

DAMAGE CAUSED BY INSECTS OF IBIS MUMMIES FROM LATE PERIOD: A CASE STUDY

Abdelrahman ELAMIN *

¹ Mummies and Human Remains Laboratory, Grand Egyptian Museum, Conservation Centre,
Ministry of State for Antiquities, Egypt

Abstract

*Late Period ibis mummies housed in the Grand Egyptian Museum (GEM) in Cairo, Egypt was selected for this study. In scholarly publications, most authors have dealt with microorganisms, while few have concerned themselves in depth with the effect of insects on the mummies. The mummies showed different signs of deterioration and degradation caused by insects, such as missing and gaps in the linen wrappings, and accumulated dust. This study aims to discuss the significance of insects and the changes they affected to the mummies. To achieve these goals, the mummies were examined by visual assessment and stereo microscope. The following insects could be identified: *Attagenus unicolor*, *Gibbium psylloides*.*

Keywords: *Mummy; Deterioration; Degradation; Stereo microscope; Attagenus unicolor; Gibbium psylloides*

Introduction

The word mummy brings to mind a host of associated ideas, the Egyptian belief in the life after death, the seemingly pervasive concern with the notion of death and elaborate preparations that were made for it. But it is well to state at the outset that religious beliefs made it necessary to preserve the dead and what seems a preoccupation with death was actually the outgrowth of a love of life and an attempt to prepare for a continuation in the next world of life as it is known in this one [1].

According to an account given in Herodotus' Histories, Mummification techniques were classified into three types: Perfect method which was the expensive one; the second was inferior to the first; the third was the cheapest of all [1-4]. Mummification is the process of preserving the body after death by rapidly removing water from the tissues [5]. Mummification reached its peak during the seventh and eighth dynasty [3]. Although mummification was used to protect the body from decay, dead tissue is a food source for microorganisms and insects, even mummification could not provide complete protection against decomposition [6].

Animal and birds mummies are a rich and unique source of information for understanding the environmental as well as the religious and cultural history of ancient Egypt. Ikram (2005) [7] mentioned that there are four types of these mummies:

* Corresponding author: elamin_555@hotmail.com

- Pets, beloved of their owners, were mummified and buried in their owners' tomb, or outside of it. Sometimes they had their own sarcophagus or coffin, as well as their own food offerings so that they would not go hungry in the Afterlife;

- Victual mummies consisted of funerary food offerings for humans. Meat and poultry, prepared to be consumed, was wrapped up and sometimes placed in individual coffines or large (picnic?) baskets, and interred with the deceased;

- Sacred animal, believed to hold an aspect or essence of a deity, were worshipped during their lifetime and mummified with pomp upon their death;

- Votive mummies were dedicated as offerings at the shrines of specific gods to whom these animals were sacred, much as votive candles are burnt in churches.

Many mummies show signs of insect infestation, either within the wrappings or on the body. A wrapped mummy may have areas on the surface which appear to have been attacked by insects such as moth larvae, or there may be small distinctive holes indicating penetration to some depth below the surface. If a mummy is being unwrapped, similar holes may be found in the deeper layers of bandages. It is also possible to find the remains of insects between the many wrapping layers [8]. David (2000) [6] said that beetles, may have infested bodies at the time of death, during embalming, in the tomb, during transportation, or even in the museum, but that flies, require a moist food source when they are in their larvae stage, therefore they probably infested the bodies prior to, or during, embalming. Insect remains can be viewed under dissection microscope or by means of SEM. Several studies of insect remains found during autopsies of mummies have been conducted.

There is ample evidence that the Ancient Egyptians were aware of the problems of insect infestation, Panagiotakopulu (2001) [9] mentioned that Levinson and Levinson (1985) have drawn attention to an illustration which shows a priest spearing a beetle, and it is probable that the spell in the Book of the Dead, "Begone from me, O Crooked-lips! I am Khum, Lord of Peshnu, who dispatches the words of the gods to Re, and I report affairs to their master" (Book of going forth by day, 36), was for the fear of beetles eating away the mummies. Peacock (1993) [10] has also recorded that several Dermestidae species, *Attagenus* sp. and *Ctesias* sp. have been identified in contexts dating from 2700 to 2200 BC. The above mentioned species feed on other insects and organic material, and they are often found in association with humans and animal mummies. Attia and Kamel (1965) [11] mentioned that *Attagenus unicolor* (Brahm) is a very common species in Egypt, found in houses, flour mills, warehouses, and granaries as well as on dried animal material. Nair (1986) [12] states that the dermestidae beetles could be very destructive to museum collections in tropical countries. Several species of dermestidae beetle belonging to the genera *Anthrenus*, *Attagenus*, *Dermestes* and *Trogoderma* have been reported by Nair as being present in museums. Beetles form the largest single group of insect species; over 600,000 different types have been described. The order *Coleoptera* contains types that are important in forensic studies. The main families among them are *Carabidae* and *Dermestidae* [13]. Panagiotakopulu (2001) [9] mentioned that *Gibbiumscotias* (= *G. psylloides sensu lato*) was identified in large numbers in a pot from Thebes.

Materials and methods

Materials

The mummies studied are located in the conservation centre, Grand Egyptian Museum. Its Museum Numbers are (GEM. 32051 and GEM. 1034). The mummies date back to the Late Period (525-343 B.C) and came from El-Ashmonin, El-Minia, Egypt.

Methods

a. Identification of isolated insects

The insects collected from studied ibis mummies were identified in Entomology Department, Faculty of Science, Cairo University (Cairo, Egypt).

b. Visual assessment

Revealing the changes associated with ibis mummies, images were recorded using a high resolution digital camera (Kodak Easy Share M 1033, 10mp, 3×Optical Zoom). The photographs recorded aspects of the deterioration and degradation caused by pests. Additionally, the authors used visual observation to explain the forms of deterioration and degradation.

c. Stereo microscope

Stereo microscope (Carl Zeiss Surgical GmbH (73446, Oberkochen, Germany) was used to observe clearly the aspects of deterioration and degradation, also to identify the isolated insects.

Results and discussions

a. Identification of isolated insects

Two types of insects were identified (Table 1 and Fig. 1). The identified insects are the larvae of black carpet beetle *Attagenus unicolor*(ibis mummy no. 32051) and adult insects of spider beetle *Gibbiumpyloides*(ibis mummy no. 1034).

Table 1. Identified insects isolated from the two ibis mummies

Order	Family	Species
Coleoptera	Dermestidae	<i>Attagenus unicolor</i> (Fig. 1A)
	Ptinidae	<i>Gibbiumpyloides</i> (Fig. 1B)

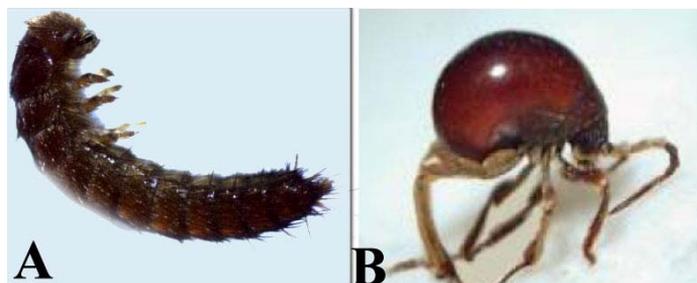


Fig. 1. Stereo microscope photos of identified insects (Mag. 10X): (A) Larva of black carpet beetle *Attagenus unicolor*; (B) Adult insects of spider beetle *Gibbium psylloides*.

These species are common in archaeological field and were mentioned by several studies. *Attagenus unicolor* (Brahm) is a very common species in Egypt, found in houses, flour mills, warehouses, and granaries as well as on dried animal material [11]. Zaitseva (1987) [14] mentioned that dermestidae beetles, (Coleoptera: Dermestidae) cause damage to a variety of museum objects throughout the world, many of them being cosmopolites. *Attagenus* Sp. is one of the most notorious pests in museum collections. A mummified piece of meat from the New Kingdom, preserved inside a gypsum-covered coffinet was examined by Panagiotakopulu (2003) [15]. The piece of meat, which is kept in the Turin museum and looked like a bird's leg, was checked under the microscope. The provided larval specimen sample was identified as *Attagenus* sp.. El-Amin [16] experimentally studied Damage Caused by insects on Egyptian mummies. *Attagenus* sp. was one of the identified insects

The spider beetle *Gibbiumpsylloides* was found in the mummies of the Two Brothers, which are dated to the early Middle Kingdom period and likewise came from Middle Egypt [17]. The beetles are flightless, and have become widely distributed as a result of accidental transport by trade [18]. This species was also noted in the Tutankhamum material which was one of the pests that were recovered from the Roman fort at Mons Claudianus in the Eastern Desert [19]. Middle Egypt, it has been found infesting foodstuffs. *G. psylloides* has been recorded in houses, hotels, mills and granaries infesting grain and bread, yeast, cake, cotton, a range of seeds, paprika, cayenne pepper, spices in general, hay, wool, leather. Although the predominant species at Amarna today is *G. aeqinoctiale*, the large numbers of fossil specimens from Pharaonic Amarna are *G. Psylloides* [9].

b. Visual assessment

Visual assessment was done on the two ibis mummies. The visual observations by critical eye are recorded in Table 2 and Figs 2 and 3.

Table 2. The aspects of deterioration and degradation of two ibis mummies

GEM. No.	Effects of deterioration and degradation
Ibis mummy (GEM No. 32051) (Fig. 2A).	<ul style="list-style-type: none"> - Degradation of linen used in ibis wrapping, and birds' drops adhered to the linen were noticed; - Missing some linen wrappings from the face area (Fig. 2B); - larvae hidden in mummy wrapping (Fig. 2C); - Tears and dryness on the linen bandages.
Ibis mummy (GEM No. 1034) (Fig. 3A).	<ul style="list-style-type: none"> - Missing parts of resin layer covered the ibis mummy (Fig. 3B); - Several insects of spider beetle in the lower side of ibis mummy (Fig. 3C).

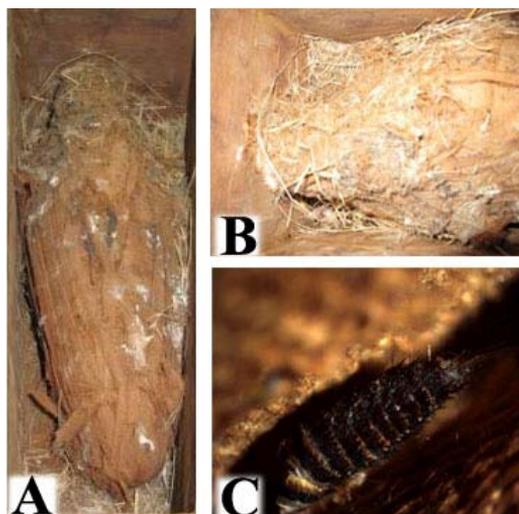


Fig. 2. Ibis mummy GEM No. 32051

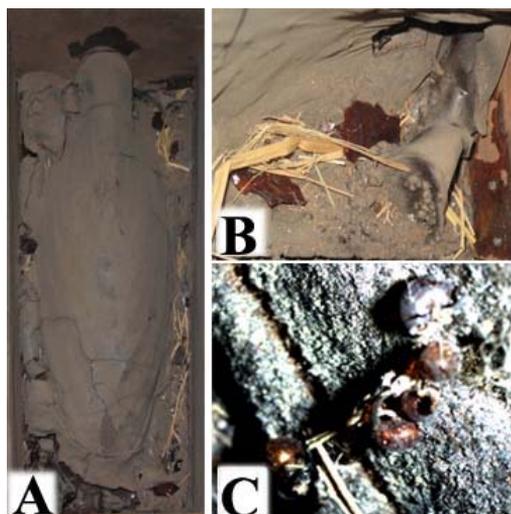


Fig. 3. Ibis mummy GEM No. 1034

Conclusions

Damage caused by insects is considered one of the most serious problems that faced conservators in museums and archaeological fields. Egyptian human and birds mummies compose of many organic materials such as skin, hair, bone, linen wrappings, and plant materials (as permanent filler). These materials make mummies susceptible to damage by insects.

Visual assessment by naked eye is very important to determine the presence of insects inside the objects and to determine the aspects of deterioration and degradation.

Attagenus unicolor (Brahm) and *Gibbiumpysilloides* are a very common species in Egypt.

The larvae of *Attagenus unicolor* are a dangerous stage which caused damage to mummies. Owing to their small size and secretive habits they are also rarely seen until the damage caused by the eating becomes obvious.

The larvae and adult beetles of *Gibbiumpysilloides* infest all mummies' materials including textile, tissue and mummification materials.

References

- [1] W.H. Peck, *Mummies of Ancient Egypt, Mummies, Disease and Ancient Cultures*. Cambridge University Press, London, 1980, pp. 11-28.
- [2] A.R. David, *Mummification, The Oxford Encyclopedia of Ancient Egypt* vol. 2 (Edited by D.B. Redford), Cairo, 2001, pp. 439-441.
- [3] R. Van Tiggelen, *Ancient Egypt and Radiology, A Future for The Past!*, **Nuclear Instruments and Methods in Physics Research B**, **226**, 2004, pp. 10-14.
- [4] D. Bickerstaffe, **Refugees for Eternity: The Royal Mummies of Thebes, Part four: Identifying the Royal Mummies**, Canopus Press, Cambridge University, London, 2009, pp. 28-48.
- [5] E. Salter-Pedersen, *The Myth of Internal Preservation: Patterns of Damage in Egyptian Mummies*, **Master Thesis**, University of Louisiana, 2004, pp. 1-15.
- [6] A.R. David Mummification, **Ancient Egyptian Materials and Technology** (Edited by P. Nicholson and I. Shaw), Cambridge University Press, London, 2000, p. 373.
- [7] S. Ikram, *The Loved Ones: Egyptian Animal Mummies as Cultural and Environmental Indicators*, **Proceedings of the Sixth International Symposium on the Archaeozoology of Southwestern Asia and Adjacent Areas** (Edited by H. Buitenhuis, A.M. Choyke, L. Martin, L. Bartosiewicz, M. Mashkour), Arc-Publicaties 123 Groningen, The Netherlands, 2005, p. 240.
- [8] R.C. Garner, *Experimental Mummification of Rats*, **Science Egyptology** (Edited by R. A. David). Symposium: 1st, London, 1986, pp. 11-12.
- [9] E. Panagiotakopulu, *New Records for Ancient Pests: Archaeoentomology in Egypt*, **Journal of Archaeological Science**, **28**, 2001, pp. 1235–1246.
- [10] E.R. Peacock, *Adults and Larvae of Hide, Larder and Carpet Beetles and Their Relatives (Coleoptera: Dermestidae) and of Derodontid Beetles (Coleoptera: Derodontidae)*, **Handbooks for the Identification of British Insects**, Royal Entomological Society of London, 1993.

- [11] R. Attia, A.H. Kamel, *The Fauna of Stored Products in U.A.R.*, **Bulletin Société Entomologique d'Égypte**, **49**, 1965, pp. 221–232.
- [12] S.M. Nair, *Biodeterioration of Museum Collections by Dermestid Beetles, With Particular Reference to Tropical Countries*, **Biodeterioration** **6** (Papers Presented at the 6th International Biodeterioration Symposium), Washington, DC, 1986, pp. 337-343.
- [13] P. Kulshrestha, D.K. Satpathy, *Use of Beetles in Forensic Entomology*, **Forensic Science International**. **120**, 2001, pp. 1-2.
- [14] G.A. Zaitseva, *Protection of Museum Textiles and Leather Against the Dermestid Beetle (Coleoptera, Dermestidae) by Means of Antifeedants*, **Studies in Conservation**, **32**(4), 1987, 176.
- [15] E. Panagiotakopulu, *Insect Remains from the Collections in the Egyptian Museum of Turin*, **Archaeometry**, **45**(2), 2003, 355-362.
- [16] A. El-Amin, *Experimental Study on the Effectiveness of Natural Materials Used For the Protection of Mummies against Deterioration Caused By Insects with Application to an Ancient Mummy*, **Master Thesis**, Faculty of Archaeology, Conservation Department, Cairo University, Cairo, 2011.
- [17] A.R. David, *The fauna, Mysteries of the Mummies*, **The Story of the Manchester University Investigations** (Edited by A.R. David), London, 1978, pp. 160–167.
- [18] B. Constantine, *A New Ecological Niche for *Gibbiumaequinotiale* Boieldieu (Ptinidae) in Britain, and a Reconsideration of Literature References to *Gibbium* spp.*, **The Coleopterist**, **3**, 1994, pp. 25–27.
- [19] E. Panagiotakopulu, M. van der Veen, *Synanthropic insect faunas from Mons Claudianus, a Roman quarry site in the Eastern Desert, Egypt*, **Studies in Quaternary entomology an inordinate fondness for insects. Quaternary Proceedings** (Edited by A.C. Ashworth, P.C. Buckland, J.P. Sadler), **5**, 1997, pp. 199–206.

Received: September, 11, 2014

Accepted: April, 25, 2015