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INSECT REMAINS FROM THE COLLECTIONS IN THE EGYPTIAN MUSEUM OF TURIN

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The identification of insects preserved in pharaonic antiquities stored in the Egyptian Museum of Turin provides new information on aspects of biogeography, storage and trade. The khapra beetle, Trogoderma granarium, the biscuit beetle, Stegobium paniceum, and the house fly, Musca domestica, were recovered from food offerings from tombs in Egypt, and Dermestes frischii was found embedded in resin from a cartonnage mask. The study produced some of the earliest records of pests of stored products, and the khapra beetle may indicate early contacts with the Indian subcontinent. The problems of differentiating modern and ancient infestation are discussed.

KEYWORDS: INSECTS, PESTS, TURIN, PHARAONIC EGYPT, TRADE, BIOGEOGRAPHY

INTRODUCTION

Most of the major museums around the world have collections of material from Egypt. This includes finds from pharaonic tombs and from excavations, which have taken place since the beginning of the 19th century or even earlier. As well as often being suitable objects for display, these are interesting in themselves in that they also provide a taste of the era in which the objects were incorporated in the collections. Some collections include primarily large objects of art and monumental architecture, but on occasions there are also large quantities of well-preserved organic remains, as for example in the Italian museums of Turin and Florence. These are sometimes reflections of the different types of objects that came from excavations, as opposed to the antiquities market or, otherwise, they reveal the personal tastes of the collectors, their education and cultural background, or even who got first choice on the loot. Together with the artefacts brought from Egypt, the insect fauna associated with them was also often accidentally transported. Most of these species are pests of stored products, and they can provide interesting insights into both trade and potential crop losses in storage (Panagiotakopulu 2001). Many species of insect pests originated in particular parts of the Old World, and later became cosmopolitan as a result of accidental transport by humans (Panagiotakopulu 2000). Old collections of pharaonic antiquities, such as those in the Egyptian Museum of Turin, provide material that is still optimally preserved for examination. However, in some cases it may be difficult to make the distinction between ancient pests and museum collection pests, and great care is required in examination of the material for signs of recent infestation (cf., Florian 1997). This was recently highlighted in a study of the insect remains from the mummy of Rameses II (Buckland and Panagiotakopulu 2001).

Amongst the largest and most interesting collections of Egyptian material outside Cairo is the one housed in Turin. In 1824, Bernadino Drovetti had donated an Egyptian collection of some 8000 objects to the Duke of Savoy, who housed it with other material in the Egyptian

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Museum of Turin in the Palazzo dell' Accademia della Scienze (Curto 1976). During this period, Italy and all of Europe were mesmerized by Egypt; the Napoleonic expedition and Champollion's decipherment of the Rosetta stone had fascinated people (Ceram 1971). At the end of the century, a great figure in Egyptology, Ernesto Schiaparelli, who had trained with Gaston Maspero in Cairo (Dawson 1972), was in charge of the Museum, and over the period from 1903 to 1920, he enhanced the collection with new material, both by purchases and by excavations. One of the sites at which excavations were carried out was at el-Gebelein (Pathyris or Aphroditopolis) in Upper Egypt. The site lies 30 km to the south of Thebes, and in Arabic its name means 'the two hills'. On one of these hills, on the eastern side of the site, there are the remains of a temple of Hathor, which dates from the 11th to the 15th Dynasties; and on the western hill there are tombs, most of which are dated to the First Intermediate Period (2181–2055 BC) (Shaw and Nicholson 1995). The Turin collection includes plant material from these and other tombs.

WHEAT FROM EL-GEBELEIN

A well-preserved deposit of wheat, *Triticum* sp., from a Middle Kingdom tomb at el-Gebelein, was made available for study. This was sorted under a low-power binocular microscope to recover any insect remains. The grain was mixed with a fine-grained reddish sediment, and evidence for infestation tended to be mostly on the surface, probably because the sediment had made it difficult for the insects to penetrate deeper down. Around two-thirds of the wheat, about 3 l, was sorted for insects. The proportion of infested seeds was recorded as 2.5%, and a variety of insect pests was recovered from the sample. Five individuals of the dermestid *Trogoderma granarium* Everts were recovered. The khapra beetle, as it is commonly called, may be a serious pest of stored products, especially of grain, at the present time (Munro 1966). Its larvae can penetrate whole seeds, damaging more than they eat. They are also able to feed on grain with a very low moisture content. Cosmopolitan in warmer parts of the world, the beetle prefers a hot and dry climate (Hill 1994). In the absence of an archaeological record, it was believed that it had originated in India, and had been spread around the world as a result of recent human accidental transport (Munro 1966; Hunter *et al*. 1973). Although the el-Gebelein evidence might suggest that we are perhaps looking at a North African as opposed to an Asiatic origin, the evidence for Middle Kingdom and earlier contacts across the Indian Ocean requires comment, since the khapra beetle may have arrived by several routes. As early as the Third Dynasty (*c*. 2600 BC), there is literary and archaeological evidence of Sumerian trade in raw materials via the Persian Gulf. Copper and dark precious or ornamental stone were supplied from Magan (Oman) via Dilmun (Bahrain); lapis, carnelian, gold, silver and tin came from Meluhha (the Indus valley) and even further afield, from Afghanistan; and timber came from the littoral of the Persian Gulf and the 'Cedar Mountain', the Amanus, north-west of Susa (Potts 1990). The beetle may have been an accidental traveller along any of these routes.

Seventeen individuals of the biscuit beetle, *Stegobium paniceum* (L.), were recovered during sorting. As the seeds that were infested were either broken or very battered, it is justifiable to assume that the damage was caused by the secondary pest *S. paniceum*, and not by primary grain pests. The beetle, which is now cosmopolitan, lives in all types of dried vegetable materials, and is found in drug and grocery stores as well as homes (Dillon and Dillon 1972). It also occurs in bakery products and other starchy foodstuffs, including drugs, spices and tobacco (Koch 1989). The previous earliest record of the beetle also comes from Egypt, in bread from *c*. 2049 BC (Chaddick and Leek 1972).

The dermestid *Attagenus astacurus* Peyer. is another pest species recovered from the sample. The species has few modern records from Egypt, and although it is not included by Alfieri (1970) in his checklist of the Egyptian beetle fauna, it is probably part of the native fauna, since there is a specimen from Aswan in the collection of the British Museum (Natural History) (Brendell, pers. comm.). The individuals from el-Gebelein are the earliest archaeological records of the pest. Two dermestid larvae, one of an *Attagenus* sp. and another of *Anthrenus* sp., were also found in the wheat. The dermestids, the skin, hide and bacon beetles, are—as their vernacular names suggest—largely pests on animal matter, feather, hair, woollen supplies and so on (Peacock 1993), and they may also feed upon dead insect matter in stored plant material. A thorax of an *Anthicus* sp., several species of which are found in Egypt in open shounas (Attia and Kamel 1965), was also retrieved from the el-Gebelein wheat.

As well as the Coleoptera, two mites of the species *Glycyphagus ornatus* (Kramer) were recovered. Difficult to separate from its congener, *G. destructor* (Schrank), it is common in wheat and hay (Hughes 1959), but it has also been recorded from rodent borrows (Zachvatkin 1941) and animal-related contexts (Newstead and Duvall 1920; Bollaerts and Breny 1951).

UNPROVENANCED WHEAT

Approximately 300 g of unprovenanced wheat from a New Kingdom tomb, stored in a modern glass container, was also examined. This had been stored in the husk, and the level of infestation observed in the grain was less than 1%. Some insect larval fragments were recovered, together with a part of a house fly, *Musca domestica* L., puparium. Skidmore (1985) has argued that the origins of the now thoroughly cosmopolitan house fly must lie in the warmer parts of the Old World temperate zone, and this specimen fits with the much larger amount of material from New Kingdom el-Amarna currently being studied (Panagiotakopulu and Skidmore, in prep.). A few mouse coprolites were also present in the sample. Storage in the husk is still practiced as a means of reducing insect infestation, and although the stored crops take up more space, it appears to be a quite effective method of preservation against both heat and insect damage (Sigaut 1988).

BREAD

Different types of New Kingdom breads (Mus. Acc. nos. 7019. 1–14), of unknown provenance, were also studied for insects. Some of the pieces examined were small fragments, while others were whole breads, triangular or circular in form. Delwen Samuel (2000) has recently discussed the Egyptian breadmaking process in detail, and has noted that with two exceptions, the loaves that she was able to examine, of various forms and sizes, were handmade. The largest one that she was able to study was from the New Kingdom and in the Turin museum, and was in the shape of a flat isosceles triangle, 28 cm in length. My re-examination of the loaves showed numerous small holes in their surfaces, and that they had been infested by the biscuit beetle, *S. paniceum*. There are an amazing number of holes and tunnels all over the bread pieces (Figs 1 and 2). As the porosity of leavened emmer and barley bread from Egyptian archaeological contexts has led to questions (Samuel 2000), it is worth noting that, as opposed to the small pores on the surface due to gases that cause vesicles during baking, in the case of beetle infestation there are regular tunnels created by the beetles, similar to those created in wood by another anobiid, the furniture beetle *Anobium punctatum* Deg. and its larvae. In many examples, the remains of the pests themselves are visible in the tunnels (Fig. 2). During the study of

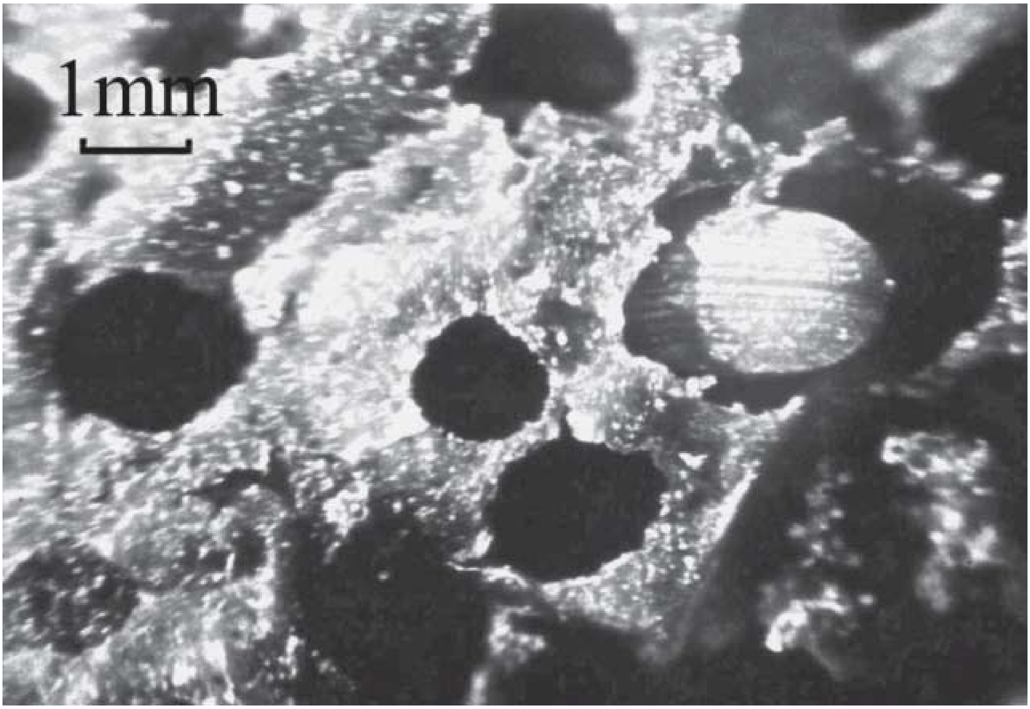

Figure 1 *Tunnels, and to the right, the elytra of a complete individual of the anobiid Stegobium paniceum (L.), infesting New Kingdom bread from the Egyptian Museum of Turin. Photograph by Di Dio.*

the Turin loaves, as the priority was not to damage the archaeological material, they were scanned under the microscope, and the debris underneath them was collected for further study. During this process, many individuals of *S. paniceum* were discovered in the numerous holes. No individuals in the bread were removed during the course of the archaeoentomological study, and only the specimens that were mixed in the extraneous debris were collected. This revealed, under the microscope, adults and different larval instars of the same pest, *S. paniceum*. Sixteen adult individuals were found, and the larval fragments included 27 heads. Finally, seven eggs of *S. paniceum* were identified. The beetle attaches its eggs with the help of its own faeces, and numerous faecal pellets were evident all over the bread surfaces and in the debris. Some of the *S. paniceum* individuals looked as if they had been eaten (cf., Fig. 2): the insects probably became cannibalistic after exploiting the available food resources. Two individuals of a small black parasitic wasp, *Bracon* sp., which may be a parasite on the *S. paniceum* larvae and adults, were found; we can assume that they were also eating their way through the biscuit beetles' larvae.

MEAT

A mummified New Kingdom piece of meat, preserved inside a gypsum-covered coffinet, lined on the inside with resin—what is known in the literature as a 'victual mummy'—was also examined (Mus. Acc. No. S 5082). 'Victual mummies' can be of various shapes: poultry, joints or slabs or strips of meat (Ikram 2000). They have been found in 13 Theban tombs of the New

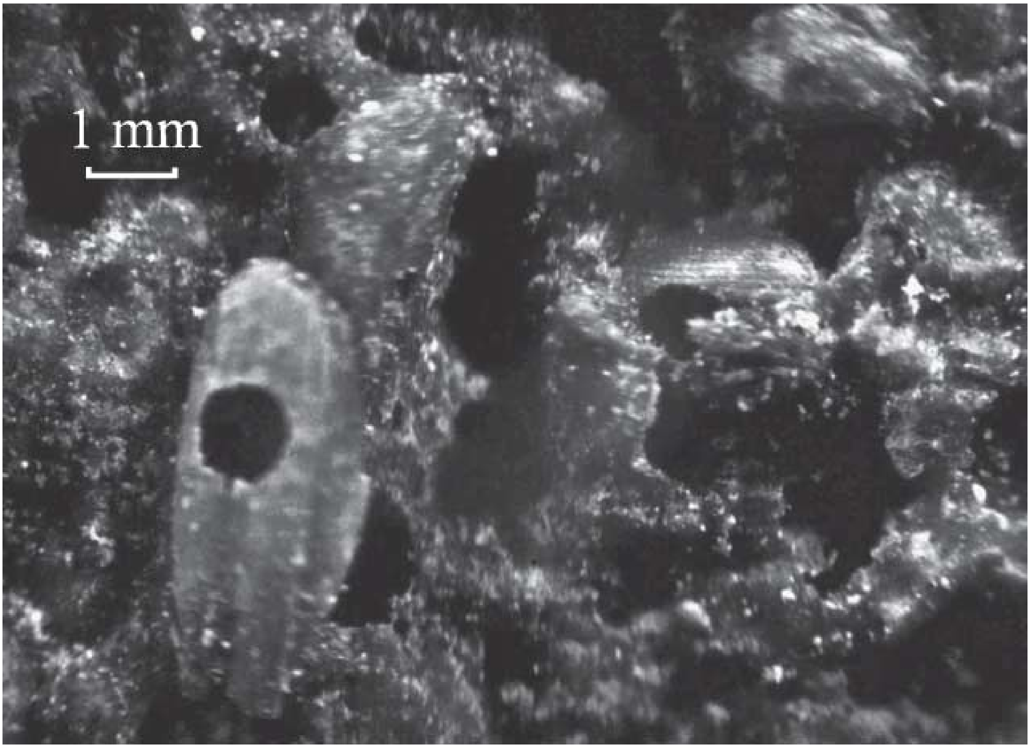

Figure 2 *A complete grain of wheat with a borehole, and to its right, the elytra of an individual of the anobiid Stegobium paniceum (L.), also bored through by a later tunnel, in infested New Kingdom bread from the Egyptian Museum of Turin. Photograph by Di Dio.*

Kingdom, in Third Intermediate Period burials and also from the Middle Kingdom burial of princess Nubhstersikhered at Dahsur (op. cit.). On examination, the piece of meat from the Turin collection looked like a bird's leg, and it was checked under the microscope. Again, in order to avoid damaging the mummified specimen, the material that produced the insect remains was the debris from inside the box. The sample provided larval individuals identified as *S. paniceum*, cf. *Attagenus* sp. and *Thylodrias contractus* Motch. *T. contractus* is a stored product pest in some countries, which feeds on animal protein (Peacock 1993). It is sometimes found in houses and also as a museum pest (Hinton 1945; Peacock 1993), where its larvae feed on dead insects and other organic matter (Peacock 1993). The genus *Attagenus* includes several well-known pests in many types of stored materials. Both dermestids have been identified from the Middle Eastern site of Sahr-i Sokhta in Mesopotamia, from contexts dated between 2700 BC and 2200 BC (Costantini *et al.* 1977). *T. contractus* is also recorded from New Kingdom Egypt, in the mummy PUM III (= Philadelphia University Museum), dated to *c.* 810 BC (Steyskal and Kingsolver 1998).

A CARTONNAGE MASK

Whilst checking a Late Ptolemaic cartonnage mask from Assiut (Mus. Suppl. No. 14271) during a routine inspection, the Museum curators found some Coleoptera within it. Cartonnage is made from layers of linen and gesso or lime plaster, although during the Graeco-Roman period waste papyri were sometimes used instead of linen (Taylor 1988). The beetles found were covered with a resinous substance, and it was noted that they were associated with the cloth on the mask, rather than with the mummy itself. They were all specimens of the dermestid *Dermestes frischii* Kug., a species that feeds on animal matter, and which has been found in carrion, smoked meat, dried fish, bones, skins and cacao (Peacock 1993). Its larva will bore in damaged timber, mortar, cork and cloth bales in order to pupate (*idem.*), and this perhaps explains the association of the adults with the cloth, having initially fed in the mummy's flesh before moving out to pupate. *D. frischii* is known from other New Kingdom sites, including the Workmen's Village at Tell el-Amarna, in the mummy of Rameses II (Steffan 1982) and in several other mummies (Strong 1981; Panagiotakopulu 2001). The resinous substance surrounding the specimens rules out any chance of modern contamination.

MODERN SPECIMENS

Organic materials stored in museums are particularly vulnerable to insect attack (cf., Florian 1997), and great care has to be taken in deciding which pest species are contemporary with the specimens and which are recent, or at least post-collection, contaminants. Modern specimens were also recovered during the study in the Egyptian Museum of Turin. A single specimen of the dermestid *Attagenus brunneus* Fald. was found, and also an individual of the caterpillar of the moth *Tinea pellionella* L. *A. brunneus* is synanthropic, and is often found infesting carpets and felt (Peacock 1993); it is very similar in appearance to *A. unicolor* (Brahm.) (Hodge and Jones 1995). *T. pellionella*, or the case-bearing clothes moth, feeds during the larval stage on dried animal and plant material, clothing and similar substances (Corbet and Tams 1943).

ANCIENT VERSUS MODERN INFESTATION

The moisture content of the food is of considerable importance for the pests of stored products, and temperature fluctuations and varying humidity levels can also play a significant role in development (Florian 1997). As highlighted by Florian (op. cit.), 'the drier the material the less vulnerable to insect attack'. In offerings in Egyptian tombs, the desiccation process leaves the material very low in nutrients and water, and it is therefore not appropriate food for most insect pests. If for some reason, damp penetrates the organic materials, the pests are able both to process them and to reproduce on a large scale. Humidity has a visible effect upon desiccated plant remains and food offerings. The wet, desiccated seeds expand and become fragile, often becoming infected with moulds. In the same way, meat and other materials decay and get infested. The resultant damage is then usually on a large scale if not rapidly contained, with species able to feed in the mould as well as on the primary material.

In overall character, modern insects that are infesting museum material tend to look different from any of the fossils, and on most occasions the species are different. For example, *Attagenus astacurus* is recorded as a pest in the pharaonic period but not in more recent materials, although the reasons for this apparent change require further research. In museums, modern infestations are usually associated with dirt and hair accumulating on or around the objects. In the case of the Egyptian Museum of Turin, no infestation had been noted while the studied material had been housed there. Curatorial intervention had been kept to a minimum, and this allows us to form clear opinions about the nature of infestation and the insects themselves, as the specimens had not been coated with varnish. Similarly, the probability of infestation in

Egyptian storerooms during transhipment is low, as there would have been visible external destruction of the meat offerings, bread and seeds, and also larger-scale infestations, dominated by larval material. The el-Gebelein wheat is kept still as originally found, mixed with sediment in a wooden box; the fauna represents the pharaonic fauna and not later contaminants.

CONCLUSION

Archaeoentomological museum material can be extremely useful when provenanced, as it enables us to produce results from diverse sites, for most of which there is limited access today. A first attempt is made here to show the different nature of infestation between pharaonic-period and modern museum infestations. However, the whole problem of distinguishing modern from ancient pests needs to be addressed by further research, and AMS dating of individual specimens may be the only way to resolve particular cases.

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