

## BEETLES (COLEOPTERA) ASSOCIATED WITH ANIMAL CARCASSES IN PORTUGAL: DATA COLLECTED SINCE 1995 AND A SURVEY OF EARLIER PUBLICATIONS

José Manuel Grosso-Silva & Patrícia Soares-Vieira

CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Campus Agrário de Vairão, 4485-661 Vairão, Portugal. – jmgrossosilva@yahoo.com.

**Abstract:** A study of the beetles (Coleoptera) associated with animal carcasses in Portugal is presented, including data collected since 1995 and a survey of earlier publications on the subject. Thirty-five beetle species, belonging to eight families, are listed, twenty-eight of which were collected since 1995. The composition of individual carcass communities, the communities colonising carcasses of each vertebrate species, the range of vertebrate associations of each beetle species and the recorded *post-mortem* intervals of occurrence are analysed.

**Key words:** Coleoptera, animal carcasses, composition of carcass communities, association of beetle species to carcass species.

**Escarabajos (Coleoptera) asociados a cadáveres de animales en Portugal: datos recogidos desde 1995 y recopilación de registros de publicaciones anteriores**

**Resumen:** Se presenta un estudio de los escarabajos (Coleoptera) asociados a cadáveres de animales en Portugal, incluyendo datos recogidos desde 1995 y una compilación de los registros contenidos en publicaciones anteriores. Se listan treinta y cinco especies, de ocho familias, veinte y ocho de las cuales se colectaron desde 1995. Se analizan la composición de las comunidades de cadáveres individuales y de los de cada especie de vertebrado, el rango de asociación a vertebrados de cada especie de escarabajos y los intervalos *post-mortem* de ocurrencia.

**Palabras clave:** Coleoptera, cadáveres de animales, composición de las comunidades de cadáveres, asociación de escarabajos a cadáveres de vertebrados.

### Introduction

Animal carcasses are temporary microhabitats inhabited by very rich and diverse invertebrate communities which fulfil a fundamental ecological role: the removal of animal dead bodies or their parts from the ecosystems (Goff, 2000; Schowalter, 2006). The majority of the invertebrates that colonise carcasses are arthropods and among these, the insect orders Diptera and Coleoptera are the dominant ones (Benecke, 2001; Kočárek, 2003).

Despite the usefulness of carrion inhabiting Coleoptera in forensic issues, namely aiding in the determination of *post-mortem* intervals in forensic cases (Varatharajan & Sen, 2000; Kulshrestha & Satpathy, 2001), the knowledge about the beetle fauna associated with animal carcasses is very limited in Portugal, even in general entomological faunistic studies. In fact, in the literature survey conducted, apart from the five recent papers commented further below (which include data collected since 1995), only seven contributions containing information were found: Barros (1896), one species of Silphidae recorded from a dead Jay, *Garrulus glandarius*, and one species of Histeridae from unspecified Reptile carcasses; Barros (1913), one species of Nitidulidae from unspecified carcasses; Barros (1926), one species of Dermestidae from decomposing animal matter; Seabra (1932-33), four beetle species from a dead Montpellier Snake, *Malpolon monspessulanus*; Salgado Costas (1990), two species of Histeridae from dead Dogs, *Canis familiaris*, three from dead Cats, *Felis catus*, and several other species from unspecified carcasses; Aguiar & Serrano (1995), nearly 20 beetle species from unspecified decomposing animal matter, explicitly excluding dung; and Kanaar & Salgado (1990), two species of Histeridae from a

dead Montpellier Snake. In total, these seven papers record the presence of 12 beetle species from the carcasses of one reptile species, one bird species and two mammal species, as well as from unspecified reptiles and decomposing animal matter.

In this paper we present the data that derives from the examination of 34 mammal, bird, and reptile carcasses found in continental Portugal since 1995, with the purpose of increasing the available information about the beetle species present, their distribution, seasonality, and the vertebrate species whose corpses they inhabit. Part of the data here analysed was already included in some previous faunistic studies (e.g., Grosso-Silva & Serrano, 2000; Prieto *et al.*, 2002; Soares-Vieira & Grosso-Silva, 2003; Grosso-Silva, 2005, 2007) and the information presented complements (as some of the papers did not include any information on the carcasses) and summarises what was previously recorded. The data contained in the literature has been compiled and is analysed together with that collected since 1995 in order to allow a synthesis of the available knowledge on the subject.

### Methods

The present study derives from the analysis of specimens collected in the 34 carcasses examined since 1995 – 27 mammals (nine species, two of which unidentified), three birds (three species, one of which unidentified), and four reptiles (three species). The carcasses were found in a total of 27 sites (listed in Table I), located in areas ranging from urban to countryside and altitudes from 10 to 1620 m above

sea level. Twenty of the dead animals (13 of which Cats) were roadkill found on or in the close vicinity of roads. In most cases, the insect colonisers in the carcasses were sampled only once. Furthermore, a literature survey was conducted, the resulting information being analysed with the dataset from the specimens collected. Literature records from animal carcasses with no further taxonomic detail (Barros, 1913, 1926; Aguiar & Serrano, 1995) were not considered.

Regarding the carcasses examined, the *post-mortem* interval was only known in five cases. In four of these, the animals were located very shortly after they were killed by cars and transported to the side of the road (an Ocellated Lizard, *Lacerta lepida*), to a backyard located less than one kilometre away, in the city of Porto (two Cats), and to a nearby shaded spot (a Dog). The fifth carcass, a Cat also located very shortly after death by collision with a car, was processed in a different manner: it was kept frozen until it was transported into the edge of a Pine woodland in a mountain area (Serra da Estrela), where it was suspended from a tree approximately 1.5 m above the ground.

The Histeridae recorded were identified by Juan de Ferrer (Cádiz, Spain), the Scarabaeidae and Trogidae by Tristão Branco (Porto, Portugal), and part of the Silphidae by Fernando Prieto (Vigo, Spain) and Javier Valcárcel (A Coruña, Spain), in the latter case for the preparation of the Iberian catalogue of the family (Prieto *et al.*, 2002).

The bulk of the data examined in this study, *i.e.*, the list of the carcasses examined since 1995, the respective sites' codes (*cf.* Table I), the data about the beetles found in each, and the reference of the corresponding faunistic studies in which part of the data has already been published (*cf.* Introduction) is presented in Table II, which also includes the data retrieved from the seven references obtained in the survey. The localities recorded in these references are presented in Table I.

The global dataset has been arranged in two ways, allowing its analysis under two complimentary approaches: carcass communities and association of beetle species to carcass species. As a result, Table III contains the beetle inventories for the carcasses of each of the vertebrate species, whereas Table IV summarises, for each of the beetle species, the vertebrate species to which they were associated, the number of carcasses and their codes, the recorded *post-mortem* intervals, and the list of sites.

## Results and Discussion

The total number of beetle species recorded from animal carcasses in Portugal is currently 35, belonging to eight families: Histeridae (13 species), Silphidae (8), Scarabaeidae (4), Dermestidae (3), Nitidulidae (3), Cleridae (2), Staphylinidae (1), and Trogidae (1) (Table IV). Twenty-eight of the species, belonging to all the listed families, were collected in the carcasses examined since 1995. The total mentioned is clearly an underestimate of the species associated with carcasses in the country, particularly in the case of the Staphylinidae, which includes a significant number of predatory necrophilous species, as shown in several recent studies, namely Castillo-Miralbes (2002), who reported 51 species from Pig (*Sus scrofa*) carcasses in the Northeast of Spain, Ferrer *et al.* (2004), who collected 85

species from a single Cat carcass in Sweden, and Wielink (2004), who found 33 species in two carcasses (Red Fox, *Vulpes vulpes*, and Roe Deer, *Capreolus capreolus*) in The Netherlands.

**Histeridae.** The hister beetles that occur in carcasses are necrophilous, their presence in the carcass microhabitat being related to the predatory habits of both their larvae and adults, who feed mostly on eggs, larvae and pupae of Diptera (Yélamos, 2002). In Portugal, with the exception of *Margarinotus brunneus* (Fabricius, 1775), recorded by Barros (1896) from unspecified reptile carcasses and not reported from carcasses since then, all species recorded are in the genus *Saprinus* Erichson, 1834 (12 species in total). The majority of these have been found on the carcasses of a single vertebrate species (in most cases, Cat), the only exception being *S. semistriatus* (Scriba, 1790), which was found in carcasses of three species of mammals (Table IV). The diversity of necrophilous species among the Portuguese Histeridae (which exceed 100 species) is certainly higher than that already known and the range of associations of the recorded species is most likely much wider, representing a clear gap in the knowledge about the ecology of carcasses in the country.

**Silphidae.** Carrion beetles are one of the better known beetle families in terms of carcass association, the larvae and adults of many species feeding on the carrion and sometimes on the larvae of Diptera (Báguena, 1952; Hastir & Gaspar, 2001; Hastir, 2002). In the genus *Nicrophorus* Fabricius, 1775 ("Burying beetles") a complex behaviour occurs that includes bisexual cooperation and parental care with trophallaxis (Halffter, 1991). The behavioural process involves the quick location and colonization, followed by the relocation, superficial burial and contamination of small carcasses by the parents' excrements. After the resulting microbiologic activity, the parents and larvae eat the liquids and fragments generated in the cavity opened in the carcass by the adults (Halffter, 1991). The Iberian fauna of Silphidae comprises 22 species whose presence was confirmed by Prieto *et al.* (2002), 13 of which are recorded from Portugal. Of these, eight have been recorded from carcasses in the country, six of which since 1995 (Table IV). Most species have been collected in carcasses of more than one vertebrate species, being particularly interesting the records of *Nicrodes littoralis* from Cat and Lagomorph carrion, considering that it usually requires carcasses larger than those of Dogs (Pardo-Alcaide & Yus, 1974). Furthermore, it is worth mentioning that *N. littoralis* was first recorded from Portugal based on part of the material collected from Cat C16 (Grosso-Silva & Serrano, 2000). Other relevant records obtained were the confirmation of the occurrence of *Thanatophilus ruficornis* in Portugal (Prieto *et al.*, 2002) (the collecting conditions of which are made available in the present paper), and the observations of *Nicrophorus interruptus* colonizing two carcasses larger than usual: one Cat and one unidentified Mustelidae of similar size. *Thanatophilus sinuatus* was found in a total of 12 carcasses of seven species (three reptiles, one bird, and three mammals), the widest species range among the studied silphids. It is noteworthy that *Nicrophorus humator* was reported by Barros (1896) and not recorded ever since in the country.

**Scarabaeidae.** In an essay about the occurrence of necrophagy in the mostly coprophagous Scarabaeoidea Laparosticti, Veiga (1985) compiled the available information concerning the European species and provided new records involving 11 species of Scarabaeidae from Spain. These included only one of the species we record, *Onthophagus similis*. Thus, the data we present possibly includes the first recorded instances of necrophagy for *O. grossepunctatus* and *O. joannae*, at least in the Iberian Peninsula. It has to be noted that the carcass in question (an Iberian Emerald Lizard, *Lacerta schreiberi*) was already very dry when it was located (being also inhabited by two dermestid, two silphid and one trogid species), which probably means that the intestinal contents were also dry. Therefore, although it was not clearly observed, it is likely that the three species of *Onthophagus* Latreille, 1802 were feeding of the carcass' tissues. The fourth Scarabaeidae collected, *Scarabaeus laticollis*, was found on the leg of a semi-buried Ocellated Lizard and in this case necrophagy was indeed observed as the specimens were feeding of the thigh muscle. As with the two *Onthophagus*, the record of necrophagy of *Scarabaeus laticollis* might be the first account of such behaviour in this species.

**Dermestidae.** Larder (or hide) beetles are also a well known beetle family regarding carcass association, representatives of the genus *Dermestes* Linnaeus, 1758 being involved in the decomposition of skin, hair, cartilage, and bones (Báguena, 1952; Goff, 2000). Members of other genera, namely *Anthrenus* Schäffer, 1776 and *Attagenus* Latreille, 1802, which consume feathers, hair, fur, and even the chitin of insect bodies (some species being serious museum pests), may also occasionally colonize carcasses. All the species recorded in the present study belong in *Dermestes* and one of them, *D. undulatus*, found in 11 carcasses, showed the widest vertebrate species range among all the studied beetles, colonizing a total of ten species (two reptile, two bird, and six mammal species). Furthermore, *D. frischii* was found in the highest number of carcasses (14 in total), belonging to three reptile and five mammal species. *Dermestes sardous* was only found once, on an Ocellated Lizard's carcass.

**Nitidulidae.** The majority of the sap beetles live in decaying fruit, fermenting plant juice and fungi, while some live in flowers. Additionally, some of the species breed in carrion, namely those of the two genera recorded in this paper: *Nitidula* Fabricius, 1775 (two species found) and *Omosita* Erichson, 1843 (one species). The three species were collected from Cat carcasses, two of them in the city of Porto, and adding to the biological information retrieved (previous records included no data about the vertebrates colonized, although one had been associated with unspecified carcasses), their finding was very interesting as it represented the second Portuguese locality for one species and the third Portuguese locality for the other two species (Grosso-Silva, 2007).

**Cleridae.** The larvae and adults of checkered beetles are predaceous and feed mainly on other beetles and beetle larvae, namely bark beetles (Scolytidae) and other wood boring beetles. In terms of carcass inhabiting species, these belong in the genus *Necrobia* Olivier, 1795, which includes three species in the Iberian Peninsula, all of which present a

cosmopolitan distribution. *Necrobia violacea* was collected four times on Cat carcasses (all inside the city of Porto) and once on an unidentified Lagomorph. The four records of *N. rufipes* derive from Cat carcasses. The apparent segregation of both species' distributions derived from the data presented here (*N. violacea* in the northern part and *N. rufipes* in the central and southern parts of the country) is an artefact, as the former is known from central Portugal (Aguiar & Serrano, 1995) while the latter is recorded from the north (Barros, 1929).

**Staphylinidae.** As already stated above, the collecting of a single rove beetle species is an obvious underestimate of the diversity associated with carcasses in the country. The species collected, *Creophilus maxillosus*, is a large predatory rove beetle which was found in six mammal carcasses, three of which were Cats.

**Trogidae.** The only species collected, *Trox perlatus*, was recorded by Veiga (1985) from Spain in the pellets of birds of prey and in Red Fox and Wolf (*Canis lupus*) excrements. The specimen recorded here was collected from the carcass of an Iberian Emerald Lizard together with seven other beetle species.

Regarding the composition of each individual carcass community sampled (Table II), the highest diversity was found in Cat C16, with nine species, followed by the single Iberian Emerald Lizard sampled (C13) and Cat C27, both with eight species. These were followed by the Spanish Moles C9 and C12, which yielded six and five species, respectively. All these carcasses were sampled between late Spring and Summer (May to August). The carcasses of Cat C16 and Iberian Emerald Lizard C13 were the only colonized by four beetle families.

In terms of the communities colonizing the carcasses of each vertebrate species (Table III), Cat carcasses included the highest global diversity, with 22 species, which is a natural outcome of the higher number of carcasses sampled (15 out of 39, including bibliographical data and excluding the record from unspecified reptiles). The Iberian Emerald Lizard, with only one carcass sampled, provided eight species, whereas the carcasses of Spanish Mole (five carcasses) and Montpellier Snake (two carcasses, both bibliographic) each yielded five beetle species overall. As many of the other species were only sampled once, the information they provided was too limited for this analysis.

As regards the range of vertebrates colonized by each beetle species (Table IV), the hide beetles *Dermestes undulatus* and *D. frischii* presented the widest carcass ranges of all the studied beetles, colonizing a total of ten and eight species, respectively. These were followed by *Thanatophilus sinuatus*, also a very widespread species in Portugal, which was found in carcasses of seven vertebrate species. Conversely, the two checkered beetles and one of the burying beetles collected presented a much more narrow range, despite having being sampled several times: *Necrobia rufipes* was only found on Cat carcasses (four in total) and *N. violacea* was also collected four times on Cat carcasses (out of the five carcasses where it was detected) whereas from the total of seven carcasses where *Nicrophorus vespilloides* was found, five were of Spanish Mole.

The data obtained on the *post-mortem* intervals (PMI) of occurrence (Table II) refers to 12 of the 28 species col-

lected since 1995 and, despite being very limited, constitutes the first information about that subject in Portugal. Overall, the PMI was obtained for 18 of the records presented, mostly relating to the first and third days after death, and only once exceeding a PMI of one week (*Necrobia violacea* on a Cat carcass with a PMI of 68 days). The latter species was also recorded four days after death in a Cat, which is in accordance with the findings of Bahillo De La Puebla & López-Colón (2001), who reported the species for PMI of 4-5 days in traps baited with young chickens.

It has to be noted that some of the species sampled under very short PMI (1 day) belong in the Histeridae and Staphylinidae (*Creophilus maxillosus*), their presence being normal this early as they predate on the larvae of Diptera that consume the carcasses' tissues before it becomes dry, while others belong in the Silphidae, carrion feeders which arrive quickly after death, particularly in the case of *Nicrophorus* burying beetles, as described earlier. Despite being involved in the decomposition of such tissues as skin and hair and, as such, being expected to appear in later stages of decay, dermestids were found as early as one day after death (Ocellated Lizard and Cat), three days (Cat) and four days (Dog). This is in agreement with observations of Castillo-Miralbes (2002) who also found *Dermestes frischii* and *D. undulatus* on one day old Pig carcasses, in the northeast of Spain.

To conclude, we stress that the results obtained for the main aspects analysed (carcass communities and association of beetle species to carcass species) are both biased by the uneven number of carcasses sampled between vertebrate species, which shows a clear dominance of Cat (14 out of 34 carcasses since 1995) and by the lack of follow up of the succession in each carcass. Despite these limitations, the data collected since 1995, together with that retrieved from the earlier literature (which dates from 1896 to 1990) provides a preliminary characterization of the communities that inhabit the carcasses of several vertebrate species in continental Portugal. Similarly, the habits of a number of beetle species regarding the range of vertebrate species whose carcasses they live on is preliminarily characterized. As a result, the present study provides a starting point for further research on both topics analysed.

### Acknowledgements

We wish to thank the friends and colleagues who identified part of the specimens recorded in our study.

### References

- AGUIAR, C. A. S. & A. R. M. SERRANO 1995. Estudio faunístico e ecológico dos coleópteros (Insecta, Coleoptera) do concelho de Cascais (Portugal). *Boln. Soc. port. Ent.*, **5**(5): 1-66.
- BÁGUENA, L. 1952. Algunas notas sobre entomología medico-legal. *Graellsia*, **X**: 67-101.
- BAHILLO DE LA PUEBLA, P. & J. I. LÓPEZ-COLÓN 2001. *Cléridos de Andalucía (Coleoptera, Cleridae)*. Baena Ruiz, M.; Delegación de Cultura del Excmo. Ayuntamiento de Utrera, Fundación El Monte & Sociedad Andaluza de Entomología (Eds.). Utrera (Sevilla). 77 pp.
- BARROS, J. M. C. 1896. Subsídios para o estudo da fauna entomológica transmontana. Coleopteros do Concelho de Sabrosa. *Ann. Sc. Nat.*, Porto, **3**: 39-44, 109-114, 186-194.
- BARROS, J. M. C. 1913. Adições ao Catalogo dos Coleopteros de Portugal. *Brotéria, Série Zoológica*, **11**: 105-118.
- BARROS, J. M. C. 1926. Notas entomológicas. *Mem. Est. Mus. Zool. Univ. Coimbra*, **6**: 7-16.
- BARROS, J. M. C. 1929. Notas para o estudo das espécies da Fam. Cleridae existentes em Portugal. *Arq. Sec. Biol. Parasit. Mus. Coimbra*, **1**: 1-25.
- BENECKE, M. 2001. A brief history of forensic entomology. *Forensic Science International*, **120**: 2-14.
- CASTILLO-MIRALBES, M. 2002. *Estudio de la entomofauna asociada a cadáveres en el Alto Aragón (España)*. Monografías S.E.A., **6**. 94 pp.
- FERRER, J., I. GOMY, S. SNÄLL & P. F. WHITEHEAD 2004. Zoosaprophagous Coleoptera from a dead domestic cat in a Swedish forest: a comparative perspective. *Entomologist's Gazette*, **55**: 185-206.
- GOFF, M. L. 2000. *A Fly for the Prosecution. How insect evidence helps solve crimes*. Harvard University Press, Cambridge, USA & London, UK. vii + 225 pp.
- GROSSO-SILVA, J. M. 2005. Additions to the fauna of Hemiptera and Coleoptera (Insecta) of Serra da Estrela Natural Park (Portugal). *Boln. S.E.A.*, **36**: 185-193.
- GROSSO-SILVA, J. M. 2007. New and interesting beetle (Coleoptera) records from Portugal (5th note). *Boln. S.E.A.*, **40**: 471-472.
- GROSSO-SILVA, J. M. & A. R. M. SERRANO 2000. Registos interessantes de coleópteros (Insecta, Coleoptera) para Portugal (2ª nota). *Boln. S.E.A.*, **27**: 1-5.
- HASTIR, P. 2002. Une famille des fossoyeurs: les Silphidae. *Forêt Wallonne*, **59**: 2-8.
- HASTIR, P. & C. GASPARD 2001. Diagnose d'une famille de fossoyeurs: les Silphidae. *Notes fauniques de Gembloux*, **44**: 13-25.
- KANAAR, P. & J. M. SALGADO 1990. Nota faunística sobre *Saprinus (Phaonius) pharao* Marseul y *Saprinus (Saprinus) maculatus* (Rossi) (Col. Histeridae). *Boln. Asoc. Esp. Ent.*, **14**: 279.
- KOČÁREK, P. 2003. Decomposition and Coleoptera succession on exposed carrion of small mammal in Opava, the Czech Republic. *European Journal of Soil Biology*, **39**: 31-45.
- KULSHRESTHA, P. & D. K. SATPATHY 2001. Use of beetles in forensic entomology. *Forensic Science International*, **120**(1): 15-17.
- PARDO-ALCAIDE, A. & R. YUS 1974. *Genera de coleópteros de la Península Ibérica - Familia Silphidae*. *Graellsia*, **30**: 93-111.
- PRIETO, F., J. P. VALCÁRCEL & F. REY-DALUZ 2002. Catálogo de los Silphidae y Agyrtidae (Coleoptera) de la Península Ibérica e Islas Baleares. *Boln. S.E.A.*, **30**: 1-32.
- SALGADO COSTAS, J. M. 1990. Contribución al conocimiento de los Histéridos de Portugal (Col. Histeridae). *Arq. Mus. Boc. (Nova Série)*, **1** (30): 429-463.
- SCHOWALTER, T. D. 2006. *Insect Ecology. An Ecosystem Approach*. Second Edition, Academic Press, London. xii + 576 pp.
- SEABRA, A. F. 1932-33. Subsídios para o conhecimento da fauna das Matas Nacionais - Conclusões de estudos realizados durante os meses de Julho e Agosto de 1925 na Mata de Leiria. *Arq. Sec. Biol. Parasit. Mus. Coimbra*, **2**(1): 45-80; **2**(2): 93-157.
- SOARES-VIEIRA, P. & GROSSO-SILVA, J. M. 2003. Novidades e registos interessantes para a fauna de coleópteros (Insecta, Coleoptera) do Parque Nacional da Peneda-Gerês. *Boln. S.E.A.*, **33**: 173-181.
- YÉLAMOS, T. 2002. *Coleoptera, Histeridae*. In: Fauna Ibérica, vol. **17**. RAMOS, M. A. et al. (Eds.). Museo Nacional de Ciencias Naturales. CSIC. Madrid. 411 pp.
- VARATHARAJAN, R. & A. SEN 2000. Role of entomology in forensic sciences. *Current Science*, **78**(5): 544-546.
- VEIGA, C. M. 1985. Consideraciones sobre hábitos de necrofilia en algunas especies de *Scarabaeoidea Laparosticti* paleárticas. (Insecta, Coleoptera). *Actas II Congr. Ibérico Entomología*, *Boln. Soc. port. Ent.*, Supl. **1**, **2**: 123-134.
- WIELINK, P. VAN 2004. Kadavers in De Kaaistoep: de natuurlijke successie van kevers en andere insecten in een vos en een ree. *Ent. Ber., Amst.*, **64**(2): 34-50.

**Table 1. List of sites with codes, UTM coordinates, altitudes, municipalities, and protected areas** (PNSE: Serra da Estrela Natural Park; PNPG: Peneda-Gerês National Park). Sites 29 to 35 are derived from the literature survey and their altitudes have not been inferred.

Code	Site	UTM	Altitude (m)	Municipality	Protected area
S1	Ponte de Alvarenga (edge of road)	29TNF6934	155	Arouca	—
S2	Near Mandanhas (edge of road)	29TPE3925	305	Castelo Branco	—
S3	Altura (edge of road)	29TPB3316	10	Castro Marim	—
S4	Near Cântaro Raso (edge of road)	29TPE1964	1620	Covilhã	PNSE
S5	Vila do Carvalho	29TPE2863	730	Covilhã	—
S6	Vendinha (edge of road)	29SPC15	200	Évora	—
S7	Vilar Torpim	29TPF7221	630	Figueira de Castelo Rodrigo	—
S8	500 m north of Quinta das Lameiras (edge of road)	29TPE3688	1080	Guarda	PNSE
S9	Near the bridge over the river Mondego (between Videmonte and Trinta)	29TPE3785	839	Guarda	PNSE
S10	Quinta das Lameiras	29TPE3779	1017	Guarda	PNSE
S11	Trinta (edge of road)	29TPE3985	880	Guarda	PNSE
S12	Albarcãs (river Zêzere banks)	29TPE2268	1079	Manteigas	PNSE
S13	Carvalheira	29TPE2374	1100	Manteigas	PNSE
S14	Fonte Santa	29TPE2371	849	Manteigas	PNSE
S15	Manteigas (village)	29TPE2473	760	Manteigas	PNSE
S16	Near Poio de Oliveira	29TPE2269	1000	Manteigas	PNSE
S17	River Zêzere banks (below Costa Limpo)	29TPE2267	1100	Manteigas	PNSE
S18	1 Km northeast from the bridge over Moadoira stream	29TNG6553	860	Melgaço	PNPG
S19	Near Cidadelhe	29TNG6334	290	Ponte da Barca	PNPG
S20	Porto (city)	29TNF2857	50	Porto	—
S21	Rio Maior (city) (edge of road)	29SND0554	90	Rio Maior	—
S22	Southeast of the geodesic mark "Cabeço Redondo" (edge of road)	29SND1051	108	Rio Maior	—
S23	Aldeia da Serra (edge of road)	29TPE1174	750	Seia	PNSE
S24	Cabeça	29TPE0664	550	Seia	PNSE
S25	Vairão (Agricultural Campus)	29TNF2775	104	Vila do Conde	—
S26	Quinta da Ervamoira	29TPF5842	150	Vila Nova de Foz Côa	—
S27	Gaia Biological Park (agricultural area)	29TNF3749	64	Vila Nova de Gaia	—
S28	Vila Verde da Raia	29TPG32	—	Chaves	—
S29	Mata de Leiria	29SNE00	—	Marinha Grande	—
S30	Sabrosa	29TPF16	—	Sabrosa	—
S31	S. Martinho de Anta	29TPF16	—	Sabrosa	—
S32	15 km northeast of Santiago do Cacém	29SNC31	—	Santiago do Cacém	—
S33	Trofa	29TNF37	—	Trofa	—

**Table II. Global list of carcasses (examined since 1995 and recorded in the literature) with respective sites and data of the beetles sampled in each: species, date, number of specimens studied/recorded (S.S.), and information about records' publication status.** Carcass 37 refers to an undetermined number of reptile carcasses reported by Barros (1896)

Code	Carcass	Site	Beetle family	Beetle species	Date	PMI	S.S.	Published
C1	Unidentified Mustelidae	S1	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790	17/07/1998	—	4	This paper
				<i>Nicrophorus interruptus</i> Stephens, 1830	17/07/1998	—	1	Prieto et al. (2002)
C2	Beech Marten, <i>Martes foina</i>	S2	Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	11/06/2005	—	1	This paper
C3	Cat, <i>Felis catus</i>	S3	Cleridae	<i>Necrobia rufipes</i> (De Geer, 1775)	16/07/1997	—	2	This paper
				<i>Necrobia rufipes</i> (De Geer, 1775)	18/07/1997	—	1	This paper
C4	Unidentified Passerine	S4	Siphidae	<i>Dermestes frischii</i> Kugelann, 1792	16/07/1997	—	2	This paper
				<i>Nicrophorus interruptus</i> Stephens, 1830	14/07/2004	—	2	This paper
C5	Spanish Mole, <i>Talpa occidentalis</i>	S5	Siphidae	<i>Nicrophorus vestigator</i> Herschel, 1807	16/06/1999	—	1	Prieto et al. (2002)
				<i>Thanatophilus rugosus</i> (Linnaeus, 1758)	16/06/1999	—	1	Prieto et al. (2002)
C6	Cat, <i>Felis catus</i>	S6	Cleridae	<i>Necrobia rufipes</i> (De Geer, 1775)	17/04/1999	—	1	This paper
				<i>Dermestes frischii</i> Kugelann, 1792	17/04/1999	—	5	This paper
C7	Domestic Sheep, <i>Ovis aries</i>	S7	Nitidulidae	<i>Nitidula flavomaculata</i> Rossi, 1790	17/04/1999	—	3	Grosso-Silva (2007)
				<i>Dermestes frischii</i> Kugelann, 1792	29/06/1999	—	1	This paper
C8	Red Fox, <i>Vulpes vulpes</i>	S8	Siphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	29/06/1999	—	1	Prieto et al. (2002)
				<i>Dermestes frischii</i> Kugelann, 1792	30/07/2003	—	2	Grosso-Silva (2005)
C9	Spanish Mole, <i>Talpa occidentalis</i>	S9	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790	30/07/2003	—	1	Grosso-Silva (2005)
				<i>Dermestes frischii</i> Kugelann, 1792	27/05/2004	—	1	Grosso-Silva (2005)
C10	Ocellated Lizard, <i>Lacerta lepida</i>	S10	Siphidae	<i>Dermestes undulatus</i> Brahm, 1790	27/05/2004	—	3	Grosso-Silva (2005)
				<i>Nicrophorus vestigator</i> Herschel, 1807	27/05/2004	—	1	Grosso-Silva (2005)
C11	Cat, <i>Felis catus</i>	S11	Siphidae	<i>Thanatophilus rugosus</i> (Linnaeus, 1758)	27/05/2004	—	2	This paper
				<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	27/05/2004	—	4	This paper
C12	Spanish Mole, <i>Talpa occidentalis</i>	S12	Dermestidae	<i>Scarabaeus laticollis</i> Linnaeus, 1767	24/05/2001	—	3	Grosso-Silva (2005)
				<i>Nicrophorus vestigator</i> Herschel, 1807	24/05/2001	—	2	Grosso-Silva (2005)
C13	Iberian Emerald Lizard, <i>Lacerta schreiberi</i>	S13	Siphidae	<i>Thanatophilus ruficornis</i> (Küster, 1851)	24/05/2001	—	1	This paper
				<i>Thanatophilus rugosus</i> (Linnaeus, 1758)	30/05/2001	—	2	This paper
C14	European Robin, <i>Erithacus rubecula</i>	S14	Dermestidae	<i>Thanatophilus rugosus</i> (Linnaeus, 1758)	30/05/2001	—	1	Grosso-Silva (2005)
				<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	30/05/2001	—	1	This paper
C15	Spanish Mole, <i>Talpa occidentalis</i>	S15	Siphidae	<i>Dermestes frischii</i> Kugelann, 1792	09/08/2000	—	6	Grosso-Silva (2005)
				<i>Dermestes undulatus</i> Brahm, 1790	09/08/2000	—	2	Grosso-Silva (2005)
C16	Unidentified Mustelidae	S16	Siphidae	<i>Nicrophorus interruptus</i> Stephens, 1830	09/08/2000	—	2	This paper
				<i>Nicrophorus vestigator</i> Herschel, 1807	09/08/2000	—	2	Grosso-Silva (2005)
C17	Unidentified Mustelidae	S17	Siphidae	<i>Thanatophilus rugosus</i> (Linnaeus, 1758)	09/08/2000	—	1	Grosso-Silva (2005)
				<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	09/08/2000	—	1	This paper
C18	Unidentified Mustelidae	S18	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792	12/05/1999	—	1	Grosso-Silva (2005)
				<i>Dermestes undulatus</i> Brahm, 1790	12/05/1999	—	100	Grosso-Silva (2005)
C19	Unidentified Mustelidae	S19	Scarabaeidae	<i>Onthophagus grossepunctatus</i> Reitter, 1905	12/05/1999	—	1	This paper
				<i>Onthophagus joannae</i> Gollan, 1953	12/05/1999	—	2	This paper
C20	Unidentified Mustelidae	S20	Scarabaeidae	<i>Onthophagus similis</i> (Scriba, 1790)	12/05/1999	—	1	This paper
				<i>Thanatophilus ruficornis</i> (Küster, 1851)	12/05/1999	—	3	Prieto et al. (2002)
C21	Unidentified Mustelidae	S21	Siphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	12/05/1999	—	1	This paper
				<i>Trox perlati</i> (Geoffroy, 1762)	12/05/1999	—	1	This paper
C22	Unidentified Mustelidae	S22	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790	17/06/1999	—	4	Grosso-Silva (2005)
				<i>Nicrophorus vestigator</i> Herschel, 1807	16/05/2001	—	2	Grosso-Silva (2005)

Code	Carcass	Site	Beetle family	Beetle species	Date	PMI	S.S.	Published
C16	Cat, <i>Felis catus</i>	S16	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792	30/07/1999	3	1	Grosso-Silva (2005)
			Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790	28/07/1999	1	5	Grosso-Silva (2005)
			Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790	30/07/1999	3	11	Grosso-Silva (2005)
			Histeridae	<i>Saprinus detersus</i> (Illiger, 1807)	28/07/1999	1	3	Grosso-Silva (2005)
			Histeridae	<i>Saprinus furvus</i> Erichson, 1834	28/07/1999	1	1	Grosso-Silva (2005)
			Histeridae	<i>Saprinus subnitescens</i> Bickhardt, 1909	28/07/1999	1	9	Grosso-Silva (2005)
			Silphidae	<i>Necrodes littoralis</i> (Linnaeus, 1761)	28/07/1999	1	1	Grosso-Silva & Serrano (2000)
			Silphidae	<i>Necrodes littoralis</i> (Linnaeus, 1761)	30/07/1999	3	4	Grosso-Silva & Serrano (2000)
			Silphidae	<i>Nicrophorus interruptus</i> Stephens, 1830	28/07/1999	1	21	Prieto et al. (2002)
			Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	30/07/1999	3	3	Prieto et al. (2002)
			Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	28/07/1999	1	6	This paper
			Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	30/07/1999	3	2	This paper
			Silphidae	<i>Nicrophorus vestigator</i> Herschel, 1807	01/09/2003	–	1	Grosso-Silva (2005)
			C17	Spanish Mole, <i>Talpa occidentalis</i>	S17	Silphidae	<i>Necrodes littoralis</i> (Linnaeus, 1761)	25/07/2002
Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	25/07/2002				–	1	Soares-Vieira & Grosso-Silva (2003)
C18	Domestic Sheep, <i>Ovis aries</i>	S18	Silphidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	25/07/2002	–	5	This paper
			Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)	16/04/2003	–	2	Soares-Vieira & Grosso-Silva (2003)
			Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790	16/04/2003	–	1	Soares-Vieira & Grosso-Silva (2003)
			Silphidae	<i>Necrodes littoralis</i> (Linnaeus, 1761)	16/04/2003	–	2	Soares-Vieira & Grosso-Silva (2003)
			Silphidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	16/04/2003	–	5	This paper
			Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)	28/01/1995	–	1	This paper
C19	Unidentified Lagomorph	S19	Nitidulidae	<i>Omosita discoidea</i> (Fabricius, 1775)	31/01/1995	–	3	Grosso-Silva (2007)
			Nitidulidae	<i>Omosita discoidea</i> (Fabricius, 1775)	16/02/1997	7	4	Grosso-Silva (2007)
C20	Cat, <i>Felis catus</i>	S20	Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)	10/03/1997	–	1	This paper
			Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)	01/05/1997	–	1	This paper
C21	Cat, <i>Felis catus</i>	S20	Nitidulidae	<i>Nitidula carnaria</i> (Schaller, 1783)	01/05/1997	–	1	Grosso-Silva (2007)
			Nitidulidae	<i>Nitidula carnaria</i> (Schaller, 1783)	04/11/1997	–	1	This paper
C22	Cat, <i>Felis catus</i>	S20	Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	04/11/1997	–	1	This paper
			Silphidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	04/11/1997	–	1	This paper
C23	Cat, <i>Felis catus</i>	S20	Silphidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	06/11/1997	–	1	This paper
			Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)	29/03/1998	4	1	This paper
C24	Hedgehog, <i>Erinaceus europaeus</i>	S20	Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)	05/06/1998	68	2	This paper
			Histeridae	<i>Saprinus semistriatus</i> (Scriba, 1790)	12/07/1999	–	1	This paper
C25	Cat, <i>Felis catus</i>	S21	Cleridae	<i>Necrobia rufipes</i> (De Geer, 1775)	03/08/1998	–	1	This paper
			Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792	03/08/1998	–	5	This paper
			Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792	12/09/1998	–	1	This paper
			Histeridae	<i>Saprinus caeruleus</i> (Hoffmann, 1803)	03/08/1998	–	1	This paper
			Histeridae	<i>Saprinus caeruleus</i> (Hoffmann, 1803)	05/08/1998	–	2	This paper
			Histeridae	<i>Saprinus cruciatus</i> (Fabricius, 1792)	03/08/1998	–	1	This paper
			Histeridae	<i>Saprinus furvus</i> Erichson, 1834	03/08/1998	–	1	This paper
			Histeridae	<i>Saprinus furvus</i> Erichson, 1834	05/08/1998	–	6	This paper
			Histeridae	<i>Saprinus georgicus</i> Marseul, 1862	05/08/1998	–	3	This paper
			Histeridae	<i>Saprinus subnitescens</i> Bickhardt, 1909	03/08/1998	–	2	This paper
			Histeridae	<i>Saprinus subnitescens</i> Bickhardt, 1909	05/08/1998	–	2	This paper
			Histeridae	<i>Saprinus tenuistriatus</i> Marseul, 1855 ssp. <i>sparisutius</i> Solskij, 1876	05/08/1998	–	1	This paper
			Histeridae	<i>Necrobia rufipes</i> (De Geer, 1775)	23/06/2006	–	1	This paper
			Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792	23/06/2006	–	6	This paper
C26	Cat, <i>Felis catus</i>	S22	Dermestidae	<i>Dermestes sardous</i> Küster, 1846	21/05/1999	1	1	This paper
			Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792	28/06/1999	–	4	Grosso-Silva (2005)

Code	Carcass	Site	Beetle family	Beetle species	Date	PMI	S.S.	Published
C31	Common Blackbird, <i>Turdus merula</i>	S25	Dermeestidae	<i>Dermestes undulatus</i> Brahm, 1790	18/06/2004	–	1	This paper
			Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	18/06/2004	–	1	This paper
C32	Cat, <i>Felis catus</i>	S25	Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	27/11/2006	–	1	This paper
C33	Dog, <i>Canis familiaris</i>	S26	Dermeestidae	<i>Dermestes frischii</i> Kugelann, 1792	11/04/2001	4	2	This paper
			Dermeestidae	<i>Dermestes undulatus</i> Brahm, 1790	11/04/2001	4	2	This paper
C34	Ladder Snake, <i>Elaphe scalaris</i>	S27	Dermeestidae	<i>Dermestes frischii</i> Kugelann, 1792	24/03/2009	–	1	This paper
			Dermeestidae	<i>Dermestes undulatus</i> Brahm, 1790	09/04/2009	–	1	This paper
			Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	29/03/2009	–	2	This paper
			Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	09/04/2009	–	3	This paper
			Histeridae	<i>Saprinus melas</i> Küster, 1849	10/05/1985	–	1	Salgado (1990)
C35	Dog, <i>Canis familiaris</i>	S28	Histeridae	<i>Saprinus semistriatus</i> (Scriba, 1790)	10/05/1985	–	2	Salgado (1990)
			Dermeestidae	<i>Dermestes frischii</i> Kugelann, 1792	–	–	–	Seabra (1932-33)
C36	Montpellier Snake, <i>Malpolon monspessulanus</i>	S29	Silphidae	<i>Nicrophorus vestigator</i> Herschel, 1807	–	–	–	Seabra (1932-33)
			Silphidae	<i>Silpha puncticollis</i> Lucas, 1846	–	–	–	Seabra (1932-33)
			Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	–	–	–	Seabra (1932-33)
			Histeridae	<i>Margarinotus brunneus</i> (Fabricius, 1775)	–	–	–	Barros (1896)
C37	Unspecified reptiles	S30	Histeridae	<i>Margarinotus humator</i> (Gleditsch, 1767)	–	–	–	Barros (1896)
C38	Jay, <i>Garrulus glandarius</i>	S31	Silphidae	<i>Nicrophorus humator</i> (Gleditsch, 1767)	–	–	–	Barros (1896)
C39	Montpellier Snake, <i>Malpolon monspessulanus</i>	S32	Histeridae	<i>Saprinus maculatus</i> (Rossi, 1792)	19/05/1982	–	1	Grosso-Silva (1990)
			Histeridae	<i>Saprinus pharao</i> Marseul, 1855	19/05/1982	–	1	Grosso-Silva (1990)
C40	Cat, <i>Felis catus</i>	S33	Histeridae	<i>Saprinus planiusculus</i> Motschulsky, 1849	10/08/1974	–	1	Salgado (1990)
			Histeridae	<i>Saprinus semistriatus</i> (Scriba, 1790)	10/08/1974	–	19	Salgado (1990)
			Histeridae	<i>Saprinus subnitescens</i> Bickhardt, 1909	10/08/1974	–	2	Salgado (1990)



**Table III. List of beetle species found in the carcasses of each vertebrate species.**  
Bibliographic data is that contained in the seven references found in the literature survey.

Carcasses of	Beetle family	Beetle species
Ladder Snake, <i>Elaphe scalaris</i> (n=1)	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)
Ocellated Lizard, <i>Lacerta lepida</i> (n=2)	Dermestidae	<i>Dermestes sardous</i> Küster, 1846
	Scarabaeidae	<i>Scarabaeus laticollis</i> Linnaeus, 1767
	Silphidae	<i>Nicrophorus vestigator</i> Herschel, 1807
	Silphidae	<i>Thanatophilus ruficornis</i> (Küster, 1851)
Iberian Emerald Lizard, <i>Lacerta schreiberi</i> (n=1)	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Scarabaeidae	<i>Onthophagus grossepunctatus</i> Reitter, 1905
	Scarabaeidae	<i>Onthophagus joannae</i> Goljan, 1953
	Scarabaeidae	<i>Onthophagus similis</i> (Scriba, 1790)
	Silphidae	<i>Thanatophilus ruficornis</i> (Küster, 1851)
	Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)
Montpellier Snake, <i>Malpolon monspessulanus</i> (n=2, bibliographic)	Trogidae	<i>Trox perlatus</i> (Geoffroy, 1762)
	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Histeridae	<i>Saprinus maculatus</i> (Rossi, 1792)
	Histeridae	<i>Saprinus pharao</i> Marseul, 1855
	Silphidae	<i>Nicrophorus vestigator</i> Herschel, 1807
	Silphidae	<i>Silpha puncticollis</i> Lucas, 1846
Unidentified reptiles (bibliographic)	Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)
	Histeridae	<i>Margarinotus brunneus</i> (Fabricius, 1775)
European Robin, <i>Erithacus rubecula</i> (n=1)	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
Jay, <i>Garrulus glandarius</i> (n=1, bibliographic)	Silphidae	<i>Nicrophorus humator</i> (Gleditsch, 1767)
Common Blackbird, <i>Turdus merula</i> (n=1)	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)
Unidentified Passerine (n=1)	Silphidae	<i>Nicrophorus interruptus</i> Stephens, 1830
Dog, <i>Canis familiaris</i> (n=2, one bibliographic)	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Histeridae	<i>Saprinus melas</i> Küster, 1849
	Histeridae	<i>Saprinus semistriatus</i> (Scriba, 1790)
Hedgehog, <i>Erinaceus europaeus</i> (n=1)	Histeridae	<i>Saprinus semistriatus</i> (Scriba, 1790)
Cat, <i>Felis catus</i> (n=15, one bibliographic)	Cleridae	<i>Necrobia rufipes</i> (De Geer, 1775)
	Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)
	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Histeridae	<i>Saprinus caerulescens</i> (Hoffmann, 1803)
	Histeridae	<i>Saprinus cruciatus</i> (Fabricius, 1792)
	Histeridae	<i>Saprinus detersus</i> (Illiger, 1807)
	Histeridae	<i>Saprinus furvus</i> Erichson, 1834
	Histeridae	<i>Saprinus georgicus</i> Marseul, 1862
	Histeridae	<i>Saprinus planiusculus</i> Motschulsky, 1849
	Histeridae	<i>Saprinus semistriatus</i> (Scriba, 1790)
	Histeridae	<i>Saprinus subnitescens</i> Bickhardt, 1909
	Histeridae	<i>Saprinus tenuistrius</i> Marseul, 1855 ssp. <i>sparsutus</i> Solskij, 1876
	Nitidulidae	<i>Nitidula carnaria</i> (Schaller, 1783)
	Nitidulidae	<i>Nitidula flavomaculata</i> Rossi, 1790
	Nitidulidae	<i>Omosita discoidea</i> (Fabricius, 1775)
	Silphidae	<i>Nicrodes littoralis</i> (Linnaeus, 1761)
	Silphidae	<i>Nicrophorus interruptus</i> Stephens, 1830
	Silphidae	<i>Thanatophilus ruficornis</i> (Küster, 1851)
	Silphidae	<i>Thanatophilus rugosus</i> (Linnaeus, 1758)
Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	
Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)	
Beech Marten, <i>Martes foina</i> (n=1)	Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)
Domestic Sheep, <i>Ovis aries</i> (n=2)	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Silphidae	<i>Nicrodes littoralis</i> (Linnaeus, 1761)
	Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)
	Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)
Spanish Mole, <i>Talpa occidentalis</i> (n=5)	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Silphidae	<i>Nicrophorus interruptus</i> Stephens, 1830
	Silphidae	<i>Nicrophorus vestigator</i> Herschel, 1807
	Silphidae	<i>Thanatophilus rugosus</i> (Linnaeus, 1758)
	Silphidae	<i>Thanatophilus sinuatus</i> (Fabricius, 1775)
Red Fox, <i>Vulpes vulpes</i> (n=1)	Dermestidae	<i>Dermestes frischii</i> Kugelann, 1792
	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
Unidentified Lagomorph (n=1)	Cleridae	<i>Necrobia violacea</i> (Linnaeus, 1758)
	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Silphidae	<i>Nicrodes littoralis</i> (Linnaeus, 1761)
	Staphylinidae	<i>Creophilus maxillosus</i> (Linnaeus, 1758)
Unidentified Mustelidae (n=1)	Dermestidae	<i>Dermestes undulatus</i> Brahm, 1790
	Silphidae	<i>Nicrophorus interruptus</i> Stephens, 1830

**Table IV. List of vertebrate species in whose carcasses each beetle species was found.**  
Carcass 37 refers to an undetermined number of reptile carcasses reported by Barros (1896)

Familia/ Species	Species and number of carcasses	PMI (days)	Carcasses' codes	Sites' codes
<b>Cleridae</b>				
<i>Necrobia rufipes</i> (De Geer, 1775)	<i>Felis catus</i> (4)	—	C3, C6, C27, C28	S3, S6, S21, S22
<i>Necrobia violacea</i> (Linnaeus, 1758)	<i>Felis catus</i> (4)	4; 68	C20, C22, C23, C25	S20
	Unidentified Lagomorph (1)	—	C19	S19
<b>Dermestidae</b>				
<i>Dermestes frischii</i> Kugelann, 1792	<i>Elaphe scalaris</i> (1)	—	C34	S27
	<i>Lacerta schreiberi</i> (1)	—	C13	S13
	<i>Malpolon monspessulanus</i> (1)	—	C36	S29
	<i>Canis familiaris</i> (1)	4	C33	S26
	<i>Felis catus</i> (6)	3	C3, C6, C16, C27, C28, C30	S3, S6, S16, S21, S22, S24
	<i>Ovis aries</i> (1)	—	C7	S7
	<i>Talpa occidentalis</i> (2)	—	C9, C12	S9, S12
	<i>Vulpes vulpes</i> (1)	—	C8	S8
<i>Dermestes sardous</i> Küster, 1846	<i>Lacerta lepida</i> (1)	1	C29	S23
<i>Dermestes undulatus</i> Brahm, 1790	<i>Elaphe scalaris</i> (1)	—	C34	S27
	<i>Lacerta schreiberi</i> (1)	—	C13	S13
	<i>Erithacus rubecula</i> (1)	—	C14	S14
	<i>Turdus merula</i> (1)	—	C31	S25
	<i>Canis familiaris</i> (1)	4	C33	S26
	<i>Felis catus</i> (1)	1; 3	C16	S16
	<i>Talpa occidentalis</i> (2)	—	C9, C12	S9, S12
	<i>Vulpes vulpes</i> (1)	—	C8	S8
	Unidentified Lagomorph (1)	—	C19	S19
	Unidentified Mustelidae (1)	—	C1	S1
<b>Histeridae</b>				
<i>Margarinotus brunneus</i> (Fabricius, 1775)	Unspecified reptiles	—	C37	S30
<i>Saprinus caerulescens</i> (Hoffmann, 1803)	<i>Felis catus</i> (1)	—	C27	S21
<i>Saprinus cruciatus</i> (Fabricius, 1792)	<i>Felis catus</i> (1)	—	C27	S21
<i>Saprinus detersus</i> (Illiger, 1807)	<i>Felis catus</i> (1)	1	C16	S16
<i>Saprinus furvus</i> Erichson, 1834	<i>Felis catus</i> (2)	1	C16, C27	S16, S21
<i>Saprinus georgicus</i> Marseul, 1862	<i>Felis catus</i> (1)	—	C27	S21
<i>Saprinus maculatus</i> (Rossi, 1792)	<i>Malpolon monspessulanus</i> (1)	—	C39	S32
<i>Saprinus melas</i> Küster, 1849	<i>Canis familiaris</i> (1)	—	C35	S28
<i>Saprinus pharao</i> Marseul, 1855	<i>Malpolon monspessulanus</i> (1)	—	C39	S32
<i>Saprinus planiusculus</i> Motschulsky, 1849	<i>Felis catus</i> (1)	—	C40	S33
<i>Saprinus semistriatus</i> (Scriba, 1790)	<i>Erinaceus europaeus</i> (1)	—	C26	S20
	<i>Canis familiaris</i> (1)	—	C35	S28
	<i>Felis catus</i> (1)	—	C40	S33
<i>Saprinus subnitescens</i> Bickhardt, 1909	<i>Felis catus</i> (3)	1	C16, C27, C40	S16, S21, S33
<i>Saprinus tenuistrius</i> Marseul, 1855 ssp. <i>sparsutus</i> Solskij, 1876	<i>Felis catus</i> (1)	—	C27	S21
<b>Nitidulidae</b>				
<i>Nitidula carnaria</i> (Schaller, 1783)	<i>Felis catus</i> (1)	—	C23	S20
<i>Nitidula flavomaculata</i> Rossi, 1790	<i>Felis catus</i> (1)	—	C6	S6
<i>Omosita discoidea</i> (Fabricius, 1775)	<i>Felis catus</i> (2)	7	C20, C21	S20
<b>Scarabaeidae</b>				
<i>Onthophagus grossepunctatus</i> Reitter, 1905	<i>Lacerta schreiberi</i> (1)	—	C13	S13
<i>Onthophagus joannae</i> Goljan, 1953	<i>Lacerta schreiberi</i> (1)	—	C13	S13
<i>Onthophagus similis</i> (Scriba, 1790)	<i>Lacerta schreiberi</i> (1)	—	C13	S13
<i>Scarabaeus laticollis</i> Linnaeus, 1767	<i>Lacerta lepida</i> (1)	—	C10	S10
<b>Silphidae</b>				
<i>Necrodes littoralis</i> (Linnaeus, 1761)	<i>Felis catus</i> (1)	1; 3	C16	S16
	<i>Ovis aries</i> (1)	—	C18	S18
	Unidentified Lagomorph (1)	—	C19	S19
<i>Nicrophorus humator</i> (Gleditsch, 1767)	<i>Garrulus glandarius</i> (1)	—	C38	S31
<i>Nicrophorus interruptus</i> Stephens, 1830	Unidentified Passerine (1)	—	C4	S4
	<i>Felis catus</i> (1)	1	C16	S16
	<i>Talpa occidentalis</i> (1)	—	C12	S12
	Unidentified Mustelidae (1)	—	C1	S1
<i>Nicrophorus vestigator</i> Herschel, 1807	<i>Lacerta lepida</i> (1)	—	C10	S10
	<i>Malpolon monspessulanus</i> (1)	—	C36	S29
	<i>Talpa occidentalis</i> (5)	—	C5, C9, C12, 15, C17	S5, S9, S12, S15, S17
<i>Silpha puncticollis</i> Lucas, 1846	<i>Malpolon monspessulanus</i> (1)	—	C36	S29
<i>Thanatophilus ruficornis</i> (Küster, 1851)	<i>Lacerta lepida</i> (1)	—	C10	S10
	<i>Lacerta schreiberi</i> (1)	—	C13	S13
	<i>Felis catus</i> (1)	—	C11	S11
<i>Thanatophilus rugosus</i> (Linnaeus, 1758)	<i>Felis catus</i> (1)	—	C11	S11
	<i>Talpa occidentalis</i> (3)	—	C5, C9, C12	S5, S9, S12
<i>Thanatophilus sinuatus</i> (Fabricius, 1775)	<i>Elaphe scalaris</i> (1)	—	C34	S27
	<i>Lacerta schreiberi</i> (1)	—	C13	S13
	<i>Malpolon monspessulanus</i> (1)	—	C36	S29
	<i>Turdus merula</i> (1)	—	C31	S25
	<i>Felis catus</i> (3)	3	C11, C16, C24	S11, S16, S20
	<i>Ovis aries</i> (2)	—	C7, C18	S7, S18

Famiia/ Species	Species and number of carcasses	PMI (days)	Carcasses' codes	Sites' codes
	<i>Talpa occidentalis</i> (3)	–	C5, C9, C12	S5, S9, S12
<b>Staphylinidae</b>				
<i>Creophilus maxillosus</i> (Linnaeus, 1758)	<i>Felis catus</i> (3)	1; 3	C16, C24, C32	S16, S20, S25
	<i>Martes foina</i> (1)	–	C2	S2
	<i>Ovis aries</i> (1)	–	C18	S18
	Unidentified Lagomorph (1)	–	C19	S19
<b>Trogidae</b>				
<i>Trox perlatius</i> (Geoffroy, 1762)	<i>Lacerta schreiberi</i> (1)	–	C13	S13

### Acuse de Recibo:

#### Creación de una Microrreserva de alto valor para la única población de Mariposa Arlequín del T. M. de Logroño (La Rioja). Solicitud de ayuda taxonómica

C/ Madre de Dios, nº 14 – 7º D, 26004 – Logroño (La Rioja)  
Asociación Española Para la Protección de las Mariposas y su Medio (ZERYNTHIA).  
[www.asociacion-zerynthia.org](http://www.asociacion-zerynthia.org)

Como indicamos en el anterior boletín (Monasterio y Escobés, 2008), desde la Asociación ZERYNTHIA estamos trabajando en la creación de la primera microrreserva de lepidópteros en nuestro país, situada en el margen superior de Logroño (La Rioja), planteando a la ciudad crear una “*isla de biodiversidad dentro de un entorno urbano*”.

Bajo la “especie paraguas” de la Microrreserva, la *Zerynthia rumina*, han ido apareciendo numerosas especies de fauna y flora de gran singularidad (*Aristolochia pistolochia*, *Ophrys speculum*, *Chthonius ischnocheles*, *Atemnus politus*, *Heliothea discoidaria*, *Saturnia pyri*, *Saturnia pavonia* y la rarísima (y más recientemente hallada) *Proserpinus proserpina*. Muchos de ellos raros en La Rioja o presentes, por el momento, tan solo en este lugar, dentro del territorio riojano.

Hemos comenzado un inventario exhaustivo de la biodiversidad del lugar que, además de las especies “singulares” que mencionábamos, está dando como resultado un extensísimo catálogo de todo tipo de grupos taxonómicos. Al tratarse de un terreno de dimensiones reducidas y bien delimitado, resulta una empresa factible llegar a un conocimiento casi total de su biodiversidad.

Así pues, nos vemos en la obligación (queriendo ser exhaustivos) de solicitar a través de éste Boletín, la ayuda de “expertos” en los diferentes grupos taxonómicos. Esta ayuda puede materializarse tanto a través de Internet (estamos creando una base de datos On-line de la biodiversidad de la Microrreserva) como mediante el envío de muestras para su identificación (o ambas).

Rogamos a todos los interesados en éste fascinante proyecto se pongan en contacto con nosotros a través del correo electrónico [zerynthia.org@gmail.com](mailto:zerynthia.org@gmail.com)

\*Base de datos On-line de la biodiversidad de la microrreserva: <http://www.asociacion-zerynthia.org/galeria/>