PEST INFESTATION AND CONSERVATION OF ETHNOGRAPHIC COLLECTIONS WITH SPECIFIC REFERENCE TO SKIN AND WOODEN MATERIALS: A CASE STUDY OF VILLAGE MUSEUM, DAR ES SALAAM.

BY

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DECLARATION

I, GREEN NYIRENDA, do hereby declare that this research project is a result of my own study and findings except where acknowledged and that it has not been submitted for a Postgraduate Diploma in any other University.

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Date. 25/06/2003

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Date ..25/06/03.....

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LIST OF ABBREVIATIONS

ICOM	International Council of Museums
PMDA	Programme for Museum Development in Africa
Tshs	Tanzanian shillings
UNESCO	United Nations Educational, Scientific and Cultural Organization

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ABSTRACT

The purpose of the study was to investigate why and how skin and wooden ethnographic artifacts are infested and what was being done to combat the problem. Hence, the study aimed at identifying insect pests, which damage skin and wooden materials and analyze their sources. It examined how improper storage and lack of conservation facilities engenders insect pest infestation. It also looked at the influence that a collection management policy has on infestation and learned from the grassroots people about their knowledge and skills in the conservation of skin and wooden artifacts versus insect pests infestation.

In order to capture the research objectives the study was guided by the following assumptions: the inherent problem of insect pests infestation at the Village Museum was attributed to improper storage room and lack of conservation facilities. Furthermore, it was assumed that the absence of a collection management policy and inability of the museum to utilize the available traditional conservation techniques engendered infestation on skin and wooden artefacts.

The findings have revealed that, the museum storage is very poor and it lacks conservation facilities. The situation has lead to conditions that favour the breeding of insect pests. The museum lacks a collection management policy and the traditional conservation techniques have also not been adequately applied. This means that the newly acquired collections are not treated before being mixed with existing ones.

With such evidence we find that the naturalistic explanations, which claim that relative humidity and high temperatures are responsible for the widespread of insect pests at the Village Museum invalid. Instead such an explanation needs to be replaced with a holistic approach which seeks to explain the problem with the museum system and human beings actions which it is a part.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

An ethnographic object can be broadly defined as any substance used or created by a cultural group. Such an object makes up the tangible culture of that group (Rose 1988:5). In this respect, ethnographic collections can range from materials made out of the complex organic materials that can simply be categorized into two forms, namely, animal and plant based organic materials. Organic materials have been created through the process of carbon change. Conversely, animal-based materials include hides, leather, fur and skin. While plant-based materials consist of fabric, paper, plant pigments, botanical specimens and wood. In this study I am specifically looking at skin and wooden materials.

In the microstructure of animal skin the true skin or corium, is composed of a reticulated network of protein fibers, the main constituent being the protein known as collagen or keratin (Plenderleith and Werner 1971: 24). Keratin is quite stable chemically, but the insect pests of fabric (such as clothes moth and carpet beetle) are troublesome because of their ability to digest and utilize keratin (Truman 1988).

On contrary, wood comes from trees and it is made up mostly of countless long narrow cells. In it is an anisotropic substance, exhibiting different degrees of hardness and toughness in different directions. It has an organized cellular structure and as the fibers are for the most part orientated in the same direction, grain is a distinctive feature. The cellular structure varies in appearance according to the species of trees and the cut of the wood. In a longitudinal median plank, two main zones are to be distinguished, namely, heartwood and sapwood, the latter being situated towards the edges adjacent to the bark (Plenderleith and Werner 1971: 125). It is this long narrow cell and its characteristics of

being either soft or hard, which dictates how it will behave in response to different environments and infestations.

It is not surprising, therefore, that skin and wood form a large part of the collections in Ethnographic Museums and their conservation is a matter of considerable importance. Skin and wooden materials are, however, not permanent materials for they are liable to attack by microorganism, pest and are very sensitive to moisture. It is due to this, when the ethnographic collections are kept in museums, that the issue of pest infestation and conservation of skin and wooden artifacts comes in.

Over the course of their evolutionary history, insect pests have become adapted to exploit a wide variety of evolutional features, often in ways that bring them into direct conflict with humankind. While humankind seeks to preserve certain artifacts for cultural reasons, insects seek to utilize them as alternatives to the natural habitants to which they are adapted (Dennis 1992:147). Conservation is one of the ways, which can help to mitigate pest's activities on skin and wooden materials.

1.2 Statement of Research Problem

Historically, museums have been regarded as potential institutions for ensuring proper care and management of artefacts. These artefacts are culturally very valuable and some are irreplaceable. However, in recent years there has been a persistence in the pest infestation of ethnographic materials, which implies that, museums are unable to ensure sustainable care for both existing and newly acquired skin and wooden ethnographic collections. The inability of museums to pay attention to these materials poses a great threat to the credibility of museums. Comparatively, there is less perceived conservation value of the ethnographic collections versus archeological, paloentological collections

and conserved traditional houses. We are thus interested in unraveling the reasons behind this.

Furthermore, skin and wooden Ethnographic collections are vulnerable to destruction from pests such as insects, rodents and mould than other categories of museum collections. This type of deterioration to skin and wooden collections is not always addressed because the damage is often gradual, obscured from general view, and therefore, unnoticed. However, over time these persistent activities have devastating effects on museum collections.

Research Questions

The study was guided by the following research questions: -

1) What are the sources of infestation and types of insect pests damage skin and wooden artefacts?
2) How does improper storage and lack of conservation facilities engender insect pest infestation?
3) What effect does lack of a collection management policy have in widespread of infestation of skin and wooden artefacts?
4) What skills do the grassroot people have in conservation of skin and wooden artefacts?

1.3 Objectives

1.3.1 General Objective

The general objective of this study was to investigate why and how skin and wooden ethnographic artefacts were infested and what was being done to combat the problem.

1.3.2 Specific Objectives

This study was set out to meet the following specific objectives:-

1) To identify sources of infestation and types insect pests which damage skin and wooden materials.

2) To examine how improper storage and lack of conservation facilities engenders insect pest infestation.

3) To look at the influence that collection management policy has on infestation.

4) To learn skills in conservation of skin and wooden artefacts versus insect pest infestation from the grassroot people.

1.4 Justification of the Study

Whereas each research tends to have socio-cultural, political, economic implications and it is transformative in nature, the same holds true to the significance of this research. Specifically, the research findings will be helpful to Museum's planners, donors and policy makers to carry out proper implementation on appropriate measures directed towards combating conservation problems facing most of the skin and wooden materials. At a time when museum institutions are faced with financial difficulties and the objects continue to be infested and damaged, the significance of this study cannot be underestimated. It is envisaged that the study will complement museum's efforts towards eradicating problems related to object infestation. This will be in terms of contributing to the nature and understanding of the problem and also the recommendation as to how the problem could be solved.

1.5 Scope and Limitations

This study essentially focused on pest infestation of ethnographic materials with special reference to skin and wood. The most impinging issues covered were the identification of insect pest in accordance to their name, culture, behaviour and damage they cause.

Other issues were to gather information on the sources of infestations with emphasis on museum surroundings, viability of storage buildings, collection management policies and staff practices. Furthermore, the study looked at different conservation strategies and methods that could be, or had been, employed by the museum to combat pest infestation. These included, among others, the modern and traditional preventive methods.

Due to time limitations the study did not cover issues related to museum climate and laboratory testing on the practicability of traditional curative methods.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter is devoted to a brief review on the literature covering sources of pest infestation in museums and conservation of infested skin and wooden artifacts. Thereafter, the theoretical framework, its relevance to the study, assumptions and definition of concepts are presented.

2.2 Literature Review

2.2.1 Sources of Pest Infestation

Every culture, however primitive or advanced, is absolutely dependent on its artifacts for its survival and self-realization. The earliest record of human beings included objects made to satisfy their many needs, for instance, to extend physical and psychic power over fellow human beings, delight fancy so as to affirm their sense of forms and create symbols of meaning (Fleming 1982: 153). Some of these artifacts, which constitute a tangible heritage and which make up museum's collections, have been entrusted to museums for safekeeping, hence, they require only the most careful handling. The fundamental importance of protecting cultural heritage and cultural exchanges is for promoting understanding between peoples and dissemination of culture for the well being of humanity and the progress of civilization (UNESCO 1995:1). It is, therefore, important to consider that deterioration or disappearance of any item of cultural or natural heritage constitutes a harmful impoverishment of the heritage of all the Nations of the World (UNESCO 1972:5).

However, the present state of conservation in many African Museums in general, and those harbouring ethnographic collections in particular, is that there has been a continuous loss of this precious cultural heritage. Pest infestation, being a biological

factor, plays a significant role in the deterioration of organic objects. To understand the culture, habits and damage caused by insect pests, it requires one to grasp their sources. As regards the sources of pest infestation, Pinniger (1994) has studied this problem in considerable detail. According to Pinniger (1994: 27), the most obvious way for insects to gain access to museums and museum stores is through doors and windows from the outside world. Carpet beetles and furniture beetles, for example, will fly readily in warm summer months and even one fertilised female can lay sufficient eggs to start an infestation. In general, the warmer the climate, the greater the risk from invasion.

Moreover birds' nest and dead animals in attics are the natural home of many pests where they live quite happily on feathers, hair and excreta. Dennis (1992) posits that birds' nests and dead animals in a roof void or gutters are also associated with the invasion of various species, particularly cloth moth, spider beetles or carpet beetle.

It is also necessary to note that, when insect numbers exceed the food available they will spread out in search of other breeding sites in the store. In addition widespread pest infestation tends to be encouraged if objects are poorly stored either in overcrowded or cramped conditions (Dudley and Wilkinson 1979). The presence of holes or cracks in a building fabric provides an entry point to insect pests. Related to this, is the fact that food wastes, soft drink containers, gum and candy wrappers are all sources of sustenance for many creatures (Edson and Den 1994:121).

Sometimes, a new material, which is already infested can be introduced into museum collections and the insect may remain undetected until a serous problem develops. This can be a problem with wood-boring beetles some of which take years to develop. A material from the museum may also be sent out for display, research or on loan and it may be returned together with infestation which has been acquired while it was away (Pinniger 1994). Truman (1988:164) concurs with the above assertions. He states that

because of their ability to live in wood without soil contact, non-subterranean termites are frequently carried in infested furniture and wooden objects into geographical areas where they are normally found. Pinniger (1994) argues that there are documented cases of costumes returning to museums infested with tiny cloth moth larvae, which had hatched from eggs laid by moths in the costumes when they were in open display.

Dennis (1992) posits that insects have various methods of dispersion and very often the principle damage is caused by the relatively sedentary, feeding larval stage, while dispersion and reproduction are achieved by winged adults. The wood boring insects such as the furniture beetle are prime examples. An open doorway or window often provides a route for insect attack; and the insect can simply fly or walk in. Another source of insect pest infestation is light. Insect pests, such as adult boring beetle, which are a greater menace to museum objects, are attracted more to lights.

Damp conditions in storage tend to attract some species of insect pests. According to Alexander (1996:144), organic materials are of animal or vegetable in origin, carbon-based and have a cellulose structure. Therefore, they are susceptible to deterioration by excessive humidity (damp) that produces molds, mildew and other biological reactions. Moulds hate draughts and love stagnant air.

2.2.2 Conservation of Skin and Wooden materials

There are different conservation measures and actions that can be taken to prevent and deal with insect pest infestations and mitigate their effects. Prevention is the best way to avoid pest infestation. Effective prevention requires an understanding of the insects as well as their habits and the adoption of a disciplined regime appropriate to the museum and the objects in its care. It also depends upon the integration of inspection, exclusion and environmental manipulation (Pinniger 1994: 31). Truman (1988:174) argues that periodic inspections are needed to determine the condition of wood and wood-destroying

beetles. It is necessary to visually examine all exposed surfaces of wood (painted and unpainted) and to sound or probe them for evidence of internal damage. There is also a need to consider any evidence of emergence holes, larval infestations or extruding frass to be an active infestation.

The influence of major environmental factors such as temperature and moisture have been stressed by many museum authors throughout and it is in the prevention of infestation where the control of the environment is of paramount importance. There is frequently conflict in display areas between the needs of comfort for the public and the requirements to keep the objects safe. However, in storages, conditions which are unfavorable to insects can be maintained to prevent them becoming established. The main environmental objectives for insect pest control in museum storage should be to keep temperatures low, keep the humidity low, keep the variation in temperature and humidity small (Pinniger 1994: 33-34). Most wood-infesting beetles cannot develop in wood that has a moisture content of below 10% to 15 %. Moisture control methods such as vapour barriers, insulation and decay prevention can be employed whenever possible. In addition to that, in ethnographic collections and indeed, wherever skin and wooden products are stored, humidity control is most important, because moulds grow readily on these materials when the relative humidity of the atmosphere is 68% at ordinary temperatures. Pye (1992:401) argues that those airborne microorganisms are difficult to control without an efficient filtering system. To mitigate insect pest is, therefore, critical to ensure that storage buildings are well ventilated and the relative humidity maintained at the level of 65 %.

The use of bags to store objects provides a unique conservation measure for skin and wooden materials. Story (1985:53) argues that polyethylene and polypropylene have shown particular promise in resisting insects. Plastic bags are useful for providing

temporary protection to vulnerable museum items during transit or as holding containers during and after irradiation. However, care must be taken to prevent condensation, which might damage the contents.

Dust on artifacts absorbs moisture which attracts microorganism growth. To unrest this situation, it is important to ensure that, the storage area is cleaned on a regular basis, dust and dirt filtered out as well as doors kept closed at all times. A neat and orderly arrangement of both storage and work areas within the storage rooms helps to prevent accidents and damage to museum objects (Dudley and Wilkinson 1979: 67-69).

Moreover, regularly setting up of traps in all museum spaces to detect the presence of insects or pests is an added preventive measure. Simple window traps placed along the usual insect run (skirting boards) can be very effective and are cheap and long lasting. It is also important to ensure that all gaps in storage buildings such as walls, roofs, windows and doors are closed. The isolation of any new acquisitions which may contain emerging adults if in doubt about their state and having a good house keeping is critical in mitigating pests.

Perhaps the utilization of deep freezing is one of the best non-chemical treatment methods for infested skin and wooden materials. It involves drastic change and re-cycling by increasing and decreasing temperatures. The treatment process involves, firstly, bagging the object in polyethylene sheet. Secondly, vacuuming the bag to stop condensation. Thereafter, exposing the bag to the sun or heat so as to activate insect pests and lastly, putting the bag in a deep freezer. Pinniger (1994: 36) posits that it has been shown that a temperature of –18 °Cs or below will kill insect pests. Therefore, some museums freeze materials to at least –18 °Cs for at least seven days whereas others freeze objects at –18 °Cs for short periods and then bring them back to the room temperature before refreezing down to –18 °Cs again. This double freezing system is said to ensure

that no insect eggs survive. Some recent work has shown that a single freezing to –30 °Cs for 48 hours may be more effective (Pinniger 1994).

Fumigation is the most reliable and effective method of eliminating wood and skin infesting pests. Truman (1988: 166) agues that, structural fumigation and direct wood treatment are appropriate treatment methods for non-subterranean termites. Structural fumigation is normally done with sulfuryl fluoride (vikane) or methyl bromide gas. The entire building is covered tightly with a fumigation cover and the gas is introduced. Vikane has the advantage of rapid and uniform dispersion within the temperature range for climates where dry wood termites are found. Only professionals thoroughly trained in the use of gas should do such fumigation. On the other hand, direct wood treatment involves the drilling of holes into the infested wood through the termite galleries, using ½ inch drill in a wood. An insecticide is then forced through these holes so as to be dispersed through the galleries. Silica gel is an example of the dust that is used. Dusts should be injected into the termite galleries in small amounts. Too much dust will plug the galleries, and the wooden termites will walk off and isolate these areas. When treating limited infestations, earosol and dust formulations are used most often.

2.3 Theoretical Framework

There are Different scholars, such as Thomson (1972), Brommelles and Werner (1996) and Dudley (1979) who have devotedly exerted their intellectual efforts, trying to explain the sources of pest infestation and associated conservation measures. While others such as Thomson (1972:86) view the source to be attributed to fluctuation in relative humidity, others such as Alexander (1996) associate it with the nature of skin and wooden materials. Since these are organic materials susceptible to infestation for they are constituted of collagen and cellulose, respectively, which are weak to insect pests attack as opposed to inorganic materials such as metal, gold, silver, tin, copper and its alloys

which are naturally resistible to infestation. This difference in explanation arises from people's differences in philosophical background, hence, outlook. Studies such as those of Pinniger (1994) and Truman (1988) have shown that these are not the real causes of infestation, but merely the effects. Pest infestation is not an independent variable. Indeed, pest infestation is positively correlated with relative humidity but it is not caused by this.

For purposes of this study, the theoretical model of Belen Morallo-Rejesus (1979) especially in his article entitled, **Principles and theory of integrated pest management** will be adopted. According to Morallo-Rejesus. B. (1979), the theory of integrated pest management brings together into a workable combination the best strategies of all control methods that apply to a given problem created by the activities of pests. It is a holistic approach which involves the practical manipulation of pest populations using sound ecological principles to keep pest populations below a level causing economic damage. The theory acknowledges the view that, there are many ways of controlling insect pests but only a few are practical, and fewer are ecologically sound.

It should be known that integrated pest management theory is not a static, unyielding system. It is dynamic, ever changing, as we develop a better understanding of all factors that affect the system. In a narrow sense, integrated pest management means the management of the few important pests generally found on our collections, but consciously or not it must include all insect pests, not only the "key" ones such as beetles, silverfish, cockroaches, mice, rats, moth and termites but also the secondary pests such as spiders and ants which seldom do any harm.

Integrated pest management seeks to approach all insect pest problems using a holistic approach rather than reacting to each of insect pests attributes separate. The central theme of integrated pest management theory is that no single strategy of pest control is likely to achieve adequate results by itself. Control can only be achieved by integrating a variety

of approaches. This means combining strategies to achieve a reduction in the immediate annoyance or problem (quick-nock down) with other strategies designed to permanently change the situation so that the problem does not occur again.

The approach has considerable advantages regarding health and safety, as it is less harmful to both human beings and environment. Also the approach advocates for a reduction in the use of pesticides, which indeed helps to lessen the risk of chemical damage to objects. This means the approach relies primarily on non-chemical means such as controlling climate, food sources and entry points to prevent and manage insect pests infestation. Chemical treatments are used only in a crisis situation threatening rapid losses or when insect pests fail to succumb to more conservation methods.

The theory acknowledges the need for an understanding of insect biology and ecology. This is due to the fact that, little concerning natural control can be understood without detailed knowledge of the biology and ecology of all the species present. This knowledge is also essential in establishing the role of each species in the system and in determining the amount of damage inflicted by each pest species. Knowledge of the biology of a certain problem pest will serve as a basis for planning the control strategies and provide operational guidelines for these strategies. In this context, it is important to know the relationship between the pest and the museum collections and the mortality factors (pest life cycle), both biotic and antibiotic (parasites, predators, temperature, relative humidity), which play a major role in the determination of pest population dynamics. This means that, an understanding of the sequential dominance of pests in relation to growth stages could provide the immediate impetus for developing a simple integrated control program based on minimum pesticide application.

The theory emphasize the fullest utilization of naturally occurring suppressive factors including any practice by human beings, which will make the total ecosystem less

favorable for the growth of the insect pest population. Obviously, this requires a thorough understanding of the ecosystem.

In storage, parameters that can be manipulated to control the buildup of a pest population are temperature, relative humidity, moisture content and composition of gases within the storage atmosphere.

2.3.1 Relevance of the theoretical framework

The theory of integrated pest management is relevant to this study for it helps to give orientation on how we can approach, study and manage the problem of pest infestation in museums. Currently, the Village Museum is faced with a critical problem of pest infestation. This is aggravated by the fact that the utilization of pesticides all over the world has diminished for they are a health hazard to human beings, as well as being very expensive and some are non-available. Implicit in this is that the relevance of this theory cannot be underestimated. The theory advocates for the reduction of the use of pesticides, which helps to lessen the effect of chemical damage to collections.

For the effective management of pest infestation, the theory does emphasize the need to understand the whole system including the identification of the correct insect pests which are involved in damaging museum collections. This also entails describing their behavior and culture, sampling of the insects or other pests, an evaluation of the situation, the sources of insect pests which include, among others, the introduction of new infested materials, lack of regular inspections, presence of food sources, poor storage and a favorable environment for the insect pest to breed.

The theory, therefore, is a means towards putting in place a Collection Management Policy, which in broad terms shall address all issues pertaining to the care and maintenance of collections at the National Museum of Tanzania, in general, and the Village Museum, in particular.

It is, therefore emphasized that it is important to approach all insect pest problems using a holistic approach rather than reacting to each of the insect pest's attributes separately. Its implications are that we should deal with pests in the context of a whole museum system rather than a problem-by-problem basis. It is on this basis that we need to employ multiple tactics rather than a single tactic. Its objectives is nothing but to reduce pest populations, preventing economic loss, accepting the view that even with proper mitigating measures still some pests will continue damaging materials. Hence, we should stress on the maintenance and conservation of the environment. Central to this is the use of several strategies for pest control, meaning that we can apply preventive conservation actions such as maintaining good harborage, biological control, cultural control improving sanitation practices, putting in place insect control programmes and the use of available traditional conservation methods in mitigating insect pest infestation.

2.4 Assumptions

The study was guided by four assumptions: -

1) Identification of sources of infestation, types of insect pests and damage they cause was critical in the conservation of skin and wooden artefacts.
2) Improper storage and lack of conservation facilities did sway the infestation of skin and wooden materials.
3) The lack of a collection management policy influenced infestation of skin and wooden artefacts.
4) The inability of museums to use the available traditional conservation knowledge did prompt infestation.

2.5 Definition of Concepts

Improper storage: A poor storage that does not meet standards and provisions of proper care to collections against insect pests infestation.

Collection management policy: A plan of action adapted by organizations, which stipulate procedures on the acquisition, movement, care and maintenance of collections.

Traditional conservation techniques: The conservation knowledge of the local people in preserving, controlling and mitigating insect pests.

Skin materials: All classes of hide materials, whether raw, cured or processed of flayed animal with or without the hair.

Pest infestation: any active or passive damage (harm) caused by insect pest on artifacts.

Pest: Any insect, rodent, fungus, nematode or weed that causes damage or is a nuisance in a given area.

Conservation: All direct or indirect actions aimed at increasing the life expectancy of a single or group of elements (artifacts) new or damaged, stable or unstable of heritage in order to make them accessible to the public. It involves preventive and remedial conservation

Wooden materials: An artifact made out of hard or soft wood.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter deals with methodological issues. The discussion begins with pinpointing the research site, to be followed with research design, population, sample and unity of analysis, sampling procedure and methods of data collection. The presentation winds up by highlighting on the method of data analysis, problems encountered in the field and their associated solutions and ethical issues.

3.2 Research Site

The Village Museum is an open-air museum which is situated along Bagamoyo road in Dar-es- Salaam city. It is referred to as being open-air because it has its exhibits in the open. The Village Museum is one of the museums under the National Museums of Tanzania. The other museums include, the Dar-es-Salaam, Arusha Declaration, Natural History and Mwalimu J .K. Nyerere Museums. The Village Museum was established in 1966 and officially opened to the public in 1967. It was established as an extension of the Ethnographic Department in the Dar-es -Salaam Museum. Its purpose is to conserve the traditional architectural styles of Tanzanian's ethnic groups. The constructed traditional houses are also used for exhibiting ethnographic collections.

3.3 Research Design

This research studied the sources of pest infestation on skin and wooden ethnographic collections and its associated conservation methods. The data were collected by undertaking insect pest management survey and interviewing the respondents to determine the types of insect pests, their entry points, sources and damages they caused.

3.4 Population

Ethnographic collections and museum staff constituted the universe of this study. This study exclusively focused on ethnographic collections and its sample consisted of skin and wooden artefacts. This was so because skin and wooden materials were museum artefacts most prone to infestation than any other categories of museum materials for instance ceramic, stone and metals.

3.5 Sample and Unit of Analysis

The skin and wooden artefacts formed an individual unit of analysis. A total of 100 artefacts were studied, whereby an equivalent number of 50 skin and wooden objects formed a sample size. This was so because of the time limit. Furthermore, a total of 40 respondents were interviewed.

3 .6 Sampling Procedure

The nature of the research problem entailed the use of respondents on one hand and artefacts on the other hand. These had a particular implication into the sampling procedure, which would be employed. In order to accomplish the stated research objectives, the researcher used a proportional stratified sampling to select 40 respondents from a target population. The process involved dividing the target population into two sub-groups that is, museum professional staff including curators, accountants, Education officer on one hand and supporting museum staff consisting of attendants, receptionists, security officers and technicians on the other. The selection criteria for respondents was any museum worker who either directly or indirectly was dealing with ethnographic artefacts. The procedure involved getting a list of names of museum staff from the

administration office. Thereafter, the simple random sampling method was used to select 5 museum professions and 35 other museum staff.

In terms of artefacts to be studied, a purposive sampling design was of great use as only organically-oriented ethnographic artefacts made out of animal skins and wood were purposely studied. In addition to that, purposive sampling was used to select 16 respondents who were included in focus group discussions.

3.7 Methods of Data Collection

This study used both qualitative and quantitative methods of data collection as below explained.

3.7.1 Documentary Method

This method was used to collect data related to the description of the study area and information on how the museum prioritises issues related to the conservation of skin and wooden artefacts. Such information was obtained from the library; whereby a survey of several relevant literature and museum annual reports was undertaken.

3.7.2. Structured Interviews

A structured questionnaire was administered to the respondents. The method enabled the researcher to ask direct questions. Also, it allowed for probing and making clarifications on questions, concerning the respondents practices and thinking on sources of pest infestation, conservation methods, state of storage and the commitment of museum management in allocating resources to conservation. The method also enabled the respondents to explain their experiences on inherent pest infestation problems facing the ethnographic collections.

3.7.3 Focus Group Discussions

The method provided qualitative data that enabled the researcher to describe and explain the causal process in relation to the problem under study. The researcher started by introducing the topic for discussion to 16 respondents who were divided into two separate groups each having a total of eight respondents. The groups constituted local people and museum staff. The searcher, however, acted as a facilitator and moderator intervening only when it was necessary but basically providing the directions of interest to the research. The researcher also recorded all-important information from each respondent. This method enabled the researcher to collect specific information covering the traditional preventive techniques from the local community. The need for conducting Focused Group Discussions arose from the desire to recapture the nature of the persistency of the infestation of skin and wooden artefacts.

3.7.4 Observation

The fact that all truth was not comprehended by means of studying past records and that events were fleeting convinced the researcher to use direct observation. Moreover, the difficulties which arose from the use of questionnaires in failing to capture the problem under study and the inability of respondents to provide all needed information, which was sensitive, compelled the researcher to use the direct observation method. With interviews, it was hard to study some of the unobservable patterns of staff behaviours and interactions. Furthermore, the direct observation method enabled the researcher to gather data related to the extent of insect infestation by physically visiting the surrounding, storage room and traditional houses as well as to inspect and examine individual artefacts. The method provided the best means for the researcher to obtain a valid picture on the state, nature and mechanism, which engendered insect pests.

Towards this end, the researcher used a magnifying glass, torchlight and the mirror for detecting the presence of pests and bottles for collecting insect pest evidence and microscope for identification.

3.7.5 Key Informants

The methods helped the searcher to collect information covering museum's collection management policy. The key informants included the Curator in-charge, Curators, Technicians and the Educational Officer. They managed to explain their knowledge about the broader museum system and issues covering a collection management policy.

3.8 Methods of Data Analysis

The nature of the research problem required the use of both qualitative and quantitative data analysis methods. After gathering the data, the researcher processed and analyzed them by using tables and figures to show correlations between different variables. Also photographs served as supporting illustrative devices to show the conditions of objects in storage and the different types of damage caused by pest infestations. Different statistical data techniques to make illustrations on the number of infested and damaged skin and wooden objects as well as the reallocation of conservation resources by museum management have been used.

The main trends and data obtained through Focus Group Discussions are reported using the respondent's own words for illustration purpose. The researcher has analyzed the information gathered by relating them to the assumptions developed for the study and thereafter, saw whether those data support or does not support the research questions and objectives. The researcher also states the findings on the bases of qualitative and quantitative data thoroughly and critically reviews the whole procedure leading to them. Subsequently, the researcher interprets the findings on the basis of any measurement

errors, bias and mistakes, which might have distorted the description of facts under the study.

3.9 Problems Experience in the Field and their Solutions

It is customary to face some problems when conducting research work. Without exception the researcher anticipated a number of problems in the field.

One of the anticipated problems was fear. Specifically, some respondents did not feel confident enough to provide some information directed towards the management. To handle this the researcher explained to those respondents that in research all the information provided was treated confidentially.

The other anticipated problem was inconsistency. It was suspected that some respondents would be biased about questions that dealt with debatable issues and that they would give answers that deemed prudent rather than true, especially questions, which directly touch on their work and practice. To overcome this problem the researcher incorporated countercheck questions. Which, indeed, helped to verify the inconsistencies.

Ulterior motive was another anticipated problem. It was assumed that some respondents expected to get some money for their participation in research. To handle this problem, the researcher explained to those respondents, the objectives and significance of undertaking the research and why their full participation and cooperation was greatly needed.

3.10 Ethical Issues

The following were some of the pertinent conservation ethics, which were used as standards for handling and treating skin and wooden artefacts. The researcher respected the aesthetic, historic and physical integrity of each individual object. As regards to people the following ethical issues were considered in this study.

All prospective research participants were fully informed about the procedures and risks involved in research and the researcher ensured that participants gave their consent to participate.

The researcher ensured that participants were not forced into participation in research.

The research guaranteed the participant's confidentiality on any given information by ensuring that the information given would not be made available to anyone who was not directly involved in the study.

CHAPTER FOUR

PEST INFESTATION AND CONSERVATION OF ETHNOGRAPHIC COLLECTIONS.

This chapter is designed to present research findings on insect pests infestation and conservation of ethnographic collections. It deals with insect pest identification and the damage they cause to skin and wooden artifacts, their modes of introduction and conservation measures. It is well acknowledged that, the goal of development is to maximize the use of resources, capital and scientific information for the welfare of humankind. However, the activities of humankind have created an environment favourable for the development of organisms competing with human beings. These organisms are designated as insect pests but such a designation is not static, since a pest may be damaging and at the same time edible. For example, winged termites, rodents, grasshopper and millipedes are culturally acceptable as food by some communities, but can be a curse to museum collections. In this regard an insect pest's problem exists when an organism interferes with human activities, desires or otherwise competes with humankind.

As it will be evidenced later, insect pests infestation is one of the real pandemic encountered at the Village Museum. It is also indicated that, in museums insect pests are the principal causes of the biodeterioration of skin and wooden artefacts. Hence, an understanding of insect pests behaviour, habits, lifestyle and their culture is the key to the sustainable design, preservation and proper management of insect pests activities to museum collections.

4.0 SOCIAL –DEMOGRAPHIC CHARACTERISTICS

The information under this study was obtained from different respondents who had differences in age, gender and occupations. A total of 40 respondents were

interviewed whereby 15 were female and 25 male. Their age limit ranged from 27 to 59 years old. Twenty-seven (27) of the interviewee were civil servants and thirteen (13) farmers.

4.1 Insect Pests Identification and the Damage Associated to them

The research findings revealed that, most of the damage done by insect pests on skin and wooden materials at the Village Museum was a core function of various species of insect pests. The respondents managed to identify six categories of insect pests responsible for infesting skin and wooden materials in the museum. These included subterranean termites, beetles, cloth moth, silverfish, cockroaches and rodents. But the respondents explanations were more or less based on their experiences and know how. In order to get an insight of the whole insect pests scenario, their scientific name, behaviour and culture, a thorough survey was conducted by the researcher in collaboration with an entomologist. The findings revealed that the most damaging insect pests were the following as explained underneath.

4.1.1 Subterranean Termites

The research findings revealed that the museum had a large number of subterranean termites. In fact, the entomological report indicated that, unlike other insect pests which have complete metamorphosis, subterranean termites developed through a gradual metamorphosis, meaning that they started by laying eggs, moving to nymphs and adult stage. It was revealed that, termites' sustenance to their livelihood depended more on eating cellulose found in organic materials in general and wooden materials in particular. The entomologists argued that, biologically subterranean termites had a friendly social relation with a complex division of labour. Whereby every individual in the colony purported to have a function, which contributed to the well functioning of the whole colony or system.

Put it simply, their social castes or divisions are divided into workers, reproducers and soldiers. This division was important as long as termites' damage in wooden and skin materials are concerned. It was argued that, this was so because it is the workers and nymphs who were seen to be the most damaging to the wooden artefacts displayed on the floors and walls in traditional houses. This was so because the social relation in subterranean termites entailed that, workers who include nymphs, work for the colony and feed the other categories in the caste such as the queen, solders and reproductive caste.

Furthermore, respondents pointed out that, nearly the whole museum compound had a large number of subterranean termites. This argument concurred with the evidence found during the survey whereby some mud tubes and hills were noticed showing that termites were a real problem, which called for an immediate panacea. It was also evidenced that, subterranean termites had eaten several objects displayed in the traditional houses as shown in Plate 4.1 below.

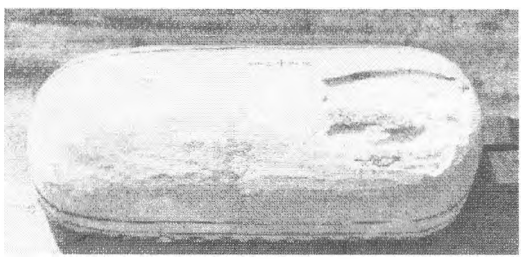

Plate 4. 1 A base of a wooden ritual tray eaten by subterranean termites. This was one among the artefacts, which was found displayed on the walls in Wasukuma house.

4.1.2 Beetles

During the survey we found that, a total of twenty-five (25) wooden objects stored in storage and traditional houses had been attacked by beetles. The findings revealed that, a wood-boring beetle had bored into wooden objects leaving an oval hole ranging from 1 to 2 mm in width. However, three major species of beetles were identified. These included *Dinoderus minutus* (fabricius) belonging to the family

Bostrichidae and *Carpophilus* of Nitidulidae family, both of them coming from Coleoptera order.

Another species was *formica* from Formicidae of Hymenoptera order. The research findings indicated that, the *Dinoderus minutus* ate a wooden part of a spear, axe and walking stick kept in Wasukuma house. Also from the holes where these beetle sheltered there was an ejection of frass (faeces) with oval cylindrical pellets of the beetle and mites (*glycyphagus domesticus)*.

It was evidenced that the presence of mites indicated that, there was a moist condition in the specimens. Furthermore, it was argued that, the presence of mites in the storage room, as it will be discussed latter, was an indication of poor (bad) storage conditions. It was pointed out that, this type of pest is hard to survive in dry conditions rather the pest prefers more damp conditions for it to breed.

It was also revealed that, the larvae of powder post beetle had attacked several wooden artefacts, whereby the miniature round holes were detected on the surface of wooden materials. Like that was not enough the larvae reduced the mortar pastel into powder destroying it into two equal pieces (see Plates 4. 2 and 4.3 below).

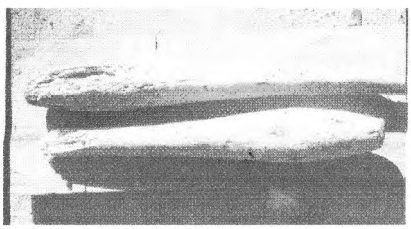

Plate 4. 2: Two pieces of wooden mortar pastel eaten by beetles

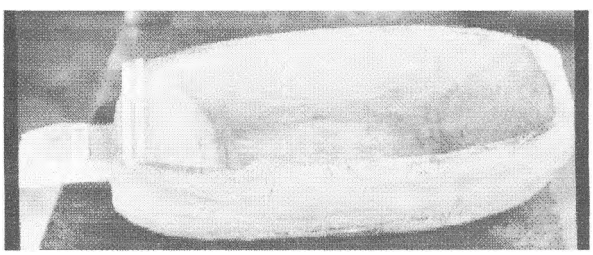

Plate 4.3: A wooden Sukuma ritual basin bored by beetles

On the other hand, the larvae and pupa of the family member Dermestidae, (Order coleoptera), with white grabs and dark heads with a light coloured web covering their bodies, were found hiding in the hair of three skin objects kept in the storage room. It was said that, probably these larvae and pupa came from *Dermestes maculatus* De Geer, the hide or leather beetles or could also have come from *Attagenus fasciatus* (Thurnberg) or *Anthrenus verbasci* (Linnaeus) but both from the same family, namely, dermestidae. Their average length ranged from 3 to 5 mm. When the larvae were exposed to light they seemed to be immobile, but in the dark they started moving. This means that it is during the darkness that the larvae were active in eating the ethnographic collections. The larvae feed on skin materials especially those which had hair leading to the detachment of the hair from the skin, leaving some parts of the skin bare. It became evident that, the presence of larvae in the storage room was attributable to the availability of food, that is keratin, from the skin materials, high temperature and high relative humidity which were not controlled as will be discussed later.

4.1.3 Rodents

It was evident through the research findings that, rodents, such as, house mice posed a serious problem to skin materials. The respondents argued that, the storage room had a lot of rats eating the skin artefacts. This was also proved during the survey whereby four skin artefacts were found totally eaten by rats (See Plate 4.4 below). The presence of rats in the storage was attributed to improper storage as well as cooking and eating practices near the storage room.

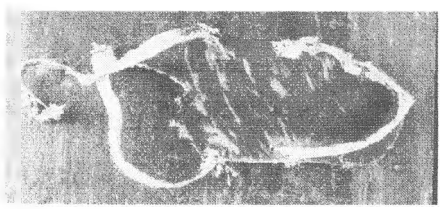

Plate 4. 4: A part of sleeper made out of animal skin eaten by rats.

4. 2. 0. Modes of Introducing Insect Pests

The research findings revealed that, some of the destructive species of insect pests get into the museum and storage room through different ways. When respondents were asked about where these insect pests come from, all of them had similar a response, that is, from the surrounding and nearby bush. But it was also observed that at the Village Museum there was a canteen located just nearby the storage room. This might also be another source for attracting rodents in the storage room. Furthermore, the respondents identified the following to be major modes of insect pests entry in the museum and storage room.

4.2.1 Newly Acquired Skin and Wooden Materials

About twenty five percent (25%) of interviewed respondents identified the acquisitions of newly untreated objects to be one of the possible modes of insect pests entry in the museum and storage room. The respondents stated that, the museum has been acquiring most of its collection through donations from the communities. The respondents argued that, these collections when they arrived at the museum domicile they were not treated and as result those artefacts were mixed up with old existing ones in the storage room. This entails that, if the newly acquired artefacts had been infested it also implies that, insect pests such as beetles were likely to spread to the old existing collections. However, none of the interviewed respondents managed to identify human beings or the return of loaned collections to be responsible for insect pests entry. This might mean that less of museum's collection was utilised by other institutions.

4.2.2 Openings (Vents and Holes)

Moreover, about seventy five percent (75%) of interviewed respondents identified openings in the storage room to be among the modes of insect pests entry. It was

evidenced that, open windows, doors, holes and vents were other suspected modes of insect pests entry. This was also the case during the survey whereby it was observed that the walls of the storage room had a lot of small vents and a gap under the door, meaning that there was easy entry for insect pests. Table 4.1 below shows the respondents opinions concerning the modes of insect pest entry in the museum and storage room.

Table 4.1: Modes of insect pest entry as per respondents point of view

Modes	**Number of respondents in percentage.**
Via human agents	-
Returned loan	-
Newly acquired untreated materials	25%
Openings	75%.

Sources: Field data 2003.

4.2.3 Food Remains and Droppings

It was revealed through the research findings that, cooking and, to some extent, eating were day-to-day staff practices and that these were being carried out near the storage room. Respondents argued that, food remains such as fish, bread or sugar and other droppings by museum staff played a key role in bringing insect pests in the storage and museum. These food remains attracted rodents and cockroaches. Interviewed respondents posited that, after eating food remains the insect pests had to find a refugee or a hiding place and that is usually in the storage room. Some respondents pointed out that, the fact that cooking was done near the storage room meant that even the utensils were kept in situ. The impact of this, as respondents pointed out, was adverse. Because in some instances already used utensils were said to have been left dirty for many days, implying that, a lot of smells or fumes to attract insect pests were emitted which automatically acted as catalysts in attracting insect pests in the storage room. Scientific explanations revealed that insect pests such as rodents and

cockroaches can easily find food by merely smelling, hence, getting an easy location of where the food is regardless of how far it is. On this basis rodents and cockroaches found in the storage room might have followed the smell in an attempt to get food. But as soon as they finished the food they entered into the storage room, therefore, finding it difficult to move out of the storage room.

4.3.0 Storage Room and Facilities

It is well acknowledged that a nice storage building and adequate conservation facilities are the key components in mitigating insect pest infestation in the museum. In Chapter Two it was assumed that improper storage and lack of conservation facilities did sway the infestation of skin and wooden materials. As research findings are concerned, it was clear that the storage room, which was supposed to be a permanent home for the collection, was in an undesirable and miserable condition. This indicates that it could not buffer the materials stored therein against possible attack by insect pests. This was so because the size of storage room was small, it was bordered with three toilets, which also served as a bathing room for museum staff. The height from the floor to the roof was 102cm, meaning that, objects were exposed to extreme heat. Moreover the storage room was leaking since the roof had a gentle slope and corroded iron sheets. This implies that there has been lack of maintenance, a situation which has resulted into high humid conditions in storage, favouring the survival and reproduction of insect pests. It becomes evident that the storage was not purposely built to store the collections rather it was an accidental happening.

4.3.1 Fixtures.

The research findings revealed that, the storage room had wooden shelves; it however, had neither enclosed drawers, cabinets, storage units nor dust filters. This implies that objects were exposed to direct dust, beetles and rodents attack. The respondents

argued that, the humidity in the storage room was not controlled, as there was no air conditioning, fans, humidifier, and dehumidifiers, thus, providing abundant conditions for the breeding of insect pests.

When the respondents were asked to comment on the condition of the museum storage, all of them agreed that it was in an extremely poor condition, leaking and that it had very small space to accommodate the collections. The situation led to the overcrowding of objects. As one respondent put it, this was tantamount to a mistreatment of the objects because overcrowding and arranging them one on top of the other meant exposing the materials to excess pressure and heating. This situation, when added to a leaking roof, gave room to the growth of microorganisms such as fungus and mould. In fact, this was observed on some of the wooden and skin artefacts, for instance, a shield that was over hundred years old which was donated by the chief of the Chagga community.

Furthermore, throughout the research, it was evidenced that respondents were dissatisfied with the present state of the storage building. Some of the respondents went as far as arguing that, the storage room did not qualify to be regarded as a storage not only because it lacked adequate facilities but also as a result of the smallness in size and leaking conditions.

When the respondents were asked on what should be done to improve the present situation in the storage room, two schools of thought arose. Forty percent (40%) of the interviewed respondents were against the idea of constructing a new storage room for the simple reason that a new construction could mean dumping a lot of financial resources, at a time being (when this research was conducted) the museum was said to be faced with financial constrains. These respondents were of the views that, what was needed was actually nothing more than a rehabilitation of the contemporary

storage room so as to ensure that all conservation facilities were put in place. But if one tries to look at the museum priority list as from 2000 to 2002, one shall notice that a lot of funds were directed towards office use, workers welfare and the construction of tradition houses as indicated in Table 4.2 below.

Table 4. 2: Village Museum Estimate expenditure and priority as from 2000 to 2002

Activities or programme	**Amount spent in Tsh.**	
	July 2000 to June 2001	July 2001 to June 2002
Official use	10,925,004.00	20,993,465.00
Rehabilitation and Construction of houses	2,328,650.00	2,775,944.00
Workers welfare	3,581,500.00	322,066.00
Education programme	78,960.00	4,400.00
Exhibition	506,570.00	929,546.00
Ethnic days	3,504,700.00	
Conservation of museum collections		6,500.00
Total expenditure	**20,925,384.00**	**25,032,921.00**

Source: Field data 2003

- Official use includes repair of vehicle, entertainment, stationeries, water and electricity, bank charges, responsible allowances, petrol and oil, photocopy, postage, e-mail and telephone charges, office repair and legal charges.
- Workers welfare includes medical capitation, training charges and allowances.

NB: Quarterly data from January 2002 to March 2002 was not available hence excluded.

Table 4. 2 above indicates that for the year 2000 to 2001 about 10,925,004/= Tsh were directed to office use, 3,581,500/= to workers welfare and none to the conservation of museum artefacts. Moreover, between the year 2001 and 2002 Table 4.2 shows that about 20,993,465/=Tsh was directed to office use and only 6,500/=Tsh for the conservation of museum collections. However, if we deduce the above statistical data to museum priority, it is simply shows that there has been less priority and commitment on issues related to the conservation of museum collections.

On the other hand, 60% of the interviewed respondents were in favour of the construction of a new storage room and the installation of standardised storage

facilities rather than rehabilitating the present storage building. Their major argument was that the present storage room even if it had to be expanded it would still remain small in size. These respondents pointed out that, the museum still continues to receive massive donations of skin and wooden materials from the communities which means the present locality of the storage room does not give provision for future expansion and consumption of donated artifacts. The respondents went as far as suggesting for a construction of new exhibition galleries, whereby objects presently displayed on the house's floor and left eaten by termites and beetle shall be exhibited in those new galleries. Table 4.3 below shows participants opinions on storage improvement.

Table 4.3: Participant's opinion on storage improvement

Activity	**Respondent**
Rehabilitation	40%
Construction of new storage	60%

Source: field data 2003

The issue related to the construction of a new exhibition room is still questionable. However, as one revisits the historical origins of the Village Museum and its purpose the propounder for the construction of a new exhibition gallery might have better ground. Since its establishment in 1967, the purpose of the Village Museum has continued to be the preservation of vernacular architectural styles of various Tanzanian communities. This means the idea of collecting and exhibiting ethnographic objects in the house were far from the mind of the founders and it was a new innovation. This situation remained so until the end of the 1980's when efforts to acquire more collections were made.

As previously pointed out, the respondents had said that, the whole of the museum compound has a large number of subterranean termites and ants. The respondent argued that even with the application of pesticides, the termites have continued to be chronic. On the other side of the coin, if the whole of the museum surroundings have termites, it also means that the traditional houses were prone to termites attack and hence objects infestation. This was revealed in the survey conducted whereby almost two among the exhibited wooden objects in four traditional houses were damaged or eaten by termites as shown in Table 4. 4 below.

Table 4.4: Objects infested by subterranean termite and beetles.

Name of the traditional House	Number of wooden materials infested	Type of insect pest
Wakwere and Wadoe	2 wooden bicycle holes on leg	Powder post beetle
Waha	2 basket eaten at the base	Subterranean termites
Wamakuwa and Wayao	1 mask ceremonial eaten on head	Subterranean termites
	2 mortar	Subterranean termite and ant
Wasukuma house	1 A x e	Beetle
	1 Slashes	Beetle
	1 mortar pastel	Beetle
	1 traditional healing basin	Subterranean termites

Source: Field survey March 2003.

4.4.0 Collection Management Policy

In Chapter Two it was assumed that lack of a collection management policy influenced the infestation of skin and wooden materials. Despite the facts that the interviewed respondents did not support this proposition, still the observations made revealed that the museum did not have such a document. The Curator in charge cited the Antiquities Act n° 10 of 1964, which defines not only what is supposed to be collected, but also stipulates who should be involved in collecting. However, such a

policy can be said to be very broad, lacking all essential components of a collection management policy. It does not state, for example, the purpose of the Village Museum, the scope of what should be collected, the control measures versus insect pests, treatment, documentation, care and maintenance, insurance, disposal procedure, how and when stocktaking should be done nor does it stipulate specific methods for collection acquisition.

The lack of a comprehensive collection management policy has in one way or another contributed to the widespread of insect pests in the museum. All of the interviewed respondents admitted that, neither the newly incoming material nor infested ones were treated. This was so because the idea of the care and maintaining of ethnographic collections was not incorporated in the policy. Contrary to what the curator in charge said the research findings revealed that, there was a translated Swahili version from the International Council of Museums (ICOM) found in the code of ethics for museums. This indicated that the museum had adopted the ICOM policy. The ICOM policy is just a model that cannot work in Tanzania because it does not reflect the social, cultural, political and economic reality of the existing museum system. In addition to that, a collection management policy is not a universal document, which can be taken from one museum to another. It is a document, which needs to be tailored to one museum. This is so because the nature of museums are not alike.

4.5.0 Conservation Methods

One of the specific objectives for this study was to describe the different methods, which can be used to control pest infestation on skin and wooden materials. In order to get a better understanding of the pest control methods, it was necessary to find out if the museum employed any conservation methods tailored on mitigating insect pest infestation.

It was evident that the museum had taken drastic measures to control subterranean termites on objects displayed in the traditional houses. The respondents pointed out that, the Technical Department had been undertaking fumigation in the houses to

terminate termites. The respondents identified gurmalin to be the most common pesticide, which has been used for fumigation. It also become evident that none of technicians had undertaken any training nor acquired skills in fumigation work. This means that there is a lot of risk to their own personal and the visitor's health.

When respondents were asked whether the museum used to fumigate infested or newly acquired skin and wooden materials all the respondents had a negative response. The research findings also indicated that, although the museum fumigated the traditional houses such an activity was not directed towards infested skin and wooden materials. The reason for that was attributed to the lack of a fumigation chamber and essential conservation facilities in the museum.

Furthermore, in Chapter Two it was assumed that, the inability of the museum to use the available traditional conservation techniques did prompt infestation. Two point of views emerged under this issue. About, sixty percent (60%) of the interviewed respondents were in favour of the view that the museum has exhaustively utilised the traditional knowledge in the conservation of skin and wooden materials. The respondents listed the following conservation methods to support their arguments: The museum has been heating the houses by using firewood so as to allow smoke to create a thin bitter layer on the artefact, hence, making it difficult for insect pests to easily eat the artefact. Though this method was seen to be effective in controlling insect pest it suffers from several drawbacks. The respondents argued that, if smoke was left to accumulate for a long period of time on the objects it was likely to form soot, hence, changing the original colour of the artefacts. However, the soot accumulated on the roof of traditional house was said to be helpful since it prevented leaking.

Moreover, burning one end of a constructing pole was another method identified by respondents to have been employed by the museum to control termites. They argued that, a burnt part which turned into charcoal did not provide potential food nutrient to termite. This is because it did not contain cellulose. Meaning termites were denied from breeding and prospering, hence, they were forced to move out of that area, and to search for food elsewhere.

On the other hand, about thirty percent (30%) of the interviewed respondents thought that the museum had not exhaustively exploited the traditional knowledge in the conservation of skin and wooden materials. The respondents argued that, there were no any efforts especially during the ethnic days [1], whereby local people were given an opportunity to address this issue in detail.

The respondents explained that they had witnessed that during cultural festivals local people were not given an opportunity to present their ideas about traditional ways of conservation. One respondent in his own words said "*the communities were not given a chance to present their ideas on how and .why the skin and wooden objects donated to the museum could be traditionally conserved or preserved*". The respondents said that, if this could be allowed to take place, a lot of local ideas could have been by now put in place to control insect pest infestation. Moreover, about 10% of the interviewed respondents believed that, museum inability to exhaustively exploit the traditional conservation techniques, was influenced by lack of expertise and funds for research undertaking.

1 A cultural festival organized by the Village Museum whereby a selected ethnic group is invited to present some aspects of their culture to other communities.

4.6.0 Traditional Conservation Techniques

4.6.1 Use of Black Poison

Throughout the research respondents identified black poison to be one of the effective traditional curative methods for killing rodents. However, respondents said that, this method does not guarantee that all mice and rats shall be killed at once. This is due to the fact that, some rodents will move outside the storage room after smelling the death of others. After a few weeks those rodents are likely to come back into the storage and continue infesting stored materials. Thus, the respondents advised that to make this poison more effective one should ensure that no water is kept in or nearby the storage room. This was because after swallowing a poison (whose formulation is designed to hydrate rodents) the respondent's experience showed that, the rodents would prefer searching for drinking water to reduce the effectiveness of poison. The respondents suggested that such a type of poison needs to be used at least twice a month followed with weekly inspections to see if rodents are still in place.

4.6.2 Use of Cats

It was revealed through the research findings that, traditionally cats have been used for catching rodents such as rats. However, the respondents warned that, the possession of cats did not mean it would finish the entire rat population in the storage room. Quite contrary, it was agreed that, rats feared cat's sound or voice.

4.6.3 Tobacco Powder

The respondents argued that, the use of tobacco powder has been one effective traditional method in mitigating powder post beetle. One of the respondents said that this powder is indeed bitter, as such when it left on the object it real denies insect pests from infesting wooden materials.

4.6.4 Catching Gear

Other respondents identified traditional rat catching gear to be among the methods that, in the local context, is normally used for catching rats. But they admitted that, these types of gear are designed to only catch a single rat at once.

4.6.5 Hygiene

Respondents pointed out that, traditionally proper house keeping was key in controlling various species of insect pests from reproducing. The respondents said that the cleaning of dust, a proper arrangement of individual objects and removing rubbish meant prohibits insect pest from breeding and getting a place for shelter.

4.6.6 Skin Drying

Many of the insect pests such as cloth moth preferred to eat skin because the materials contained keratin and moisture. Traditionally, to handle such a problem respondents said that, they usually dry the skin in the sun or on fire to the extent that no smell is emitted. This also meant a reduction of keratin from which many insect pests are attracted to eat.

They also identified individual killing of insect pests by either using bare hands or sticks to be a prominent way of reducing their numbers in the storage.

The focus group discussion respondents pointed out that, insect pests like to infest stagnant artefacts. To resolve this situation respondents said that, traditionally they usually ensure that the artefacts are in continuous use for different household activities. In addition to that, they make sure that there is a daily inspection of each of the artefacts.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 Discussion

The general objective for this study was to investigate how and why skin and wooden ethnographic artefacts were infested and what was being done to combat the problem. The objective was guided by assumptions including that the inherent insect pests infestation problems on skin and wooden artefacts were influenced by improper storage and lack of conservation facilities, the lack of a collection management policy and the inability of the museum to utilize the available traditional conservation knowledge.

The major findings have revealed that insect pests are the principle causes of the biodeterioration of skin and wooden objects in the museum. This is so because insect pests tend to successfully exploit the situation, which is provided in museums since features of their body form, breeding habits and lifestyles that make them particularly well adapted to this role. Therefore, an understanding of insect pests' forms, culture and function is essential to the design and operation of successful pest prevention and control programmes. This also means that given ideal conditions of abundant food, optimum temperature, humidity, poor hygiene, poor storage and little disturbance some species will be encouraged to complete their development from egg, larvae, pupa to adulthood. Therefore, there is little wonder that museums and stores, which provide an ideal environment for insects, are often plagued with pests leading to the loss of materials which are of aesthetic, cultural, historic and scientific importance. As Edson and Dean (1994: 92) concur, collections are central to any museums. If collection objects are destroyed or allowed to be destroyed not only does the museum

lose a valuable asset, but also humankind loses an element of its cultural and scientific heritage that may be irreplaceable.

It is also important to acknowledge the view that, insect pests are not spontaneously generated in artifacts and it follows that, if an infestation develops, it must have been acquired from some other sources. Poor storage, with cracks, holes, leaking roofs and lacking proper maintenance and conservation facilities, provides an ideal condition for insect pest infestation. This is so because the museum is less investing in the conservation of ethnographic collections as compared to traditional houses, as well as palaentological and archeological collections.

Furthermore, and as previously stated, insect pests need food for survival. Staff practices of eating and cooking in museums tend to attract insect pests in the storage for the leftover food. Also, garbage bins and pits located near the museums or stores provide food sources for pests.

Besides, the absence of a collection management policy, which could help to mitigate against pest infestation by ensuring that there is a system of quarantine, museums also do not use the traditional conservation knowledge systems. With the lack of a collection management policy, it becomes even more difficult for museums to detect infestations to newly acquired materials leading to the spread of infestations. Moreover, widespread infestation leads to the loss of the aesthetic, historic, cultural and scientific significance of skin and wooden artifacts, making it difficult to meet museum missions and visions, hence, being irrelevant to the public. Therefore, effective prevention and control of insect pest requires an understanding of the insect pests, their habits, culture, source and adoption of a disciplined regime appropriate to the museum and the objects in its care.

5.2 Conclusion

From the research findings we can conclude by arguing that, the inherent persistence of insect pest infestation on skin and wooden artifacts at the Village Museum is a function of improper storage and lack of conservation facilities, the absence of a collection management policy and the inability of the museum to utilize traditional conservation knowledge.

5.3 Recommendations

Thus, the study recommends that, in order to mitigate and properly manage the problem of insect pest infestation and improve the conservation state of skin and wooden ethnographic artifacts at the Village Museum, there is a need for the museum to prioritize preventive conservation measures by incorporating them in the museum annual budget. Related to prioritizing is the establishment of a preventive conservation strategy by controlling pests, sealing vents, regular cleaning, inspection of objects and the deep-freezing of already infested artifacts.

Furthermore, there is need to have a detailed collection management policy, which shall give not only directions on the scope of collections, the procedure for accessioning, deaccessioning but also it should thoroughly address issues pertaining to the care and maintenance of collections.

There is also a need for the construction of a new storage room, which should be installed with all required conservation facilities. These include, among other things, fans, combined humidifier and dehumidifier, drawers, cabinets, shelves and air conditioners.

Whereas the museums claims to suffer from financial constrains, it is cost-effective to start using the traditional conservation methods, which are cheap and available.

As far as fumigation is concerned, such work should be done in consultation with fumigant companies and experts, who are competent and skilled enough in the

handling and management of fumigants. As an immediate response towards terminating beetles activity, there is a need to use naphthalene or moth balls in storage and on the already infested skin and wooden artifacts.

There is a need to develop quarantine for new and incoming artifacts so as to avoid the problem of insect pests being introduced as results of normal museum activities.

Furthermore, there is need to keep food consumed by human beings outside the museum and storage areas. In additional to that, there is a need for the museum to deny insect pests harbourage, that is, a safe place and conditions for insect pests to live and reproduce. This can be done through improving the hygiene regime, blocking their access to the storage room and the museum, to carry out appropriate treatment procedures so as to deny an ample environment in which insect pests can feed and breed when they get in.

Objects in the storage room need to be bagged in self-sealed Polyethylene bags, which have shown particular promise in resisting insects. However, care must be taken to prevent condensation, which might make objects prone to attack by microorganism. This can be done by putting into the bag a silica gel.

There is a need for the installation of self-closing devices and to have sweeps and gaskets on all exterior doors, caulking all building penetrations so as to prevent insect pests access, to eliminate water and moisture problems, to ensure adequate environmental controls, as well as to have a stable and low humidity. Moreover, there is a need to eliminate food sources in the museum and to use appropriate exterior lighting, such as sodium vapor, which is less attractive to insects.

Museum staff need to be trained on the causes and dangers associated with insect pest infestation in the museum collections. However, to achieve all what these study has recommended it needs committed museum management.

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Appendix 1: Main Questionnaire

UNIVERSITY OF NAIROBI

POSTGRADUATE DIPLOMA IN CARE AND MANAGEMENT OF HERITAGE AND MUSEUM COLLECTIONS

Dear respondent the aim of this questionnaire is to collect opinions from the museum staff with the ultimate aim of improving the conservation state of skin and wooden materials in museums.

A. IDENTIFICATION

1. Name of the respondent .....
2. Sex a) Male
   b) Female _____

B. Modes of Introducing Insect Pests

3. What type of collections (materials) does the museum have?
   i).....
   ii).....
   iii).....
   iv).....
   others.....

4. Which among the above listed material categories are susceptible to insect pests infestation?.....
   .....

5. What type of insect pests are encountered in your museum?
   .....
   .....

6. Which insect pests poses the greatest threat to skin and wooden materials?
   .....
   .....

7. Where these pests come from?.....
   .....
   .....

8. Which, among the following, do you think are suspected modes of pest entry?
   a) Via human
   b) Return of loaned collections _____
   c) Newly acquired untreated skin and wooden materials
   d) Others .....

9. In your opinion, what brings these insect pests in the museum and storage?
   .....
   .....
   .....

10. How does cooking and eating near the storage influence the wide spread of pest?
    .....

.....

11. What damage does insect pests cause on wooden and skin materials?.....
.....
.....
.....

C. Storage and Facilities

12. Does the museum have display cases?

a) Yes b) No _____

13. If yes, do they provide adequate protection to skin and wooden object against infestation?

a) Yes b) No _____

14. If the answer in question No: 12 above is No, then how does the museum exhibit its collections?.....
.....

15. Does the museum have enclosed drawers /storage units?

a) Yes b) No _____

16. Is the storage building heated?

a) Yes b) No _____

17. Does the storage have air conditioning and fans?

a) Yes b) No _____

18. Is the humidity in the storage controlled?

a) Yes b) No _____

19. Does the storage have dust filters?

a) Yes b) No _____

20. Comment on the condition of the museum storage.

a) The roof is leaking
b) It has very small space to harbour objects _____
c) Both a and b
d) others.....
.....
.....

21. In your opinion what should be done to improve the present situation the storage?
.....
.....

D. Conservation Methods

22. Do you normally use fumigants for infested skin and wooden materials?

a) Yes b) No ——————————

23. What methods of pest control does the museum employ?

.....

.....

24. Are the incoming skin and wooden object fumigated?

a) Yes b) No

25. Do you think the museum have exhaustively exploited the traditional knowledge in the conservation of skin and wooden materials?

a) Yes b) No ——————————

26 If the answer is No then why do you think the situation is like that.....

.....

.....

27 If the answer is Yes, then list those specific traditional conservation methods which the museum use at the moment?

i).....

.....

ii).....

.....

iii).....

.....

others .....

28. What traditional conservation techniques can be used for preserving infested skin and wooden materials?

i) .....

ii).....

.....

iii).....

Thanks a lot for your cooperation

Appendix 2:The insect Pests control Survey Checklist

A	**Inspection starting from the general to specific.** ***i) Environment and the sounding*** Look on the kind of insect pests; identify their possible source of breeding, types.
B	**Storage building** **Get plan of storage building** ▪ Observe the storage building from outside and inside looking if there are holes, cracks, air vents gaps in ceiling etc. ▪ See if there is any evidence for cooking or food remains Size of storage (is it small or big?, Does it provide adequate protection to insect pest?
C	**Fixtures** ▪ See if there is any evidence for active insect pests. what material for construction have been used?, Is it infested or not? What insect pests are likely to have infested it?
D	**Object** ▪ Observe an individual sampled object in storage and exhibits to see if there is any evidence insect pest. ▪ Look for signs of insect pest activities and assess level of activity ▪ Use photography as a supportive tools for collecting evidence, other tools are such as a small tipped paint brush for manipulating small insects, hand lens to better identification, collect specimens in bottles etc
E	**Determine the type of damage by assessing individual sampled object on the basis of: -** ▪ Mechanical damage ▪ Chemical damage ▪ Biological damage

NB: Museum personnel responsible for maintaining collection will be asked to describe how their collection are being stored, what problems do they have with pest and which methods they use to remedy these problems.

Appendix 3: Study Guide for Key Informants

Collection Management Policy

1. How does the museum acquire it collection?

a) Gift
b) Purchase
c) Field work
d) Loan
e) Bequest
f) Others.....

2. Does the museum have a collection management policy?

a) Yes b) No

3. If the answer is Yes then what component it has ?

a).....
b).....

c).....
d).....
e).....
f).....

4. What museum policy address issues related to care and maintenance of collections

a).....
b).....

5. What procedures does the museum use to deaccessing any infested wooden and skin artifacts?

a).....
b).....
c).....

6.To what extent do you think lack of collection management policy have contributed to the wide spread of insect pest infestation? (Probe for reasons)

.....
.....
.....