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Studies on seasonal arthropod succession on carrion in the southeastern Iberian Peninsula

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Abstract A global study of the sarcosaprophagous community that occurs in the southeastern Iberian Peninsula during all four seasons is made for the first time, and its diversity is described with reference to biological indices. A total of 18,179 adults and, additionally, a number of preimaginal states were collected. The results for the main arthropod groups, and their diversity are discussed in relation to the season and decompositional stages. The results provide an extensive inventory of carrion-associated arthropods. An association between decomposition stages and more representative arthropod groups is established. With respect to the biological indices applied, Margalef's index shows that the diversity of the community increases as the state of decomposition advances, while Sorenson's quantitative index shows that the greatest similarities are between spring and summer on the one hand, and fall and winter, on the other.

Keywords Forensic entomology · Arthropod succession · Sarcosaprophagous fauna · Iberian Peninsula · Postmortem interval

Introduction

Studies on the entomosarcosaprophagous communities and the successional patterns in decomposing animal remains are the basis of forensic entomological investigations. Identification of the species found during the various stages of decomposition, a knowledge of the duration of each stage and the influence of environmental factors allow the postmortem interval to be estimated. However, despite the increasing number of studies on the biogeography and ecology of this kind of community, many areas and environments still remain to be studied. In this sense, knowledge of local fauna is very useful in forensic investigations because data from other areas, which may have both different environmental and faunal characteristics, may not provide a sufficient degree of accuracy.

In the Iberian Peninsula global studies in this field are scarce (Arnaldos Sanabria 2000; Castillo Miralbes 2002) and other papers contribute data only in certain groups (Romero & Munguía 1986; Arnaldos et al. 2001, 2003; Berzosa et al. 2001; Martínez et al. 2002). Our study deals with the decomposition of animal carcasses resulting in an extensive inventory of carrion-associated arthropods. It emphasises the faunal diversity, as indicated by faunistic indices, the relative abundance of adults and the occurrence of different species throughout the decomposition process, and recognises differences in seasonal patterns of succession and the identity of significant forensically interesting taxa.

Material and methods

A variation of the trap described by Schoenly et al. (1991) was used to collect the material. Schoenly's model is designed to trap all arthropods, both those that are attracted to the bait and those that emerge from the decaying remains themselves, enabling them to be recorded while minimising the interference in the natural decomposition process and faunal succession. The fact that the arthropods are caught continuously as long as they are present means that many kinds of statistical analyses can be carried out.

The trap is designed to collect adult entomofauna, however, since a complete life cycle may elapse in some of the species involved during the study period, a given species may be found in all its development stages. The preimaginal stages of some insects showing a holometabolous development, for example some Diptera and Coleoptera, tend to abandon the cadaver and move some distance away before attempting to bury themselves; these too, might be captured by the device but not in their entirety. For this reason, the preimaginal stages will only be considered as qualitative biological data (for example, to indicate the moment that migratory, post-feeding, Diptera larvae appear) and will not be taken into account for obtaining diversity indices.

The trap was positioned in a natural area of the experimental agricultural field of the Espinardo campus of Murcia University, about 6 km north of Murcia City. The trap was baited every season

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with two chicken carcasses with the flesh partially removed and the viscera present.

Samples were taken during all four seasons of 1 year defined as spring (16 May 1996–12 July 1996), summer (27 July 1996–9 September 1996), fall (19 October 1996–10 December 1996) and winter (1 February 1997–20 March 1997). Each sampling lasted about 7 weeks. Samples were taken daily during the first 2 weeks and, afterwards, every other day or slightly longer until the end of the experiment.

Several descriptive statistics were used to estimate the ecological parameters of the sarcosaprophagous community. These include Margalef's index (MI) (S–1)/lnN, where *S* is the number of identified taxa and *N* is the number of collected specimens (Clifford & Stephenson 1975). This index allows the richness of taxa in a community to be established in a simply and easily calculable way (Magurran 1989), and is valid from a descriptive point of view. Its values vary as a function of the number of taxa existing and the total number of specimens, for which reason it has no concrete limits. To estimate the diversity of a community it is also interesting to use a similarity index (Magurran 1989), of which many exist (Clifford & Stephenson 1975), although the most widely used is Sorenson's (CS) as modified by Bray & Curtis (1957), i.e., 2jN/(aN+bN), where *aN* is the total number of individuals in site A, *bN* is the total number of individuals in site B and *jN* is the sum of the least abundant species found in both sites. This index permits a comparison of the diversity of two places and is designed to be equal to 1 in case of total similarity and equal to zero if the sites are dissimilar and have no species in common.

Results and discussion

Global study of the sarcosaprophagous community

A total of 18,179 adult specimens from 208 different taxa belonging to 18 orders of Chaelicerata, Crustacea, Myriapoda and Insecta were collected. Tables 1 and 2 show the presence or absence of the taxa in each season and in the different stages of decomposition. The great richness of the faunal composition recorded is evident. Other related works (Fuller 1934; Reed 1958; Early & Goff 1986; Goff et al. 1986; Richards & Goff 1997; Tantawi et al. 1996; Olaya 2001; Lopes de Carvalho & Linares 2001; Centeno et al. 2002) also show the great diversity of the sarcosaprophagous fauna, but our data revealed the greatest diversity and the higher number of collected taxa except for that of Payne (1965). We have taken into account all the collected taxa because we considered the sarcosaprophagous community as a whole. The different species making up the sarcosaprophagous community can be classified into five ecological categories (see Smith 1986 among others): necrophagous species which are the first to arrive and which feed off the cadaver, necrophilous species which feed off the necrophagous species present by predation and parasitism, omnivorous species which feed off both the cadaver and associated fauna, opportunist species which use the cadaver as a refuge and heat source and, lastly, accidental species whose presence in the cadaver is due to chance alone.

The maximum number of individuals, expressed as percentages (Fig. 1), was caught in spring and the lowest number in winter. This contrasts with the data obtained from the Mediterranean area by Tantawi et al. (1996), who collected more arthropods in fall and winter. Nevertheless, other authors (Reed 1958; Rodríguez & Bass 1983; Lord & Burger 1984) found that the carrion fauna is more abundant and diverse in warm than in cold conditions, when the low temperatures inhibit arthropod activity. Our data agree with these findings, because the warmest seasons (spring and summer) provided the greatest diversity (Table 3), although summer saw a low percentage of captures. This fact could be due to the environmental conditions (high temperatures and low relative humidity), which accelerated the decomposition process, meaning that the corpse was reduced to bones in a short time period, which would also have reduced the time for arthropod colonisation.

Diversity of the community

According to Margalef's diversity index, the season providing the greatest diversity was spring (MI=16.834), while fall provided the lowest level (MI=10.129) with spring and winter lying inbetween (MI=13.451 and 11.024, respectively).

When the phases of decomposition were considered separately in each of the seasons, the same index showed that the diversity tended to increase with time (Table 3), the only exceptions being the advanced decomposition stage in summer and fall.

Quantitatively, Sorenson's index (Table 4) showed that the most similar seasons were spring and summer on the one hand, and fall and winter on the other. A study of the similarity in each phase of decomposition showed that the most similar seasons were fall and winter during the fresh and advanced decomposition stages, while summer and fall were the most similar with regards to the decomposition stage (see below for definition of stages).

Decomposition stages and associated fauna

Four decomposition stages were identified: fresh, decomposition, advanced decomposition and skeletonisation, the characteristics of which have been described in Martínez et al. (2002).

The fresh stage took place during the two first sampling days in spring and summer, and during the first three sampling days in fall and winter. The decomposition stage had a shorter duration in warm (days 3–12 in spring and days 3–7 in summer) than in colder seasons (days 4–20 in fall and days 4–25 in winter). This stage ended with a sudden loss of humidity in the corpse, when the post-feeding larvae of primary Diptera left the corpse. The advanced decomposition stage was the last observed in spring (from day 14 onwards), fall (from day 22 onwards) and winter (from day 27 onwards). In summer this stage took place between days 8 and 13, skeletonisation was only observed in summer from day 14 onwards.

Of particular note was the delay in corpse colonisation in fall and winter, and the tardiness with which the post-feeding larvae left the corpse, both of which are good indicators of the postmortem interval for forensic purposes.

Table 1 Insect groups or taxa in the different seasons and in every decomposition stage

Order	Family	Species	Fresh				Decomposition				Advanced decomposition				SK
			SP	SU	F	W	SP	SU	F	W	SP	SU	F	W	SU
Diptera	Cecidomyiidae	Not identified	X	X	X		X		X	X	X	X	X	X	X
	Culicidae	Not identified						X							
	Psychodidae	Not identified	X	X	X		X		X	X	X	X	X	X	X
	Sciaridae	Not identified	X	X		X	X	X	X	X	X		X	X	X
	Tipulidae	Not identified					X								
	Anthomyiidae	Not identified				X	X	X	X	X	X		X	X	
	Calliphoridae	*Calliphora vicina*	X	X	X	X	X		X	X			X	X	
		Calliphora vomitoria								X					
		Chrysomya albiceps	X	X	X	X	X	X	X	X					
		Phaenicia sericata	X	X	X		X	X	X	X	X		X	X	X
		Pollenia sp.	X				X			X	X	X			
	Dolichopodidae	*not identified*									X				
	Fannidae	*Fannia sp.*	X	X	X		X	X	X	X			X	X	
	Lauxaniidae	Not identified									X				
	Muscidae	*cf Alloeostylus sp*		X	X				X	X			X		
		Musca domestica	X	X	X		X	X	X		X	X	X		X
		Muscina assimilis	X						X	X					
		Muscina pabulorum							X	X					
		Muscina stabulans	X	X	X	X	X	X	X	X	X	X	X	X	X
	Phoridae	Not identified	X	X	X	X	X	X	X	X	X	X	X	X	X
	Sarcophagidae	*Sarcophaga (Bercaea) africa*	X	X	X		X	X	X		X	X	X	X	
		Sarcophaga (Liopygia) argyrostoma		X				X							X
		Sarcophaga (Heteronychia) balanina									X				
		Sarcophaga (Liopygia) crassipalpis		X				X	X		X			X	X
		Sarcophaga (Lipygia) cultellata							X						
		Sarcophaga (Heteronychia) filia									X				
		Sarcophaga (Helicophagella) hirticus					X	X			X				
		Sarcophaga (Liosarcophaga) jacobsoni						X	X					X	
		Sarcophaga (Heteronychia) javita									X				
		Sarcophaga (Liosarcophaga) marshalli										X			
		Sarcophaga (Liosarcophaga) tibialis	X	X	X		X	X	X		X	X			X
		Sarcophila sp.		X			X	X	X	X	X	X		X	X
		Not Identified		X	X		X		X	X	X	X	X	X	X
		Ravinia pernix						X							
	Scatophagidae	Not identified					X	X	X				X		
	Sphaeroceridae	Not identified	X	X			X	X		X	X			X	
Coleoptera	Anthicidae	Not identified		X			X	X			X	X	X		X
	Carabidae	Not identified					X								
	Chrysomelidae	Not identified					X				X				
	Clambidae	Not identified							X						
	Cleridae	*Necrobia rufipes*		X					X	X	X		X	X	X
	Coccinellidae	Not identified					X			X	X				
	Corylophidae	*Sericoderus lateralis*				X			X	X			X	X	
	Cryptophagidae	Not identified			X				X	X				X	
	Curculionidae	Not identified				X			X						X
	Dermestidae	*Attagenus obtusus*		X											
		Dermestes frischii		X			X	X	X	X	X	X		X	X
	Elateridae	Not identified					X							X	X
	Geotrupidae	Not identified									X				
	Histeridae	*Carcinops pumilio*										X			
		Histerini sp					X								
		Saprinus chalcites						X						X	X
		Saprinus furvus					X	X			X	X			X
		Saprinus maculatus						X							X
		Saprinus niger							X		X				
		Saprinus politus							X	X					
		Saprinus semistriatus					X	X	X			X			X

Table 1 (continued)

Order	Family	Species	Fresh				Decomposition				Advanced decomposition				SK
			SP	SU	F	W	SP	SU	F	W	SP	SU	F	W	SU
	Nitidulidae	Not identified					X		X	X	X		X	X	X
	Ptinidae	Not identified					X								
	Scarabaeidae	*Aphodius sp*								X					
		Not identified					X	X							
	Silphidae	Not identified											X		
	Silvanidae	Not identified											X		
	Staphylinidae	Not identified		X			X	X	X	X	X	X	X	X	X
	Tenebrionidae	*Gonocephalum sp*											X		
		Stenopsis sp			X							X			X
		Tentyria sp						X				X			X
		Not identified	X				X	X	X		X		X	X	X
Hymen-optera	Apoidea	Not identified													X
	Bethylidae	Not identified		X				X			X				X
	Braconidae	Not identified	X				X	X	X	X	X	X	X		X
	Ceraphronidae	Not identified									X				
	Chalcididae	Not identified						X	X						X
	Crabronidae	Not identified									X				
	Diapriidae	Not identified	X				X	X	X	X	X	X	X	X	X
	Formicidae	*Aphaenogaster iberica*		X	X		X	X	X		X	X		X	X
		Camponotus sylvaticus									X				X
		Cataglyphis ibericus	X	X				X			X	X		X	X
		Lasius niger									X				
		Linepithema humile									X				
		Messor barbarus	X				X	X	X		X	X	X	X	X
		Pheidole pallidula	X	X	X	X	X	X	X	X	X	X	X	X	X
		Plagiolepis pygmaea					X				X				
		Plagiolepis schmitzii	X				X	X			X	X		X	X
		Plagiolepis xene									X				
		Pyramica membranifera									X	X			
		Solenopsis sp									X				X
	Encyrtidae	Not identified					X	X	X	X	X	X	X		X
	Eucoilidae	Not identified									X				
	Eulophidae	Not identified									X				
	Ichneumonidae	Not identified									X				
	Macromeridae	Not identified		X				X			X	X			X
	Methocidae	Not identified									X				X
	Mymaridae	*Alaptus sp.*					X		X	X		X	X	X	X
		Alaptus pallidicornis												X	
		Anagrus atomus								X					
		Camptoptera sp								X		X		X	
		Erythmelus panis									X				
		Gonatocerus litoralis					X				X				
		Polynema sp					X			X	X				
		Stethynium triclavatum										X			
	Pemphredonidae	Not identified					X								
	Philantidae	Not identified						X							
	Pompilidae	Not identified									X	X			
	Proctotrypidae	Not identified									X				
	Scelionidae	Not identified				X	X	X	X		X	X			
	Vespidae	*Pollistes sp*		X											
		Vespula sp			X				X				X		
		Not identified									X				
Psoc-optera	Caeciliusidae	*Caecilius flavidus*									X				
	Ectopsocidae	*Ectopsocus sp*	X					X	X	X	X			X	X
		Ectopsocus briggsi					X				X				X
	Lachesillidae	*Lachesilla pedicularia*	X				X		X	X	X		X	X	X
		Lachesilla quercus				X				X	X			X	

Table 1 (continued)

Order	Family	Species	Fresh				Decomposition				Advanced decomposition				SK
			SP	SU	F	W	SP	SU	F	W	SP	SU	F	W	SU
	Liposcelididae	*Liposcelis sp*							X	X	X		X	X	X
	Psyllipsocidae	*Dorypteryx sp*			X						X				
	Trichopsocidae	*Trichopsocus dalii*					X				X				
Thysan-optera	Aeolothripidae	*Aeolothrips teunicornis*	X												
	Phlaeothripidae	*Haplothrips rivnayi*	X												
	Thripidae	*Anaphothrips sudanensis*						X	X						X
		Chirothrips aculeatus								X	X				
		Chirothrips manicatus					X				X				
		Eremiothrips manolachei							X						
		Frankliniella intonsa									X				
		Frankliniella occidentalis					X				X				
		Limothrips angulicornis	X				X				X				
		Odothrips ignobilis					X								
		Pseudodendrothrips mori											X		
		Scolothrips longicornis						X			X				
		Tenothrips discolor		X							X		X		
		Thrips tabaci					X		X	X	X	X	X	X	X
Collem-bola		Not identified	X	X	X	X	X	X	X	X	X	X	X	X	X
Zygen-toma	Lepismatidae	Not identified			X										X
	Zygentoma	Not identified							X						
Lepid-optera		Not identified	X				X				X	X		X	X
Embi optera	Embiidae	*Embia sp*	X												
	Oligotomidae	*Haploembia sp*					X			X					
	Embioptera	Not identified						X	X	X					X
Hom-optera	Aphidoidea	Not identified	X		X		X		X		X	X	X	X	X
	Aleyrodidae	Not identified					X				X				X
	Cixiidae	Not identified	X				X								
	Coccidae	Not identified			X						X		X		X
	Jassidae	Not identified	X	X			X	X	X		X	X		X	X
	Psyllidae	Not identified					X		X	X					
Heter-optera	Anthocoridae	Not identified	X				X			X	X		X		
	Cydnidae	Not identified	X				X				X				
	Lygaeidae	Not identified					X				X		X		X
		Geocoris sp								X	X			X	
	Microphysidae	Not identified									X				
	Miridae	Not identified									X			X	X
	Pyrrhocoridae	*Pyrrhocoris apterus*								X	X			X	X
	Reduviidae	*Empicoris sp*									X				
	Tingidae	Not identified									X				
	Ninfas	Not identified										X			X
Derm-aptera	Forficulidae	*Forficula auricularia*					X				X				
	Forficulidae	Not identified												X	
Neur-optera	Coniopterigydae	not identified					X								X
	Myrmeleontidae	Not identified						X			X				
Orth-optera	Acrididae	*Truxalis nasuta*						X							
	Acrididae	Not identified									X				
	Gryllidae	Not identified						X			X	X			X

SP Spring.
SU Summer.
F Fall.
W Winter.
SK Skeletonization.

Table 2 Arthropod groups or taxa other than insects in the different seasons and in every decomposition stage

Order	Family	Species	Fresh				Decomposition				Advanced decomposition				SK
			SP	SU	F	W	SP	SU	F	W	SP	SU	F	W	SU
Araneida	Agelenidae	*Tetrilus arietinus*									X				
		Textrix sp.						X							
		Textrix variegata							X						
		Not identified									X				
	Clubionidae	Not identified								X	X				
	Dictynidae	*Dictyna sp*									X				
	Dysderidae	*Dysdera sp*	X				X		X	X	X				
		Dysdera crocata								X				X	X
	Erigonidae	*Erigone dentichelis*	X				X						X		
		Lessertia dentichelis					X								
		Not identified	X	X	X	X	X		X	X	X	X	X	X	X
	Filistatidae	Not identified									X				
	Gnaphosidae	*Drassodes sp*									X				
		Haplodrassus sp												X	
		Nomisia exornata									X				
		Pterotricha sp					X				X				
		Zelotes sp			X		X			X	X			X	X
		Not identified		X	X		X	X	X	X	X	X	X	X	X
	Lycosidae	*Pardosa sp*			X	X									
		Not identified			X						X		X		
	Mimetidae	*Ero sp.*		X			X								X
	Oecobiidae	*Oecobius cellariorum*			X		X		X	X	X	X	X	X	X
		Oecobius sp													X
		Not identified	X												
	Philodromidae	Not identified		X		X								X	
	Salticidae	*Phlegra fasciata*			X									X	X
		Not identified				X		X	X		X	X	X		X
	Theridiidae	*Enoplognatha sp*								X				X	
		Steatoda sp				X									
		Not identified			X			X			X	X	X	X	X
	Thomisidae	*Xysticus sp*					X							X	
		Xysticus sabulosus												X	
	Titanoecidae	*Titanoeca sp*					X				X			X	
	Uloboridae	*Uloborus sp*							X						
	Zodariidae	*Zodarion sp.*		X				X	X	X	X	X	X	X	X
Acarida	Acaridida	Not identified			X	X			X	X					X
	Actinedida	Not identified	X	X	X	X	X	X	X	X	X	X	X	X	X
	Gamasida	Not identified	X		X	X	X	X	X	X	X			X	X
	Ixodida	Not identified									X				
	Oribatida	*Gallumnatarsipennatum*								X					
		Medioppia pinsapi											X		
		Oribatula tibialis											X		
		Zigoribatula connexa								X					
Isopoda	Porcellionidae	*Acaeroplastes sp*					X				X				X
		Leptotrichus panzeri					X				X				
		Porcellio laevis	X					X			X		X		X
		Porcellio scaber		X				X			X	X	X		X
Scutigero-morpha	Scutigeridae	*Scutigera coleoptrata*						X							X

SP Spring.
SU Summer.
F Fall.
W Winter.
SK Skeletonisation.

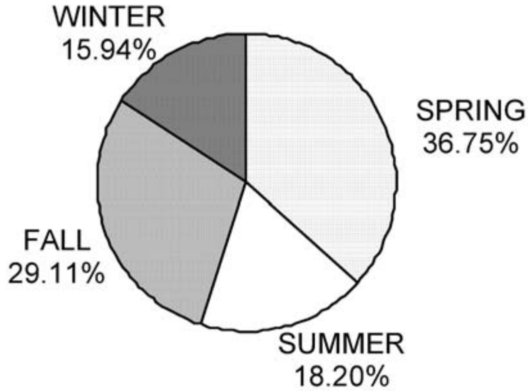

Fig. 1 Total captures in the different seasons expressed as percentages

Table 3 Decomposition stages expressed as the Margalef index value (MI)

Decomposition stages	Spring	Summer	Fall	Winter
F	6.461	6.281	5.287	3.559
D	11.575	9.384	8.360	8.376
AD	14.359	8.170	6.732	8.534
SK	–	10.596	–	–

F Fresh.
D Decomposition.
AD Advanced decomposition.
SK Skeletonisation.

Table 4 Similarity between the different seasons as a whole (total) and between the different decomposition stages as expressed by the quantitative Sorenson's index

Seasons	Quantitative Sorenson index			
	Total	F	D	AD
Spring-Summer	0.409	0.313	0.34	0.107
Spring-Fall	0.24	0.212	0.278	0.174
Spring-Winter	0.285	0.135	0.401	0.217
Summer-Fall	0.296	0.407	0.24	0.177
Summer-Winter	0.313	0.164	0.125	0.246
Fall-Winter	0.421	0.537	0.441	0.34

F fresh.
D decomposition.
AD advanced decomposition.

Capture percentages (Table 5) in the four seasons differed depending on the decomposition stages considered. The fresh stage generally gave lower capture percentages while the values were similar in spring, fall and winter. This result was to be expected due to the short duration of this stage and because this was the period when only necrophagous arthropods took advantage of the corpse. Decomposition and advanced decomposition stages shared higher capture percentages except in summer, a season that constituted an exception to the general trend, since the maximum captures were obtained in the skeletonisation stage.

Table 5 Captures in the different seasons and in every decomposition stage expressed as percentages

Decomposition stages	Season			
	Spring	Summer	Fall	Winter
Fresh	7.30	12.66	7.96	7.16
Decomposition	18.73	19.73	50.06	44.78
Advanced decomposition	73.97	9.62	41.98	48.06
Skeletonisation	–	57.99	–	–

The fresh stage (Tables 1 and 2) was characterised in all seasons by Dipteran Calliphoridae, *Muscina stabulans* (Muscidae), Phoridae and by the Hymenopteran Formicidae, mainly *Pheidole pallidula*. The Calliphoridae species (*Calliphora vicina, Chrysomya albiceps* or *Phaenicia sericata*) varied throughout the year (Arnaldos et al. 2001), thus permitting the season when death occurred to be estimated. It is interesting to highlight the presence of the predatory Erigonidae (Araneida) and the saprophagous or parasitic Acarida.

In the decomposition stage (Tables 1 and 2) more Dipteran groups were present (Sciaridae, Anthomyidae, Calliphoridae, Fannidae, Muscidae as *Muscina stabulans*, Phoridae and Sarcophagidae). Some characteristic Coleoptera appeared (*Dermestes frischii* adults and Staphylinidae). Besides *Pheidole pallidula*, among the Hymenoptera, some parasitoid groups, such as Diapriidae, Braconidae and Encyrtidae, gained in significance.

In the advanced decomposition stage (Tables 1 and 2) the only Diptera common to all seasons were Nematocera, *Muscina stabulans* and Phoridae. Staphylinidae were the only Coleoptera, and Formicidae and Hymenopteran parasitoids continued to be present.

The skeletonisation stage (Tables 1 and 2) was characterised by a great number of Dermestidae adults and larvae, mainly of *Dermestes frischii*, Formicidae (*Pheidole pallidula*) and Acarida. Coleopteran Cleridae and Anthicidae were also present, although less abundant.

Predominant orders

In general, the prevalent orders were Diptera and Hymenoptera, to which may be added Collembola, Acarida and Araneida due to the number of collected specimens. The prevalence of Hymenoptera was due to the presence of Formicidae, which were very numerous because of the kind of recruitment of some species (Martínez et al. 2002). Among these groups, Collembola should be disregarded because they are very common in soil fauna and are not clearly related to corpses. Their presence should be considered as accidental. On the other hand, Coleoptera should be taken into account because, although they were not very numerous, they have a special significance for forensic purposes due to their necrophagous, necrophilous and omnivorous character.

When studying the distribution of these orders in relation to the different decomposition stages it could be seen

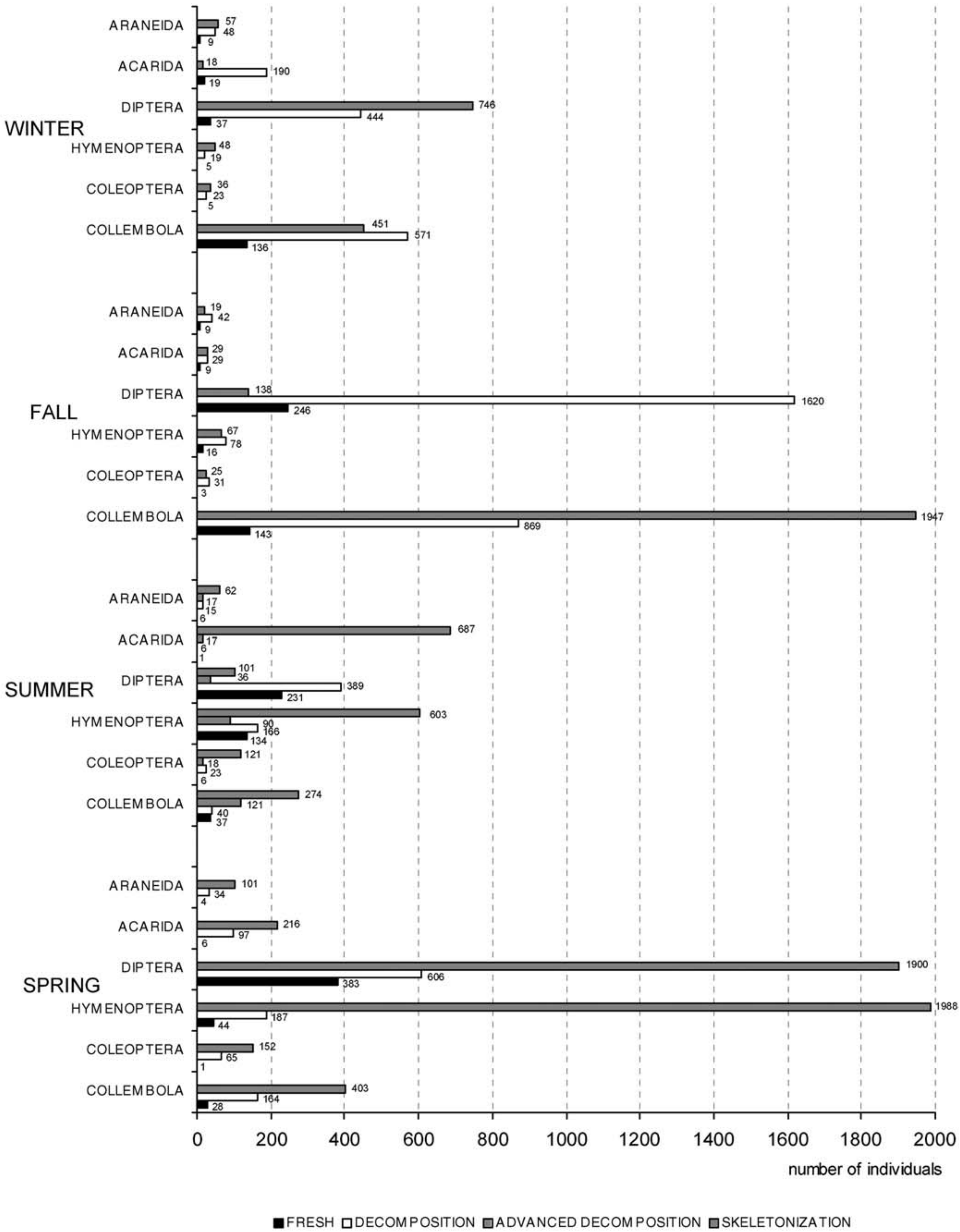

Fig. 2 Number of collected specimens of each of the predominant orders in the different seasons and in every decomposition stage

that in spring (Fig. 2) all the groups were captured in great numbers in the advanced decomposition stage. Hymenoptera, especially Formicidae, and Diptera, were numerous due in the latter case to the emergence of a new adult generation of *Phaenicia sericata* (Calliphoridae) bred in the corpse. This fact shows the importance of taking into account a possible second generation of adults bred in the corpse when trying to estimate the postmortem interval in forensic practice.

In summer (Fig. 2) the general trend was for specimens to be captured in the skeletonisation stage, because the different stages were so short, except for Diptera which were collected mostly in the decomposition stage.

In fall (Fig. 2), when the decomposition stage tended to be longer, almost all the groups were prevalent including Coleoptera, which were slightly more abundant than in the advanced decomposition stage. In winter (Fig. 2), Diptera and Collembola were the most abundant groups. Coleoptera and Diptera were prevalent in the advanced decomposition stage, the latter due to the emergence of a second adult generation of *Calliphora vicina* (Calliphoridae). This result emphasises once again the importance of a possible second generation bred in the corpse when evaluating the entomological evidence to estimate the postmortem interval.

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