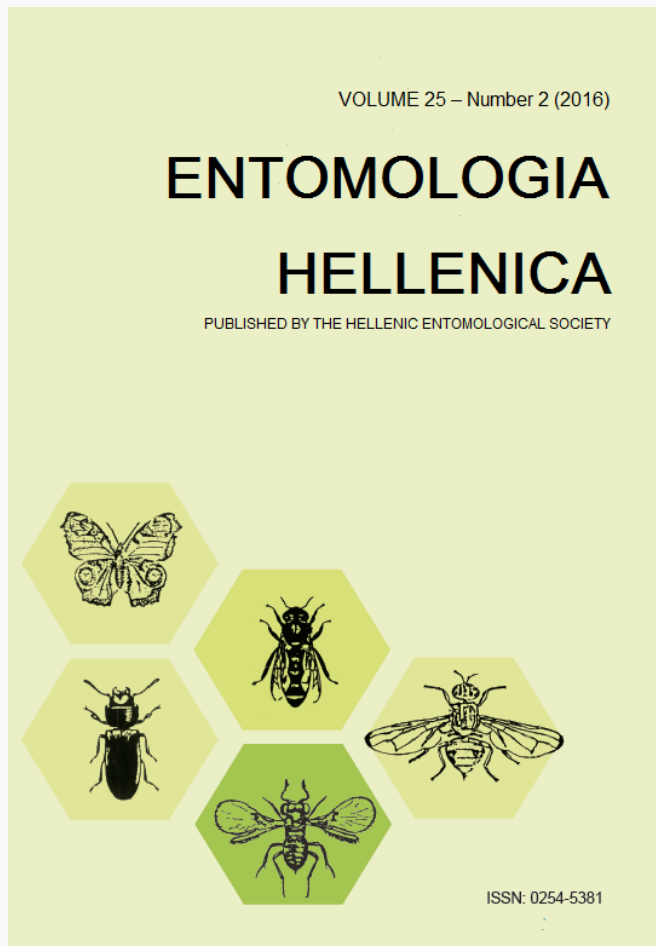


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A catalogue of Coleoptera specimens with potential forensic interest in the Goulandris Natural History Museum collection

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ABSTRACT

This paper presents a catalogue of the Coleoptera specimens in the Goulandris Natural History Museum collection that have potential forensic interest. Forensic entomology can help to estimate the time elapsed since death by studying the necrophagous insects collected on a cadaver and its surroundings. In this paper forty eight species (369 specimens) are listed that belong to seven families: Silphidae (3 species), Staphylinidae (6 species), Histeridae (11 species), Anobiidae (4 species), Cleridae (6 species), Dermestidae (14 species), and Nitidulidae (4 species). The aim of this paper is to present this collection and its importance for studying forensic entomology.

KEYWORDS: forensic entomology, Goulandris Museum, necrophagous, Silphidae, Staphylinidae.

Introduction

Forensic entomology is the study of insects and other arthropods (i.e. spiders, mites) in a situation where a crime has been committed. The insects recovered from a crime scene can provide vital information for the investigation team and can help to estimate the time elapsed since death by studying the necrophagous insects collected on a cadaver and its surroundings (Aggarwal 2005). Two insect orders are the most important in forensic entomology, Diptera and Coleoptera (Oliva 2001, Lefebvre and Gaudry 2009, Çoban and Beyarslan 2013, Açıkgöz 2016). Most forensic studies are focused on Diptera pattern colonization while neglecting Coleoptera

succession (Dekeirsschieter et al. 2013). Beetles in both their immature and adult stage can be found on dead bodies. They move fast and are often found under the body, or in and under clothing. There are data connecting the date of pupation and emergence for a number of species which are used to calculate the age of specimens at the time of collection from the crime scene (Oliva 2001).

There are very few publications on the subject from Greece (Kanaki et al. 2003). There is a relevant paper for Egypt including a key to the families of the Egyptian Coleoptera with forensic importance (Sawaby et al. 2016). In Italy three cases of forensic interest regarding the estimation of postmortem interval (PMI) by entomological data were studied (Introna et al. 1998). In Turkey also, there are some

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publications on the insect species of forensic importance (Çoban and Beyarslan 2013, Açıkgöz 2016).

The increasing interest for this sector in Greece and in the wider area indicates that information on the forensic species already exist should be searched and then become disseminated to the scientific community to contribute in the further development of the sector. A valuable source of this kind of information can be explored in the entomological collections of the area.

The insect collection of the Entomological Department of the Goulandris Natural History Museum (GNHM) in Greece was established in 1973. It contains insect collections predominantly from Greece but also from other countries. One particularly significant collection is that of Georgi Polychronis Moazzo, which contains insects (Coleoptera in their majority) collected since 1910 from regions that are very different today (sometimes drastically so), with towns and suburbs having emerged or spread, and ecosystems becoming built over or degraded (Goulandris 1977). Moazzo's entomological collection of GNHM includes 5500 specimens. Among them there are 1312 beetle species belonging to 58 families (Dimaki and Tylianakis 2006, Tylianakis and Dimaki 2006).

The aim of this paper is to identify the species with forensic interest in the entomological collection of GNHM and compile a catalogue accompanied with relevant information for the most common species. This paper aims to offer valuable information as a reference for anyone seeking this kind of information and to contribute to the development of this scientific field, since this is the first effort of this kind in Greece to the best of our knowledge.

Materials and Methods

The specimens were collected during fieldwork and have all been mounted on pins and arranged in unit trays within cabinet drawers at the GNHM. A

determination label accompanies each specimen. However, some specimens are undated. The material has been examined and described mainly by G.P. Moazzo and Th. Petanidou.

Seven Families are represented which were selected based on literature (Kulshrestha and Satpathy 2001; <http://www.forensicentomology.com/beetle.htm>), species that were collected from crime scenes (Lefebvre & Gaudry 2009), or using beef as bait (Oliva 2001). The selected Families are: Silphidae, Staphylinidae, Histeridae, Ptinidae, Cleridae, Dermestidae and Nitidulidae. Most of these Museum specimens belong to G.P. Moazzo's collection, which includes material from the following collectors: A. Carneri, G. Louvet, B. Alpes, Talbiele, Petroff, Winkler, McMaygiore, Efflatun and G.P. Moazzo himself. The rest come from Th. Petanidou's collection. All specimens have been collected during the 20th century.

In the list a short description of each Family in regard to its forensic interest is given. Then each species follows with its collection data: the number of specimens (spm), the place and the year of the collection, and the webpage with the catalogues we used to find the current name of the species.

Results and Discussion

The Families and the species of Coleoptera in the entomological collection of GNHM with potential forensic interest are given in the following catalogue together with relevant information.

Silphidae (Burying Beetles)

Scavenging and carnivorous beetles with clubbed antennae and a very good sense of smell. Their elytra are often strongly truncated (Chinery 1986). The beetles usually have flattened body and most of them are fairly large (4-30 mm) (Harde 2000). Members of family Silphidae are

typically the first of the coleopterans to come in contact with carrion and considered to be of significant importance to forensic entomologists because their presence on a decaying body helps to estimate a post-mortem interval (PMI) (Ratcliffe 1972, Schwaller 1996, Watson and Carlton 2005).

GNHM Collection, 5 specimens, 3 species:

Silpha (Aclypea) turkestanica Say 1823: 3 spm, Constantinople (Turkey), gni.globalnames.org (last updated 2016)

Necrodes surinamensis (Fabricius, 1775): 1 spm, U.S.A., bugguide.net (last updated 2007)

Necrodes sp. (undetermined): 1 spm, insecte.org/forum (last updated 2008)

Staphylinidae (Rove Beetles)

Staphylinidae is a large family of beetles, primarily distinguished by their short elytra that leave more than half of their abdomen exposed. With over 46000 species in thousands of genera, the group is the second largest family of beetles after the Curculionidae (the true weevils). It is an ancient group, with fossil rove beetles known from the Triassic, 200 million years ago (Chatzimanolis et al. 2012). In Indonesia, these beetles carry viruses that can infect human skin. Rove beetles are necrophagous and are found on decaying carcasses (Dekeirsschietter et al. 2013).

GNHM Collection, 8 specimens, 6 species:

Bledius (Hesperophilus) longulus Erichson 1839: 2 spm, faunaeur.org (last updated 2011)

Lathrobium angusticolle Boisduval - Lacordaire 1835: 1 spm, Lyonnais (France), nbn.org.uk (last updated 2012)

Alexia sp. (undetermined) Lameere 1900: 1 spm, Alp. Marit. (La Turbie, France) wikipedia.org (last updated 2016)

Eusphalerum (Anthobium) robustum Weer 1839: 2 spm, Austria, gni.globalnames.org (last updated 2015)

Eusphalerum (Anthobium) stramineum Kraatz 1857: 1 spm, Austria, zipcodezoo.com (last updated 2004)

Creophilus erythrocephalus (Fabricius) 1775: 1 spm, Chile, itis.gov/servlet (last updated 2016)

Histeridae (Clown Beetles or Hister Beetles)

Their body is particularly hard and chitinous, they have geniculate antennae with a thick, button-like club and their elytra leave the last two abdominal tergites exposed. They are able to retract their head beneath their pronotum. Both the larvae and the adult beetles are predacious and hunt the larvae of other insects in decaying plant and animal matter. They are found chiefly in carrion, dung, rotting fungi and under bark (Harde 2000).

This family will occupy almost any kind of niche throughout the world. It has been proved that they are useful during forensic investigations by helping to estimate the time of death. Also, certain species are used in the control of livestock pests that infest dung and to control houseflies. Because they are predacious and will even eat other Hister beetles, they must be isolated when collected alive (Ozdemir and Osman 2009).

GNHM Collection, 96 specimens, 11 species:

Hister sp. (*major*) (Linnaeus): 16 spm, Smouha, Mariout, Siouf (Egypt), 1936, 1339 itis.gov/servlet (last updated 1997)

Hister (Atholus) bimaculatus Linnaeus 1758: 5 spm, Alexandria (Egypt), itis.gov/servlet (last updated 1997)

Atholus (Hister) scutellaris (Erichson 1834): 1 spm, Mariout (Egypt), 1923, faunaeur.org (last updated 1997)

Hister spp. (undetermined): 10 spm, Siouf, Alexandria (Egypt), 1923, 1939

Carcinops pumilio Erichson 1834: 2 spm, Mariout (Egypt), 1921, bugguide.net (last updated 2014)

Saprinus semipunctatus (Fabricius 1792): 2 spm, Cleopatra, Rond-Point (Egypt), 1920, 1923, taxonomicon.taxonomy.nl (2004-2016 Universal Taxonomic Services)

Saprinus gilvicornis Erichson 1834: 3 spm. Alexandria (Egypt), 1922, 1923, 1939 itis.gov/servlet (last updated 1997)

Saprinus chalcites (Illiger 1807): 25 spm, Cleopatra, Rond-Point, Chatby (Egypt), 1918, 1920, 1943, itis.gov/servlet (last updated 1997)

Saprinus semipunctatus (Fabricius 1792): 12 spm, Palais (Egypt), 1923, zipcodezoo.com (last updated 1997)

Saprinus speculifer Latreille: 2 spm, Alexandria (Egypt), 1929, 1937, zipcodezoo.com (last updated 2012)

Saprinus beduinus Marseul 1862: 18 spm, Chile, itis.gov/servlet (last updated 1997)

Anobiidae (Woodworms) {Ptininae (Spider Beetles)}

Spider beetles have a cylindrical body and their head is usually hidden by their pronotum (Harde 2000). There are approximately 500 species of beetles in the subfamily Ptininae of the family Anobiidae. Lately the family is considered a separate one (Ptinidae). Spider beetles have round bodies with long, slender legs and lack wings. They are generally 1–5 mm long. Both the larvae and the adults are scavengers. They reproduce at the rate of two to three generations per year (Jacobs 2006).

GNHM Collection, 7 specimens, 4 species:

Ptinus spp. (undetermined): 1 spm

Dignomus (Ptinus) xylopertha (Boieldieu, 1856): 1 spm, faunaeur.org (last updated 2013)

Ptinus latro (letourneuxi) Fabricius 1775: 1 spm, Alexandria (Egypt), 1925, faunaeur.org (last updated 2013)

Ptinus spp. (undetermined): 4 spm, Alexandria (Egypt), 1937, 1938

Cleridae (Checkered Beetles)

Checkered beetles are often highly colored with intricate patterns. They are small to medium in size, often cylindrical and usually hairy. The adults are found under bark and on flowers and they are predacious (Jaques 1973).

They have a minor significance in forensic entomology, some species are occasionally found on carrion in the later dry stages of decay. Also, some species are pests of stored products and are found infesting various food products. Research efforts related to Cleridae have focused primarily on using certain species as biological controls. This is a very effective technique for controlling bark beetles due to the voracity of many Clerid species (Souza and Linhares 2008).

GNHM Collection, 30 specimens, 6 species

Trichodes affinis Chevrolat 1843: 4 spm, Abou-el-Checut (Egypt), 1917, faunaeur.org (last updated 2015)

Trichodes crabroniformis (Fabricius 1787): 1 spm, Alexandria (Egypt), faunaeur.org (last updated 2015)

Necrobia rufipes (Fabricius 1781): 21 spm, faunaeur.org (last updated 2016)

Necrobia sp. (undetermined): 1 spm

Necrobia (piligera): 1 spm, Abou-kir (Egypt), 1939

Rhizobus (piceus): 2 spm, Abou-kir (Egypt), 1922

Dermestidae (Skin or Larder or Carpet Beetles)

Dermestidae are commonly referred as skin beetles. Other common names include larder beetle, hide or leather beetles, carpet beetles, and khapra beetles. Mostly somber-colored scavengers, clothed with scales or hairs. They have clubbed antennae which can be hidden under the body. Many are cosmopolitan pests of stored foods and fabrics (Chinery 1986). There are approximately 500 to 700 species worldwide. They are small to medium sized

(Jaques 1973). Dermestids have a variety of habits; most genera are scavengers that feed on dry animal or plant material such as skin or pollen, animal hair, feathers, dead insects and natural fibers.

Members of *Dermestes* genus are found in animal carcasses, while others may be found in mammal, bird, bee and wasp nests.

Thaumaglossa only lives in the egg cases of mantids, while *Trogoderma* species are pests of grain. These beetles are significant in forensic entomology. Some species are known to be associated with decaying carcasses which help with criminal investigations. Some species are pests (urban entomology) and can cause extensive damage to natural fibers at homes and businesses. They are used in taxidermy and by natural history museums to clean animal skeletons. Some dermestid species, commonly called "bow bugs" infest violin cases, feeding on the bow hair (Catts and Goff 1992, Goff 1993).

GNHM Collection, 195 specimens, 14 species:

Attagenus (gloriosae) fasciatus Thunberg 1795: 25 spm, Alexandria (Egypt), 1938, 1939, 1941, dermestidae.com (last updated 2013)

Attagenus bifasciatus Olivier 1790: 4 spm, Alexandria (Egypt), 1938, 1939, 1941, dermestidae.com (last updated 2013)

Attagenus (sericeus): 7 spm, Abou-kir, Saba Pacha, Alexandria (Egypt), 1919, 1922, 1939, 1943, dermestidae.com (last updated 2013)

Attagenus simplex Reitter 1881: 1 spm, Egypt, dermestidae.com (last updated 2013)

Telopes (Attagenus) uniformis Fairmere 1860: 25 spm, Saba-Pacha, Mex, Ramleh, Rond-point (Egypt), 1918, 1923, 1924, 1943, dermestidae.com (last updated 2013)

Telopes (Dermestes) clavicornis Linnaeus 1758: 23 spm, Mouzha Alexandria, Mariout, Dekhela, Saba-Pacha, Nourha (Egypt), 1918, 1919, 1920, 1925, 1939, dermestidae.com (last updated 2013)

Anthrenus pimpinellae pimpinellae Fabricius 1775: 63 spm, Saba-Pacha, Siouf, Alexandria, Rond-Point (Egypt), 1918, 1923, 1934, 1938, 1940, eol.org (last updated 2011)

Anthrenus rauterbergi Reitter 1908: 16 spm, Alexandria, Rond-Point (Egypt), 1918, nl.wikipedia.org (last updated 2010)

Anthrenus flavipes (fasciatus) (Le Conte 1854): 6 spm, Alexandria, Rond-Point, Mex, Montaza, Smouha (Egypt), 1916, 1917, 1923, 1929, 1939, 1940, ensam.inra.fr (last updated 2016)

Anthrenus museorum (Linnaeus, 1761): 1 spm, Attica (Greece), bugguide.net (last updated 2014)

Anthrenus sp. (undetermined): 1 spm, Attica (Greece)

Dermestes frischii Kugelann 1792: 19 spm, Gebel-Asfar (Egypt), 1936, 1937, itis.gov/servlet (last updated 2002)

Globicornis (Dermestes) nigripes Fabricius, 1792: 1 spm, dermestidae.com (last updated 2013)

Trogoderma sp. (undetermined): 3 spm, dermestidae.com (last updated 2013)

Nitidulidae (Sap Beetles or Picnic Beetles)

Small (2–6 mm) ovoid, usually dull-colored beetles, with knobbed antennae. Some species have red or yellow spots or bands. They feed mainly on decaying vegetable matter, over-ripe fruit and sap. There are a few pest species within this family (Univ. of Florida and Dep. of Agriculture, Website: <http://ifas.ufl.edu/>).

GNHM Collection, 28 specimens, 4 species:

Nitidula flavomaculata Rossi 1790: 1 spm, Rond-Point (Egypt), 1923, eol.org (last updated 2013)

Meligethes sp. (undetermined): 3 spm, Alexandria, Mex, Parcs. Mun. (Egypt), 1919, 1923, 1938, wikipedia.org (last updated 2016)

Carpophilus hemipterus (Linnaeus 1758): 21 spm, Alexandria, Siouf (Egypt),

1923, 1924, 1939, 1940, bugguide.net (last updated 2016)

Carpophilus obsoletus Erichson 1843: 3 spm, Abou-kir (Egypt), 1923, bugguide.net (last updated 2016).

Conclusion

Entomological collections from Natural History Museums should be used for comparison with entomological material collected from crime scenes by forensic authorities.

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**Καταγραφή ειδών κολεοπτέρων εντόμων
ιατροδικαστικού ενδιαφέροντος
στις συλλογές του Μουσείου Γουλανδρή Φυσικής Ιστορίας**

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ΠΕΡΙΛΗΨΗ

Η εργασία παρουσιάζει τα είδη Κολεοπτέρων που υπάρχουν στις συλλογές του Μουσείου Γουλανδρή Φυσικής Ιστορίας και έχουν δυνητικά ιατροδικαστικό ενδιαφέρον. Η ιατροδικαστική εντομολογία μπορεί να βοηθήσει στην εκτίμηση του χρόνου που παρήλθε από το θάνατο, με τη μελέτη των συλλεγόμενων εντόμων από ένα πτώμα και του περιβάλλοντός του χώρου. Πρόκειται για 369 δείγματα εντόμων που ανήκουν σε 7 οικογένειες, την οικογένεια Silphidae με 3 είδη, Staphylinidae με 6 είδη, Histeridae με 11 είδη, Anobiidae με 4 είδη, Cleridae με 6 είδη, Dermestidae με 14 είδη και Nitidulidae με 4 είδη. Ο σκοπός αυτής της εργασίας είναι η κοινοποίηση του περιεχομένου της συλλογής, καθώς και η σημασία της έτσι ώστε να χρησιμοποιηθεί ως υλικό αναφοράς και σύγκρισης για ταυτοποίηση τέτοιων ειδών στην Ελλάδα και την ευρύτερη περιοχή.