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An overview of the status of taxidermy in Bangladesh with a study of pest control of a mammal collection

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Abstracts

The situation of taxidermy and taxidermists in Bangladesh is discussed. An analysis of scientific collections of vertebrates in all universities and zoological institutes of Bangladesh is given. The results are unsatisfied. A modern taxidermy and collection storage and collection management is missing in the whole country. Some proposals of future development and saving the small number of well prepared specimens are shown. For modern taxidermy Bangladesh needs well educated and trained taxidermists. The scientific collections need more attention, because they are the basic of a modern biological education and for research. Also a professional pest control and protection management of the collection is needed.

Key words: Taxidermy, Bangladesh, standardization, natural history, fauna, scientific collections

1. Introduction

Taxidermy is a general term describing the many methods of reproducing a life-like three-dimensional representation of an animal for permanent display (Layne 1998). In some cases, the actual skin (including the fur, feathers or scales) of the specimen is preserved and mounted over an artificial armature (Williams 1996). In other cases, the specimen is reproduced completely with man-made materials. The word „taxidermy“ is derived from ancient Greek: *taxis* = means movement, and *derma* = skin (Williamson 1994). This is a fairly appropriate definition as many taxidermy procedures involve removing the natural skin from the specimens, replacing this skin over an artificial body, and adjusting the skin until it appears life like (Farber 1977).

The art of bio-design is also called taxidermy. This usually means entire skin of an animal have to skinning with a particular strategy and makes an animal like previous exact live animal by a specific method (Cook 1954). Bengali meaning of taxidermy is animal skin representation or skin reflection. Taxidermy can be done on all vertebrate species of animals. Modern taxidermy can be done also for some invertebrates (Chan 1961).

Several authors described the process of taxidermy and their progress beginning from the last decades of 18th century up to now as well as the methods of pest control of the prepared animals (Walker 1869, Lucas 1898, Davie & Oliver 1900, East 1954, Prince et al. 2003). For modern taxidermists the knowledge about anatomy, behavior and ecology of their objects
is absolutely necessary.

2. Short historical overview

Taxidermy has existed since man began hunting. Archeological evidence of very early taxidermy shows the remains of animals draped over rocks and blocks of wood, which experts speculate may have served either a totemic purpose, or simply served as target practice for novice hunters (Allard et al. 1994). Taxidermy in modern sense, however, didn't really begin until the 18th century (Wonders 2005).

Initially, taxidermy was a crude and unsophisticated process. Animals were literally gutted, their hides were tanned and then stuffed with cotton or straw and sewed back up for display. These early attempts did not go over so well, though, because the animal was never properly preserved. This mean that the eyes, nose, teeth and tongue would eventually rot (Brown 1833).

The majority of taxidermists have a deep knowledge and appreciation of natural history as this helps them to accurately preserve the specimen and recreate the natural living environment. Taxidermy is a highly skilled craft and the quality of work depends on the knowledge, patience and artistic ability of the exponent. Modern materials are available and techniques are constantly being updated, giving far better results (Sterling 1989).

Taxidermy is becoming a growing wildlife art all over the world. Ever since the pioneers' introduction of more detailed taxidermy procedures, taxidermists around the world have been continuously looking for more ways to create artistic reproduction of animals. Canada has been one of the countries fervently supporting the art of taxidermy (Smith & Pamela 2004).

The methods of taxidermy were found in the books of Belon (1517–1564) who was the naturalist in France. Belon wrote the earliest scientific explanation and instructions for taxidermy procedures in 1555. His principal achievement was a history of birds ‚L'Histoire de la nature des oyseaux' (The Natural History of Birds) (Belon 1555).

After that Olina (1622) and Aitinger (1626) gave a brief description of taxidermy or likely methods of their century and described the procedures of taxidermy. In the same year, Olina & Pietro (1622) wrote the book „Uccelliera overo discorso della natura e proprieta di diversi uccelli" in Rome and described the method of taxidermy.

After many years, Reaumur & Eerchault (1748) published the „Preserving Dead Birds as Taxidermy" in London. Kuckhan (1771) also described the process of bird taxidermy.

Other scientists of the 18th century published also several papers and books about early taxidermy, like Lettsom (1774) and Cutler (1795).

The more developed methods in the beginning time of industrial revolution during the 19th century was described by many specialists and those who want to become one. Examples are the works Bowdich (1820), Brown (1833), Lee (1843), Baird (1854), Peale (1864), Walker (1869), Manton (1876), Holder (187a, b), Maynard (1883) and Allen (1891). They all described several and different methods of taxidermy on vertebrates and only a few also on insects or other invertebrates.

The more or less same situation can be found in the beginning of the 20th century, but some methods were developped on a more scientific base. The natural history museums in the United Kingdom, USA, Germany and France increased their collections hardly and so the interest on a good and sustain conservation and preparation for bigger public exhibitions demand modern methods of taxidermy. These were published for example by Holden (1914), Nutting (1917), Shufeldt (1917), Preble & Grinnell (1926) and Soper (1943). From the last decades of the 20th century the number of publications about modern taxidermy is

enormously. For example we listed only a few of them in this paper, like Vonendt (1959), Waller & William (1965), Parker & Holliman (1972), Farber (1977), Morris (1982), Pimm (1986), Held (1989) and Layne (1998). The development of new synthetic materials and coulours, special instruments, connected with scientific research of pest control in collections bring a new quality in the science of taxidermy as well for scientific collections as in exhibitions. Altogether with new methods of storage in collections the new taxidermy shows in the present time a high level of science and aesthetics.

In the beginning 21st century the papers on taxidermy deal with more special facts of preparation, conservation, pest control or coulouration of single groups. So Sirois & Sansoucy (2001) described an analysis of museum objects for hazardous pesticides residues for a guide to techniques. Desmond (2002) published his book on 'Displaying Death Animating Life' in India for Changing Fictions of liveness from taxidermy to animatronics.

Prince et al. (2003) also published 'Stuffing Birds, Pressing Plants, and Shaping Knowledge' from USA for the natural history in North America. Smith & Beentjes (2010) published an overview of taxonomy USA, while Hagen et al. (2003) give an overview of the methods of bird taxidermy in Germany from ancient time up to the Renaissance.

For Bangladesh evident are the papers of Das (2010). He described the history of taxidermy, the necessity of taxidermy and the necessity of natural history museum in Bangladesh. Fischer (2010) described these facts too and give some ideas for teaching and future projects.

3. Taxidermy related works in Bangladesh

Taxidermy is a neglected subject in Bangladesh. In fact, there was no well trained taxidermist in the former Eastern Bengal / East Pakistan. Till 2010, Bangladesh also had shortage of well trained and skilled taxidermists. In the country generally unskilled people prepare animal bodies, which are mainly used in schools, colleges and

universities for academic purposes. The materials and methods followed not a scientific sense and as a result almost all these preserved animals could not sustain for a long time due to attack of various pests (Das 2010).

For the first time the Department of Zoology of the Rajshahi University took an initiative to organize a taxidermy training bringing a world famous taxidermist from Germany. The training was organized under DelPHE programme (Development Partnerships in Higher Education) of the Zoology Department, funded by DFID, UK and coordinated by the British Council.
The training was divided into two phases. Phase I: General training course on taxidermy, held during 8th –23rd March, 2010; and phase II: advanced training course on taxidermy, held during 23rd December 2010 to 22nd January 2011. Altogether 27 and 18 participants attended in the first and second phases respectively out of which most of them were common for these two phases. The participants were undergraduate and postgraduate students, fellows, staff members (Department of Zoology, University of Rajshahi and other government and private institutions).
The world famous taxidermist, Mr. Marco Fischer, Natural History Museum Erfurt, Germany (won best award in European Competition in 2010, 3rd award of excellence in 2014 and 2nd best award in World Competition in 2008) trained the participants in these two phases.

3.1 Scope of taxidermy in Bangladesh

Taxidermy has academic, professional and industrial aspects in Bangladesh since it is fascinating and rewarding subject. Usually when a wild or captive animal dies in a National Park or Zoo in Bangladesh, they are simply buried. A unknown number of animals also die in Bangladesh due to cyclone or other disasters. However, these dead animals can be conserve for scientific research and education, and also some of these can be exported for commerce.
Unfortunately Bangladesh is still at infancy on this subject. The number of trained taxidermist is really zero in this country. In universities and in some post-graduate teaching (zoology) colleges animals are prepared by unskilled persons. In fact each educational institute should have collection of stuffed animals, but in reality these are hardly to found. Accordingly, Bangladesh needs taxidermists. Stuffing rare animals would provide opportunities for Bangladeshi students to learn more about the wildlife and protect the fauna from extinction (Das 2010).

3.2 Aims and objectives of the present study

Taxidermy is hardly recognized as one of the fine arts. The truthfulness of representation, and the artistic effects of posing and grouping which „mounted“ animals may exhibit, can often invest such work with an interest for those who may not be much inclined toward – taxidermy for the sake of the skin-preserving in this country.
In fact, Bangladesh needs a lot of skilled taxidermists. At present, the condition of stuffed animals in different universities and colleges are not good and not related with scientific methods. As a result, these are attacked by different types of pests and most of them have already been destroyed.

The aim of this work is to develop taxidermy in Bangladesh and the objectives of the present study are:
- to know the status of taxidermy through survey of stuffed animals in different institutions,
- to identify the pest of staffed animals preserved in different institutions,
- to select appropriate preparation techniques of animals for weather conditions,
- to conduct a trial using different types of ingredients including traditional for preservation of staffed animals.

For examples of modern, correct scientific and sustainable taxidermy see the figures 10 and 11.

4. Status of prepared animals in Bangladesh

In Bangladesh, different schools, colleges and universities had limited number of stuffed animals. These stuffed animals are not in good condition and most of them are infected by different types of pests. The main reason of this fact was that they were not prepared by the trained and skilled taxidermists. Nearly all of these were prepared by untrained and unskilled people, who

Figure 1. *Gracupica contra,* new bird taxidermy at Rajshahi University. by Abdullah Al Mamun. All figures made by Al Mamun.

followed very crude methods to prepare the animals. However, we do not have any idea regarding the status of stuffed animals in different institutions of Bangladesh. This situation must be change, if Bangladesh's institution will become a international scientific standard. Keeping these in mind, a survey was conducted to know the status of the prepared animals in Bangladesh. Altogether four universities, viz. Rajshahi University, Dhaka University, Chittagong University and Jagannath University were selected for this survey. Five colleagues, viz. Rajshahi College, Rajshahi New Govt. Degree College, Rajshahi Govt. City College, Dhaka College and Chittagong College were also selected for the present study. The survey was conducted from 15th July to 15th October 2012.

4.1 Materials and Methods

Stuffed animals(birds & mammals) in each zoological museum (Rajshahi University, Dhaka University, Chittagong University, Jagannath University and five colleagues, viz. Rajshahi College, Rajshahi New Govt. Degree College, Rajshahi Govt. City College, Dhaka College and Chittagong College) was examined. In order to do this, permissions were taken from the Head of the Departments of each Institution.

The entire stuffed animals were examined carefully both by a hand lens and naked eye. Percentage of pest infection was also determined in the notebook. Some photos were taken by camera in the infected birds and mammals. Any pest found during the examination was collected and preserved in 70% alcohol. Magnifying glass also used to primary pest identification. The preserved specimens (pests) were brought to the laboratory (Ecology, Department of Zoology, University of Rajshahi) and were identified later.

4.2 Results

Percentage of infection of stuffed animals and the name of the pests in different zoological museums (Rajshahi University, Dhaka University, Chittagong University, Jagannath University and five colleges, *viz.* Rajshahi College, Rajshahi New Govt. Degree College, Rajshahi Govt. City College, Dhaka College and Chittagong College) are provided below:

a) Zoological Museum, Department of Zoology, University of Rajshahi

Total numbers of stuffed animals (birds and mammals) were 112 and 75.

Percentage of pest infection on stuffed animals in birds and mammals was 71.44% and 69.33% respectively.

Total five insect pests, one arachnid and two fungal pest species were found in this museum. These are: ticks (*Aponomma* sp.), carpet beetle (*Anthrenus* sp.), webbing clothes moth (*Tineola bisselliella*), ant (*Formica* sp.), bird lice (*Felicola* sp.), slender Pigeon lice (*Columbicola columbae*) and fungus (*Aspergillus* sp. and *Penicillium* sp.).

b) Zoological Museum, Department of Zoology, University of Dhaka

Total numbers of stuffed animals (birds and mammals) were 78 and 35.

Percentage of pest infection on stuffed animals in birds and mammals was 76.92% and 74.29% respectively.

Total five insect pests and two fungal pest species were found in this museum. These are: carpet beetle (*Anthrenus* sp.), webbing clothes moth (*Tineola bisselliella*), ant (*Formica* sp.), bird lice (*Felicola* sp.), slender pigeon lice (*Columbicola columbae*) and fungus (*Aspergillus* sp. and *Penicillium* sp.).

c) Zoological Museum, Department of Zoology, University of Chittagong

Total numbers of stuffed animals (birds and mammals) were 45 and 31.

Percentage of pest infection on stuffed animals in birds and mammals was 82.22% and 77.42% respectively.

Total four insect pests, one arachnid and two fungal pest species were found in this museum. These are: ticks (*Aponomma* sp.), carpet beetle (*Anthrenus* sp.), webbing clothes moth (*Tineola bisselliella*), ant (*Formica* sp.), bird lice (*Felicola* sp.) and fungus (*Aspergillus* sp. and *Penicillium* sp.).

d) Zoological Museum, Department of Zoology, University of Jagannath

Total numbers of stuffed animals (birds and mammals) were 30 and 9.

Percentage of pest infection on stuffed animals in birds and mammals was 93.33% and 88.89% respectively.

Total five insect pests, one arachnid and two fungal pest species were found in this museum. These are: ticks (*Aponomma* sp.), carpet/fur beetle (*Attagenus* sp.), spider beetle (*Ptinus* sp.), webbing clothes moth (*Tineola bisselliella*), ant (*Formica* sp.), slender pigeon lice (*Columbicola columbae*), bird lice (*Felicola* sp.) and fungus (*Aspergillus* sp. and *Penicillium* sp.).

e) Zoological Museum, Department of Zoology, Rajshahi College

Total numbers of stuffed animals (birds and mammals) were 10 and 8.

Percentage of pest infection on stuffed animals in birds and mammals was 90% and 87.5% respectively.

Total four insect pests and two fungal pest species were found in this museum. These are: carpet/fur beetle (*Attagenus* sp.), carpet beetle (*Anthrenus* sp.), spider beetle (*Ptinus* sp.), webbing clothes moth (*Tineola bisselliella*), ant (*Formica* sp.), slender pigeon lice (*Columbicola columbae*), and fungus (*Aspergillus* sp. and *Penicillium* sp.).

f) Zoological Museum, Department of Zoology, Rajshahi New Govt. Degree College

Total numbers of stuffed animals (birds and mammals) were 10 and 0.

Percentage of pest infection on stuffed animals in birds and mammals was 90% and 0% respectively.

Total four insect pests and two fungal pest species were found in this museum. These are: carpet/fur beetle (*Attagenus* sp.), carpet beetle (*Anthrenus* sp.), ant (*Formica* sp.), slender pigeon lice (*Columbicola columbae*), and fungus (*Aspergillus* sp. and *Penicillium* sp.).

g) Zoological Museum, Department of Zoology, Rajshahi Govt. City College

Total numbers of stuffed animals (birds and mammals) were 11 and 4.

Percentage of pest infection on stuffed animals in birds and mammals was 90.91% and 75% respectively.

Total three insect pests and two fungal pest species were found in this museum. These are: carpet/fur beetle (*Attagenus* sp.), ant (*Formica* sp.), slender pigeon lice (*Columbicola columbae*), and fungus (*Aspergillus* sp. and *Penicillium* sp.).

h) Zoological Museum, Department of Zoology, Dhaka College

Total numbers of stuffed animals (birds and mammals) were 6 and 3.

Percentage of pest infection on stuffed animals in birds and mammals was 100%.

Total two insect pests and two fungal pest species were found in this museum. These are: carpet beetle (*Anthrenus* sp.), ant (*Formica* sp.) and fungus (*Aspergillus* sp. and *Penicillium* sp.).

j) Zoological Museum, Department of Zoology, Chittagong College

Total numbers of stuffed animals (birds and mammals) were 5 and 2.

Percentage of pest infection on stuffed animals in birds and mammals was 100%.

Total three insect pests and two fungal pest species were found in this museum. These are: carpet beetle (*Anthrenus* sp.), ant (*Formica* sp.), bird lice (*Felicola* sp.) and fungus (*Aspergillus* sp. and *Penicillium* sp.).

From this information, it is evident that altogether 7 insects species, 1 arachnid species and 2 fungal species were recorded as the pests of stuffed animals in different museums, *viz.* Rajshahi University, Dhaka

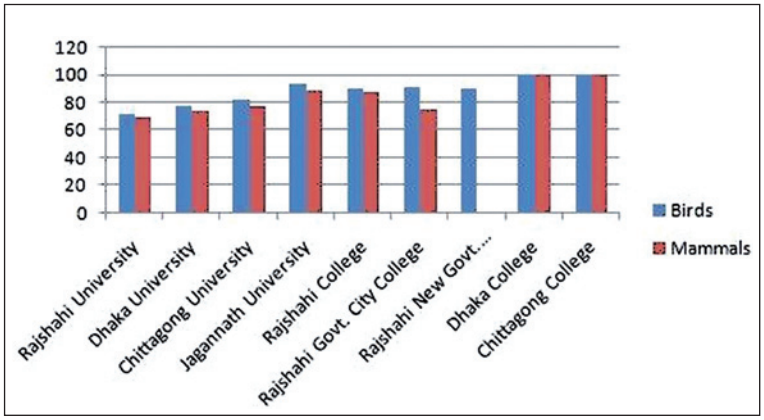

Figure 2. Percentage of pest infection in 9 museums.

Figure 3. Pests infected bird of Rajshahi New Govt. Degree College.

Figure 4. Example for a mammal in collection of Chittagong College.

Figure 5. Example of Mammal Taxidermy of the collection of Rajshahi Govt. City College.

University, Chittagong University, Jagannath University and five colleges, *viz.* Rajshahi College, Rajshahi New Govt. Degree College, Rajshahi Govt. City College, Dhaka College and Chittagong College.

Percentage of pest infection for different museums are shown in Figure 2. It is evident that highest percentage of pest infection was in the museum of Dhaka College and Chittagong College followed by Jagannath University museum. The lowest percentage of pest infection was recorded in the Rajshahi University.

5. Discussion

The percentage of infection found through this survey is really threatening. It appears that most of the specimens kept in different museums in Bangladesh will be destroyed soon. It will be really difficult to replace all those destroyed specimens immediately. Temperature and high humidity are the main two physical factors of the environment that are mainly responsible for the sustainability of the stuffed animals. Under higher temperature and moisture the conditions for pests of stuffed animals are well developed to attack and they breed and multiply quickly. Damp weather and careless are also reason for pest infection.

Many insects tolerate a wide range of moisture and survive for long periods in a very dry or humid environment. Some species require very particular conditions to complete all phases of their life cycle and so thrive. For example, beetles need a damper environment. In general, low temperatures and drier conditions are less attractive to most pest species (Pinniger & Winsor 1998).

A pest of stuffed museum specimen *Anthrenus* sp. is known as carpet beetle. It is a serious and destructive coleopteran insect to stuffed and preserved museum bird and mammal specimens. The larvae devoured the feather, hair and skin of stuffed animals. The stuffed animals became feather or hairless and ultimately destroyed (Hasan et al. 2007).

In all museums, pest's particularly insect pests were viewed as the greatest threat to the preservation of collections. Most of them were affected in the insect's pests. It was occurred for the technical method of taxidermy (Goldberg 1996).

The most effective pest control measures for museum specimens are preventive; the avoidance and exclusion methods described above should be the priority. Only when these methods prove ineffective should chemical treatments be considered. If pests are found in specimens or in the building then a decision must be made on whether some remedial action is necessary (Pinniger & Winsor 1998).

The management authorities of museums are completely unconscious about the management and consciousness of museums. A good decoration is also demand for all museums. Care should be taken in all time and management should be systematically. Bangladesh lacked information on the status of museum specimens. The present survey will fill up this gap.

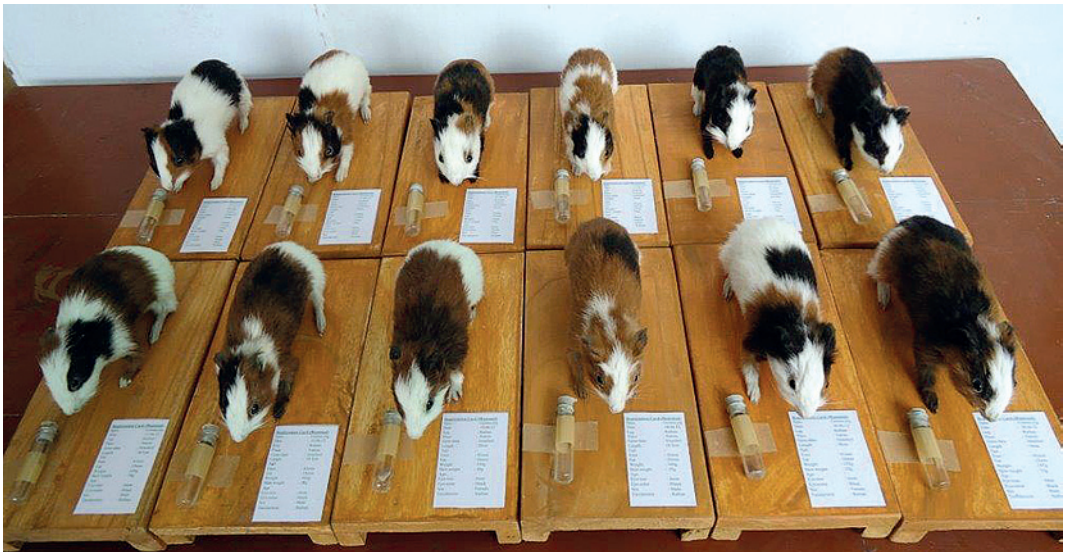

Figure 6. Complete stuffed Guinea pigs for the experiments of prepared animals.

6. Standardization of taxidermy procedure

The standardization of taxidermy or museum stuffed animals have not been developed in Bangladesh (Das 2010). Nobody is familiar about the appropriate preparation technique of taxidermy in this country. The process or preparation technique of animals needs to be scientific and developed for the long lasting in museums. However, technique differs greatly from country to country. In fact, it depends upon the environmental condition of the country where the animals will be preserved.

Weather is a main factor for long lasting of museum stuffed animals. The weather in Europe is completely different from these of Bangladesh. Most of the European countries is temperate. Cool conditions are discouraged insects from breeding and any areas with temperatures of 20°C and above will encourage insect breeding (Pinniger & Winsor 1998). So museum pests of stuffed animals are very low in these temperate regions.

The humidity is very high in Bangladesh. Generally, it is extremely difficult to preserve stuffed animals in Bangladesh. For this reason, a successful procedure should be established in Bangladesh to preserve staffed animals in museums. However, till now, there is no standard technique for the preparation of museum specimens in Bangladesh, but it have to be developed. Keeping this fact in mind, efforts were made to standardize animal preparation techniques for preservation in the museums of Bangladesh.

7. Experiments of prepared animals

7.1. Materials and methods

A total of 12 guinea pigs [*Cavia porcellus* (Linnaeus, 1758)] samples were collected from a private farm in Rajshahi. Guinea pigs were selected for this experiment because of their availability and they are farmed. Wild animals should not be taken for this type of experiment where they are killed. Age of the guinea pigs were 21days.The average weight of the animals was 150 g and they was couloured black, yellow and white. This experiment started on May, 2012 to February, 2013.

7.2 Treatment design

Twelve guinea pigs were divided into four groups and treated as:

Group A: Treated with Copper (II) sulfate.

Group B: Treated with Arsenic trioxide.

Group C: Treated with neem and borax.

Group D: Control.

7.3 Results

Degrees of infection on treated and control guinea pigs are provided in Table 1. As a result it was evident that R1, R2 and R3 treated with neem and borax were moderately infected by fungus. Pest infection did not find in samples of R1, R2, R3 treated with copper (II) sulfate and arsenic trioxide. Control guinea pigs were moderately infected by fungus and insect pests.

Table 1. Comparison of pests on stuffed animals treated with different ingredients and control. + = moderate, ++ = high, +++ = severe; F = Fungus, I = Insect.

Date	Chemicals	Replication (R)			Gr. D: Control
		R 1	R 2	R 3	
28.08.2012	Gr. A: Copper (II) Sulfate				+F
	Gr. B: Arsenic Trioxide				+F
	Gr. C: Neem and Borax	+F	+F	+F	+F
28.09.2012	Gr. A: Copper (II) Sulfate				++FI
	Gr. B: Arsenic Trioxide				++FI
	Gr. C: Neem and Borax	++F	++F	+F	++FI
28.10.2012	Gr. A: Copper (II) Sulfate	+F			++FI
	Gr. B: Arsenic Trioxide				++FI
	Gr. C: Neem and Borax	++F	++F	+F	++FI
28.11.2012	Gr. A: Copper (II) Sulfate	+F			++FI
	Gr. B: Arsenic Trioxide				++FI
	Gr. C: Neem and Borax	+++F	+++F	++F	++FI
28.12.2012	Gr. A: Copper (II) Sulfate	+F		+F	+++FI
	Gr. B: Arsenic Trioxide				+++FI
	Gr. C: Neem and Borax	+++F	+++FI	+++F	+++FI
28.01.2013	Gr. A: Copper (II) Sulfate	+F		+F	+++FI
	Gr. B: Arsenic Trioxide				+++FI
	Gr. C: Neem and Borax	+++FI	+++FI	+++F	+++FI
28.02.2013	Gr. A: Copper (II) Sulfate	+F		+F	+++FI
	Gr. B: Arsenic Trioxide				+++FI
	Gr. C: Neem and Borax	++FI	+++FI	+++F	+++FI

R1 treated with copper (II) sulfate were moderately infected by fungus. Whereas pest infection did not find in samples of R2, R3 with copper (II) sulfate and the samples of R1, R2 and R3 with arsenic trioxide. R1, R2 treated with neem and borax were highly infected by fungus and moderately infected in R3 replication. Control guinea pigs were highly infected by fungus and insects.

R1, R2 treated with neem and borax were severe infected by fungus and highly infected in R3 replication. Control guinea pigs were highly infected by fungus and insects.

R1, R3 treated with copper (II) sulfate were moderately infected by fungus. Pest infection did not find in samples of R2 with copper (II) sulfate and the samples of R1, R2 and R3 with arsenic trioxide. Whereas R1, R2, R3 treated with neem and borax were severe infected by fungus. Control guinea pigs were severe infection by fungus and insects.

Figure 7. Treated Guinea pig with copper (II) sulfate & arsenic trioxide.

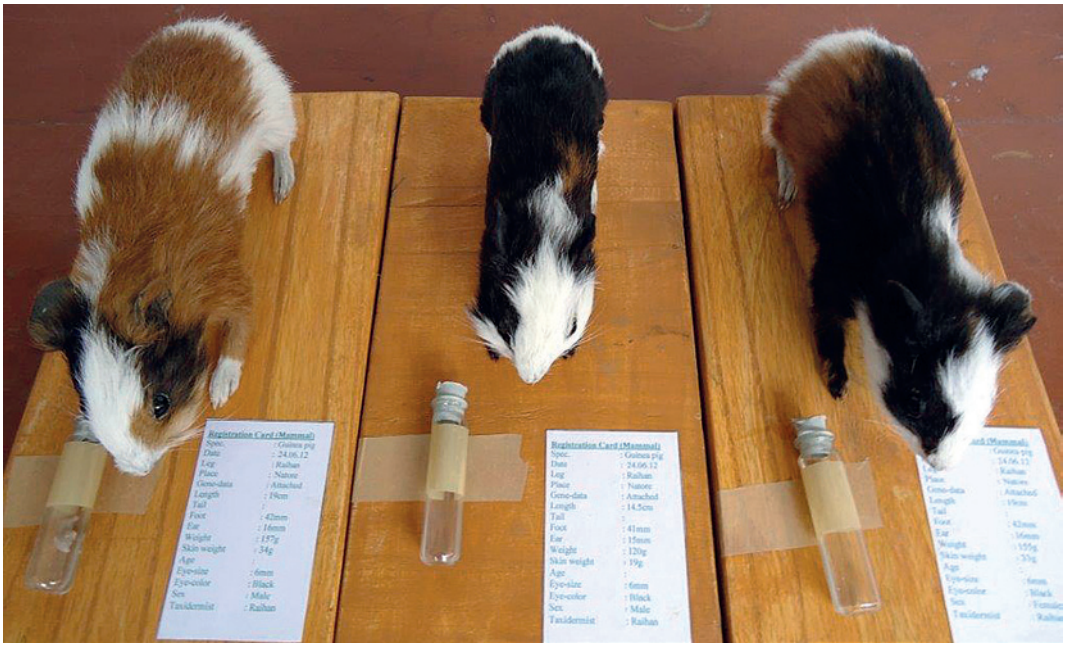

Figure 8. Treated Guinea pig with neem with borax & control.

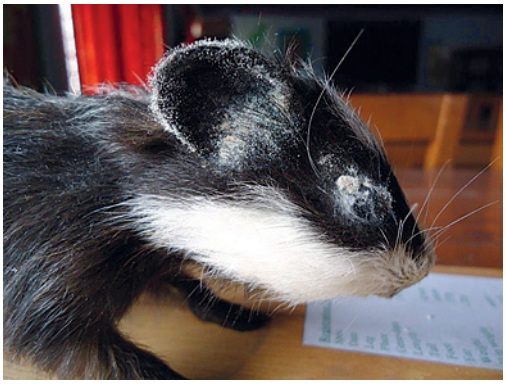

Figure 9. Insect and fungus pests of Museum stuffed animals.

8. Discussion

From the result it is evident that fungus and insect pests were found in the stuffed animals of different replications (R1, R2, and R3) and control group. From the Table 19, it is also evident that highest degrees of pest infection were in the Neem and Borax followed by Copper (II) Sulfate. Fungus and pest infection did not find in the replications R1, R2, R3 treated with Arsenic Trioxide.

Treated guinea pigs with Copper (II) Sulfate were attacked by arachnids and fungus after three months. Fungus and Mallophagas insects were found in the control group. Altogether insect's species, arachnid and fungal species were recorded as the pests of stuffed animals in the experimented animals.

Although very early in the beginning (16th to 18th) of taxidermy, arsenic was a popular in museum stuffed animals but day by day the use of arsenic is relatively low now (from 19th century) depending on the harmful effect of arsenic. It has become evident that increasing human activities have modified the global cycle of heavy metals and metalloids, including the toxic non-essential elements like As, Hg, Cd, and Pb (Roy & Saha 2002).

In taxidermy, arsenic is better known for the preservative arsenical soap, invented by the French Jean-Baptiste Becoeur (1718-1777). During his lifetime, Becoeur kept the composition of his miraculous product a secret and it was not revealed until 1800 (Dufresne 1800). The preservative was composed of camphor, arsenic oxide, carbonate of potash, soap and lime powder. This composition has been fairly constant through the centuries (Pequignot 2002).

The history of taxidermy shows us that the vast majority of stuffed animals found in museum collections may have been prepared with arsenic. This does not only cover ‚ancient specimens' as arsenic has been used in more recent times (Hawks & Williams 1986, Knapp 2000).

Arsenic produced good results, however, due to its tremendous side effects on human health this cannot be recommended in taxidermy. The second option (copper sulfate) from the present experiment could be used but this is also not enough for long lasting. However, in order to have more effective result, mixture of copper sulfate and different types of botanicals (following permutation and combination method) are recommended.

Although arsenic is dangerous for human health then it can be used for taxidermy work in Bangladesh by taking lot of awareness or caution. Air condition and proper management must be needed for any kind of museums for keeping long lasting of the animals. On the other hand, it can be also used by looking tannery factory in Bangladesh which chemicals they used for making skin tanning so that a taxidermist can use these chemicals by following permutation and combination method. But to make competition with other countries, all chemicals can be ordered from different taxidermy companies or looked in alternative chemicals in Bangladesh which can be ideal used for the animal Preparation.

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Figure 10: New prepared Crane, *Grus grus*, by collective taxidermists (Abdullah Al Mamun, Aminul Islam, Delowar Hossain).

Figure 11: New prepared squirrel, *Sciurus vulgaris*, by Abdullah Al Mamun.

for giving permission to work in their Zoological museums as well as in laboratories.
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Bayerische Akademie der Wissenschaften (Hrsg.) (2013): Schutz und Nutzung von Tropenwäldern. – Rundgespräche der Kommission für Ökologie 42: 160 S., ISBN 978-3-89937-156-7, Preis 25,- €.

Tropenwälder – konkreter, die massive Abnahme ihrer Fläche – stehen im Fokus internationaler Diskussionen vor allem wenn es um die Gefährdung der Biodiversität unseres Planeten geht. Aber auch im Zusammenhang mit der Erwärmung des Weltklimas spielt dies eine Rolle, immerhin stammen 20 % der weltweiten Treibhausgasemissionen aus der Vernichtung der Tropenwälder. Deren Ausmaß beschreibt Reinhard Mosandl in der Einführung. Josef H. Reichholf schildert darauffolgend in seiner Übersicht die verschiedenen Typen von Tropenwäldern, deren Ausprägung überwiegend von der zur Verfügung stehenden Wassermenge bestimmt wird. Der Überfluss von (Sonnen)energie und die zumindest saisonal häufigen Niederschläge sind Quellen einer ungeheuren Vielfalt. Dies hat bis in die Gegenwart zu dem Missverständnis geführt, dass sich diese Ökosysteme genauso gut und genauso intensiv nutzen lassen, wie die der gemäßigten Breiten. Aber in den Böden sind häufig nur vergleichsweise geringe Nährstoffmengen gebunden, die durch die großen Niederschlagsmengen permanent von der Auswaschung bedroht sind. Die erheblichen regionalen Unterschiede bei der Verfügbarkeit von Pflanzennährstoffen decken sich erstaunlich gut mit der historischen Siedlungsdichte indigener Völker.
Konrad Martin stellt am Beispiel des Kautschukanbaus im südlichsten China die Auswirkungen von Plantagenkulturen dar. Dort wird im großen Stil Naturkautschuk für die internationale Reifen- und Fahrzeugindustrie gewonnen und damit ein deutlicher Einkommenszuwachs für die ansässigen Kleinbauern generiert. Dem gegenüber stehen durch großflächige Waldzerstörungen nicht nur erhebliche Verluste an Artenvielfalt, sondern auch eine drastische Zunahme von Erosion, saisonalen Wassermangel und Kontamination mit Agrochemikalien. Die Produzenten gehen zudem ein erhebliches Risiko ein, da sie sich mit den Plantagen auf Jahrzehnte festlegen. Ein entsprechendes – von Deutschland betreutes und finanziertes – Entwicklungsprojekt möchte diese Nutzung diversifizieren, wirkt aber angesichts der Dimensionen von Waldzerstörung und Marktdruck etwas naiv.