was statistically significant ($\chi^2 = 48.84$, df = 20, $P<0.05$). This indicates the existence of variation in the level of infestation and distribution of key pest animals.

The respondents perceived as many of their products like food, household materials and equipments, different items for trade, livestock (cattle, goat, sheep, camel, donkey, poultry and beehives) and cultivated crops (cereals,

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

fruits and vegetables), plantations and infrastructures were damaged by these key pest animals. Some of them also cited as they affect human being by causing disease, biting and making scare on the skin and becoming nuisance. For instance, respondents that mentioned cockroach as their key pest animal reported as it destroy almost all things what they posses mostly food, household materials and equipments. They also reported as it bite human and makes scare on the skin. Further more, the record of infestation and prevalence in almost all villages of the study areas, can also be used as an indicator for its extents of distributions and impacts. In line with this [13] described as cockroaches are as one of the most adaptable and successful insect groups distributing in the world by inhabiting human dwelling and eating virtually anything like sweat, fingernails, glue, grease, paper, soap, paint and each other. Their feeding habits and unpleasant smelling secretions make them to carry many pathogenic microorganisms and to become persistent, unpleasant and troublesome pests. Their offensive chemical secretion spoils the flavour of food and increases asthma problems in human [14].

To minimize and prevent the damage by the pest animals, all respondents reported as they try all their best to control the pest animals by different methods or techniques. However, few respondents did not know any means used to control some pest animals. They only wait for the relief obtained after they passed away, migrated to other area or in some case after government or non-government organizations controlled over them. In general, the respondents use either traditional, modern or both methods for their pest animal managements.

The majority (59.2%) of respondents prefer to use both traditional and modern methods simultaneously. However, the respondents who prefer traditional and modern methods were 25.3% and 15.5%, respectively. The respondents methods of preference was statistically significant ($\chi^2 = 54.86$, df = 2, $P<0.05$). The variation in the preference of the methods might be associated to level of income and, level of education, social background of respondents and the type of pest animal needed to be controlled.

For more than 62% of respondents the reasons of preference for cultural methods were associated to its low cost (Table 2).

Table 2: Respondents' response on reasons of preference for pest controlling methods

Item	Alternatives	Percentage
Reason of preference for traditional method	Low cost	62.6
	Easily applicability and accessibility	19.0
	Cultural norm or custom	9.5
	Low negative impact	5.4
	Adopted unknowingly from ancestor	3.4
Total		100

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

The other reasons for preference of traditional method mentioned were due to its easily applicability and accessibility, cultural norm or custom, its low negative impact or environmental friendly and adopted unknowingly from ancestors (Table 2).

The traditional or cultural methods used by respondents were grouped into nine categories to ease the identification of the methods. These groups were organic pesticide, poisoned bait, field burning and elimination of breeding site, elimination of food sources, trapping, hunting, biological control and repellents. From these groups or categories organic pesticides, poisoned bait, repellent and trapping with plant were majorly based on botanical source.

As a traditional botanical based pest controlling method, they use the leaves, stems, fruits, seeds, roots or the combination of plant parts to kill or repel the pests. They use it as direct toxicant, sterilant, as antifeedant, repellent or behaviour modifiers. The dominantly used plant species as organic pesticides or repellents were neem tree (*Azadirachta indica)*, hot pepper (*Capsicu annuum*), aloe (*Aloe vera*), 'badano' (*Croton macrostachyus*), eucalyptus (*Eucalyptus camaldulensis*, *E. Globules*), garlic (*Allium sativum*), orange (*Citrus sinensis*), lemon (*C. Limon*), olive (*Olea europaea*), incense (*Boswellia papyrifera*), 'kencher' (*Kleinia spp.*), 'ebicha' (*Vernonia amygdalina*),'buri' (*Euphorbia spp.*), 'chekata' (*Calpounia aurea*), 'karabicho' (*Echinops kebericho*), 'tanbo' (*Nicotiana tabacum* and 'keraru' (*Carrissa schimperi*) (Table 3). The names in the quotation mark indicates local name whereas the names in the bracket shows scientific or botanical name.

To eradicate cockroach infestations different plants as organic pesticides were used in the form of poisoned bait, smoke and spray of the extraction of its crude fluid. The dominantly used plants were *Azadirachta indica*, *Aloe vera*, *Croton macrostachyus* and *Calpounia aurea* (Table 3).

Beside this the eliminations of food source and breeding site, shooting and use of zoological based pest biological controlling methods were also used. As biological control chicken, cat and reptiles were used. During the practice of using zoological based pest management they tried to expose cockroaches from their hiding site to chicken and cat to facilitate its predation. For reptiles (gecko) usage as controlling agent they facilitated their entrance into their house or kitchen where cockroach infestation was seems to be high in order to allow the gecko to feed up on cockroaches. Then gecko feed up on cockroaches efficiently by the help of their sensitive tongue and other sense organs from either their hiding site or during time of their active movement.

In the same way, organic pesticides and repellents were used for the management of mosquitoes. As a repellent they use different parts of the potential plant as fumigant or by smoking in the house and in some cases by squashing and rubbing it on their skin before they sleep. They also fire the fresh or dried plants of *Azadirachta indica*, *Olea europaea*, *Citrus sinensis* and *C. limon* fruit peel, *Allium sativum*, *Eucalyptus camaldulensis* and *E. Globules*, *Echinos* and others plants as repellent (Table 3). The previous study by [15] indicated as smoking is common method used to repel biting insects like mosquito throughout the world and its results of efficiency laboratory evaluation ranges from 70-97%. Few respondents were also used organic pesticides to kill adult and larvae in the collected swage water near their residence. This is because the extracts (aqueous or oil) of some plant materials are toxic to some species of insect pests [16, 17]. For instance essential oils of Eucalyptus (*Eucalyptus camaldulensis*) were effective as fumigants against many insects [18].

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

Table 3: Traditional botanical based pest controlling methods for different key pest animals and the used some potential plants

Pest animal	Botanical base pest control	Potential plant species
Cockroach	Organic pesticide	*Azadirachta indica*, *Aloe vera*, *Croton macrostachyus*, *Calpounia aurea*
Mosquito	Repellent and organic pesticide	*Azadirachta indica*, *Eucalyptus camaldulensis*, *E. Globules*, *Citrus sinensis*, *Citrus limon*, *Allium sativum*, *Echinops kebericho*, *Olea europaea*
Bedbug	Trapping	'kontom' un identified herbaceous plant
Fly	Repellent and organic pesticide	*Azadirachta indica*, *Aloe vera*, *Eucalyptus camaldulensis*, *E. Globules*, *Boswellia papyrifera*, *Kleinia spp.*, *Vernonia amygdalina*, *Euphorbia spp*., *Calpounia aurea*, *Croton macrostachyus*, *Echinops kebericho*, *Olea europaea*, *Carrissa schimperi*
Weevil	Repellent and organic pesticide	*Capsicu annuum*, *Aloe vera*, *Croton macrostachyus*, *Boswellia papyrifera*, *Kleinia spp.*, *Vernonia amygdalina*, *Euphorbia spp*., *Carrissa schimperi*
Ant	Ash and repellent	*Azadirachta indica*, *Capsicu annuum*, *Eucalyptus camaldulensis*, *E. Globules*, *Allium sativum*, *Citrus sinensis*, *C. limon*, *Boswellia papyrifera*, *Kleinia spp.*, *Vernonia amygdalina*, *Euphorbia spp*., *Calpounia aurea*, *Croton macrostachyus*, *Echinops kebericho*, *Olea europaea*, *Carrissa schimperi*
Termite	Ash and repellent	*Azadirachta indica*, *Capsicu annuum*, *Aloe vera*, *Croton macrostachyus*, *Eucalyptus camaldulensis*, *E. Globules*, *Citrus sinensis*, *C. limon*, *Boswellia papyrifera*, *Allium sativum*, *Kleinia spp.*, *Vernonia amygdalina*, *Echinops kebericho*, *Olea europaea*, *Carrissa schimperi*
Ticks and mite	Organic pesticide	*Croton macrostachyus*, *Vernonia amygdalina*, *Calpounia aurea*, *Carrissa schimperi*, *Nicotiana tabacum*

For the control of flies different botanical based pest controlling methods like the use of organic repellents and organic pesticides were use by majority of respondents. They mostly use smoke of *Azadirachta indica*, *Aloe vera*, *Eucalyptus camaldulensis*, *E. globules*, *Boswellia papyrifera*, *Kleinia spp.*, *Vernonia amygdalina*, *Euphorbia spp*., *Calpounia aurea*, *Croton macrostachyus*, *Echinops kebericho*, *Olea europaea*, *Carrissa schimperi* (Table 3).

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

Flies play important roles in the transmission pathogenic microorganisms because they are in close association with animals, humans and their food stuffs. Their biology and ecology also makes it as an ideal mechanical vector of human and animal pathogens hence it needs to be controlled [19].

The botanical based pest management methods used to control bedbug was by trapping with herbaceous plant with sticky fruit locally named 'kontom' (Table 3). Its trapping was used to avoid the bedbug's bite if it was trapped before its contact with slept person. It can also trap bedbug after blood meal by preventing its return to hiding site and next day bite. Hence, the usage of trapping seems to have double advantages. For the application, they cut plant with matured sticky fruits and place in layer under their bed sheet. After the bedbugs were trapped over the night, in the morning the trapped bedbugs with the plant will be disposed in the place far away from human residence or burnt. Relatively, few respondents were also use organic pesticides to kill the bedbugs. Although much practice was made by respondents in controlling bedbug, their biological and physiological features and ability to survive for a long time with out food make them to be frustrated in managing them [20] & [21]. In the similar way bed bugs have also recently reported as infest even five-star hotels, journey ships, college residence halls, hospitals and virtually all other types of housing and apartments even in the developed countries. Moreover, its eradicating becomes difficult and costly than other pest animals [22] & [23].

Weevils were controlled by different traditional methods and techiniques. Almost all respondents who practice traditional methods uses oranic pesticides to control weevil. Some of organic pestcides used were prepared from locally avialble plants like *Aloe vera*, *Kleinia spp.*, *Veronia amygdalina*, *Capsicum annuum* and *Euphorbia spp*. (Table 3). Extracts of some plant materials are toxic to some species of insect pests of crops. These extracts with lethal activity on insects may be prepared in mixture form with less toxic plant extracts to assure the management of pests [16]. They were also place cuting these plants in the traditional constracted underground storage locallled called Bola to avoid their feeding and as repellent. Even though this techinques known by most respondents as the result of low and subsestence nature and style of harvest currently the majority of them were not using underground storage. As [24] stated them as weevils are major constraint to crop production worldwide by causing substantial losses both in the field and during postharvest storage and recommended its management.

Pest ants were mostly controlled by using ash and other orgainc pestcides. In most cases, botanical based orgainc pestcides and repellents like *Azadirachta indica*, *Eucalyptus camaldulensis* and *E. globules*, *Citrus sinensis*, *Citrus limon*, *Boswellia papyrifera*, *Allium sativum*, *Echinops kebericho* and *Olea europaea* and *Carrissa schimperi* were used as major method to control ant (Table 3). This is because some biologically active organic ingredients derived from plants have pesticide and repellent properties used for the management of pest organisms [25]. Further more, the local communities were also use sheep and goat urine in their nest to kill them.

Since ticks and mite cause a greate damage on livestock respondents who had ticks and mite infestation beside the use hand picking techniques they use organic pestcides prepared from *Calpounia aurea*, *Croton macrostachyus*, *Carrissa schimperi* and *Aloe vera* and others like *Nicotiana tabacum* (Table 3).

For the termite control similar to ants ash was dominantly used. To avoid or prevents the termites damage, the dusting of ash arround the crops or structures were practiced. Likewise the studies made in South America indicated that termites are abundant and diverse particularly in tropical lowland. Of these 77 species are pests for structure or agriculture and managed by different traditional techniques like the use of ash [26].

Caterpillars were majorly controlled by the use of organic pestcides. Wood ash, soil and its mixture were used by some respondents to manage it. In view of the fact that usually the locust infestations come in outbreak and

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

migratory form most respondents do not know the traditional techniques for its management except waiting for the government or NGO to control by modern techniques. However, the solitary locusts were controlled by most respondents by using different techniques of eliminating breeding and food sources. The hiding of crops by covering it under soil until migratory swarm of locust move away from the field were also used to control migratory locusts. Shooting or killing was used by about 23% of respondents. Studies made in Australia indicated as locusts form dense bands and swarms that cause substantial damage to pastures and crops and culturally controlled by eliminating its breeding site through ploughing of egg beds or fire to burn the locusts [27].

For the rest vertebrates pests they mostly inclined on zoological based pest control and other traditional methods like trapping and shooting, elimination of food and breeding site, and poisoned bait with modern chemicals. As a biological control dogs and cats were dominantly used. Although the usage of cat as biological control has long history, currently most respondents did not prefer them due to increased price of milk and meat for the cat. Furthermore, some respondents also blame as some cats stop feeding on rat and mice rather than they started to compete with human and becoming vegetarian. Dogs have acted as guarding and an early warning system for approaching predators and any visitors to human settlements [28].

`

4. CONCLUSIONS AND RECOMMENDATIONS

The majority of respondents prefer both traditional and modern methods rather than depending on only one method. The major reasons for preference for traditional method were due to its low cost, easily applicability and accessibility, cultural norm or custom, low negative impact and adoption unknowingly from ancestors. Almost all the key pest animals were managed by application of at least one type of traditional methods. The organic pesticides, poisoned bait and repellents used for different pest managements were prepared from different potential plants like *Azadirachta indica*, *Capsicu annuum*, *Aloe vera*, *Croton macrostachyus*, *Eucalyptus camaldulensis*, *E. globules*, *Allium sativum*, *Citrus sinensis*, *C. limon*, *Olea europaea*, *Boswellia papyrifera*, *Kleinia spp*., *Vernonia amygdalina*, *Euphorbia spp*., *Calpounia aurea*, *Echinops kebericho*, *Nicotiana tabacum* and *Carrissa schimperi*. In addition 'kontom' plant was used for trapping of bedbug and other insects. For most vertebrate pest animals other methods like the elimination of food and breeding site and biological control (dog and cat) were used.

Despite of its benefits the traditional based pest controlling methods application seems to be mostly ignored by most urban residents and young generation and even by some rural communities. Thus, more awareness should be created on the importance and usage for the key pest animal management. Since the present study was limited to gathering of information to catalogue key pest animals and traditional botanical based pest control further identification, adaption and adoption of cost effective, efficient and environmental friendly indigenous knowledge and techniques including traditional botanical based pest controlling methods should be made and incorporated as integrated pest management.

5. ACKNOWLEDGEMENTS

I owe deepest gratitude to Dr. Fekedu Lemessa and Ato Paulos Asrat for their tremendous contribution and devotion they made for the realization and completion of this work. I am grateful to all concerned officers, enumerators, volunteer research teams and all respondents. I thank Dire Dawa University for financial support.

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

6. REFERENCES

[1] Grenier L. (1998) Working with Indigenous Knowledge - A Guide for Researchers**,** IDRC, Ottawa, Canada.

[2] Kuponiyi FA and Bamigboye EO. (2009) The use of indigenous knowledge systems (IKS) in rice production by farmers in Ekiti state, Nigeria. *Internl. J. Agri. Econ. Rur. Develop.*, 2: 67-74.

[3] Pavela R. (2007) Possibilities of botanical insecticide exploitation in plant protection. *Pest Technol.*, 1:47–52.

[4] Mihale M.J. and Kishimba M.A. (2004) Contamination of Water and Sediments by Obsolete Pesticides at Vikuge Farm, Kibaha District, Tanzania. *Tanz. J. Sci.*, 30: 21-31.

[5] Fantahun A. and Williamson S. (2001) Ethiopian farmers test alternatives to pesticides. *Pestic New*, 52: 8-9.

[6] Hillock D. and Bolin P. (2004) *Botanical Pest Controls***,** Oklahoma Cooperative Extension Service, HLA-6433.

[7] Hoddy E. (1991) Nature's bitter boon: the neem tree as a substitute for pesticides. *Develop. Communic.*, **5:** 29-30.

[8] Devlin F. and Zettel T. (1999) *Ecoagriculture: Initiatives in Eastern and Southern Africa***.** Weaver Press. Harare, Zimbabwe.

[9] Philogene J.R. and Lambert D.H. (1993) Botanical pesticides: optimizing pest control and minimizing environmental impacts, **In**: Forget G, Goodman T. and de Villiers A, eds). *Impact of Pesticide Use on Health in Developing Countries*. IDRC, Ottawa, Canada, 280-291.

[10] Central Statistical Agency (2008) *Summery and Statistical Report of the 2007 Population and Housing Census: Population size by Age and Sex*. Federal Democratic Republic of Ethiopia, Population Census Commission, Addis Ababa, Ethiopia.

[11] World Food Program (2009) *Food Security and Vulnerability in Selected towns of Somali, Harari and Dire Dawa Regions, Ethiopia*, WFP, Ethiopia Vulnerability Assessment and Mapping (VAM), Addis Ababa, Ethiopia.

[12] Tadele T. (2004) Farmers' perceptions of sorghum stem-borer and farm management practices in eastern Ethiopia," *Intern. J. Pest Manag.*, **50**: 35- 40.

[13] Hoffmann H. (2007) Cockroaches and their control. *Garden Note* ,2005; 39:1-4.

[14] Rust M.K. (2007) Cockroaches. *Pest notes, Publication* 7467: 1-7.

[15] Karunamoorthi K. Adane M. and Fentahun W. (2008) Laboratory evaluation of traditional insect/mosquito repellent plants against *Anopheles arabiensis*, the predominant malaria vector in Ethiopia. *Parasitol. Res.*, 103: 29–534.

[16] Oparaeke, A.M., Dike M.C. and Amatobi C.I. (2005) Botanical pesticide mixtures for insect pest management on Cowpea, *Vigna unguiculata* (L.) walp plants-2. the Pod Borer, *Maruca vitrata* FAB. (Lepidoptera: *Pyralidae*) and Pod Sucking Bug, *Clavigralla tomentosicollis* stal (Heteroptera: *Coreidae*). *Agr. Trop. Subtrop.*, 38: 33-38.

GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

[17] Gillij Y.G., Gleiser R.M. and Zygadlo J.A. (2008) Mosquito repellent activity of essential oils of aromatic plants growing in Argentina. *Biores Technol.*, 99: 2507–2515.

[18] Tuni I. and Sahinkaya S. (1998) Sensitivity of two green house pests to vapours of essential oils. *Entom. Exper. Appl.*, 86:183-187.

[19] Graczyk T.K., Knight R. and Tamang L. (2005) Mechanical transmission of human protozoan parasites by insects. *Clinic Microbiol Rev.*, 18: 128–132.

[20] Johnson C.G. (1942) The ecology of the bedbug, *Cimex lectularius* L., in Britain. *J. Hygein.*, 41:45 – 461.

[21] Davis N.T. (1964) Studies of the reproductive physiology of Cimicidae (Hemiptera) fecundation and egg maturation. *J. Insect Physiol.*, 10: 947–963.

[22] Boase C.J. (2004) Bed-bugs reclaiming our cities. *Biologist*, 54: 1–4.

[23] Columbus Apartment Association (2008) *Integrated Pest Management Plan***,** Columbus Apartment Association, Dublin, Ireland.

[24] Nottingham S.F., Son K., Wilson D.D., Severson, R.F. and Kays, S.J. (1989) Feeding and oviposition preferences of sweet potato weevil; *Cylas formicarius elegantulus* (summers), on storage roots of sweet potato cultivars with differing surface chemistries. *J. Chemical Ecol.*, 15: 895-903.

[25] Asogwa E.U., Ndubuaku C.N., Ugwu J.A. and Awe O. (2010) Prospects of botanical pesticides from neem, *Azadirachta indica* for routine protection of cocoa farms against the brown cocoa mired *Sahlbergella singularis* in Nigeria. *J. Med. Plant Resear.*, 4: 001-006.

[26] Constantino R. (2002) The pest termites of South America: taxonomy, distribution and status. *J. Appl. Ent.*, 126: 355–365.

[27] Hunter D.M. **(**2004) Advances in the control of locusts (Orthoptera: Acrididae) in eastern Australia: from crop protection to preventive control. *Austr. J. Entomol.*, 43: 93-303.

[28] Anagaw A., Williams S, Afework B. and Thirgood S. (2010) Livestock predation in the Bale Mountains, Ethiopia. *Afr. J. Ecol.*, 48:1076–1082.