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Symbiotic relationships between silverfish (Zygentoma: Lepismatidae, Nicoletiidae) and ants (Hymenoptera: Formicidae) in the Western Palaearctic. A quantitative analysis of data from Spain

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Abstract

A large dataset of various associations between silverfish (order Zygentoma) and Formicidae is presented; this was obtained from samples collected across continental Spain. Associations have been detected in 693 ant nests of 14 different genera of Formicidae, hosting two species of Zygentoma belonging to the family Nicoletiidae (subfamily Atelurinae) and 17 species of Lepismatidae (subfamily Lepismatinae). A high diversity of interactions has been found: Overall, 157 different associations (species of Zygentoma – species of Formicidae) have been recorded. Comparing our data with the existent literature, 41 of these pairs are reported here for the first time.

A quantitative criterion is being followed to classify taxa of Spanish Zygentoma occurring in ant nests. According to their obligateness, three groups are distinguished: xenomyrmecophiles, occasional and strict myrmecophiles and, in the latter, at least two degrees of host specificity: generalist and specialist species. A cladogram of Spanish Lepismatinae places specialist silverfish as the more apomorphic taxa.

Moreover, the number and type of guest species of the most frequent ant genera and the number of individuals and species per nest have been compared and the Zygentoma-Formicidae quantitative network has been analysed. In conclusion, more than one mode of association occurs between Zygentoma and Formicidae in the Western Palaearctic. Nests of *Messor* FOREL, 1890 host a lot of species of silverfish, most of which are specialists that have likely developed a higher level of integration and are far from strict parasites. A second group of associations is represented by several common ant genera such as *Camponotus* MAYR, 1861, or *Formica* LINNAEUS, 1758, which mostly host a few species of myrmecophilous Zygentoma (those that are considered generalists). The position of *Aphaenogaster* MAYR, 1853, is intermediate between these two opposite groups. In the latter two groups, silverfish are likely parasites.

Key words: Zygentoma, Lepismatidae, Thysanura, Formicidae, myrmecophiles, symbiotic relationships, Western Palaearctic, Spain.

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Introduction

It is generally known that several species of silverfish (Zygentoma = Thysanura s. str.) live in association with ant colonies (WASMANN 1894, WHEELER 1910, WILSON 1975). Already in the 19th century, the silverfish-ant association was documented; *Atelura formicaria* HEYDEN, 1855 was the first species of myrmecophilous Zygentoma that was described on the basis of specimens that were found with ants, specifically with *Tetramorium caespitum* (LINNAEUS, 1758).

Two families of silverfish include myrmecophilous species: Nicoletiidae and Lepismatidae. Inside the first one, only species of the subfamily Atelurinae are usually associated with ants or termites (PACLT 1963, KISTNER 1982). Compared with tropical regions, the diversity of Atelurinae in the Palaearctic is very poor; only two genera are widespread: *Atelura* HEYDEN, 1855 and *Proatelurina* PACLT, 1963, both of them represented by one species in Spain. On the other hand, several species of Lepismatidae are reported to live with ants (PACLT 1967, MENDES 1987), most of them belonging to three subfamilies: Mirolepismatinae, Acrotelsatinae and Lepismatinae. The first is centred in America and two of its genera (*Prolepismina*

Tab. 1: Classification of Zygentoma in terms of their association with ants. Thw groups in MENDES (1987) are compared to the groups that are established in this work using quantitative criteria. The criteria of our classification are given in the Table, with the criteria of Mendes being described in the text.

Mendes' groups	**New groups**	**Quantitative criterion used**	**Biological characteristics of the group**
a. Xenomyrmecophiles	A. Xenomyrmecophiles	The absence of association with ants is significant in a binomial test.	These species live in different habitats but they are found in ant nests rarely.
	B. Occasional (or facultative) myrmecophiles	Both absence and presence with ants are not significant in a binomial test.	This group includes species with a more marked tendency to live inside ant nests, but they can be found often without relation with ants. When living with ants, they usually do not show preference for one ant genus (they can be considered as generalists).
	C. Strict myrmecophiles (=Myrmecophiles)	The association with ants is significant in a binomial test.	These species live usually inside ant nests and develop ethologic and morphologic adaptations to live with ants.
b. Panmyrmecophiles	C.1. Generalists	The percentage of associations with any genus of ants is less than 70% of the total interactions that are registered for the species.	These species are strict myrmecophiles, but do not show a marked preference for one genus of ants; they live with many ant genera (but not with all of them, as suggested by the denomination "panmyrmecophiles").
c. Symphiles	C.2. Specialists	The percentage of associations with only one genus of ants is greater than 70% of the total associations that are registered for the species.	These species are strict myrmecophiles, show a clear preference for a genus of ants, and live always or nearly always in the nests of one genus. The term "Symphiles" is not adequate because, according to Wasmann's criteria (WASMANN 1894), it implies a concrete type of association that does not match with the silverfish establishment with ants.

Fig. 1: An interaction of a *Messor structor* worker facing the silverfish *Neoasterolepisma spectabilis*, a frequent guest in *Messor* nests, with no evidence of aggressive behaviour by the ant. Photograph by R. Molero-Baltanás, obtained in Lucena (Córdoba), Spain.

SILVESTRI, 1940 and *Mirolepisma* SILVESTRI, 1938) are usually found with ants. This is also the case of the deserticolous genus *Lepismina* GERVAIS, 1844 (subfamily Acrotelsatinae). However, most references in the literature correspond to Lepismatinae, with more than 30 species of myrmecophiles. Lepismatinae associated with ants have been found in the Afrotropical Region and in the poorly studied Oriental and East Palaearctic Regions (MENDES 1988); they are well represented in the Mediterranean basin and are particularly diverse in Spain, with 18 species in the Iberian Peninsula (MOLERO-BALTANÁS & al. 2002). Because the relationship of Lepismatinae with ants has been poorly studied, this paper gives a greater emphasis on this group (Fig. 1).

The information provided in the literature about the biological aspects of the relationship between ants and silverfish is scant. A lot of species are rarely reported with ants, and in these cases, nothing can be concluded. With the scarce data available, MENDES (1987) established a classification of Zygentoma species depending on their obligateness and host specificity, distinguishing three groups of Zygentoma: "Xenomyrmécophiles" (or "Myrmecoxenes", i.e., usually absent from ant nests), "Panmyrmécophiles" or "Myrmécophiles s.l." (i.e., usually found with ants belonging to any taxon) and "Symphiles". Inside the latter group, which includes host-specific species, Mendes established several subdivisions according to the ant group with which they are associated. This classification was based on qualitative considerations and supported by a quite limited number of samples and observations. Although derived from Mendes' classification, the division proposed in this work is based on quantitative criteria and distinguishes the following groups: true xenomyrmecophiles, occasional myrmecophiles and strict myrmecophiles; inside this last group, there are generalist and specialist species. The correspondence between Mendes' groups and ours and the criteria for this classification are presented in Table 1.

From the point of view of the type of these associations, several classifications have been proposed, such as the classical division made by WASMANN (1894) and followed by BERNARD (1968) or those presented by WILSON (1975) and HÖLLDOBLER & WILSON (1990). Summarising the categories presented by these authors, we can distinguish mutualism, in which both members benefit, from antagonistic relationships (predation or parasitism). An intermediate category, commensalism, can be created for those guests that do not harm or benefit the ants. However, some associations do not fit completely in any of the categories and a special one must be created for a particular relationship (LE MASNE 1994).

Concerning the biology of myrmecophilous Zygentoma, most of the information found in the literature is restricted to the taxon of the ants which silverfish are associated with. The scarce concrete information available had led to some authors considering silverfish to be either parasites or commensals.

The option of parasitism is supported by the observations of JANET (1896) and WITTE & al. (2009), based on species of the subfamily Atelurinae: the European *Atelura formicaria* with *Lasius umbratus* (NYLANDER, 1846) and the Malaysian *Malayatelura ponerophila* MENDES, VON BEEREN & WITTE, 2011, with *Leptogenys distinguenda* (EMERY, 1887). Both authors reported that these silverfish rob the ants of part of the nutritional drops that they exchange and avoid the aggression of ants by escaping quickly (*Atelura*) or by using imperfect chemical camouflage (*Malayatelura*).

In contrast, the observations of RETTENMEYER (1963) on another Atelurinae, the American *Trichatelura manni* (CAUDELL, 1925) with *Eciton* spp. LATREILLE, 1804, suggest that at least in some cases, some silverfish could behave as commensals or even provide some services to the colony. WILSON (1975) considered that silverfish would be considered commensals, designating their relationship "nest commensalism". Moreover, SILVESTRI (1912), PACLT (1956), BERNARD (1968) and MENDES (1987) agree with this hypothesis and even the possibility of emerging mutualistic associations, but do not support this with experimental evidence, so antagonism is currently assumed as the most likely option "by default".

As each of the aforementioned authors proposed only one type of relationship, none of them raised the possibility that, as myrmecophilous Zygentoma and ants are diverse groups with diverse biology, there could be different modes of association. However, during a sampling of silverfish fauna performed across the Spanish territory (carried out mainly during the period 1986 - 1994 for the "Fauna Ibérica" Project), we noticed that this hypothesis could be confirmed. An important dataset of all the myrmecophilous silverfish of the Spanish fauna was obtained, allowing us to perform an extensive analysis. The first target of this analysis is identifying which Zygentoma-Formicidae associations occur in Spain and compare this information with previously published data to determine which ones are reported for the first time. After this, we aim to classify Zygentoma species in relation to their association with ants (degree of myrmecophily and host specificity) on the basis of a quantitative criterion, distinguishing between occasional and strict myrmecophiles and, within this group, to identify generalist and specialist taxa. We also intend to check whether these groups correspond with monophyletic clusters in order to glimpse how myrmecophily evolved inside West-Palaearctic Lepismatinae. Moreover, the quantitative analysis of this dataset is used to discriminate whether all the ant-silverfish associations in Spain are similar (all considered as parasitism?) or if there is more than one mode of interaction (interpreted as commensalism or mutualism?). Presenting and analysing the network pattern of the associations between Zygentoma and ants in Spain can clarify the aforementioned question and provide a network pattern that can be compared with other ecological networks.

Material and methods

Three groups of data are considered in this work. The first group comes from the literature referring to silverfish-ants associations in the West-Palaearctic region, including 225 reports. Only those works performed by Zygentoma specialists have been considered (a lot of misidentifications have been detected in the remaining papers). A list of these works is presented in the references section of Appendix S1 (as digital supplementary material to this article, at the journal's web pages); from these, we have accounted only those reports where ants were identified. These reports have not been used to add their data to our quantitative analysis because they are not comparable in terms of sampling methods; however, they are used to support our conclusions.

A second group of data includes published data from our own samplings in continental Spain and the Balearic Islands (reported in papers detailed in Tabs. S1.1 - S1.73 in Appendix S1).

Finally, a third group includes unpublished data from our own samplings in the same territory; this subset of data comes from an unpublished PhD thesis by one of the authors (R.M.B.) and are treated here as new data (and detailed in Appendix S1). The two latter groups of data are now joined together to form a dataset that is used for a quantitative analysis.

The three groups of data are considered together in Appendix S1 (Tabs. S1.1 to S1.73) and in some parts of the Discussion section to generalise our conclusions.

Our sampling scheme includes more than 1000 localities and several thousands of ant colonies, homogenously covering all regions of Spain; for a map, see MOLERO-BALTANÁS & al. (2002). The sampling was carried out to identify all of the taxa of silverfish of the Spanish fauna from all of the habitats where they can occur. For this reason, all types of habitats were examined, including ant nests. Silverfish were mostly found under stones, but also in vegetal debris, trunks of trees, human dwellings, caves, soil, etc. Habitats with different ecological conditions and different anthropogenic modification intensities were inspected (urban environments, agroecosystems, autochthonous oak-trees and introduced pine forests, semiarid shrubland, plains, mountains, etc.). All of the sampling was performed by the same individual, taking the same time (1 hour) in each locality; although performed in all seasons of the year, the experience suggested concentrating the efforts in the Northern parts of Spain during the period from May to September.

Most samples were obtained more than 20 years ago, but the ecological conditions have not significantly changed (R. Molero-Baltanás, unpubl.) and, with regard to the aims of this work, the results of the samples are representative of the present situation.

In each site, myrmecophilous silverfish were usually found under stones that cover ant nests and were caught with an aspirator together with some worker ants of the same nest. When the number of silverfish was high, it was

Tab. 2: Detailed data registered in Spain on the Zygentoma-Formicidae association. Data correspond to the number of nests of each genus of ants where each species of Zygentoma was found (834 associations in 677 nests where silverfish were identified at species level are accounted). This is a synthesis of Table S2.1 given in Appendix S2, after grouping data of each genus of ants. Acronyms of Zygentoma species see Table 4. Abbreviations of ant genera: Aph: *Aphaenogaster*. Bot: *Bothriomyrmex*. Cam: *Camponotus*. Cre: *Crematogaster*. For: *Formica*. Las: *Lasius.* Lin: *Linepithema*. Mes: *Messor*. Phe: *Pheidole*. Pla: *Plagiolepis*. Tap: *Tapinoma.* Tem: *Temnothorax.* Tet: *Tetramorium*. N: Total number of associations for each row (ant genus) or column (Zygentoma species).

		Zygentoma																			
		Av	Pp	Lb	Lc	Ls	Nb	Ncr	Ncu	Nd	Nf	Ng	Nh	Nl	Np	Nso	Nsp	Nw	Ta	Ti	N
Formicidae	Aph	2	18	1	1	2	0	1	19	6	1	0	13	1	6	0	3	3	0	0	77
	Bot	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Cam	2	37	0	1	0	0	1	37	1	0	0	1	2	3	0	2	5	0	2	94
	Cat	0	1	0	0	0	0	0	11	0	0	0	0	0	0	0	1	0	0	0	13
	Cre	0	0	3	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	8
	For	0	9	0	0	0	0	0	29	0	0	0	0	2	2	0	0	0	0	0	42
	Las	1	14	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	19
	Lin	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Mes	2	49	0	1	1	7	53	35	1	41	14	0	57	1	12	143	40	4	0	461
	Phe	0	44	2	9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	56
	Pla	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Tap	0	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	Tem	0	2	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	6
	Tet	1	26	3	11	2	0	0	0	0	0	0	0	0	0	0	0	1	1	0	45
	N	8	211	11	29	6	7	55	132	8	42	14	15	64	13	12	150	50	5	2	834

not possible to collect all of the specimens from the nest, so the total number of hosted Zygentoma was not estimated. However, it can be considered that the sampling was homogeneous and the obtained data are comparable because all of the samples were obtained in the same way: In each case, the number of insects that were caught was the maximum possible within the constraints. Apart from the 693 nests where Zygentoma were found, many additional colonies were investigated, but data did not account for those where silverfish were not detected. From the aforementioned 693 nests, 16 were discarded for some analysis because Zygentoma could not be identified at species level.

An independent sampling where all ant nests were accounted was designed to test whether the ants preferred by silverfish are usually the most abundant or not. Initial results from eight sampling sites are shown in Appendix S2. This information suggests that silverfish prefer several genera of ants, and supports our sampling method: Since there is no evident relation between the number of nests of an ant genus and the number of these nests inhabited by silverfish, it is not necessary for our aims to account the total number of nests without Zygentoma. We have made the reasonable assumption that most frequent ant taxa (grouped by genus) are abundant enough in most localities to be available for silverfish, and these have the choice, influenced by their requirements and by the biology of the different types of ants, but not by the relative frequency of these types.

More than one species of silverfish cohabited in a significant proportion of the sampled nests where silverfish were found; this fact (known as parabiosis) has led each Zygentoma-ant couple to be considered a different association. For example, if three species of Lepismatidae were collected in the same ant nest, this situation was treated as one sample but with three different associations. As an illustrative example, 320 nests of the genus *Messor* hosted silverfish, but 461 associations were registered. The samples in which it was not possible to identify the Zygentoma at the species level were not included in Tables 2 and S2.1 (see Appendix S2), but they were considered in Table 5 and the subsequent analyses.

The identification of silverfish was carried out following the keys of MENDES (1988) and papers on taxonomic problems solved after publication of these keys (these papers, detailed in Table S1.73 in Appendix S1, established some new synonyms or even some new taxa). The identification of ants was based on the use of Collingwood's keys (COLLINGWOOD 1979, COLLINGWOOD & PRINCE 1998) and also the experience of one of the authors (A.T.). The studied material is deposited in the Departamento de Zoología, University of Córdoba, with the exception of the types of the new species of silverfish, which are deposited in the Museo Nacional de Ciencias Naturales (MNCN) in Madrid.

Once the ants and silverfish were identified, several statistical analyses were performed. Formicidae species were cross-tabulated together with the Zygentoma species hosted by them (see Table S2.1 in Appendix S2) and from this contingency table, a correspondence analysis was carried out using the ca package in R developed by NENADIĆ & GREENACRE (2007). To avoid the abundance of zeros in the contingency table, a similar analysis was performed after considering the genera instead of ant species (Tab. 2). More reasons to support why Formicidae species were grouped by genus are provided in Appendix S2.

To determine the fidelity of silverfish, Bonferroni corrected binomial tests were carried out for each genus and for each species of Zygentoma occurring in Spain; these tests allow the distinction between xenomyrmecophile taxa and those that can be considered occasional or strict myrmecophiles, particularly when the number of samples is sufficiently high. When the number of samples was not high enough (few infrequent taxa or data from the literature), we used the criterion to consider a species a xenomyrmecophile if ants were found in less than 10% of the samples, and a strict myrmecophile if more than 75% of the samples came from ant nests. Inside strict myrmecophiles, generalist and specialist species were separated following the criterion presented in Table 1.

With the intention to test if these groups are congruent with the evolutionary relationships of silverfish, a cladogram based on 24 morphologic characters (details of these characters and their states are provided in Appendix S3) was constructed with 20 species of Spanish Lepismatinae, using a xenomyrmecophile species as an outgroup. We decided to include species from the Canary Islands since they are well known by the authors and may help clarifying the evolutionary issues of this group in the Western Palaearctic region. Atelurinae were excluded from this analysis because this subfamily has an independent evolutionary origin and is poorly diversified in the studied region. Mesquite (MADDISON & MADDISON 2014) was the program used for this aim.

To compare the tolerance of different ant genera, several parameters of the associations were tested: Pearson chi-square tests and Bonferroni correction for the contrast of the difference of proportions and General Linear Model with Bonferroni multiple comparisons test to compare the mean number of silverfish per ant nest.

Program R (R CORE TEAM 2015) was used to perform all statistical tests and make related graphics. The bipartite package in R (DORMANN & al. 2008) was also used to obtain a plot of the bipartite network Zygentoma-Formicidae in continental Spain and calculate some parameters of this network, as well as some specialisation indexes of individual species.

Results

New data of the relationships between Zygentoma and ants in Spain. Results of the new samplings compared with existing literature

In our samplings in Spain from 1986 - 1994, 693 ant nests of 40 species belonging to 15 different genera of Formicidae (Fig. 2) were found, hosting 22 different species of Zygentoma: 2 Atelurinae, 19 Lepismatinae and 1 Coletiniinae, approximately 50% of the known taxa of this order in Spain (Tab. 2 and S2.1 in Appendix S2). Parabiosis has been detected in about 19% of the sampled nests where silverfish were found. The total number of associations of Zygentoma with ants is 834. During these samplings, more than 1000 samples of Zygentoma were gathered in other habitats, without any relation with ants (and in more than 4000 ant colonies, silverfish were not found).

Table S2.1 (Appendix S2) presents the ant-Zygentoma associations that were detected in our samplings, and Tables S1.1 to S1.72 (Appendix S1) compare these data with those documented in the literature, indicating those rela-

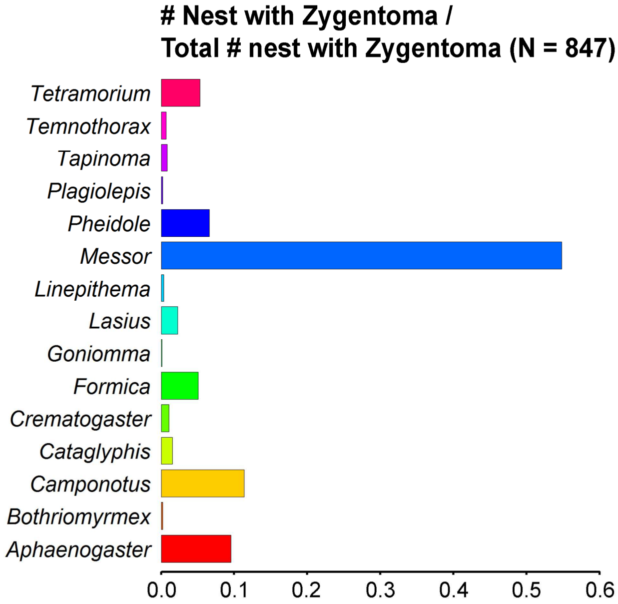

Fig. 2: Bar chart showing the frequencies of samples of the different genera of Formicidae hosting Zygentoma in Spain (these frequencies are relative to total number of nests with Zygentoma; nests without silverfish were not accounted).

tionships that are new (reported for the first time). Moreover, all of the data of the associations that have not been previously published are detailed in Appendix S1. In the Western Palaearctic, at least 51 species of 17 genera of ants have been detected, hosting at least 26 species of Zygentoma. A total of 193 different associations are reported; overall, 152 were previously known and 41 are cited for the first time. Moreover, 116 of the previously known relationships have been confirmed by our samplings in Spain.

Table 2 (and S2.1 in Appendix S2) also show that the greater proportion of associations corresponds to Lepismatinae of the genus *Neoasterolepisma* and to ants of the genus *Messor*. The number of associations of *Proatelurina* is also notable, within the Atelurinae. Table 2, grouping ant taxa by genus, is used for most of the subsequent analyses.

Classification of Spanish species of Zygentoma according to their fidelity to ants

Genus level

In Table 3, the number of samples of each genus of Spanish Zygentoma that were found with and without Formicidae is detailed. Using binomial tests with Bonferroni correction, we conclude that the genera *Neoasterolepisma* and *Tricholepisma* PACLT, 1967, as well as the two of Atelurinae, are strict myrmecophiles; the remaining genera can be considered xenomyrmecophiles.

Species level

Table 4 includes the classification of most Spanish species in the categories mentioned in the introduction and justified in Table 1. Some silverfish of the different groups proposed are illustrated in Figures 3 - 7 and a diagram with three bar charts of the most representative groups of strict myrmecophiles is presented (Fig. 8) showing their frequencies of occurrence with different ant genera. This

Figs. 3 - 7: Five species of Spanish silverfish classified in different categories according with their relationship with ants: (3) *Allacrotelsa kraepelini*, a xenomyrmecophile. (4) *Lepisma baetica*, an occasional myrmecophile. (5) *Proatelurina pseudolepisma*, a generalist. (6) *Neoasterolepisma delator*, an *Aphaenogaster* specialist. (7) *Neoasterolepisma lusitana*, a *Messor* specialist. Body lengths of specimens ranging from 5.5 mm in (4) and (5) to 10 mm in (3). Most silverfish species are not distinguishable without microscopic study.

Tab. 3: Data for the classification of Zygentoma genera of the Spanish fauna according to their association with ants. Results of the Binomial test with Bonferroni multiple comparison correction for each genus. The three last lines also detail the results for each species of the genus *Lepisma*. NS: number of samples that were studied for each genus of Zygentoma. WF: number of samples that were found with Formicidae. NF: number of samples without ants (found in other habitats). %WF: percentage of samples with ants with respect to the total of samples of Zygentoma of each genus. %NF: percentage of samples without ants. z: probability value as calculated by the binomial test. Sig: significance level associated with the z parameter. Explanation of the results in the text.

Zygentoma genera / *Lepisma* species	**NS**	**WF**	**NF**	**%WF**	**%NF**	**z**	**Sig**	**Classification**
Atelura	9	8	1	88.89	11.11			Strict myrmecophile
Proatelurina	234	210	24	89.74	10.26	12.16	<1E-10	Strict myrmecophile
Allacrotelsa	38	1	37	2.63	97.37	-5.84	1.14E-09	Xenomyrmecophile
Ctenolepisma	813	2	811	0.25	99.75	-28.37	<1E-10	Xenomyrmecophile
Neoasterolepisma	612	580	32	94.77	5.23	22.15	<1E-10	Strict myrmecophile
Tricholepisma	7	7	0	100.00	0.00			Strict myrmecophile
Coletinia	5	1	4	20.00	80.00			Xenomyrmecophile or Occasional myrmecophile
Lepisma	195	46	149	23.59	76.41	-7.38	<1E-10	Xenomyrmecophile
L. baetica	30	11	19	36.67	63.33	-1.46	0.30	Occasional myrmecophile
L. chlorosoma	57	29	28	50.88	49.12	0.13	1.00	Occasional myrmecophile
L. saccharina	108	6	102	5.56	94.44	-9.24	<1E-10	Xenomyrmecophile

Tab. 4: Silverfish species analysed and their acronyms used in this work. The column "myrmecophile category" assigns a classification for each species. Genus degree is the number of genera of ants linked with each species (the number in brackets indicates the number of genera where the association was observed more than once). SSI: species specificity index; d': weighted specialisation index for individual species. Species where these indexes are not calculated are those that are not included in the network because they are not Iberian (marked with *), they are xenomyrmecophiles or the number of available data is very low (? in the classification column). Authors of species that are not mentioned in the text are also indicated.

Species	**Acro-nym**	**Myrmecophile category**	**Genus degree**	**SSI**	**d'**
Allacrotelsa kraepelini (ESCHERICH, 1905)	–	Xenomyrmecophile	–	–	–
Atelura valenciana MOLERO-BALTANÁS, GAJU-RICART, BACH DE ROCA & MENDES, 1998	Av	Generalist	5 (3)	0.398	0.086
Lepisma baetica MOLERO-BALTANÁS, GAJU-RICART, BACH DE ROCA & MENDES, 1994	Lb	Occasional	5 (4)	0.404	0.478
Lepisma chlorosoma LUCAS, 1846	Lc	Occasional	8 (3)	0.457	0.454
Lepisma saccharina LINNAEUS, 1758	Ls	Xenomyrmecophile	–	–	–
Neoasterolepisma balearica MOLERO, BACH & GAJU, 1997	Nb	*Messor* specialist	1 (1)	1.000	0.081
Neoasterolepisma crassipes (ESCHERICH, 1905)	Ncr	*Messor* specialist	3 (1)	0.961	0.167
Neoasterolepisma curtiseta MENDES, 1988	Ncu	Generalist	6 (5)	0.406	0.312
Neoasterolepisma delator MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1996	Nd	*Aphaenogaster* specialist	3 (1)	0.750	0.272
Neoasterolepisma foreli (MONIEZ, 1894)	Nf	*Messor* specialist	2 (1)	0.975	0.166
Neoasterolepisma gauthieri ssp. *calva* MOLERO, MENDES, GAJU & BACH, 1994	Ng	*Messor* specialist	1 (1)	1.000	0.127
Neoasterolepisma hesperica MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1996	Nh	*Aphaenogaster* specialist	3 (1)	0.869	0.494
**Neoasterolepisma inexpectata* MENDES, MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1993	–	Xenomyrmecophile / Occasional?	–	–	–
Neoasterolepisma lusitana (WYGODZINSKY, 1941)	Nl	*Messor* specialist	6 (3)	0.883	0.131
**Neoasterolepisma myrmecobia* (SILVESTRI, 1908)	–	Occasional?	–		–
Neoasterolepisma pallida MOLERO-BALTANÁS, GAJU-RICART & BACH DE ROCA, 1995	Np	Generalist?	5 (3)	0.498	0.208
Neoasterolepisma soerenseni (SILVESTRI, 1908)	Nso	*Messor* specialist	1 (1)	1.000	0.120
Neoasterolepisma spectabilis (WYGODZINSKY, 1945)	Nsp	*Messor* specialist	5 (3)	0.950	0.262
**Neoasterolepisma vulcana* MENDES, BACH DE ROCA & GAJU-RICART, 1993	–	Xenomyrmecophile / Occasional?	–		
Neoasterolepisma wasmanni (MONIEZ, 1894)	Nw	*Messor* specialist	5 (3)	0.792	0.074
Proatelurina pseudolepisma (GRASSI & ROVELLI, 1890)	Pp	Generalist	13 (10)	0.307	0.241
Tricholepisma aurea (DUFOUR, 1831)	Ta	*Messor* specialist	2 (1)	0.810	0.050
Tricholepisma indalica MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1995	Ti	*Camponotus* specialist?	–	–	–

classification is also supported by binomial tests, correspondence analyses (Fig. 9) and the criterion to distinguish generalist from specialist species agrees with the species specificity index (SSI) calculated with the R bipartite package (DORMANN & al. 2008).

Occasional myrmecophiles. Binomial tests carried out at the species level gave similar results to those for silverfish genera, except for the genus *Lepisma* LINNAEUS, 1758. When species of this genus are studied separately (as shown in the three last lines of Tab. 3), heterogeneous trends can be detected: whereas *L. saccharina* LINNAEUS, 1758, shows a low percentage of association with ants (5.5%), *L. baetica* MOLERO-BALTANÁS, GAJU-RICART, BACH DE ROCA & MENDES, 1994, and particularly *L. chlorosoma* LUCAS, 1846, are associated with higher frequencies (36.7 and 52.5%, respectively). It can be con-

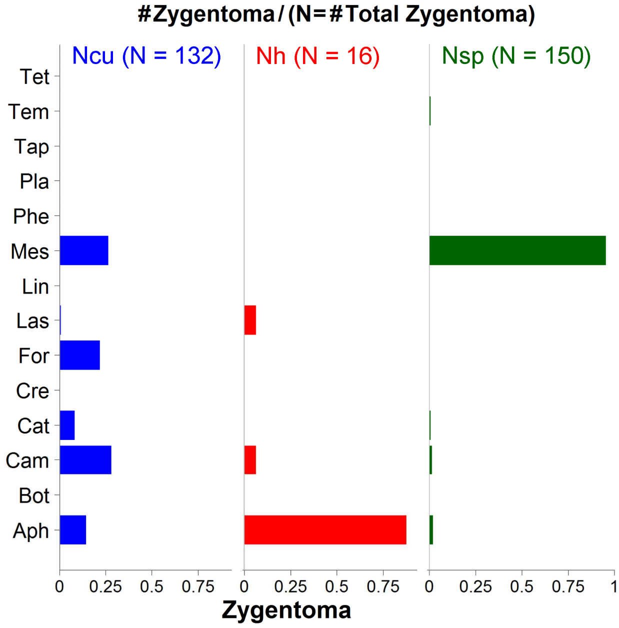

Fig. 8: Bar chart representing the proportions of association of three species of strict myrmecophiles, *Neoasterolepisma curtiseta* (Ncu, a generalist species), N. hesperica (Nh, an *Aphaenogaster* specialist), and *N. spectabilis* (Nsp, a *Messor* specialist), with different genera of ants. Proportions are relative to the total number of ant nests where each silverfish species has been found and not to the total number of nests, since this number is not the total of colonies sampled, but only the number of nests hosting silverfish. Moreover, these proportions show the generalist or specialist condition better.

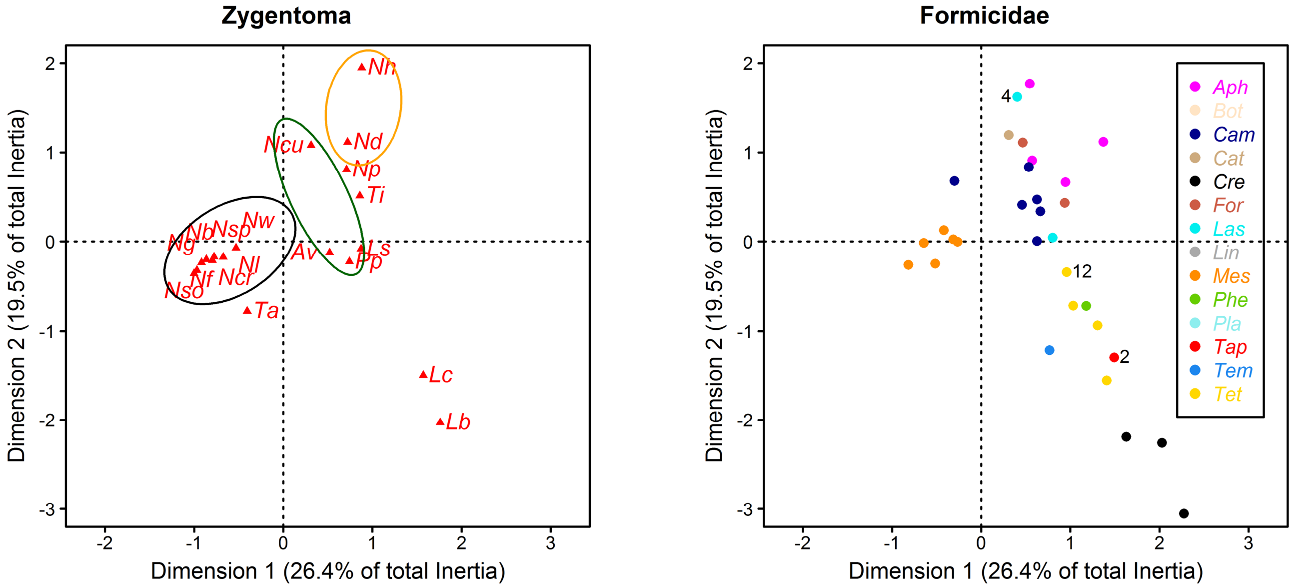

Fig. 9: Left: Plot representing the placement by the correspondence analysis of the different Zygentoma species of the Spanish mainland (acronyms: see Table 4). Groups that the analysis indicates are surrounded with lines: Group 1: *Messor* specialists (black line). Group 2: *Aphaenogaster* specialists (yellow line). Group 3: Generalists (green line). Some occasional myrmecophiles are placed in the bottom right-hand corner. The horizontal axe discriminates *Messor* specialists from the remaining genera and the vertical one discriminates from strict myrmecophiles and occasional species. Right: Plot representing the placement by the correspondence analysis of the different genera and species of ants hosting silverfish. Numbers in the plot indicate the coincidence of several species in the same place. *Messor* ants form a group nearly in the centre of the plot, while the remaining taxa are distributed along the Dimension 2 line of the plot (genera with wider tolerance are placed in the upper part of this line). The axes of both plots can be superimposed to show correspondence with the placements of silverfish species (for example, *Messor* ants are placed in a similar region of the plot as *Messor* specialists). The vertical axe discriminates ants with higher range and frequences of guests (in the top of the map) from those ant taxa with few guests and lower range of silverfish.

cluded that although *L. saccharina* is clearly a xenomyrmecophile, *L. chlorosoma* and *L. baetica* can be classified as occasional myrmecophiles. Therefore, we have included *Lepisma* in the subsequent analyses.

Generalist silverfish. Within strict myrmecophiles, two species of the Iberian fauna can be clearly considered generalists: the Atelurinae *Proatelurina pseudolepisma* (GRASSI & ROVELLI, 1890) and the Lepismatinae *Neoasterolepisma curtiseta* MENDES, 1988 (Fig. 8). The bar chart of preferences of *P. pseudolepisma* (Fig. 11 in MOLERO-BALTANÁS & al. 1998) shows that it can be found with at least 13 different genera of ants. *Neoasterolepisma curtiseta* also inhabits nests of several genera of ants with a high frequency and there is no evident preference for one ant genus.

We can also include *Atelura valenciana* MOLERO-BALTANÁS, GAJU-RICART, BACH DE ROCA & MENDES, 1998 in the group of generalists, but without such a clear statist-

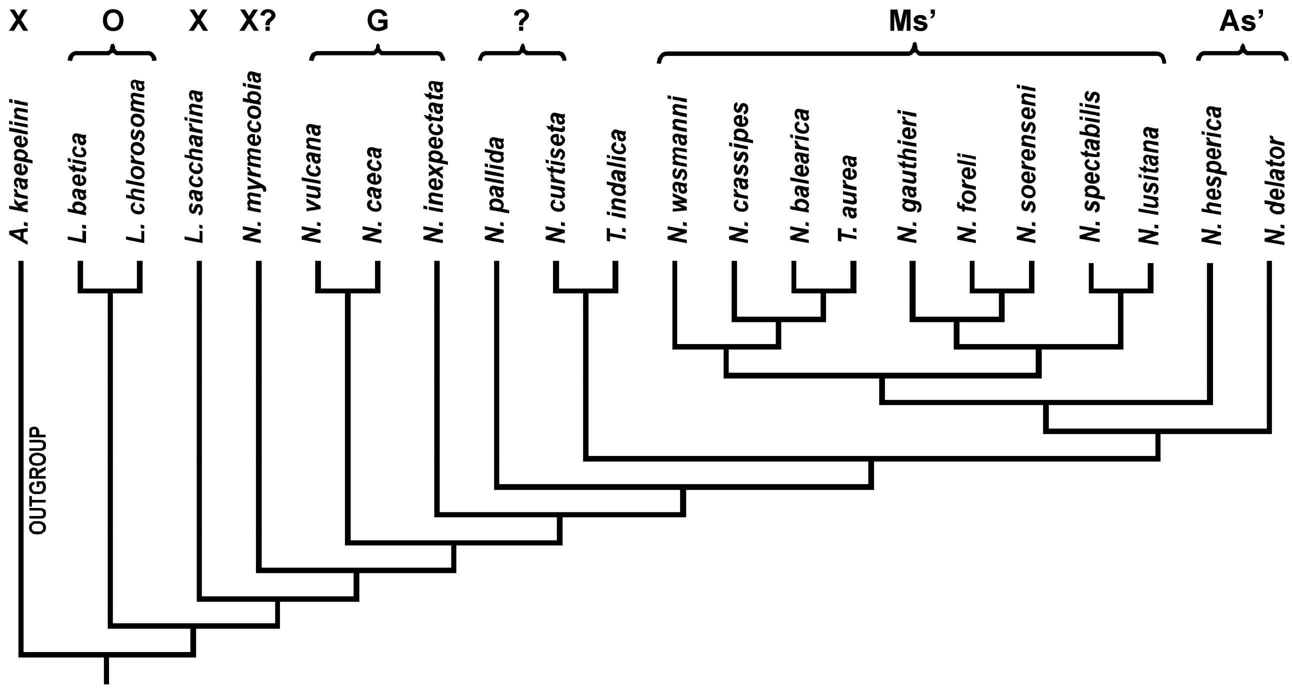

Fig. 10: Cladogram of Spanish Lepismatinae (including species from the Canary Islands and Continental Spain). The morphological characters and their status as considered for the analysis are presented in Appendix S3. X: xenomyrmecophiles. O: occasional myrmecophiles. G: generalist species. As': *Aphaenogaster*-specialists. Ms': *Messor* specialists.

Tab. 5: Data for the comparison of the number of specimens per nest and of the number of species of Zygentoma that were found with different genera of Formicidae. The genera that are marked with (**) are those that have been statistically compared (results in Table 6). Metrics given in columns are self-explanatory. Abbreviations: N.: number; Zyg.: Zygentoma; sp. / spp: species. The number given in brackets in the column of number of species hosted in Spain correspond to the number of additional species in Western Palaearctic.

Ant genera	N. of studied nests	% nests with respect to total N. of nests	N. of spp. hosted in Spain	Total N. of Zyg. specimens found in nests	Mean of N. of Zyg. specimens per nest	Variance of the N. of Zyg. specimens per nest	N. of nests with more than 1 sp. of Zyg.	% of nests with more than 1 sp. of Zyg.
*Aphaenogaster***	76	10.97	14 (2)	230	3.03	8.24	5	6.6
Bothriomyrmex	2	0.29	2 (2)	11	5.50	0.50	0	–
*Camponotus***	87	12.55	12 (3)	243	2.79	5.17	7	8.0
Cataglyphis	13	1.88	3 (1)	59	4.54	45.77	1	8.3
Crematogaster	9	1.30	3 (–)	20	2.22	2.19	0	–
*Formica***	41	5.92	4 (1)	121	2.95	16.60	2	4.9
Goniomma	1	0.14	1 (–)	1	1.00	–	0	–
Lasius	19	2.74	1 (–)	56	2.95	12.72	0	–
Linepithema	3	0.43	6 (1)	20	6.67	65.33	0	–
*Messor***	331	47.76	16 (3)	2941	8.89	105.59	110	33.2
*Pheidole***	53	7.65	4 (4)	111	2.09	1.74	3	5.7
Plagiolepis	2	0.29	1 (1)	3	1.50	0.50	0	–
Tapinoma	7	1.01	2 (1)	11	1.57	1.29	0	–
Temnothorax	5	0.72	4 (1)	17	3.40	11.30	1	20.0
*Tetramorium***	44	6.35	7 (1)	155	3.52	16.44	3	7.1
Total	**693**	**100.00**	**19(7)**	**3999**	**5.77**	**64.54**	**132**	**19.0**

Tab. 6: Results of the tests for comparing the number of specimens per nest (grey background) and the proportion of nests with more than one species of Zygentoma (white background) that were found with the six most common genera of Formicidae hosting silverfish. In each cell, the value corresponds to the comparison between the Formicidae genera in the corresponding row and column. The number of specimens per nest was compared using the General Linear Model (family quasipoisson, link logarithmic, variance proportional to the square of the mean) and Bonferroni multiple comparison test. The proportion of nests with two or more species of silverfish was compared using the χ^2 test (Bonferroni correction applied). The multiple comparison of means statistic and its p-value are indicated in each test, and significant differences are marked with asterisks. Abbreviations used for ant genera are shown in Table 2.

	Aph	0.0033 1.000	0.0979 1.000	321.0525 <0.01 ***	0.0464 1.000	0.0132 1.000	**χ^2** **p-value**
	-0.0802 1.000	**Cam**	0.0976 1.000	321.0523 <0.01 ***	0.0462 1.000	0.0129 1.000	
	-0.0251 1.000	0.0551 1.000	**For**	321.1469 <0.01 ***	0.1408 1.000	0.1075 1.000	
	1077.041 <0.01 ***	1157.233 <0.01 ***	1102.168 <0.01 ***	**Mes**	321.0954 <0.01 ***	321.0622 <0.01 ***	
	-0.3681 1.000	-0.2879 1.000	-0.3430 1.000	-1445.148 <0.01 ***	**Phe**	0.0561 1.000	
Estimate **p-value**	0.1519 1.000	0.2321 1.000	0.1770 1.000	-0.9252 <0.01 ***	0.5200 1.000	**Tet**	

ic support because of the low number of samples. A bar chart of preferences was also presented in MOLERO-BALTANÁS & al. (1998).

Moreover, if the preferences of the category of occasional myrmecophiles (such as those of the genus *Lepisma*) are considered, it can be observed that they also show generalist trends. In fact, the correspondence analysis places them closer to generalist than to specialist species (Fig. 9).

Specialist silverfish. The remaining strict myrmecophiles can be assigned to the group of specialists. Apart from *Tricholepisma indalica* MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1995 which was found only on a few occasions with *Camponotus sylvaticus* (OLIVIER, 1792), they can be included in the following subdivisions:

- *Aphaenogaster* specialists: *Neoasterolepisma delator* MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1996 and *N. hesperica* MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1996 (Fig. 8) are found mostly with ants of the genus *Aphaenogaster*. Data in the literature, especially the numerous samples from Portugal that were reported by MENDES (1992, 2002), support this. The correspondence analysis places *Aphaenogaster* specialists far from *Messor* specialists and closer to generalist species (Fig. 9). Finally, despite the preferences of *N. pallida* MOLERO-BALTANÁS, GAJU-RICART & BACH DE ROCA, 1995 are quite marked, this species can be included in a group with intermediate characteristics. The correspondence analysis places it between generalist species and *Aphaenogaster* specialists (Fig. 9).
- *Messor* specialists: This constitutes the largest group within the Iberian fauna because eight species of *Neoasterolepisma* and one of *Tricholepisma* show strong preferences (often close to 100%) for ants of the genus *Messor* (see Tab. 2 and an example in Fig. 8). This group is clearly supported by the correspondence map (Fig. 9), which places *Messor* specialists very close together and separates all of them from the remaining Zygentoma.

Evolutionary relationships in Lepismatinae

The cladogram of Figure 10 includes Iberian and Canarian species in order to understand the origin of myrmecophily in Lepismatinae (see Material and methods section and Appendix S3). The cladogram shows that *Messor* specialists are the most apomorphic species of the group, and that generalist species and mainly the occasional myrmecophiles occupy the root of the tree.

Analysing data for detecting different degrees of tolerance of the Formicidae hosts

While the previous section is focused in the "silverfish point of view", in this section we centre on the Zygentoma-Formicidae relationship in terms of the ants. Tables 2 and 5 summarise the information of our samplings in Spain upon grouping the data by genus of Formicidae.

Considering the percentage of nests of the different ant genera harbouring Zygentoma, almost 50% of the total of ant nests corresponded to *Messor* (Fig. 2). Other genera with significant percentages are *Aphaenogaster* (10.5%), *Camponotus* (12.8%), *Formica* (6.2%), *Pheidole* WESTWOOD, 1839 (7.8%) and *Tetramorium* MAYR, 1855 (6.3%).

Table 5 shows data of all of these genera. The parameters that are compared include the number of species hosted by the different ant genera, the number of individuals that were found per nest (results in Tab. 6) and the number (and percentage) of nests in which two or more species of Zygentoma have been found (results in Tab. 6). Moreover, Table 7 shows the percentage of interactions of each genus of ants with specialist or generalist species of Zygentoma.

The three last parameters have been compared only in the genera of Formicidae with a significantly high number of samples. The GLM quasipoisson option has been followed by comparing the means of the number of silverfish

Tab. 7: Percentages of interactions with generalist or specialist silverfish in the nests of the most abundant genera of ants. The occasional myrmecophiles are considered generalists. Ant genera with fewer than ten interactions and the silverfish species *Tricholepisma indalica* (found only twice) are discarded. *Messor* is marked with bold characters to remark the clearly different tendency of this genus.

	Interactions with generalist Zygentoma	Interactions with specialist Zygentoma
Aphaenogaster	62.33%	37.67%
Camponotus	86.96%	13.04%
Cataglyphis	92.31%	7.69%
Formica	95.24%	4.76%
Lasius	89.47%	10.53%
Messor	**19.30%**	**80.7%**
Pheidole	98.21%	1.79%
Tetramorium	96.56%	4.44%

per nest because the variance, as a general rule, is nearer the square mean than the mean.

All of these comparisons show that the genus *Messor* produces very different results from the others: This genus harbours a clearly greater number of individuals than the other ant genera, the incidence of parabiosis is significantly higher in *Messor* samples and the majority of ant genera interact with generalist silverfish, except *Messor*, which interacts mostly with specialists.

Moreover, Tables 2 and 5 show how *Messor* harbours a higher diversity of silverfish. The number of species that are hosted in *Messor* nests is 16 (12, if those that were found just once are not taken into account), and this number can increase in more than 20 species if the whole Western Palaearctic is considered. The only genera showing a similar degree in the Iberian area are *Aphaenogaster* and *Camponotus*, which host 14 and 12 species, respectively (only 9 and 8 if species which were found only once were discarded). Nevertheless, *Camponotus* nests, as a whole, have a lower diversity because only associations with two generalist species are frequent (the remaining 10 species are collected rarely). This contrasts with *Messor* nests, where none of the proportions of their guests prevail (Fig. 11); the differences among hosted species may correspond to their higher or lower abundance or geographic range, presented in MOLERO-BALTANÁS & al. (2002).

The correspondence analysis (Fig. 9) also clearly separates *Messor* colonies from the remaining genera.

The ecological network Formicidae-Zygentoma

A graphic of the bipartite network representing the association of ant genera and silverfish species in Peninsular Spain and the Balearics is presented (Fig. 12). As described in other ecological bipartite networks, such as those presented by JORDANO & al. (2003) or BASCOMPTE & al. (2007), the silverfish-ants symbiotic network is very heterogeneous (most species have a few associations, but a few species are much more connected than is expected by chance), nested (specialists interact with subsets of the species with which generalists interact), and built on weak and asymmetric links among species.

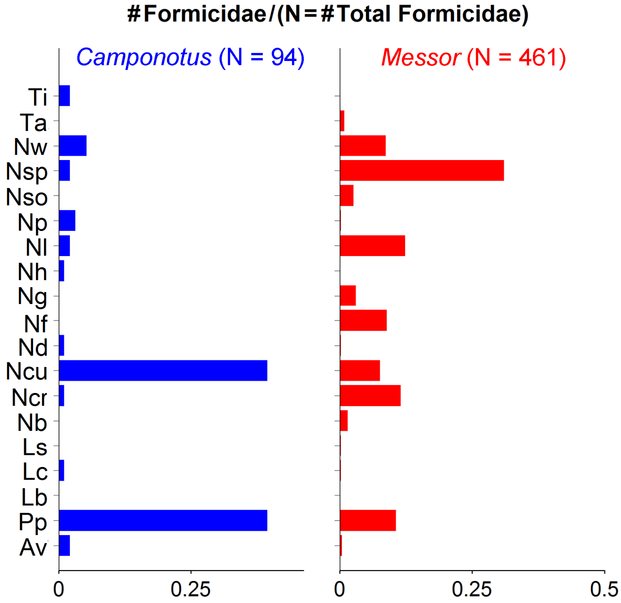

Fig. 11: Bar chart showing the proportions of association of *Camponotus* and *Messor* with different species of Zygentoma.

Tab. 8: Network metrics calculated for the Zygentoma-Formicidae network, with silverfish and ants considered at species level and pooling ants by genus.

Network metrics	Species level network (Tab. S2.1 in Appendix S2)	Network with ants pooled by genera (Tab. 2)
Connectance	0.1915	0.2970
Web-asymmetry	0.4242	-0.1515
Links per species	2.5910	2.3940
H2'	0.3081	0.3568
Modularity Q	0.3615	0.3931
Nestedness (temperature)	11.2225	8.6112

Some metrics of the network at the species level and the generic level (ants pooled by genus) are presented in Table 8. As *Messor* frequencies in the matrix do not reflect their relative abundance in the field because they are biased by the strong preferences of their specialists, d' and H2' are not the most relevant indices to take into account for a measure of specialisation (of single species and of the network as a whole, respectively). Both metrics are replaced by species-specificity index (SSI) and by modularity Q (DORMANN & STRAUSS 2014) as defined by R bipartite package (DORMANN & al. 2008). The first index (Tab. 4) gives values for each silverfish species that agrees with our classification criterion given in Table 1. Regarding the Q index of modularity, it shows a high value compared with most networks where this parameter has been calculated. Four modules can be detected by the QuaBiMo algorithm included in R bipartite package; from better to less-defined, these modules are: a) *Messor* and their specialists; b) *Aphaenogaster* and their specialists; c) most ant genera (mainly small ants) associated with the generalist Atelurinae and occasional *Lepisma*; d) common ant genera (especially, large ants) with the generalist *Neoas-*

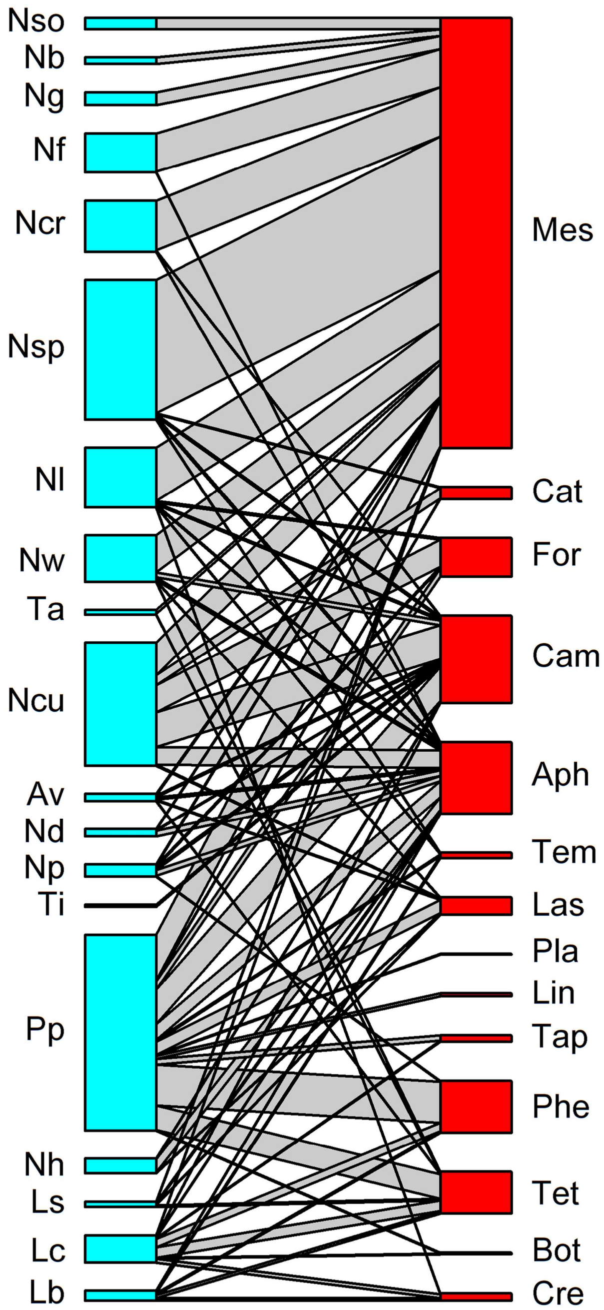

Fig. 12: Bipartite network Zygentoma species (left) – ant genera (right) in continental Spain. The graphic has been obtained by the R bipartite package from data of Table 2. The width of each link is proportional to the number of associations established between the connected taxa. Acronyms see Table 4.

terolepisma curtiseta and *N. pallida*. These modules can be seen in the plot of the correspondence analysis (Fig. 9).

Discussion

Classification of Zygentoma based on their preferences and their evolutionary trends

If we consider the data in the literature about Zygentoma-ant interactions over the entire Western Palaearctic region, several species can be added to the groups of myrmecophiles that have been distinguished.

Occasional myrmecophiles. There are some species of *Neoasterolepisma* in the Macaronesian region and North Africa that have been found only without ants or can be considered occasional myrmecophiles. This is the case of the Canarian species *Neoasterolepisma myrmecobia* (SILVESTRI, 1908), *N. vulcana* MENDES, BACH DE ROCA & GAJU-RICART, 1993 and *N. inexpectata* MENDES, MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART, 1993, which have been included in the cladogram of Lepismatinae and are near the base of the tree (Fig. 10). This contrasts with our analysis on *Neoasterolepisma* based on Iberian species (Tab. 3), which classifies this genus, as a whole, as a Strict Myrmecophile. It seems that primitive species of the genus *Neoasterolepisma* were not myrmecophilous and that the relationship with ants developed after the origin of this clade.

Occasional myrmecophiles, such as these primitive *Neoasterolepisma* and *Lepisma chlorosoma*, are generalists (SSI index lower than 0.5). Our data suggest that they seem to prefer small-sized Myrmicinae (*Tetramorium*, *Pheidole*, and *Crematogaster* LUND, 1831).

Generalist species. The myrmecophilous relationships of the two Iberian Atelurinae have been discussed in MOLERO-BALTANÁS & al. (1998). *Proatelurina pseudolepisma* stands out from the rest of European myrmecophiles due to the width of its preferences (Tabs. 2, S2.1 in Appendix S2 and the histogram of Fig. 11 in MOLERO-BALTANÁS & al. 1998). The literature indicates that *Atelura formicaria*, which is widespread in Europe, is also a generalist species (PACLT 1963). Although the wide preferences of these species, we do not believe it appropriate to designate them as "panmyrmecophiles" because they are most likely not admitted throughout the Formicidae that have been reported in the area. A certain preference for Formicidae of small size as *Pheidole pallidula* (NYLANDER, 1849) has been observed, but large ants of the genus *Camponotus* are also frequent hosts of Spanish Atelurinae. The number of specimens per nest is usually low (1 - 3), but some *Pheidole* colonies host a higher number.

The bar chart of preferences of *Neoasterolepisma curtiseta* (Fig. 8) and the low SSI index are also typical of a generalist species: This silverfish has been found with high frequencies in the nests of several genera of ants (*Messor*, *Formica*, and *Camponotus* nests are the more visited). Although it represents a high percentage of *Formica* guests, this does not mean that *N. curtiseta* prefers *Formica*; this genus seems to be little attractive for silverfish and it is only visited occasionally by some generalist species.

Specialist myrmecophiles. In Spain, all species classified in this group belong to the subfamily Lepismatinae: They exhibit a limuloid shape, with a wide thorax due to the extension of lateral areas of nota (most likely to avoid the biting of the ants); most of them show golden scales, elongated tenth urotergite (particularly in females, most likely to protect the ovipositor) and shortened terminal filaments. Host-specific species also exhibit different types of apomorphic characters, such as a trend to sexual dimorphism concerning the shape and chaetotaxy of the hind tibiae of males, whose function is not clearly established (this setation is lacking in most generalists).

These characteristics can also be observed in species outside the Spanish fauna, such as *Tricholepisma gyriniformis* (LUCAS, 1846) from the South and East Mediterranean region (a specialist in *Aphaenogaster*), the *Messor* specialist *Neoasterolepisma balcanica* (STACH, 1922) from the Eastern Mediterranean and some North African species such as *N. imitans* (MENDES, 1988). The *Messor* specialists group seems to be more diverse than the *Aphaenogaster* specialists, and also more widely distributed. Parabiosis is frequent in this group of specialists and deserves further study.

Evolutionary relationships among groups of Lepismatinae

The cladogram of Spanish Lepismatinae (Fig. 10) suggests that in the Western Palaearctic, silverfish of this subfamily began as occasional myrmecophiles with wide preferences (generalists) and then evolved to strict myrmecophiles. Specialists require a higher degree of morphological specialisation than generalists, and the cladogram places specialists as the more apomorphic clade. Inside these, species that are linked to *Messor* ants seem to be those that have acquired the most specialised condition.

Lepismatinae is an ancient group (the outgroup of the cladogram, *Allacrotelsa* SILVESTRI, 1935, is a xenomyrmecophile genus that occurs on both sides of the Atlantic Ocean), but it is not known exactly when Lepismatinae began to enter ant nests. It is likely that the beginning of this association befell more than 40 myr ago (after the breakup of Gondwanaland, since myrmecophile Lepismatinae are absent from the New World). As the genus *Messor* originated about 10 myr prior to *Aphaenogaster*, according the phylogeny of ant genera provided by MOREAU & al. (2006), we think that Lepismatinae living with *Messor* had more time to develop morphologic and ethologic specialisations to integrate with their hosts than *Aphaenogaster* specialists, which are most likely less integrated (R. Molero-Baltanás & M. Gaju-Ricart, unpubl.).

Are Zygentoma-Formicidae associations homogeneous? Analyses of data from associations in Spain suggest different levels of integration

As a consequence of the comparison of ant genera shown in Tables 5 - 7 (and also the data of the literature that confirm the same conclusions for the whole Western Palaearctic, see Appendix S1), three groups of Formicidae can be established according to their tolerance and specificity for the Zygentoma guests:

The first group includes ants with High and Broad Tolerance: genus *Messor*. These ants harbour a great number of species, several of which often cohabit in the same nest. The higher percentages of interactions correspond to specialist guests. Most of the Lepismatinae specialists are associated with *Messor*. The number of specimens found in each nest is comparatively high (and the actual number is much greater than the mean data shown in Table 5 because all of the specimens present could not be collected in many cases).

The second group of ants includes *Aphaenogaster*, with Low and Broad Tolerance. This genus harbours a high number of species, although the number of specimens per nest is usually low. The percentage of specialists that are lodged is not as high as that in *Messor* nests. Therefore, it is rare for two or more silverfish species to cohabit in *Aphaenogaster* nests. In contrast to what happens with *Messor* specialists, *Aphaenogaster* specialists seem to be mutually exclusive (*Neoasterolepisma delator*, *N. hesperica* and even *N. pallida* do not overlap in their geographical distributions but seem to be vicariants).

Finally, a third group of ants with a Low and Narrow Tolerance includes the remaining genera of Formicidae which harbour Zygentoma in their nests: *Camponotus*, *Formica*, *Pheidole*, *Cataglyphis* FÖRSTER, 1850, *Tetramorium*, etc. These ants permit the presence of few species of Zygentoma. Although *Camponotus* ants show more species, two generalist guests amount to more than the two-thirds of the total associations. The number of admitted specimens per nest is very low and, on rare occasions, two or more species of Zygentoma are found cohabiting in the same colony. Specialist Zygentoma have not been detected, unless *Tricholepisma indalica* could be allied with *Camponotus*.

The aforementioned differences among the different groups of ant genera could be related to different modalities of symbiotic relationship. At least two modes of association can be found inside West Palaearctic silverfish and ants; one of these modes can be interpreted as a trophic parasitism called "kleptoparasitism" and the other is most likely a case of commensalism, and can be designated "kleptobiosis". The difference between both terms was presented, for example, by IYENGAR (2008) or VOLLRATH (1984); kleptobionts steal items that have not been digested or used by the hosts or items that are so abundant that the consumption of a few of them by the guests does not incur an energetic cost to the host.

To understand and discuss the differences that are indicated by our results, it is necessary to compare several factors. The first one is the colony size. In regard to this, we could come to think that large colonies provide more abundant resources for silverfish (food and refuge). The available information about the colony size of *Messor* in Spain (BALLESTA & al. 1995) and France (CERDAN 1989) agrees with the classification by BARONI-URBANI (1977) in a group of ants with a moderately high colony size, except large nests of *M. barbarus*, with up to 23,000 workers, which can be classified in the high colony size group; this could explain our results (*Messor*, and especially *M. barbarus*, host a lot of species and individuals in the same nest). However, colonies of other genera in Spain are as large as *Messor* nests or larger, as indicated, for example, by data provided by BOULAY & al. (2007) on *Aphaenogaster* or by HUAN & DORNHAUS (2008) on *Formica*; silverfish inhabit them significantly less. Thus, we think that the colony size is not the key factor that explains the differences between *Messor* and the remaining common genera. This factor can be used only to justify that genera such as *Temnothorax* MAYR, 1861, classified by BARONI-URBANI (1977) in a group with small nests and low biomass / number or workers, show a lower number and diversity of silverfish.

If we focus on the different levels of aggressiveness as a factor to explain our differences, it could be concluded that the most aggressive ants should be those with less diversity and fewer guests, which could imply that *Messor* are the less aggressive ants of the Iberian fauna. However, if they were less aggressive, the frequencies of generalist silverfish could be higher in *Messor* than in other ants, but this is not what happens, as shown in the bar charts of Atelurinae and *Neoasterolepisma curtiseta*

(Fig. 8). The available information to grade the relative levels of aggressiveness of the different taxa of ants is based on "ant against ant" aggression tests (RETANA & CERDÁ 1995, CERDÁ & al. 1997, etc.); from these data, it is clear that *Messor* are far from being the least aggressive ants. However, no data are available regarding "ant against silverfish" tests.

Zygentoma are preadapted to run, so the quick escape is the more plesiomorphic of their strategies to avoid aggression. A second strategy of myrmecophile species is chemical mimicry: The available studies on this topic (WITTE & al. 2009, LENOIR & al. 2012) indicate that silverfish acquire the odour of the ants by contact. This behaviour has been probably developed only by the more specialised species. Most Zygentoma that are considered occasional or generalist myrmecophiles probably use only the ancestral escape strategy and often prefer small ants (with small mandibles), as supported by our data. *Messor* specialists and perhaps some generalists can live with large ants (potentially more harmful for silverfish) because they have developed the behaviour of approaching workers to acquire their odour, managing to scrape the ventral part of the body of the host; this strategy is favoured by the large size of the ant.

The more relevant factor that explains our results (mainly the differences between *Messor* and the remaining ant genera) is surely the diet of the ants. Most Western Palaearctic ant genera of Formicidae generate a small volume of residues that are available to the Zygentoma; in these colonies, silverfish probably develop a more primitive strategy of trophic parasitism (kleptoparasitism), stealing the food that has been pre-digested by the ants and attempting to go unnoticed. In this case, the presence of a reduced number of parasites in the nest (shown by our results) could be advantageous. Conversely, in *Messor* colonies, the abundant nutritional resources that these ants generate attract a lot of guests and favour the evolution of numerous specialists that have adapted to live in these nests. Although a wide range of silverfish guests is also observed with *Camponotus* and *Aphaenogaster*, these genera of ants host few specialists. We think that *Messor* is different because it seems to have established a more "friendly relationship" with Lepismatinae specialists. This association is most likely related to the seed-based diet of the ants and the possibility of a cleaning symbiosis (mutualistic association) or at least of a "welcome" kleptobiotic commensalism. As MENDES (1987) had already suggested, the relationship between *Messor* and their guests is based on a nutritional complementarity: Ants are unable to digest the husks of the gathered seeds (these husks must be expelled from the nest) and Lepismatinae silverfish (but probably not Atelurinae) are capable of feeding on these and other residues. The capacity to digest cellulose and other carbohydrates without the need for endosymbiotic microbiota is very uncommon among insects, but has been demonstrated in some species of Lepismatidae (LASKER & GIESE 1956). If this feeding complementarity of *Messor* and their specialists exists, the high density of the population of silverfish in the nest is not an important problem for the ants. As the cladogram of Figure 10 demonstrates, *Messor* specialists are the more evolved inside myrmecophilous Lepismatinae, developing strategies to achieve a higher level of integration with their hosts.

Network interpretation

A detailed interpretation of the Zygentoma-Formicidae network represented in Figure 12 is not the aim of this work, but some aspects of the association and the sampling in which it is based should be taken into account for further in-depth analysis:

As it has been proved (DORMANN & STRAUSS 2014), a high value of modularity Q is correlated with high H2' levels, implying high levels of specialisation. According to BLÜTHGEN & al. (2006), it can be interpreted that the low values of H2' calculated are due to an overestimation of *Messor* abundance and not to low levels of specialisation.

The geographic area from where the data are obtained is very large, about 400,000 km^2, and some different types of ecosystems are included.

Some silverfish species are not widespread over the entire study area (some of them are endemic of a relatively reduced area and even some of them can be considered as vicariants), but treated as genera, the distribution of most ants covers the whole area.

As argued before, this is not a homogeneous network in terms of the type of association. It is likely that a good number of the relationships between occasional or generalist Zygentoma and ants are antagonistic, but indications are presented that associations between *Messor* specialists and their hosts tend to be of commensalism or even mutualistic. The best way to represent these associations is probably a merged tripartite network, such as those presented by SAUVE & al. (2014). Ant genera can be placed in a central column, parasite silverfish in a second column on one side and commensals or mutualistic guests can be included in a third column on the contrary side. In Spain, exclusively all *Messor* specialists can be included in this column. Nevertheless, this positive relationship is not comparable to typical mutualistic plants-pollinators networks, where there is an important (nearly symmetric) mutual dependence. *Messor* ants probably do not depend significantly on silverfish, because the benefit they obtain is not indispensable. The relationship is very asymmetric and coevolution processes are not clearly developed. Silverfish have not significantly conditioned the evolution of ants, but Lepismatinae silverfish have experienced important adaptive modifications (morphological, biological and ethological) to live inside ant colonies, and the more striking modifications seem to be developed in *Messor* specialists, meaning that this group deserves further investigation.

Conclusions

Here, 157 associations between Zygentoma and Formicidae species are reported in Spain, with 41 of them described for the first time. Adding our data to those of the literature, 193 different associations are known in the Western Palaearctic region.

Spanish silverfish species are classified according to their preferences for ants into four groups: Xenomyrmecophiles, Occasional Myrmecophiles, Strict Generalist Myrmecophiles and Strict Specialist Myrmecophiles. The higher number of species is inside this last group and most of them (9 species) are *Messor* specialists. This classification has a statistical and phylogenetic support.

Messor ants host a higher number of species and specimens per nest than the remaining genera of ants studied, suggesting that the association with their specialist partners is different (probably, commensalism or even mutualistic) from those associations established between ants and generalist silverfish (antagonistic). The seed-based diet of these ants could be the main factor influencing the evolution of a group of silverfish species with a higher level of integration.

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Digital supplementary material to

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Appendix S1: Zygentoma hosted by ants in the Western Palaearctic region (Europe, North Africa and Macaronesian region). Tables integrate data of literature with new data generated in this work.

In this document, two types of tables are presented:
1) Summary of interactions of each ant genus with various species of Zygentoma.
2) Details of interactions of each ant species with various species of Zygentoma (giving the references to literature and the data of the new samples studied).
These two types are condensed in a single table for those genera where only one species is reported (or where no specific identification of the ant is available).

The references included in the tables that are not in the main article are detailed at the end of this file. Before the list of references of this Appendix, an additional table (Table S1.73) includes previously published data on the associations analysed in this work.

Remarks for all tables:

Abbreviations of species of Zygentoma as in Table 4 of the main article.

Other abbreviations given in tables:
Tot.: Total number of samples studied in Spain (published or reported in this work).
Lit est.: Number of samples previously published and included in the statistical study made in Spain (presented in the main paper).
Lit not incl.: Number of samples mentioned in the literature of Western-Palaearctic Zygentoma and not included in the statistic study of Spain (mainly published by other authors and for other countries).

The references to Molero-Baltanás are abbreviated to Molero. The references to Bach de Roca and Gaju-Ricart are also abbreviated to Bach and Gaju, respectively.

New interactions are highlighted in the tables with bold characters and grey background.

Detailed references tables for each ant species include the name of the author(s) and the year of publication for each interaction in the literature. The number of samples included in each reference is given in brackets. Literature references not included in the statistical study of the main article are marked with an asterisk. For new data, tables of each ant species include the locality, date, number of specimens (M = males, F = females, J = juveniles) and the reference in the collection of the Universidad de Córdoba (UCO) where they are deposited. In these tables, the bold character means new interactions (reported here for the first time).

Species and genera authorities are given only when they are not mentioned in the main article.

Interactions of silverfish with ants identified at the generic level are not considered new unless there is no other reference of the silverfish with another ant species of the same genus.

Tab. S1.1: Numbers of the different types of interaction of *Aphaenogaster* ants with silverfish. 35 different types of interactions, 30 of them reported in Spain, nine of them new. 77 interactions from samples of Spain for statistic study (47 of them previously published), 40 additional Western-Palaearctic interactions from literature not included in statistics.

***Aphaenogaster* species**	**Av**	**Pp**	**Lb**	**Lc**	**Ls**	**Ncr**	**Ncu**	**Nd**	**Nf**	**Nh**	**Nl**	**Np**	**Nsp**	**Nw**	**Tot**	**Lit stat**	**Lit not incl**
A. dulcinea		3													3	3	0
A. gibbosa	2	7			**1**		**2**	1		1		1	**1**	1	17	13	5
A. iberica		5		**1**	**1**	**1**	**11**	2		2		5	**1**	2	31	16	0
A. senilis		1					6	1	1	8	**1**		1		19	11	22
A. subterranea		1						1							2	2	1
A. testaceopilosa															0	0	4
Aphaenogaster sp.			1					1		3					5	3	8

Tab. S1.2: Detailed references of interactions of ants of the species *Aphaenogaster dulcinea* SANTSCHI, 1919 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
Proatelurina pseudolepisma (3)	MOLERO & al. (1998b) (3)	–

Tab. S1.3: Detailed references of interactions of ants of the species *Aphaenogaster gibbosa* (LATREILLE, 1798) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
Atelura valenciana (2)	MOLERO & al. (1998b) (2)	–
P. pseudolepisma (8)	MENDES (1980a)* (1); MOLERO & al. (1998b) (7)	–
***Lepisma saccharina* (1)**		Orense, Petín (42° 21' N, 7° 07' W), 23-09-1989, Ref. Z1873.
***Neoasterolepisma curtiseta* (2)**		Granada, Rubite, Contraviesa mountains, A-4131 road (formerly C-333), Km 32 (36° 49' N, 3° 20' W), 19-03-92, 1M, Ref. Z1014. Valencia, Montroi, road to Torís, (39° 21' N, 0° 38' W), 27-04-92, 1M + 2F together with *A. valenciana*, Ref. Z1473.
N. delator (1)	MOLERO & al. (1996a) (1)	–
N. hesperica (5)	MENDES (1980a)* (2); MENDES (1982)* (1); MENDES (1988) *(1); MOLERO & al. (1996a) (1)	–
N. pallida (1)	MOLERO & al. (1995b) (1)	
***N. spectabilis* (1)**		Córdoba, Hornachuelos, Aljabaras, 19-11-83, 1M + 1F (as *N. iberica* in MOLERO & al. (1992), Ref. Z0464.
N. wasmanni (1)	MOLERO & al. (1996a) (1)	–

Tab. S1.4: Detailed references of interactions of ants of the species *Aphaenogaster iberica* (EMERY, 1908) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (5)	MOLERO & al. (1998b) (5)	–
***L. chlorosoma* (1)**		Madrid, Olmeda de las Fuentes, road to Mondéjar (40° 21' N, 3° 10' W), 13-09-91, 1F, Ref. Z1241.
***L. saccharina* (1)**		Segovia, Maderuelo to Fuentelcésped (41° 33' N, 3° 33' W), 27-8-92, 1F, Ref. Z1921.
***N. crassipes* (1)**		Zaragoza, Santa Cruz del Moncayo (41° 52' N, 1° 45' W), 21-06-92, 1J together with *P. pseudolepisma*, Ref. Z1694.
***N. curtiseta* (11)**		Albacete, Valdeganga, next to Júcar river (39° 08' N, 1° 45' W), 29-04-92, 1M + 1F, Ref. Z1170. Almería, Alcolea, from Berja to Ugíjar, Gádor mountains (36° 56' N, 2° 57' W), 19-03-92, 1F, Ref. Z0997. Almería, Tíjola, from Purchena to Serón (37° 20' N, 2° 23' W), 16-04-92, 2M + 2F + 3J, Ref. Z0894. Almería, Vélez-Rubio, El Charche (37° 38' N, 2° 03' W), 26-10-91, 2M, Ref. Z1068. Almería, Turre, Aguas river (37° 08' N, 1° 55' W), 10-4-1992, 1J, Z0884. Granada, Lanjarón, road to Órgiva (36° 54' N, 3° 28' W), 18-03-92, 4M + 1F, Ref. Z1037. Granada, Polopos (Granada), A-4131 road (formerly C-333), Km 42.5 (36° 48' N, 3° 18' W), 19-03-92, 1M + 1F, Ref. Z0983. Guadalajara, Esplegares, road to Saelices de la Sal (40° 52' N, 2° 09' W), 24-08-92, 1F + 2J, Ref. Z1237. Madrid, San Martín de la Vega, road to Morata de Tajuña (40° 13' N, 3° 31' W), 13-09-91, 3M + 2F, Ref. Z1116 (published in MOLERO & al., 1994b as *Aphaenogaster* sp.). Murcia, Caravaca de la Cruz, road to Lorca, pine-tree forest besides Quípar river (37° 59' N, 1° 55' W), 26-10-91, 3M, Ref. Z1447. Valencia, Aras de Alpuente, road to Santa Cruz de Moya (39° 56' N, 1° 09' W), 14-05-92, 2M, Ref. Z1520.

N. delator (2)	MOLERO & al. (1996a) (2)	–
N. hesperica (2)	MOLERO & al. (1996a) (2)	–
N. pallida (5)	MOLERO & al. (1995b) (5)	–
***N. spectabilis* (1)**		Málaga, Coín, road to Tolox (36° 40’ N, 4° 47’ W), 6-12-91, 1M, Ref. Z1074.
N. wasmanni (2)	MOLERO & al. (1996a) (2)	–

Tab. S1.5: Detailed references of interactions of ants of the species *Aphaenogaster senilis* (MAYR, 1853) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (2)	MOLERO & al. (1992) (1), MENDES (1992)* (1)	–
N. curtiseta (7)	MENDES (1980a)* (1)	Almería, Berja, Castala, 650 m (36° 53’ N, 2° 57’ W), 23-03-89, 1M + 1F, Ref. Z0416. Almería, Mojácar beach (37° 08’ N, 1° 49’ W), 10-04-92, 1M + 1F, Ref. Z0890. Cáceres, N-630, Km 547 (39° 31’ N, 6° 25’ W), 01-03-89, 1M + 2F, Ref. Z0785. Cáceres, Monfragüe Nat. Park, CC-912 Km 16 to Torrejón el Rubio (39° 49’ N, 6° 02’ W), 02-03-89, 1M, Ref. Z0737. Córdoba, Los Morales (37° 55’ N, 4° 48’ W), 06-05-91, 1M, Ref. Z1043. Cuenca, Barajas de Melo, road to Tarancón (40° 05’ N, 2° 55’ W), 16-09-91, 2M + 1F + 1J, Ref. Z1253.
N. delator (1)	BACH & GAJU (1987) (1)	–
N. foreli (2)	MOLERO & al. (1994b) (1); MENDES (2002a)* (1)	–
N. hesperica (26)	MENDES (1980a)* (7); MENDES (1982)* (1); MENDES (1988)* (1); MENDES (1992)* (3); MENDES (2002a)* (6); MOLERO & al. (1996a) (8)	–
***N. lusitana* (1)**		Badajoz, Capilla, Zújar river (38° 47’ N, 5° 05’ W), 1-5-91, 1F together with *N. spectabilis*, Ref. Z767.
N. spectabilis (2)	MENDES (1980a) (1)	Badajoz, Capilla, Zújar river (38° 47’ N, 5° 05’ W), 1-5-91, 2M+5F together with *N. lusitana*, Ref. Z768.

Tab. S1.6: Detailed references of interactions of ants of the species *Aphaenogaster subterranea* (LATREILLE, 1798) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	BACH & GAJU (1987) (1)	–
N. angustothoracica (1)	GRASSI & ROVELLI (1890)* (1)	–
N. delator (1)	BACH & GAJU (1987) (1)	–

Tab. S1.7: Detailed references of interactions of ants identified in literature as *Aphaenogaster testaceopilosa* (LUCAS, 1849) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
L. chlorosoma (1)	Referred by PACLT (1967)* as *L. lucasi* (1)	–
N. wasmanni (1)	Referred by PACLT (1967)* (1)	–
Tricholepisma aurea (1)	DUFOUR (1831), referred by PACLT (1967)* (1)	–
T. gyriniformis (1)	GRASSI & ROVELLI (1890)*, referred by PACLT (1967)* (1)	–

Tab. S1.8: Detailed references of interactions of ants identified as *Aphaenogaster* sp. with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
L. baetica (1)	Molero & al. (1994a) (1)	–
N. curtiseta (1)	Mendes (2002a)* (1)	–
N. delator (1)		Montes de Málaga (36° 48’ N, 4° 22’ W), 30-10-84, 1M, Ref. Z2139.
N. hesperica (10)	Molero & al. (1996a) (2); Mendes (2002a)* (7)	Cádiz, Zahara de la Sierra (36° 50’ N, 5° 24’ W), 19-3-2011,1M + 1F, Ref. Z2492.

Tab. S1.9: Interactions of ants of the genus *Bothriomyrmex* Emery, 1869 (sp. indet.) with silverfish. Two types of interactions, one of them new (marked with bold character and grey background). Two interactions from Spain for statistic study (one of them previously published), no additional interactions from literature.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
P. pseudolepisma (1)	Molero & al. (1998b)	–
***L. chlorosoma* (1)**		Zamora, Castronuevo, Valderaduey river (41° 43’ N, 5° 32’ W), 24-9-1992, 3M + 1F + 2J, Ref. Z1889.

Tab. S1.10: Number of the different types of interactions of ants of the genus *Camponotus* with silverfish. 30 types of interactions, 25 of them reported in Continental Spain, three of them new. 95 interactions from samples of Spain for statistic study (60 of them previously published), 15 additional Western-Palaearctic interactions from literature not included in statistics.

***Camponotus* species**	**Av**	**Pp**	**Lc**	**Ncr**	**Ncu**	**Nd**	**Nh**	**Nl**	**Np**	**Nso**	**Nsp**	**Nw**	**Ti**	**Tot**	**Lit stat**	**Lit not incl**
C. aethiops		5			**4**							2		11	7	2
C. cruentatus		14			22		1	**2**	1			1		41	20	5
C. ligniperda																1
C. cf. micans					1						1			2	2	0
C. nylanderi														0	0	1
C. pilicornis		5			3	1						1		10	9	0
C. sicheli		1												1	1	0
C. sylvaticus	2	10		**1**	5				2			1	2	23	17	2
C. sp.		2	1		1					1	1			6	4	4

Tab. S1.11: Detailed references of interactions of ants identified as *Camponotus aethiops* (Latreille, 1798) with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
P. pseudolepisma (7)	Grassi & Rovelli (1890)*, referred as *C. marginatus*; Mendes & Bach (1981)* (1); Molero & al. (1998b) (5)	–
***N. curtiseta* (4)**		Burgos, Castrojeriz (42° 16’ N, 4° 06’ W), 26-09-92, 2F, Ref. Z1927. Cuenca, Gascueña (40° 17’ N, 2° 30’ W) 19-08-92, 1M + 1J, Ref. Z1105. Navarra, Yesa, road intersection to the Leyre monastery (42° 37’ N, 1° 09’ W), 10-07-92, 2F, Ref. Z1707. Soria, Berlanga de Duero, road to Andaluz (41° 28’ N, 2° 51’ W), 24-08-92, 2M + 2F + 8J, Ref. Z1953.
N. wasmanni (2)	Molero & al. (1996a) (2)	–

Tab. S1.12: Detailed references of interactions of ants identified as *Camponotus cruentatus* (LATREILLE, 1802) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (19)	Forel, referred by ESCHERICH (1903)* (1) MENDES (1980a)* (2), MENDES (2002a)* (2), MOLERO & al. (1998b) (14)	–
N. curtiseta (22)	GAJU & al. (1987) (1); MOLERO & al. (1992) (2)	Ávila, Muñana, road to Puerto de las Fuentes (40° 37’ N, 5° 02’ W), 22-09-92, 1M + 4F together with *P. pseudolepisma*, Ref. Z1827. Badajoz, Valencia del Mombuey (38° 13’ N, 7° 05’ W), 02-09-81, 1M + 2F + 2J, Ref. Z0727. Barcelona, Sitges, Garraf mountains (41° 15’ N, 1° 48’ E), 21-V-92, 3M+1F+1J, Ref. Z1600, published in MOLERO & al., 1994b as hosted by *Camponotus* sp. Cáceres, Berzocana (39° 26’ N, 5° 27’ W), 07-06-91, 1M, Ref. Z0857. Cáceres, Cabezuela del Valle (40° 11’ N, 5° 49’ W), 07-06-91, 3M, Ref. Z0756. Cáceres, Las Hurdes, Santibáñez el Alto, C-513, Km 65 (40° 11’ N, 6° 33’ W), 08-06-91, 4M, Ref. Z0731. Cuenca, Abia de la Obispalía (40° 01’ N, 2° 24’ W), 16-09-91, 1M + 1F, Ref. Z1231. Cuenca, Cañizares, road to Beteta, pine-tree forest (40° 31’ N, 2° 09’ W), 20-08-92, 1M + 1F, Ref. Z1138. Granada, Castril, road to Benamaurel (37° 47’ N, 2° 46’ W), 24-10-91, 1M + 1F, Ref. Z1047. Huelva, Corteconcepción, Aracena pond (37° 53’ N, 6° 28’ W), 27-03-92, 1F, Ref. Z0978. Huelva, Santa Bárbara de Casa, road to Paymogo, grassland (37° 47’ N, 7° 13’ W), 28-03-92, 4F + 2J together with *N. hesperica*, Ref. Z1025. Huesca, Benabarre, road to Lérida (42° 03’ N, 0° 29’ E), 14-07-92, 7M + 3F, Ref. Z1759. Huesca, Loporzano, near Sipan (42° 10’ N, 0° 17’ W), 09-07-92, 1M and several juveniles, together with *N. wasmanni* and *P. pseudolepisma*, Ref. Z1733. Os de Balaguer (Lérida), Serra del Convent (41° 52’ N, 0° 44’ E), 15-07-92, 2M, Ref. Z1625. Olmeda de las Fuentes (Madrid), road to Mondéjar (40° 21’ N, 3° 10’ W), 13-09-91, 1F, Ref. Z1203. Tarragona, mountain pass of Falset (41° 08’ N, 0° 50’ E), 24-05-92, 1F together with *P. pseudolepisma*, Ref. Z1608. Toledo, grassland with oaks, near Polán and Guadamur (39° 49’ N, 4° 10’ W), 12-09-91, 1M + 3F, Ref. Z1208. Valladolid, Castromonte, Torozos forest, near La Espina monastery (41° 44’ N, 5° 05’ W), 26-09-92, 1F, Ref. Z1929. Zamora, Fermoselle, besides Tormes river (41° 16’ N, 6° 23’ W), 23-09-92, 3M + 3F, Ref. Z1839.
N. hesperica (1)	MOLERO & al. (1996a) (1)	–
***N. lusitana* (2)**		Albacete, Alcaraz mountains, road to Riópar (38° 31’ N, 2° 26’ W), 27-10-91, 1J, Ref. Z1187. Cáceres, Alía, Guadarranque river (39° 28’ N, 5° 08’ W), 6-6-91, 1M, Ref. Z808.
N. pallida (1)	MOLERO & al. (1995b) (1)	–
N. wasmanni (1)	MOLERO & al. (1996a) (1)	–

Tab. S1.13: Detailed references of interactions of ants identified as *Camponotus ligniperda* (LATREILLE, 1802) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	ESCHERICH (1903)* (mention of a reference from Wasmann), referred as *Grassiella polypoda* (1)	–

Tab. S1.14: Detailed references of interactions of ants identified as *Camponotus* cf. *micans* (NYLANDER, 1856) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
N. curtiseta (1)		Jaén, road N-322 near Villarrodrigo (38° 29’ N, 2° 42’ W), 4-4-92, 1M, together with *N. spectabilis*, Ref. Z954.
N. spectabilis (1)		Jaén, road N-322 near Villarrodrigo (38° 29’ N, 2° 42’ W), 4-4-92, 1M, together with *N. curtiseta*, Ref. Z2060.

Tab. S1.15: Detailed references of interactions of ants identified as *Camponotus nylanderi* EMERY, 1921 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
Tricholepisma aurea (1)	PACLT (1967)* (1)	–

Tab. S1.16: Detailed references of interactions of ants identified as *Camponotus pilicornis* (ROGER, 1859) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (5)	MOLERO & al. (1992) (3); MOLERO & al. (1998b) (2)	–
N. curtiseta (3)	MOLERO & al. (1992) (2)	Andújar (Jaén), Jándula Pond, 03-03-1991, 1 J, Ref. Z0522 (reported as *Camponotus* sp. in MOLERO & al. 1992).
N. delator (1)	MOLERO & al. (1992) (as *N. iberica*) (1)	–
N. wasmanni (1)	MOLERO & al. (1996a) (1)	–

Tab. S1.17: Detailed references of interactions of ants identified as *Camponotus sicheli* MAYR, 1866 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	Reported from Balearic Islands by MOLERO & al. (1998b) (1)	–

Tab. S1.18: Detailed references of interactions of ants identified as *Camponotus sylvaticus* (OLIVIER, 1792) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. valenciana (2)	MOLERO & al. (1998b) (2)	–
P. pseudolepisma (10)	GAJU & BACH (1987) (1); MOLERO & al. (1998b) (9)	–
***N. crassipes* (1)**		Mora de Ebro (Tarragona), road to Gandesa (41° 05' N, 0° 56' E), 25-5-1992, 3M+4F+1J, Ref. Z1576.
N. curtiseta (7)	MENDES (1980a)* (1), MENDES (1988)* (1)	Lanjarón (Granada), road to Órgiva (36° 54' N, 3° 28' W), 18-03-92, 1F, Ref. Z1033. Huelva, El Campillo, from Zalamea la Real to Jabugo, near Odiel river (37° 43' N, 6° 42' W), 29-03-92, 1M + 1F + 1J, Ref. Z0963. Murcia, near San Pedro mountain pass from Monte Blanco to Sucina (37° 57' N, 0° 57' W), 11-04-92, 3M + 1F + 2J, Ref. Z1448. Murcia, Totana, Sierra Espuña (37° 49' N, 1° 36' W), 15-04-92, 1F, Ref. Z1529. Valencia, Requena, road to Casas-Ibáñez near Cabriel river (39° 20' N, 1° 21' W), 29-04-92, 2F, Ref. Z1314.
N. pallida (2)	MOLERO & al. (1995a) (2)	–
N. wasmanni (1)	MOLERO & al. (1996a) (1)	–
T.indalica (2)	MOLERO & al. (1995a) (2)	–

Tab. S1.19: Detailed references of interactions of ants identified as *Camponotus* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (1)	KRATOCHVIL (1945)* (1)	–
P. pseudolepisma (2)	MOLERO & al. (1998b) (2)	–
L. chlorosoma (2)	MENDES (2002a) (1)	Ciudad Real, Fuencaliente, Sierra Madrona, Piedra Escrita (38° 23' N, 4° 17' W), 12-3-88, 1M, Ref. Z1983.
N. curtiseta (2)	MOLERO & al. (1992) (1); MENDES (2002a) (1)	–
N. soerenseni (1)	MOLERO & al. (1994c) (1)	–
***N. spectabilis* (1)**		Valencia, Casinos (39° 42' N, 0° 45' W), 29-4-92, 1F together with *P. pseudolepisma*, Ref. Z1338.
N. vulcana (1)	MENDES (1993) (1)	–

Tab. S1.20: Number of the different types of interactions of ants of the genus *Cataglyphis* with silverfish. Eight types of interactions, five of them reported in Continental Spain, four of them new. 13 interactions from samples of Spain for statistic study (only one of them previously published), four additional Western-Palaearctic interactions from literature not included in statistics.

Cataglyphis species	Pp	Ncu	Nsp	Tot	Lit stat	Lit not incl
C. hispanica	1	7	1	9	1	
C. iberica		2		2		
C. velox + *C.* cf. *velox*		2		2		
C. viatica						4

Tab. S1.21: Detailed references of interactions of ants identified as *Cataglyphis hispanica* (EMERY, 1906) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	MOLERO & al. (1998b) (1)	–
***N. curtiseta* (7)**		Badajoz, Siruela, road to Agudo (38° 58' N, 4° 59' W), 01-05-91, 4M + 2F, Ref. Z0762. Cáceres, Santibáñez el Alto, CC-513, Km 65 (40° 11' N, 6° 33' W), 08-06-91, 2H, Ref. Z0755. Cáceres, Serradilla, Monfragüe Nat. Park (39° 49' N, 6° 01' W), 27-03-91, 1M, Ref. Z0861. Huelva, Aroche, road to Cortegana (37° 57' N, 6° 55' W), 28-03-92, 3M + 1F, Ref. Z0961. Huelva, Rosal de la Frontera, Ribera Calaboza (37° 54' N, 7° 12' W), 28-03-92, 2M + 6F + 1J together with *N. spectabilis*, Ref. Z1004. Jaén, Castellar (38° 15' N, 3° 07' W), 30-04-92, 16M and several females and juveniles, together with *N. spectabilis*, Ref. Z0958. Madrid, Rozas del Puerto, road C-501 to Casillas (40° 18' N, 4° 30' W), 21-07-92, 1F, Ref. Z1099.
***N. spectabilis* (1)**		Rosal de la Frontera (Huelva), Ribera Calaboza (37° 54' N, 7° 12' W), 28-03-92, 3M + 1F together with *N. curtiseta*, Ref. Z2055. Jaén, Castellar (38° 15' N, 3° 07' W), 30-04-92, 2M and several females and juveniles, together with *N. spectabilis*, Ref. Z0958.

Tab. S1.22: Detailed references of interactions of ants identified as *Cataglyphis iberica* (EMERY, 1906) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
***N. curtiseta* (2)**		Zaragoza, Belchite, near Pueyo sanctuary (41° 18' N, 0° 50' W), 27-06-92, 1F, Ref. Z1742; Zaragoza, Caspe, road to Alcañiz (41° 11' N, 0° 10' W), 27-06-92, 1F, Ref. Z1651.

Tab. S1.23: Detailed references of interactions of ants identified as *Cataglyphis velox* SANTSCHI, 1925 or *C. viatica* (FABRICIUS, 1787) with silverfish. References in the literature to *C. viatica* in the Iberian Peninsula must be attributed to *C. velox* (or related species, identified here as *Cataglyphis* cf. *velox*).

Species of Zygentoma (number of samples)	Literature references	New data
Lepismina emiliae (1)	ESCHERICH (1903) (1)	
***N. curtiseta* (2)**	MOLERO & al. (1992) (published as *C. viatica*)	Granada, Padul, Venta del Fraile, road to Otívar, Almijara mountains (37° 01' N, 3° 40' W), 20-03-92, 3F, Ref. Z0990.
N. spectabilis (1)	MENDES (1988)* (1)	–
N. wasmanni (2)	ALFIERI (1932)* (1); ESCHERICH (1903)* (1)	–

Tab. S1.24: Number of the different types of interactions of ants of the genus *Crematogaster* with silverfish. Five types of interactions, four of them reported in Spain, two of them new. Eight interactions from samples of Spain for statistic study (two of them previously published), one additional interaction in Western-Palaearctic from literature not included in statistics.

Crematogaster species	Lb	Lc	Nl	Tot	Lit stat	Lit not incl
C. auberti	2	3	**1**	6	2	0
C. laestrygon	**1**			1	0	0
C. scutellaris				0	0	1
Crematogaster sp.		1		1	0	0

Tab. S1.25: Detailed references of interactions of ants identified as *Crematogaster auberti* EMERY, 1869 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
L. baetica (2)	MOLERO & al. (1994a) (1)	The sample of *L. chlorosoma* in BACH & GAJU (1987) correspond actually to *L. baetica*.
L. chlorosoma (3)	GAJU & al. (1987) (1)	Toledo, Corral de Almaguer to Lillo (39° 45' N, 3° 12' W), 19-8-1992, 1J, Ref. Z1179. Zamora, Tabara, near Ferreras de Abajo (41° 52' N, 6° 0' W), 24-9-92, 1J, Ref. Z1865.
***N. lusitana* (1)**		Jaén, road N-322 near Villarrodrigo (38° 29' N, 2° 42' W), 24-2-92, 2M + 1J, Ref. Z0953.

Tab. S1.26: Detailed references of interactions of ants identified as *Crematogaster laestrygon* EMERY, 1869 with silverfish. This represents a new interaction (marked with bold character) and the first citation of *L. baetica* for the Balearic islands.

Species of Zygentoma (number of samples)	Literature references	New data
***L. baetica* (1)**		Majorca, punta Amer, Sa Coma (39° 34' N, 3° 23' E), 4M + 1F, Ref. Z1298.

Tab. S1.27: Detailed references of interactions of ants identified as *Crematogaster scutellaris* (OLIVIER, 1792) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
L. choloroma (1)	Cited as *L. lucasi* by GRASSI & ROVELLI (1890)* (1)	–

Tab. S1.28: Detailed references of interactions of ants identified as *Crematogaster* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
L. chlorosoma (1)		Cáceres, Cañaveral (39° 48' N, 6° 22' W), 30-3-91, 2M + 2F, Ref. Z0751.

Tab. S1.29: Interactions of ants of the genus *Solenopsis* WESTWOOD, 1840 with silverfish. Species *S. fugax* (LATREILLE, 1798). One interaction from the literature, none reported in Spain.

Species of Zygentoma (number of samples)	Literature references	New data
N. balcanica (1)	MENDES (1988)*	–

Tab. S1.30: Number of the different types of interactions of ants of the genus *Formica* s.lat. with silverfish. Eleven types of interactions, seven of them reported in Spain, one of them new. 42 interactions from samples of Spain for statistic study (27 of them previously published), eleven additional Western-Palaearctic data of interactions from literature not included in statistics.

Formica (s.lat.) species	Pp	Ncu	Nl	Np	Tot	Lit stat	Lit not incl
F. cinerea					0		1
F. fusca					0		1
F. gerardi	1			1	2	2	0
F. rufibarbis		**1**			1	0	0
F. sanguinea							1
F. subrufa	8	28	2	1	39	25	0
Formica sp.					0	0	10

Tab. S1.31: Detailed references of interactions of ants identified as *Formica cinerea* MAYR, 1853 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (1)	SILVESTRI (1942)* (1)	–

Tab. S1.32: Detailed references of interactions of ants identified as *Formica fusca* LINNEUS, 1758 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (1)	SILVESTRI (1942)* (1). Perhaps this reference to *F. fusca* is based on a report of Janet mentioned by ESCHERICH (1903).	–

Tab. S1.33: Detailed references of interactions of ants identified as *Formica gerardi* BONDROIT, 1917 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	MOLERO & al. (1998b) (1)	–
N. pallida (1)	MOLERO & al. (1995b) (1)	–

Tab. S1.34: Detailed references of interactions of ants identified as *Formica rufibarbis* FABRICIUS, 1793 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
***N. curtiseta* (1)**		Teruel, Escorihuela (40° 31' N, 0° 57' W), 21-8-92, 2F, Ref. Z1717.

Tab. S1.35: Detailed references of interactions of ants identified as *Formica sanguinea* LATREILLE, 1798 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria	Wasmann, referred to by ESCHERICH (1903)* (1)	–

Tab. S1.36: Detailed references of interactions of ants identified as *Formica subrufa* ROGER, 1859 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (8)	MOLERO & al. (1992) (2); MOLERO & al. (1998b) (6)	–
N. curtiseta (28)	BACH & GAJU (1987) (12), GAJU & al. (1987) (1), MOLERO & al. (1992) (2)	Albacete, Ossa de Montiel, La Lengua lagoon (38° 56' N, 2° 51' W), 26-05-92, 1M, Ref. Z2063. Badajoz, Siruela, road to Agudo (38° 58' N, 4° 59' W), 01-05-91, 1M + 1F, Ref. Z0818. Cáceres, Alcántara pond, CC-912 Km 16 (39° 35' N, 6° 18' W), 02-03-89, 1M + 2F + 3J, Ref. Z0736. Ciudad Real, Retuerta del Bullaque, Torre de Abraham pond (39° 22' N, 4° 14' W), 12-09-91, 1M + 1F, Ref. Z1192. Córdoba, Cardeña, road to Villanueva (38° 17' N, 4° 24' W), 12-07-89, 1F, Ref. Z0449. Córdoba, Hornachuelos, Bona-jarafe river, 1F incorrectly identified as *N. spectabilis* in BACH & GAJU (1987), Ref. Z0020. Cuenca, Huete, road to Carrascosa del Campo (40° 07' N, 2° 41' W), 16-09-91, 1M + 1F, Ref. Z1240. Guadalajara, Pastrana, near Tajo river (40° 22' N, 2° 54' W), 13-09-91, 1J, Ref. Z1148. Huelva, El Campillo, road to Minas de Riotinto (37° 41' N, 6° 37' W), 30-03-92, 2M + 3F + 1J together with *P. pseudolepisma*, Ref. Z1020. Jaén, Hinojares, from Tíscar to Pozo Alcón (37° 44' N, 2° 59' W), 24-10-91, 3M + 1F, Ref. Z1061. Va-lencia, Cofrentes (39° 13' N, 1° 05' W), 25-04-92, 1F + 2J, Ref. Z1484. Valencia, Vilamarxant (39° 32' N, 0° 38' W), 27-04-92, 1M + 1F, Ref. Z1457. Zaragoza, Mequinenza, road to Caspe (41° 19' N, 0° 09' W), 26-06-92, 1F together with *P. pseudolepisma*, Ref. Z1705.
N. lusitana (2)	BACH & GAJU (1987) (1)	Albacete, Ossa de Montiel, La Lengua lagoon (38° 56' N, 2° 51' W), 26-05-92, 1M, Ref. Z1156.
N. pallida (1)	MOLERO & al. (1995b) (1)	–

Tab. S1.37: Detailed references of interactions of ants identified as *Formica* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria	KRATOCHVIL (1945)* (1)	–
P. pseudolepisma (5)	MENDES (1982)* (1); MENDES (2002a)* (4)	–
N. curtiseta (3)	MENDES (1980a)* (1); MENDES (1988)* (1); MENDES (2002a)* (1)	–
N. hesperica (1)	MENDES (1982)* (1)	–

Tab. S1.38: Interactions of ants of the genus *Goniomma* EMERY, 1895 with silverfish. *Goniomma blanci*: This is the first time, as far as we know, that a Zygentoma is reported in a nest of this genus of ants. The sample was published in MOLERO & al. (1992), but in this work no reference to the ant was indicated. So at this moment the interaction is referred as new. This interaction is not included in Tables 2 and S2.1, but in Table 5 of the main document, since the specimen of Lepismatinae was in bad condition and it was no possible to identify it at species level.

Species of Zygentoma (number of samples)	Literature references	New data
***Neoasterolepisma* sp. (1)**		Granada, road from Guadix to Baza (37° 23' N, 3° 01' W), 21-6-86. 1F. Ref. Z0215.

Tab. S1.39: Number of the different types of interaction of ants of the genus *Lasius* FABRICIUS, 1804 with silverfish. Thirteen types of interactions, ten of them reported in Spain, one of them new. Nineteen interactions from samples of Spain for statistic study (18 of them previously published), twelve additional Western-Palaearctic data of interactions from literature not included in statistics.

***Lasius* species**	**Av**	**Pp**	**Ls**	**Ncu**	**Nh**	**Nw**	**Tot**	**Lit stat**	**Lit not incl**
Lasius alienus		1					1	1	2
L. brunneus		5					5	5	1
L. emarginatus		1					1	1	
L. flavus		1					1	1	2
L. niger	1	6	**1**		1	1	10	9	5
L. umbratus							0	0	1
Lasius sp.		1		1			2	2	1

Tab. S1.40: Interactions of ants identified as *Lasius alienus* (FÖRSTER, 1850) with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
P. pseudolepisma (3)	Wasmann, referred by ESCHERICH (1903)*, (1); MENDES (1980a)* (1), MOLERO & al. (1998b)	–

Tab. S1.41: Interactions of ants identified as *Lasius brunneus* (LATREILLE, 1798) with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
P. pseudolepisma (6)	Wasmann, referred by ESCHERICH (1903)* (1); MOLERO & al. (1998b) (5)	–

Tab. S1.42: Interactions of ants identified as *Lasius emarginatus* (OLIVIER, 1792) with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
P. pseudolepisma (1)	MOLERO & al. (1998b) (1)	–

Tab. S1.43: Interactions of ants identified as *Lasius flavus* (FABRICIUS, 1781) with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
A. formicaria (2)	SILVESTRI (1942)* (1); perhaps based in a reference of Janet mentioned by ESCHERICH (1903); PARMENTIER & al. (2013)*	–
P. pseudolepisma (1)	MOLERO & al. (1992) (1)	–

Tab. S1.44: Interactions of ants identified as *Lasius niger* with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
A. formicaria (3)	STACH (1929)* (1); SILVESTRI (1942)* (1); CHRISTIAN (1994)*	–
A. valenciana (1)	MOLERO & al. (1998b) (1)	–
P. pseudolepisma (8)	Wasmann, referred to by ESCHERICH (1903)* (1); PACLT (1961)* (1); MOLERO & al. (1998b) (6)	–
L. saccharina (1*)		Granada, Güéjar-Sierra, Vereda de la Estrella (37° 08’ N, 3° 23’ W), 1400 m, 1J, Ref. Z2068.
N. hesperica (1)	MOLERO & al. (1996a) (1)	–
N. wasmanni (1)	MOLERO & al. (1996a) (1)	–

Tab. S1.45: Interactions of ants identified as *Lasius umbratus* (NYLANDER, 1846) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (1)	JANET (1896)* explained the cleptobiotic behavior of this silverfish (1)	–

Tab. S1.46: Interactions of ants identified as *Lasius* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (1)	KRATOCHVIL (1945)* (1)	–
P. pseudolepisma (1)	MOLERO & al. (1992) (1)	–
N. curtiseta (1)	MOLERO & al. (1992)	–

Tab. S1.47: Interactions of ants of the genus *Linepithema* MAYR, 1866 with silverfish. One interaction. three samples for Spain for statistic study (all of them previously published), four additional Western-Palaearctic data from literature not included in statistics.

***Linepithema* species**	Pp	Tot	Lit stat	Lit not incl
Linepithema humile	3	3	3	4

Tab. S1.48: Interactions of ants identified as *Linepithema humile* MAYR, 1868 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (7)	MENDES (1980a) (3); MOLERO & al. (1998) (3); MENDES (2002a) (1)	–

Tab. S1.49: Interactions of ants of the genus *Messor* with silverfish. 51 interactions, 47 of them reported in Spain, 12 of them new. 461 samples for Spain for statistic study (157 of them previously published), 109 additional Western-Palaearctic data from literature not included in statistics.

***Messor* species**	Av	Pp	Lc	Ls	Nb	Ncr	Ncu	Nd	Nf	Ng	Nl	Np	Nso	Nsp	Nw	Ta	Tot	Lit stat	Lit not incl
M. barbarus	2	17			3	29	4	1	32	12	38	1	11	77	21	3	251	93	51
M. bouvieri		3			2	3	**5**		3					18	6		40	14	2
M. capitatus		8			1	**8**	13		2	**1**	7			16	5		61	15	12
M. hispanicus		5					**3**		**1**	**1**	**3**			**6**			19	5	0
M. structor		6	**1**		1	**10**	**2**		1		3			10	6	1	41	16	3
Messor sp.		10		**1**		3	8		2		6		1	16	2		49	14	41

Tab. S1.50: Interactions of ants identified as *Messor barbarus* (LINNAEUS, 1767) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. valenciana (2)	MOLERO & al. (1998b) (2)	–
P. pseudolepisma (17)	MOLERO & al. (1992) (3); MOLERO & al. 1998b (14)	–

N. balearica (3)	MOLERO & al. (1998a) (3)	–
N. crassipes (30)	ESCHERICH (1905)* (1); BACH & al. (1993) (2); MOLERO & al. (1994b) (1)	Barcelona, Monistrol de Montserrat (41° 36' N, 1° 49' E), 21-05-92, 1M + 1F + 4J together with *N. wasmanni*, Ref. Z1578. Barcelona, Olivella (41° 18' N, 1° 49' E), 16-05-92, 2M + 2F + 2J, Ref. Z1566. Barcelona, Sant Quintí de Mediona (41° 28' N, 1° 39' E), 19-05-92, 2M + 2F + 7J, Ref. Z1558; Barcelona, Sentmenat, road to Sabadell (41° 35' N, 2° 07' E), 23-05-92, 3M + 2F together with *N. balearica*, Ref. Z1562. Castellón, Alcalá de Chivert (40° 18' N, 0° 11' E), 28-04-92, 3M + 1F + 19J together with *N. foreli* and *P. pseudolepisma*, Ref. Z1499. Castellón, Chert (40° 31' N, 0° 06' E), 15-05-92, 1M together with *N. foreli*, Ref. Z.1427. Gerona, Llagostera (41° 49' N, 2° 57' E), 21-05-92, 4M + 5F + 5J, Ref. Z1591. Huesca, Albalate de Cinca (41° 43' N, 0° 08' E), 26-06-92, 3F + 1J, Ref. Z1678; same locality and date, in another nest, 12M + 9F + 2J together with *N. wasmanni*, Ref. Z1690; Huesca, Candasnos, road N-II to Peñalba Km 404 (41° 30' N, 0° 01' E), 25-06-92, 2M + 3F + 1J together with *N. wasmanni*, Ref. Z1668; same locality and date, in another nest, 1M + 4F together with *N. wasmanni*, Ref. Z1687; Huesca, Lalueza to Marcén (41° 52' N, 0° 16' W), 25-06-92, 1F, Ref. Z1686. Navarra, Carcastillo, road to Sádaba (42° 20' N, 1° 25' W), 23-06-92, 3M + 3F, Ref. Z1777; Navarra, Los Arcos, road to Viana (42° 33' N, 2° 14' W), 23-06-92, 2M + 1J, Ref. Z1772; Navarra, Pitillas (42° 24' N, 1° 35' W), 23-06-92, 11M + 6F + 10J together with *P. pseudolepisma*, Ref. Z1665; Navarra, Tafalla, road to Estella (42° 32' N, 1° 46' W), 23-06-92, 1F + 5J, Ref. Z1762. Tarragona, Segur de Calafell (41° 12' N, 1° 38' E), 24-05-92, 6M + 4F + 1J together with *T. aurea* and *P. pseudolepisma*, Ref. Z1617; Tarragona, La Bisbal del Penedés, Can Gordey (41° 15' N, 1° 28' E), 18-05-92, 1J together with *N. wasmanni*, Ref. Z1583; Tarragona, Mas de Barberans (40° 44' N, 0° 23' E), 15-05-92, 1F, Ref. Z1587. Teruel, La Fresneda, from Valderrobres to Alcañiz (40° 56' N, 0° 04' E), 24-05-92, 1M + 1J together with *N. wasmanni*, Ref. Z1769. Zaragoza, Caspe, road to Alcañiz (41° 11' N, 0° 10' W), 27-06-92, 1M together with *N. wasmanni*, Ref. Z1745; Zaragoza, Mequinenza (41° 19' N, 0° 09' W), 26-06-92, 11M + 3F together with *N. wasmanni*, Ref. Z1743; Zaragoza, Pina de Ebro, La Retuerta (41° 28' N, 0° 21' W), J. Blasco col., 1-06-91, 1F, Ref. Z0600. Zaragoza, Santa Cruz del Moncayo (41° 52' N, 1° 45' W), 21-06-92, 1M, Ref. Z1696; Zaragoza, Zuera, road to Castejón (41° 55' N, 0° 55' W), 24-06-92, 4M + 4F together with *N. wasmanni* and *P. pseudolepisma*, Ref. Z1654; Zaragoza, Zuera, road to Las Pedrosas (41° 58' N, 0° 49' W), 24-06-92, 1M + 2F and several juveniles together with *N. wasmanni* and *P. pseudolepisma*, Ref. Z1765.
N. curtiseta (6)	MENDES (1980a)* (1); MOLERO & al. (1992) (1); MENDES (2002a)* (1);	Burgos, Cogollos (42° 12' N, 3° 40' W), 27-08-1992, 2M + 2F, Ref. Z1851. Cáceres, Cañaveral, Alcántara pond (39° 44' N, 6° 26' W), 30-03-1991, 1M, Ref. Z0792. Toledo, Corral de Almaguer, road to Lillo (39° 45' N, 3° 12' W), 11-08-1992, 2M + 2F + 2J, Ref. Z1100.
N. delator (1)	MOLERO & al. (1996a)* (1)	–
N. foreli (38)	ESCHERICH (1903)* (1); MENDES (1980a)* (4); MENDES (2002a)* (1); MOLERO & al. (1992) (6); MOLERO & al. (1994b) (1); MOLERO & al. (1994c) (5)	Albacete, Estación de Chinchilla (38° 53' N, 1° 40' W), 24-04-92, 11M + 6F + 10J together with *N. wasmanni*, Ref. Z1255; Albacete, Hellín, road to Liétor (38° 31' N, 1° 47' W), 30-04-92, 2F + 1J, Ref. Z1086. Alicante, Calpe, peñón de Ifach (38° 38' N, 0° 04' E), 13-04-92, 2M + 2F + 3J, together with *N. gauthieri calva*, *N. spectabilis*, and *A. valenciana*, Ref. Z1355; Alicante, Gata de Gorgos, road to Llíber (38° 45' N, 0° 02' E), 13-04-92, 6M + 2F, Ref. Z1445; Alicante, Orihuela, cape Roig (37° 53' N, 0° 45' W), 11-04-92, 8M +11F + 2J together with *N. gauthieri calva*, Ref. Z1432. Almería, Mojácar beach (37° 08' N, 1° 49' W), 10-04-92, 2F + 1J together with *N. spectabilis*, Ref. Z0888. Barcelona, Rubí, Can Oriol (41° 29' N, 2° 03' E), 25-05-82, 1F together with *N. balearica*, Ref. Z1550; same locality and date in another nest, 1M + 1F, Ref. Z1548, Castellón, Altura (39° 51' N, 0° 30' W), 27-04-92, 10M + 11F + 8J together with *N. wasmanni*, Ref. Z1479; Castellón, Cabanes (40° 08' N, 0° 01' E), 28-04-92, 5M + 13F + several juveniles, together with *N. spectabilis*, Ref. Z1411; Castellón, Villafames (40° 06' N, 0° 04' W), 28-04-92, 3M + 2F + 3J, Ref. Z1419. Granada, Arenas del Rey, near Los Bermejales pond (36° 57' N, 3° 52' W), 20-03-92, 11M + 6F + 2J, Ref. Z1000. Jaén, Arroyo del Ojanco, road to Puente de Génave (38° 20' N, 2° 52' W), 24-04-92, 14M + 5F together with *N. lusitana* and *P. pseudolepisma*, Ref. Z0945. Murcia, Caravaca road to Lorca, near Quípar river (37° 59' N, 1° 55' W), 26-10-1991, 6M + 3F + 1J, Ref. Z1424. Murcia, Mazarrón (37° 36' N, 1° 17' W), 10-4-92, 17 M + 5F + 3J together with *N. gauthieri calva*, Ref. Z1504. Murcia, Pliego (37° 58' N, 1° 29' W), 15-4-92, 2M + 4F + 4J together with *N. gauthieri calva*, Ref. Z1491. Murcia, Yecla, Sierra de las Pansas (38°

		28' N, 1° 08' W), 14-04-1992, 3M + 5F + 2J together with *N. gauthieri calva*, Ref. Z1377. Toledo, Almorox (40° 14' N, 4° 22' W), 22-07-92, 2M + 1F together with *N. lusitana* and *N. spectabilis*, Ref. Z1130. Valencia, Alcira (39° 08' N, 0° 26' W), 27-04-92, 1F together with *N. gauthieri calva* and *N. spectabilis*, Ref. Z1422; Valencia, Cortes de Pallás, near El Oro (39° 17' N, 0° 55' W), 25-04-92, 11M + 11F + several juveniles, together with *N. gauthieri calva* and *N. spectabilis*, Ref. Z1408.
N. gauthieri + *N. gauthieri calva* (14)	MENDES (1980a)* (2); MOLERO & al. (1994c) (5)	Alicante, Busot (38° 29' N, 0° 24' W), 14-1-1992, 2M + 2F + 5 J, Ref. Z1415. Alicante, Calpe, peñón de Ifach (38° 38' N, 0° 04' E), 13-04-92, 1M + 2F +1 J, together with *N. foreli*, *N. spectabilis* and *A. valenciana*, Ref. Z1356. Alicante, Orihuela, cape Roig (37° 53' N, 0° 45' W), 11-04-92, M +F + J together with *N. foreli*, Ref. Z1432. Murcia, Mazarrón (37° 36' N, 1° 17' W), 10-4-92, 1J together with *N. foreli*, Ref. Z2050. Murcia, Pliego (37° 58' N, 1° 29' W), 15-4-92, 2M together with *N. foreli*, Ref. Z1493. Murcia, Yecla, Sierra de las Pansas (38° 28' N, 1° 08' W), 14-04-1992, 2 M + 2 F + several juveniles, together with *N. foreli*, Ref. Z1377. Valencia, Alcira (39° 08' N, 0° 26' W), 27-04-92, 1M + 1F together with *N. foreli* and *N. spectabilis*, Ref. Z1423.
N. lusitana (52)	MENDES (1980a)* (10); MENDES (1982)* (1); BACH & GAJU (1987) (2); MENDES (1988)* (3); MOLERO & al. (1992) (6); MOLERO & al. (1994b) (1)	Ávila, Madrigal de las Altas Torres (41° 05' N, 4° 58' W), 23-09-92, 1M + 2F together with *N. spectabilis*, Ref. Z1806. Badajoz, Alconchel (38° 30' N, 7° 04' W), 29-03-92, 1F together with *N. spectabilis*, Ref. Z0875; Badajoz, Mérida, Proserpina pond (38° 57' N, 6° 22' W), 26-03-91, 2M + 1F together with *N. spectabilis* and *N. soerenseni*, Ref. Z0789; Badajoz, Monesterio, road to Zafra (38° 08' N, 6° 16' W), 31-03-91, 3M + 2F together with *N. spectabilis*, Ref. Z0805; Badajoz, Villanueva del Fresno, Alcarrache river (38° 21' N, 7° 08' W), 29-03-92, 1M + 1F together with *N. spectabilis*, Ref. Z0865. Cáceres, Alía, Guadarranque river (39° 28' N, 5° 08' W), 06-06-91, 3M + + 3J together with *N. spectabilis*, Ref. Z0782; same locality and date, 2M + 1F in other nest together with *N. spectabilis*, Ref. Z0793, and also in a third nest 12M + 7F + 2J with *N. spectabilis*, Ref. Z0820; Casar de Cáceres (39° 32' N, 6° 27' W), 01-03-89, 1F together with *N. spectabilis*, Ref. Z0772; same locality and date, 1F in another nest with *N. spectabilis*, Ref. Z0777; Cáceres, Cañamero, Ruecas river (39° 22' N, 5° 22' W), 06-06-91, 4M + 5F + 2J together with *N. spectabilis*, Ref. Z0753; Cáceres, Escurial, C-401 (40° 36' N, 5° 56' W), 01-03-89, 1M together with *N. spectabilis*, Ref. Z0739. Ciudad Real, Puertollano (38° 42' N, 4° 05' W), 09-11-91, 1M together with *N. spectabilis*, Ref. Z1102; Ciudad Real, Valdemanco de Esteras, road from Almadén to Agudo, next to Esteras river (38° 54' N, 4° 47' W), 01-05-91, 1M, Ref. Z1229. Córdoba, Cardeña, road to Montoro (38° 12' N, 4° 19' W), 02-06-91, 3F together with *N. spectabilis*, Ref. Z1076. Cuenca, Mota del Cuervo, road to Belmonte (39° 31' N, 2° 49' W), 13-05-92, 1F together with *N. spectabilis*, Ref. Z2064. Guadalajara, Mondéjar, road to Almoguera (40° 19' N, 3° 04' W), 13-09-91, 10J together with *Messor barbarus* and *N. spectabilis*, Ref. Z1189. Huelva Corteconcepción, near Aracena pond (37° 53' N, 6° 28' W), 27-03-92, 1M, Ref. Z0939; Huelva, Rosal de La Frontera, Ribera Calaboza (37° 54' N, 7° 12' W), 28-03-92, 6M + 2F + 1J together with *N. spectabilis* and *P. pseudolepisma*, Ref. Z0992; Huelva, Villanueva de Los Castillejos (37° 29' N, 7° 17' W), 26-03-92, 1M together with *N. spectabilis*, Ref. Z0967. Jaén, Arroyo del Ojanco, road to Puente de Génave (38° 20' N, 2° 52' W), 24-04-92, 1M + 1F together with *N. foreli* and *P. pseudolepisma*, Ref. Z0946; Jaén, Castellar (38° 15' N, 3° 07' W), 30-04-92, 2M, Ref. Z0959; Jaén, Génave (38° 26' N, 2° 45' W), 24-04-92, 2M, Ref. Z0940. Madrid, Navas del Rey (40° 23' N, 4° 14' W), 21-07-92, 3M + 1F, Ref. Z1111; Madrid, Rozas del Puerto to Casillas (40° 18' N, 4° 30' W), 21-07-92, 1J together with *N. spectabilis*, Ref. Z1168. Málaga, Casares (36° 24' N, 5° 16' W), 06-12-91, 2F together with *N. spectabilis* and *N. soerenseni*, Ref. Z1039; Málaga, Valle de Abdalajís, road to Álora (36° 54' N, 4° 41' W), 06-12-91, 1F together with *N. spectabilis* and *P. pseudolepisma*, Ref. Z1056. Toledo, Almorox (40° 14' N, 4° 22' W), 22-07-92, 3M + 4F + 1J together with *N. spectabilis* and *N. foreli*, Ref. Z1131. Zamora, Castronuevo, near Valderaduey river (41° 43' N, 5° 32' W), 24-09-92, 1M + 2F + 6J together with *N. spectabilis*, Ref. Z1902.
N. pallida (1)	MOLERO & al. (1995b) (1)	–
N. soerenseni (21)	MENDES (1980a)* (6); MENDES (1982)* (1); MENDES (1988)* (2); MOLERO & al. (1994b) (3); MOLERO & al.	Badajoz, Cabeza del Buey (38° 43' N, 5° 12' W), 6-6-91, 1 M together with *N. spectabilis*, Ref. Z0814. Badajoz, Mérida, Proserpina pond (38° 57' N, 6° 22' W), 26-03-91, 1M together with *N. lusitana* and *N. spectabilis*, Ref. Z0791. Huelva, Villanueva de los Castillejos (37° 29' N, 7° 17' W), 26-03-92, 3M + 2F + 1J, Ref. Z2069; same locality and date, in another nest, 6M + 2F, Ref. Z0968. Málaga,

	(1994c) (2); MENDES (2002a)* (1)	Casares (36° 24' N, 5° 16' W), 6-12-91, 2M + 1F together with *N. lusitana* and *N. spectabilis*, Ref. Z1040. Málaga, Mijas, road to Coín (36° 35' N, 4° 39' W), 13-02-93, 1M together with *N. spectabilis*; Ref. Z1976.
N. spectabilis (88)	MENDES (1980a)* (9); MENDES (1982)* (1); GAJU & al (1987) (1); MOLERO & al. (1992) (9); MOLERO & al. (1994b) (3); MENDES (2002a)* (1)	Alicante, Calpe, peñón de Ifach (38° 38' N, 0° 04' E), 13-04-92, 4M + 9F + several juveniles, Ref. Z2046; Alicante, Salinas (38° 31' N, 0° 52' E), 14-04-92, 3F + several juveniles, Ref. Z2049; Alicante, San Vicente del Raspeig (38° 25' N, 0° 32' E), 11-04-92, 2M + 2F + 2J, Ref. Z1502. Almería, Alcolea, Gádor mountains northwards Berja (36° 56' N, 2° 57' W), 19-03-92, 16M + 20F + 5J, Ref. Z0972; Almería, Mojácar beach (37° 08' N, 1° 49' W), 10-04-92, 2M + 4F + 7J, Ref. Z0889. Ávila, Madrigal de Las Altas Torres (41° 05' N, 4° 58' W), 23-09-92, 8M + 15F + 16J, Ref. Z1807. Badajoz, Alconchel (38° 30' N, 7° 04' W), 29-03-92, 3M + 2F, Ref. Z0874; Badajoz, Cabeza del Buey (38° 43' N, 5° 12' W), 06-06-91, 1M + 2F, Ref. Z0813; Badajoz, La Puebla de Alcocer, near La Serena pond, road to Cabeza del Buey (38° 57' N, 5° 13' W), 01-05-91, 5M + 15F + 1J, Ref. Z0757; same locality and date, 5M + 7F + 3J in another nest, Ref. Z0810; Badajoz, Mérida, Proserpina pond (38° 57' N, 6° 22' W), 26-03-91, 2M + 1J, Ref. Z0790; Badajoz, Monesterio, road to Zafra (38° 08' N, 6° 16' W), 31-03-91, 2F + 3J, Ref. Z0804; Badajoz, Talarrubias (39° 0' N, 5° 14' W), 06-06-91, 2M, Ref. Z0750; Badajoz, Usagre, Sierra de Almorchón (38° 20' N, 6° 08' W), 05-03-89, 2M + 3F, Ref. Z0734; Badajoz, Villanueva del Fresno, Alcarrache river (38° 21' N, 7° 08' W), 29-03-92, 4M + 2F, Ref. Z0864; Badajoz, Zafra, Sierra del Castellar (38° 24' N, 6° 25' W), 31-03-91, 1M, Ref. Z0796. Cáceres, Alía, near Guadarranque river (39° 28' N, 5° 08' W), 06-06-91, 1M, Ref. Z0783; same locality and date, 1F in another nest, Ref. Z0794, and 2M + 4F in a third nest, Ref. Z0821; Cáceres, Berzocana (39° 26' N, 5° 27' W), 07-06-91, 1F, Ref. Z0842; Cáceres, road N-630, Km 547 (39° 24' N, 6° 21' W), 01-03-89, 2M, Ref. Z0786; Cáceres, Guadiloba pond (39° 18' N, 6° 17' W), 30-03-91, 1M + 3F + 4J, Ref. Z0837; Casar de Cáceres (39° 32' N, 6° 27' W), 01-03-89, 2M + 1F + 1J, Ref. Z0773, and 1M + 1F + 2J in another nest, Ref. Z0778; Cáceres, Cañamero, near Ruecas river (39° 22' N, 5° 22' W), 06-06-91, 1M + 1F, Ref. Z0754; Cáceres, Escurial (40° 36' N, 5° 56' W), 01-03-89, 1M + 2F + 2J, Ref. Z0738. Cádiz, Medina-Sidonia, road to Alcalá de Los Gazules, A-381, formerly C-440, (36° 28' N, 5° 52' W), 13-07-90, 2F + 8J, Ref. Z0498. Castellón, Cabanes (40° 08' N, 0° 01' E), 28-04-92, 3F + several juveniles, Ref. Z1412. Ciudad Real, Almodóvar del Campo, near Retamar (38° 40' N, 4° 13' W), 12-09-91, 4M + 2F + 1J, Ref. Z1126; Ciudad Real, Puertollano (38° 42' N, 4° 05' W), 09-11-91, 2F + 1J, Ref. Z1101; same locality and date, 09-11-91, 1F + 1J, Ref. Z1254. Córdoba, Cardeña, road to Montoro (38° 12' N, 4° 19' W), 02-06-91, 3M, Ref. Z1075; Córdoba, Obejo, Guadalbarbo river (38° 05' N, 4° 49' W), 05-05-91, 6M, Ref. Z0564; Córdoba, Pozoblanco, Virgen de Luna hermitage (38° 19' N, 4° 43' W), 12-07-89, 1J, Ref. Z0453; Córdoba, Puente-Genil, Sierra del Castillo (37° 22' N, 4° 41' W), 20-03-93, 2M + 2F, Ref. Z1982. Cuenca, Mota del Cuervo, road to Belmonte (39° 31' N, 2° 49' W), 13-05-92, 4F + 2J, Ref. Z1236. Granada, La Puebla de Don Fadrique, Toscana Nueva (37° 53' N, 2° 23' W), 26-10-91, 5F, Ref. Z1065; Granada, Rubite, Contraviesa mountains (36° 49' N, 3° 20' W), 19-03-92, 1M + 3F + 4J, Ref. Z0988. Guadalajara, Mondéjar, road to Almoguera (40° 19' N, 3° 04' W), 13-09-91, 6J, Ref. Z1190; Guadalajara, Trillo, road to Gárgoles de Abajo (40° 42' N, 2° 36' W), 23-08-92, 3M + 4J, Ref. Z1164. Huelva, Rosal de La Frontera, Ribera Calaboza (37° 54' N, 7° 12' W), 28-03-92, 1M, Ref. Z0993; Huelva, Villanueva de los Castillejos (37° 29' N, 7° 17' W), 26-03-92, several juveniles, Ref. Z0966. León, Villamañán (42° 18' N, 5° 35' W), 25-09-92, 4M + 6F + 9J, Ref. Z1886. Madrid, Guadalix de la Sierra, road to Soto del Real (40° 46' N, 3° 43' W), 21-07-92, 1M, Ref. Z1227; Madrid, Rozas del Puerto, C-501, road to Casillas (40° 18' N, 4° 30' W), 21-07-92, 1F, Ref. Z1167. Málaga, Alameda, near La Ratosa lagoon (37° 12' N, 4° 41' W), 19-10-91, 1M, Ref. Z1080; Málaga, Casares (36° 24' N, 5° 16' W), 06-12-91, 1M + 1F + 1J, Ref. Z1041; Málaga, Coín, road to Tolox (36° 40' N, 4° 47' W), 06-12-91, 1M + 6F + 1J, Ref. Z1072; Málaga, Mijas, road to Coín (36° 35' N, 4° 39' W), 13-02-93, 1M + 1F, Ref. Z1977; Málaga, Valle de Abdalajís, road to Álora (36° 54' N, 4° 41' W), 06-12-91, 6M + 8F + 4J, Ref. Z1055. Murcia, Mazarrón, road to La Pinilla (37° 38' N, 1° 18' W), 10-04-92, 2F + 1J, Ref. Z1505. Salamanca, Ledesma (41° 05' N, 6° 01' W), 24-09-92, 2M + 2F, Ref. Z1918; Salamanca, Saucelle (41° 02' N, 6° 47' W), 23-09-92, 1M + 1F, Ref. Z1803; same locality and date, 2M + 1F + 2J in another nest, Ref. Z1815, and 2M + 4F + 4J in a third nest, Ref. Z1869; Salamanca, Valdelosa, near road N-630 (41° 12' N, 5° 42' W), 23-09-92, 1M + 2F, Ref. Z1813; same locality and date, 3M + 4F in another nest, Ref. Z1840. Toledo, Almorox (40° 14' N, 4° 22' W), 22-07-92, 8M + 8F, Ref. Z1132. Valencia, Alcira (39° 08' N, 0° 26' W), 27-04-92, 2J, Ref. Z2048; Valencia, Cortes de Pallás,

		near El Oro (39° 17' N, 0° 55' W), 25-04-92, 4F, Ref. Z2047. Valladolid, Cigales (41° 45' N, 4° 42' W), 26-09-92, 3M + 2F + 3J, Ref. Z1854. Zamora, Castronuevo, besides Valderaduey river (41° 43' N, 5° 32' W), 24-09-92, 2M + 9F + 7J, Ref. Z1901; Zamora, Pereruela, near Pueblica del Campeán (41° 24' N, 5° 49' W), 24-09-92, 1F, Ref. Z1876; Zamora, Villar del Buey, road to Fermoselle, near La Almendra pond (41° 19' N, 6° 15' W), 23-09-92, 2M + 3F + 2J, Ref. Z1836.
N. wasmanni (25)	ESCHERICH (1905)* (1); ALFIERI (1932)* (2); BACH & al. (1993) (3); MENDES (1980a)* (1); MOLERO & al. (1996a) (18)	–
T. aurea (5)	GRASSI & ROVELLI (1890)* (1); SILVESTRI (1912)* (1)	Gerona, Blanes (41° 41' N, 2° 46' E), 22-05-1992, 2M + 3F + 1J, Ref. Z1596; Tarragona, La Bisbal del Penedés, Can Gordey (41° 15' N, 1° 28' E), 18-05-1992, 1J, Ref. Z1582; Tarragona, Segur de Calafell (41° 12' N, 1° 38' E), 24-05-1992, 1F together with *N. crassipes* and *P. pseudolepisma*, Ref. Z1618.

Tab. S1.51: Interactions of ants identified as *Messor bouvieri* (BONDROIT, 1918) with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
P. pseudolepisma (3)	MOLERO & al. (1998b) (3)	–
N. balearica (2)	MOLERO & al. (1998a) (2)	–
N. crassipes (3)	BACH & al. (1993) (1)	Huesca, Lalueza, road to Marcén (41° 52' N, 0° 16' W), 25-06-1992, 2M + 1F + 1J, Ref. Z1794; Tarragona, El Perelló (40° 53' N, 0° 41' E), 15-05-1992, 1M together with *P. pseudolepisma*, Ref. Z1570.
***N. curtiseta* (5)**		Cáceres. Cabezuela del Valle (40° 11' N, 5° 49' W), 7-06-1991, 1F, Ref. Z0854; Granada, La Puebla de Don Fadrique, road to Huéscar (37° 53' N, 2° 26' W), 25-10-1991, 5M + 5F together with *N. spectabilis*, Ref. Z2056; Valencia, Requena, road to Casas del Río (39° 20' N, 1° 07' W), 25-04-1992, 6M + 2F + 2J, Ref. Z1439; Zaragoza, Ariza, road to Bordalba (41° 21' N, 2° 04' W), 20-06-1992, 6M + 3F Ref. Z1753; Formentera (Balearic Islands), Punta des Faro (38° 39' N, 1° 34' E), 13-05-1992, 3M, Ref. Z1291.
N. foreli (4)	MOLERO & al. (1994c)* (1)	Albacete, Férez, road to Elche de la Sierra (38° 24' N, 2° 0' W), 27-10-1991, 1M + 1F, Ref. Z1107. Almería, Tíjola, road to Serón (37° 20' N, 2° 23' W), 16-04-92, 1M + 1F, Ref. Z0892. Murcia, Yecla, sierra de Las Pansas (38° 28' N, 1° 08' W), 14-04-92, 2M + 2J, Ref. Z1458.
N. spectabilis (18)	BACH & GAJU (1987) (1); MOLERO & al. (1992) (2)	Almería, Turre, Aguas river (37° 08' N, 1° 55' W), 10-04-92, 1M, Ref. Z0882. Cáceres, Hernán Pérez, CC-513, Km 48 (40° 12' N, 6° 29' W), 08-06-91, 1M, Ref. Z0760. Cuenca, Gascueña (40° 18' N, 2° 30' W), 19-08-92, 5M + 4F, Ref. Z1104. Granada, La Puebla de Don Fadrique, road to Huéscar (37° 53' N, 2° 26' W), 25-10-91, 4F, Ref. Z1077. Granada, Órgiva, road to Ugíjar, near detour to Albuñol (36° 52' N, 3° 22' W), 19-03-92, 1M + 1F, Ref. Z1002. Murcia, Águilas, Cope cape (37° 26' N, 1° 29' W), 10-04-92, 1M, Ref. Z1386. Murcia, Cartagena, near Canteras (37° 36' N, 1° 03' W), 10-04-92, 1M + 2J, Ref. Z1371. Murcia, Mazarrón, road to La Pinilla (37° 38' N, 1° 18' W), 10-04-92, 6M + 1F + 1J, Ref. Z1506. Salamanca, Ledesma (41° 05' N, 6° 01' W), 24-09-92, 1M, Ref. Z1834. Segovia, near arroyo Tejadilla (40° 56' N, 4° 09' W), 27-09-92, 1F + 1J, Ref. Z1915. Valencia, Bicorp, road to Quesa (39° 07' N, 0° 46' W), 26-04-92, 4M + 4F + 2J, Ref. Z1347. Valencia, Casinos, pine-tree forest near road to Villar del Arzobispo (39° 42' N, 0° 45' W), 29-04-92, 8F + 1J, Ref. Z1337. Valencia, La Llosa de Ranés, N-340, Km 852 (39° 01' N, 0° 33' W), 02-11-91, 1M, Ref. Z1352. Valencia, Chera, road to Sot de Chera (39° 35' N, 0° 57' W), 29-04-92, 6F + 1J, Ref. Z1507. Zamora, Peñausende, near Tamame (41° 18' N, 5° 52' W), 24-09-92, 2M, Ref. Z1850.
N. wasmanni (6)	MOLERO & al. (1996a) (5)	Granada, Baza, road to Cúllar (37° 30' N, 2° 43' W), 25-10-1991, 8M + 9F + 5J Ref. Z1018 (published erroneously in MOLERO & al. (1994b) as with *M. barbarus*).
T. aurea (1)	HANDSCHIN (1927)* (1)	–

Tab. S1.52: Interactions of ants identified as *Messor capitatus* (LATREILLE, 1798) with silverfish; cf. indicates that the identification of the ant is not sure.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (8)	MOLERO & al. (1998b) (8)	–
N. balearica (1)	MOLERO & al. (1998a) (1)	–
***N. crassipes* (8)**		Barcelona, Caserras, road to Gironella (42° 01' N, 1° 50' E), 23-05-92, 1F, Ref. Z1634. Huesca, Benabarre, road to Lérida (42° 23' N, 0° 27' E),14-07-92, 1M + 2J, Ref. Z1760. Huesca, Riglos (42° 20' N, 0° 43' W), 11-07-92, 2M + 2F, Ref. Z1722. Lérida, Alfarrás, road to Tamarite de Litera (41° 50' N, 0° 33' E), 26-06-92, 8M + 2F together with *N. wasmanni* and *P. pseudolepisma*, Ref. Z1588. Lérida Os de Balaguer, road to Balaguer, Serra del Convent (41° 52' N, 0° 44' E), 15-07-92, 1F, Ref. Z1624. Zaragoza, Belchite, Pueyo sanctuary (41° 18' N, 0° 50' W), 27-06-92, 2M together with *N. wasmanni* and *P. pseudolepisma*, Ref. Z1791. Zaragoza, Luna, road to Erla (42° 09' N, 0° 56' W), 24-06-92, 3M + 2F, Ref. Z1659. Zaragoza, Santa Cruz del Moncayo (41° 52' N, 1° 45' W), 21-06-92, 2F + 2J, Ref. Z1798.
N. curtiseta (16)	MENDES (1980a)* (2); MENDES (1988)* (as *M. sancta*) (1)	Burgos, Santo Domingo de Silos (41° 57' N, 3° 24' W), 26-08-92, 1M + 4F + 4J, Ref. Z1922. Guadalajara, Herrería (40° 53' N, 1° 57' W), 22-08-92, 2M, Ref. Z1127. León, Cebanico, from Valmartino to Almanza (42° 43' N, 5° 02' W), 25-09-92, 1M +1F, Ref. Z1864; same locality and date, 1M +12F + 3J in another nest, Ref. Z1942. León, Paradaseca, road to Villafranca del Bierzo (42° 40' N, 6° 47' W), 13-7-1991, 1M, Ref. Z1846. Soria, Abejar (41° 46' N, 2° 46' W), 25-08-92, 2M + 2F + 2J, Ref. Z1866. Soria, Alpanseque, Altos de Barahona (41° 16' N, 2° 42' W), 24-08-92, 1M + 2J, Ref. Z1856. Soria, Deza (41° 28' N, 2° 02' W), 20-06-92, 1M + 1F, Ref. Z1844. Soria, Villasayas, road to Barahona (41° 20' N, 2° 36' W), 24-08-92, 3M + 3F, Ref. Z1939. Teruel, Albentosa (40° 06' N, 0° 47' W), 14-05-92, 4F + 3J, Ref. Z1790; Teruel, Bañón (40° 49' N, 1° 10' W), 22-08-92, 2M, Ref. Z1737. Teruel, Camarillas, road to Aliaga (40° 37' N, 0° 45' W), 21-08-92, 6M + 7F, Ref. Z1782; Teruel, Cañizar del Olivar, Puerto de las Traviesas (40° 48' N, 0° 39' W), 21-08-92, 3M + 3F + 1J together with *P. pseudolepisma*, Ref. Z1775.
N. foreli (3)	MENDES (1980a)* (as *M. sancta*) (1)	Castellón, Benicasim, Desierto de las Palmas (40° 04' N, 0° 02' E), 28-4-1992, 2F, Ref. Z1512. Valencia, Cofrentes (39° 13' N, 1° 05' W), 25-4-92, 1M together with *N. gauthieri*, Ref. Z1482.
***N. gauthieri calva* (1)**		Valencia, Cofrentes (39° 13' N, 1° 05' W), 25-4-92, 2M + 1F together with *N. foreli*, Ref. Z1481.
N. lusitana (8)	MENDES (1980a)* (as *M. sancta*) (1)	Cuenca, Gascueña (40° 18' N, 2° 30' W), 19-08-92, 1M + 1F, Ref. Z1103. Guadalajara, Brihuega (40° 45' N, 2° 50' W), 23-08-92, 1M together with *N. spectabilis*, Ref. Z1199. Guadalajara, Casas de San Galindo, road to Jadraque (40° 52' N, 2° 57' W), 23-08-92, 2M + 2F together with *P. pseudolepisma*, Ref. Z1222; Guadalajara, Retiendas, road to Tamajón (40° 58' N, 3° 16' W), 22-08-92, 1M + 1F together with *N. spectabilis*, Ref. Z1136; León, Valdepolo (42° 34' N, 5° 13' W), 25-09-92, 1M + 2F + 8J, Ref. Z1845; Madrid, Valdemorillo, next to Pino-Alto (40° 30' N, 4° 03' W), 20-07-92, 1M, Ref. Z1258. Palencia, Baltanás, road to Cevico Navero (41° 54' N, 4° 13' W), 26-09-92, 1M + 1F, Ref. Z1892.
N. soerenseni (1)	MENDES (1980a)* (as *M. sancta*) (1)	–
N. spectabilis (22)	BACH & GAJU (1987) (1); MENDES (1980a)* (3), MENDES (2002a)* (3), as *M. sancta*	Albacete, Robledo (38° 44' N, 2° 27' W), 24-04-92, 2F, Ref. Z1210. Almería, María (37° 42' N, 2° 09' W), 26-10-91, 1F, Ref. Z1069. Ávila, El Hoyo de Pinares, road to Valdemaqueda (40° 30' N, 4° 23' W), 20-07-92, 3M + 4F, Ref. Z1925. Ávila, Muñana, road to Las Fuentes mountain pass (40° 37' N, 5° 02' W), 22-09-92, 1M + 1J, Ref. Z1832. Castellón, Bejís (39° 54' N, 0° 42' W), 21-04-92, 2F + 3J, Ref. Z1438. Ciudad Real, Santa Cruz de los Cáñamos (38° 37' N, 2° 51' W), 30-04-92, 3M + 4F, Ref. Z1084. Granada, Castril, road to Benamaurel (37° 47' N, 2° 46' W), 1F, Ref. Z1044. Guadalajara, Brihuega (40° 45' N, 2° 50' W), 23-08-92, 8F + 5J, Ref. Z1198. Guadalajara, Retiendas, road to Tamajón (40° 58' N, 3° 16' W), 22-08-92, 2M

		+ 3F, Ref. Z1135. Huelva, Bollullos del Condado, road to La Palma del Condado (37° 21’ N, 6° 32’ W), 31-03-92, 4M + 3F + 4J, Ref. Z0920. Segovia, Sepúlveda (41° 17’ N, 3° 46’ W), 27-08-92, 6M + 8F, Ref. Z1882. Sevilla, Aznalcóllar, road to Escacena (37° 29’ N, 6° 18’ W), 27-03-92, 1F, Ref. Z0930. Valencia, Aras de Alpuente, road to Santa Cruz de Moya (39° 56’ N, 1° 09’ W), 14-05-92, 4M, Ref. Z1519. Valencia, Cofrentes (39° 13’ N, 1° 05’ W), 25-04-92, 2M + 1F + several juveniles, Ref. Z1483. Zamora, Fermoselle, near Tormes river (41° 16’ N, 6° 23’ W), 23-09-92, 1M + 3F + 3J, Ref. Z1817.
N. wasmanni (5)	MOLERO & al. (1996a) (5)	–

Tab. S1.53: Interactions of ants identified as *Messor hispanicus* SANTSCHI, 1919 with silverfish; cf. indicates that the identification of the ant is not sure.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
P. pseudolepisma (5)	MOLERO & al. (1998b) (5)	–
***N. curtiseta* (3*)**		Albacete, Peñas de San Pedro, near La Solana (38° 44’ N, 2° 0’ W), 30-04-92, 2M + 3F + 6J, together with *N. gauthieri calva* and *P. pseudolepisma*, Ref. Z1183. Ávila, Navatalgordo (40° 24’ N, 4° 51’ W), 21-07-92, 1M + 2F, Ref. Z1949. Cuenca, Campillos-Paravientos, road from Cañete to Landete (39° 58’ N, 1° 33’ W), 14-05-92, 4M + 8F + 1J together with *P. pseudolepisma*, Ref. Z1247.
***N. foreli* (1*)**		Albacete, Carcelén, road to Casas de Juan Gil (39° 16’ N, 1° 06’ W), 25-04-1992, 1M, Ref. Z1219.
***N. gauthieri calva* (1*)**		Albacete, Peñas de San Pedro, near La Solana (38° 44’ N, 2° 0’ W), 30-04-92, 2M + 3F + 6J, together with *N. curtiseta* and *P. pseudolepisma*, Ref. Z1182.
***N. lusitana* (3*)**		Albacete, El Bonillo, road to Lezuza (38° 56’ N, 2° 28’ W),20-04-92, 4M + 1F + 2J together with *N. spectabilis*, Ref. Z1121 (cf.). Guadalajara, Tamajón, road to Cogolludo, near Sorbe river (40° 59’ N, 3° 12’ W), 25-08-92, 1M together with *N. spectabilis*, Ref. Z1081 (cf.). León, Valdepolo (42° 34’ N, 5° 13’ W), 25-09-92, 3M + 1F, Ref. Z1867 (cf.).
***N. spectabilis* (6*)**		Albacete, El Bonillo, road to Lezuza (38° 56’ N, 2° 28’ W), 20-04-92, 1M + 4J, Ref. Z1120. Albacete, Paterna del Madera, near Riópar towards El Barrancazo mountain pass (38° 33’ N, 2° 20’ W), 27-10-91, 2J, Ref. Z1188. Cuenca, Fuentes, road to Rocho mountain pass (39° 56’ N, 2° 0’ W), 14-05-92, 7M + 6F + 3J, Ref. Z1142. Guadalajara, El Pedregal (40° 46’ N, 1° 34’ W), 22-08-92, 5M + 6F + 9J, Ref. Z1123. Guadalajara, Tamajón, road to Cogolludo, near Sorbe river (40° 59’ N, 3° 12’ W), 25-08-92, 1M + 1J, Ref. Z1082. Valencia, Sinarcas, road to LaTorre de Utiel (39° 42’ N, 1° 14’ W), 24-5-1992, 2M + 1F + 4J, Ref. Z1470.

Tab. S1.54: Interactions of ants identified as *Messor structor* (LATREILLE, 1798) with silverfish.

Species of Zygentoma (number of samples)	**Literature references**	**New data**
A. formicaria (1)	SILVESTRI (1942)* as *M. rufitarsis* (1)	–
P. pseudolepisma (6)	MOLERO & al. (1992) (1), MOLERO & al. (1998b) (5)	–
***L. chlorosoma* (1)**		Palencia, Husillos (42° 05’ N, 4° 30’ W), 27-09-92, 2M + 3F + 4J, Ref. Z1931.
N. balearica (1)	MOLERO & al. (1998a) (1)	–
***N. crassipes* (10)**		Barcelona, Els Prats del Rei, road from Igualada to Calaf, near La Manresana dels Prats (41° 41’ N, 1° 32’ E), 20-05-92, 4M + 4F + 11J together with *N. wasmanni*, Ref. Z1627. Barcelona, Sant Quirze Safaja, road from San Feliú de Codines to

		Centelles (41° 43' N, 2° 10' E), 23-05-92, 6M + 4F + 5J, Ref. Z1559. Guadalajara, Sigüenza (41° 01' N, 2° 39' W), 24-08-92, 1M + 5F + 5J, Ref. Z1092. Huesca, Loarre (42° 18' N, 0° 39' W), 24-06-92, 4M + 3F + several juveniles, Ref. Z1748; Huesca, Loporzano, near Sipan (42° 10' N, 0° 17' W), 09-07-92, 1M + 2F + 1J together with *N. wasmanni*, Ref. Z1788. Lérida, Agramunt, road to Tárrega (41° 44' N, 1° 06' E), 20-05-92, 1M + 9F together with *N. wasmanni*, Ref. Z1615. Lérida, Isona, Pas de Finestres (42° 07' N, 1° 04' E), 16-07-92, 3M + 2F + 8J, Ref. Z1564. Tarragona, El Pla de Santa María, road to El Pont de Armentera (41° 22' N, 1° 19' E), 18-05-92, 1M + 1F + 3J together with *P. pseudolepisma*, Ref. Z1574. Tarragona, Horta de Sant Joan, road to Bot (40° 58' N, 0° 19' E), 24-05-92, 6M + 2F + 5J, Ref. Z1580. Tarragona, Santa Coloma de Queralt, road to Vallfogona de Riucorb (41° 32' N, 1° 21' E), 19-05-92, 3J, Ref. Z1631.
***N. curtiseta* (2)**		Soria, San Leonardo de Yagüe, road to Río Lobos canyon (41° 48' N, 3° 05' W), 25-08-92, 10M + 7F + 1J, Ref. Z1887. Teruel (40° 21' N, 1° 05' W), 21-08-92, 1M together with *N. wasmanni*, Ref. Z1755.
N. foreli (1)	MOLERO & al. (1992) (1)	–
N. lusitana (3)	MOLERO & al. (1992) (1)	Palencia, Fuentes de Valdepero (42° 05' N, 4° 30' W), 25-09-92, 1F + 2J together with *N. spectabilis*, Ref. Z1948. Toledo, Noblejas (39° 58' N, 3° 24' W), 16-09-91, 1F together with *N. spectabilis*, Ref. Z1150.
N. spectabilis (10)	BACH & GAJU (1987) (2); MOLERO & al. (1992) (1)	Cáceres, Guijo de Santa Bárbara, Garganta de Jaranda, southern Gredos mountains (40° 09' N, 5° 39' W), 29-03-91, 1J, Ref. Z0797. Cáceres, Navaconcejo, Jerte valley (40° 10' N, 5° 50' W), 28-03-91, 1M, Ref. Z0832. Ciudad Real, Almuradiel, N-IV, Km 237 (38° 29' N, 3° 30' W), 29-12-82, 1F, Ref. Z0064. Jaén, Quesada, near Tíscar mountain pass, 1150 m (37° 47' N, 3° 03' W), 24-10-91, 1F + 2J, Ref. Z1052. Madrid, Pozuelo del Rey (40° 22' N, 3° 20' W), 13-09-91, 1M + 5F + 10J, Ref. Z1197. Palencia, Fuentes de Valdepero (42° 05' N, 4° 30' W), 25-09-92, 5M + 1F + 3J, Ref. Z1947. Toledo, Noblejas (39° 58' N, 3° 24' W), 16-09-91, 3F + 3J, Ref. Z1149.
N. wasmanni (6)	MOLERO & al. (1996b) (4)	Cuenca, Iniesta, road to Tarazona de la Mancha (39° 24' N, 1° 47' W), 26-05-1992, 2M + 2F, Ref. Z1242. Lérida, Ponts (41° 54' N, 1° 10' E), 19-05-1992, 5M + 10F + 7J, Ref. Z1569.
T. aurea (3)	SILVESTRI (1912)* (1); MENDES (1980a)* as *M. rufitarsis* (1)	Barcelona, Montseny (41° 45' N, 2° 24' E), 23-5-1992, 7M + 2F + 1J, Ref. Z1573.

Tab. S1.55: Interactions of ants identified as *Messor* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (11)	MENDES (1980a)* (1), MOLERO & al. (1998b)* (10)	–
L. saccharina (1*)		Valencia, Ayora, road to Zarra (39° 04' N, 1° 04' W), 25-04-1992, 1M + 1J together with *N. spectabilis*, Ref. Z2052.
N. angustothoracica (1)	MOLERO & al. (2000)* (1)	–
N. crassipes (8)	MENDES (1980b)* (2); MOLERO & al. (2000) (2); MENDES (2002b)* (1)	Lérida, Ager, Sierra del Montsec (42° 01' N, 0° 44' E), 15-07-92, 7M + 8F + 10J together with *P. pseudolepisma*, Ref. Z1592. Tarragona, Prades (41° 17' N, 1° 0' E), 18-05-92, 2M + 2F + 7J together with *P. pseudolepisma*, Ref. Z1560; Zaragoza, Nuévalos, near Monasterio de Piedra (41° 11' N, 1° 46' W), 27-06-92, 3M together with *N. wasmanni*, Ref. Z1735.
N. curtiseta (8)		Burgos, Santo Domingo de Silos (41° 57' N, 3° 24' W), 26-08-92, 8M + 2F + 3J, Ref. Z1934. Huesca, Berdún (42° 35' N, 0° 49' W), 10-07-92, 5M + 2F, Ref. Z1751; Madrid, Cercedilla (40° 44' N, 4° 02' W), 21-07-92, 3M + 1F, Ref. Z1117; Soria, Berlanga de Duero (41° 28' N, 2° 51' W), 24-08-92, 1F + several juveniles, Ref. Z1954; Soria, Garray, near Numancia ruins (41° 48' N, 2° 26' W), 26-08-92, 1M + 2F + 9J, Ref. Z1858; Teruel, Escorihuela

		(40° 31’ N, 0° 57’ W), 21-08-92, 2M + 4F, Ref. Z1719. Zaragoza, Miedes, road from Cariñena to Calatayud, C-221, Km 22,8 (41° 15’ N, 1° 25’ W), 27-06-92, 3F, Ref.Z1692. Same locality and date, 4M +3F, Ref. Z1802.
N. foreli (6)	MENDES (1980a)* (1), MENDES (1988)* (1), MENDES (1992)* (1), MOLERO & al. (1994b)* (1)	Albacete, Alcalá del Júcar, road to Casas de Ves (39° 13’ N, 1° 24’ W), 25-04-92, 8M + 5F + 7J together with *N. lusitana*, Ref. Z1145. Castellón, Val de Uxó, road to Algar (39° 47’ N, 0° 15’ W), 29-04-92, 2M + 1F, Ref. Z1487.
N. lusitana (10)	MENDES (2002a)* (4)	Albacete, Alcalá del Júcar, cruce a Casas de Ves (39° 13’ N, 1° 24’ W), 25-04-92, 8M + 5F + 7J together with *N. foreli*, Ref. Z1146. Badajoz, Jerez de los Caballeros (38° 19’ N, 6° 48’ W), 29-03-92, 6M + 1F + 1J together with *N. spectabilis*, Ref. Z0868. Burgos, Castrojeriz (42° 16’ N, 4° 06’ W), 26-09-92, 1J together with *P. pseudolepisma*, Ref. Z1896. Cádiz, Olvera (36° 56’ N, 5° 13’ W), 1-11-1994, 2M + 2F, Ref. Z2132. Sevilla, Coria del Río, Isla Menor grassland (37° 12’ N, 6° 01’ W), 25-03-92, 3M + 3F + 1J together with *N. spectabilis* and *N. soerenseni*, Ref. Z1011. Valladolid, Viloria (41° 27’ N, 4° 22’ W), 27-09-92, 1M together with *N. spectabilis*, Ref. Z1862.
N. myrmecobia (1)	MENDES (1993)* (1)	–
N. soerenseni (7)	MOLERO & al. (1994c)* (4), MENDES (2002a)* (2)	Sevilla, Coria del Río, Isla Menor grassland (37° 12’ N, 6° 01’ W), 25-03-92, 4M together with *N. spectabilis* and *N. lusitana*, Ref. Z1013.
N. spectabillis (32)	MENDES (1980a)* (2), BACH & GAJU (1987) (1), MENDES (1988)* (1), MENDES (1992)* (1), MOLERO & al. (1992) (1), MENDES (2002a)* (12)	Ávila, Muñogalindo (40° 36’ N, 4° 52’ W), 22-09-92, 1F, Ref. Z1841. Ávila, Ojos-Albos (40° 42’ N, 4° 31’ W), 22-09-92, 1M + 1F + 3J, Ref. Z1805; same locality and date, 1J in another nest, Ref. Z1824. Badajoz, Jerez de los Caballeros (38° 19’ N, 6° 48’ W), 29-03-92, 6M + 1F + 1J together with *N. lusitana*, Ref. Z0867. Barcelona, Olost, road to Vic (41° 57’ N, 2° 08’ E), 23-05-92, 6F, Ref. Z1555. Castellón, Albocácer, road to Benassal (40° 21’ N, 0° 01’ W), 28-04-92, 4F, Ref. Z1441. Palencia, Fuentes de Valdepero (42° 05’ N, 4° 30’ W), 25-09-92, 7J, Ref. Z1958. Salamanca, Puente de La Salud (40° 57’ N, 5° 42’ W), 08-04-73, 1M + 1F, Ref. Z1907. Segovia, Maderuelo, road C-114 to Fuentelcésped (41° 33’ N, 3° 33’ W), 27-08-92, 11M + 6F, Ref. Z1911. Segovia, Villacastín (40° 46’ N, 4° 26’ W), 22-09-92, 2M + 1F + 2J, Ref. Z1821. Sevilla, Coria del Río, Isla Menor grassland (37° 12’ N, 6° 01’ W), 25-03-92, 6M + 10F + 2J together with *N. lusitana* and *N. soerenseni*, Ref. Z1012. Valencia, Ayora, road to Zarra (39° 04’ N, 1° 04’ W), 25-04-1992, 1F + 1J together with *L. saccharina*, Ref. Z1389. Valladolid, Viloria (41° 27’ N, 4° 22’ W), 27-09-92, 2F together with *N. lusitana*, Ref. Z1861. Zamora, Ferreras de Abajo, road from Tábara to Sanabria (41° 52’ N, 6° 0’ W), 24-09-92, 1F, Ref. Z1908.
N. wasmanni (2)	MOLERO & al. (1996a)* (2)	–
T. aurea (4)	MENDES (1980a)* (1); MENDES (1988)* (1); MOLERO & al. (2000) (1); MENDES (2002b)* (1)	–

Tab. S1.56: Interactions of ants of the genus *Myrmica* LATREILLE, 1804 with silverfish. Species *M. rubra* (LINNAEUS, 1758). One interaction from the literature, none reported in Spain.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (1)	ESCHERICH (1905), reported as *Myrmica laevinodis*	–

Tab. S1.57: Number of interactions of ants of the genus *Pheidole* with silverfish. Eight interactions, four of them reported in Spain, none of them new. 56 samples for Spain for statistic study (48 of them previously published), 13 additional Western-Palaearctic data from literature not included in statistics.

***Pheidole* species**	**Pp**	**Lb**	**Lc**	**Np**	**Tot**	**Lit stat**	**Lit not incl**
Pheidole pallidula	44	2	9	1	56	48	13

Tab. S1.58: Detailed references of interactions of ants identified as *Pheidole pallidula or Pheidole sp.* with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (1)	SILVESTRI (1942)* (1)	–
P. pseudolepisma (49)	MENDES (1980a)* (2), MENDES (1981)* (1), MENDES (1982*) (1), BACH & GAJU (1987) (3), MOLERO & al. (1992) (3), MOLERO & al. (1998) (38), MENDES (2002a)* (1)	–
L. baetica (2)	MOLERO & al. (1994a) (2)	–
L. chlorosoma (11)	MENDES (1980a)* (1), MENDES (1988)* (1), MOLERO & al. (1992) (1)	Cáceres, Guijo de Granadilla, near Gabriel y Galán pond (40° 12' N, 6° 10' W), 08-06-91, 2M + 1F, Ref. Z0803; Cáceres, Hernán-Pérez, CC-513, Km 48 (40° 12' N, 6° 29' W), 08-06-91, 1M, Ref. Z0816. Same locality and date, 1F in another nest, Ref Z0848. Huelva, Jabugo, road to Castaño del Robledo (37° 53' N, 6° 43' W), 30-03-92, 1J, Ref. Z0932. Madrid, Robledo de Chavela (40° 29' N, 4° 15' W), 20-07-92, 3M, Ref. Z1097. Toledo, Las Ventas con Peña Aguilera, El Milagro mountain pass (39° 33' N, 4° 14' W), 12-09-91, 1M, Ref. Z1207. Zamora, Faramontaos de Tábara, near Esla river (41° 50' N, 5° 48' W), 24-09-92, 2J, Ref. Z1904. Same locality and date, 1F in another nest, Ref. Z1963.
N. pallida (1)	MOLERO & al. (1995b) (1)	–
N. soerenseni (1)	MOLERO & al. (1994c) (1)	–
N. spectabilis (1)	MENDES (1988)* (1)	–
T. aurea (1)	MENDES (1980a)* (1)	–

Tab. S1.59: Number of interactions of ants of the genus *Plagiolepis* MAYR, 1861 with silverfish. Two interactions, one of them reported in Spain, none of them new. One sample for Spain for statistic study (previously published), one additional Western-Palaearctic data from literature not included in statistics.

Plagiolepis **species**	Pp	Tot	Lit stat	Lit not incl
Plagiolepis pygmaea	1	1	1	1

Tab. S1.60: Detailed references of interactions of ants identified as *Plagiolepis pygmaea* (LATREILLE, 1798) or *Plagiolepis* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. montana (1)	MENDES (1981)* (1)	–
P. pseudolepisma (1)	MOLERO & al. (1998b) (1)	–

Tab. S1.61: Number of interactions of ants of the genus *Tapinoma* FÖRSTER, 1850 with silverfish. Four interactions, three of them reported in Spain, one of them new. Seven samples for Spain for statistic study (six previously published), one additional Western-Palaearctic data from literature not included in statistics.

Tapinoma **species**	Pp	Lc	Tot	Lit stat	Lit not incl
Tapinoma erraticum	1	**1**	2	1	0
T. nigerrimum	4		4	4	0
Tapinoma sp.	1		1	1	1

Tab. S1.62: Detailed references of interactions of ants identified as *Tapinoma erraticum* (LATREILLE, 1798) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	MOLERO & al. (1998b) (1)	–
***L. chlorosoma* (1)**		Zamora, Villar del Buey, road to Fermoselle (41° 19' N, 6° 12' W), 23-9-1992, 1F, Ref. Z1837.

Tab. S1.63: Detailed references of interactions of ants identified as *Tapinoma nigerrimum* (NYLANDER, 1856) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (4)	MOLERO & al. (1998b) (4)	–

Tab. S1.64: Detailed references of interactions of ants identified as *Tapinoma* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	MOLERO & al. (1998b) (1)	–
L. saccharina (1)	MENDES (1980)* (a)	–

Tab. S1.65: Number of interactions of ants of the genus *Temnothorax* MAYR, 1861 with silverfish. Five interactions, four of them reported in Spain, none of them is new. Six samples for Spain for statistic study (five of them previously published), five additional Western-Palaearctic data from literature not included in statistics.

Temnothorax species	Pp	Lb	Nl	N sp	Total	Lit stat	Lit not incl
Temnothorax sp.	2	2	1	1	6	5	5

Tab. S1.66: Detailed references of interactions of ants identified as *Temnothorax* sp. with silverfish (most of them referred as *Leptothorax* sp. in the literature).

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (6)	Wasmann, referred by ESCHERICH, (1903)* (1); MENDES (1980a)* (1); MOLERO & al. (1992) (2); MENDES (2002a)* (2)	–
L. baetica (2)	MOLERO & al (1994a)* (1)	Jaén, Huelma, road to Jódar (37° 40' N, 3° 23' W), 18-8-1988, 4J, Ref. Z0381.
N. hesperica (1)	MENDES (1980a)* (1)	–
N. lusitana (1)	MOLERO & al. (1992) (1)	–
N. spectabilis (1)	MOLERO & al. (1992) (1)	–

Tab. S1.67: Number of interactions of ants of the genus *Tetramorium* with silverfish. Fifteen interactions, 13 of them reported in Spain, six of them new. 45 samples for Spain for statistic study (28 previously published), seven additional Western-Palaearctic data from literature not included in statistics.

Tetramorium species	Av	Pp	Lb	Lc	Ls	Nw	Ta	Tot	Lit stat	Lit not incl
Tetramorium caespitum		5		**2**	**1**	1		9	6	4
T. forte		12		**6**	**1**			19	12	0
T. cf. *meridionale*		1						1	1	0
T. semilaeve	1	4	**3**	3			**1**	12	5	1
Tetramorium sp.		4						4	4	2

Tab. S1.68: Detailed references of interactions of ants identified as *Tetramorium caespitum* with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (4)	HEYDEN (1855)* (1) DALLA TORRE (1888)* (1) ESCHERICH (1903)* (1); SILVESTRI (1942)* (1)	–
P. pseudolepisma (5)	MOLERO & al. (1992) (1); MOLERO & al. (1998b) (4)	–
***L. chlorosoma* (2)**		Badajoz, Cabeza del Buey (38° 43' N, 5° 12' W), 6-6-1991, 1M + 1F, Ref. 0775. Palencia, Fuentes de Valdepero (42° 05' N, 4° 30' W), 25-9-1992, 1F + 1J together with *P. pseudolepisma*, Ref. Z1875.
***L. saccharina* (1)**		Zaragoza, Santa Cruz del Moncayo (41° 52' N, 1° 45' W), 21-6-1992, 1J, Ref. Z1800.
N. wasmanni (1)	MOLERO & al. (1996a) (1)	–

Tab. S1.69: Detailed references of interactions of ants identified as *Tetramorium forte* (FOREL, 1904) with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (12)	MOLERO & al. (1998b) (12), as *T. hispanicum*	–
***L. chlorosoma* (6)**		Madrid, Valdemorillo (40° 30' N, 4° 03' W), 20-07-92, 1M + 2F, Ref. Z1259. Palencia, Villarrabé, road from Saldaña to Sahagún (42° 25' N, 4° 48' W), 25-09-92, 7M + 5F + 1J, Ref. Z1957. Toledo, Guadamur (39° 49' N, 4° 10' W), 12-09-91, 2M + 1F, Ref. Z1230; Zamora, Ferreras de Abajo, road from Tábara to Sanabria (41° 52' N, 6° 0' W), 24-09-92, 11M + 5F + 2J, Ref. Z1941. Zamora, Olmillos de Castro, near San Martín de Tábara (41° 44' N, 5° 59' W), 21-09-89, 1M, Ref. Z1894. Zamora, Villar del Buey, road to Fermoselle (41° 19' N, 6° 12' W), 23-09-92, 1J, Ref. Z1826.
***L. saccharina* (1)**		Huelva, Almonte (37° 13' N, 6° 30' W), 17-5-1988, 1M, Ref. Z0441.

Tab. S1.70: Detailed references of interactions of ants identified as *Tetramorium* cf. *meriodionale* EMERY, 1870 with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
P. pseudolepisma (1)	MOLERO & al. (1998b) (1)	–

Tab. S1.71: Detailed references of interactions of ants identified as *Tetramorium semilaeve* (ANDRÉ, 1883) or *T.* cf. *semilaeve* with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. valenciana (1)	MOLERO & al. (1998b) (1)	–
P. pseudolepisma (4)	MOLERO & al. (1998b) (4)	–
L. baetica (3)		Minorca island (Balearics), Alaior, Es Bec Nou (39° 57' N, 4° 05' E), 21-09-91, 5M + 2F +1J, Ref. Z0643. Minorca island, Es Mercadal, Cala Binimella (40° 02' N, 4° 03' E), 20-09-91, 1M, Ref. Z0644. Cádiz, Alcalá de los Gazules, road to Ubrique, near Sierra del Aljibe (36° 31' N, 5° 38' W), 06-05-92, 2M + 4F, Ref. Z0955.
***L. chlorosoma* (3)**	MENDES (1980a) (1)	Badajoz, Jerez de los Caballeros (38° 19' N, 6° 48' W), 29-03-92, 2M + 2F; Ref. Z0872. Cáceres, Castañar de Ibor (39° 38' N, 5° 25' W) 07-06-91, 1M

		+ 2F, Ref. Z0846. Cáceres, Garganta la Olla (40° 06' N, 5° 47' W), 07-06-91, 2M + 8F, Ref. Z0807.
***T. aurea* (1)**		Minorca island (Balearics), Es Mercadal, Cala Binimella (40° 02' N, 4° 03' E), 2F, Ref. Z0646.

Tab. S1.72: Detailed references of interactions of ants identified as *Tetramorium* sp. with silverfish.

Species of Zygentoma (number of samples)	Literature references	New data
A. formicaria (2)	MOLERO & al. (2000) (2)	–
P. pseudolepisma (4)	BACH & GAJU (1987) (4)	–

Summary

193 Zygentoma-Formicoidea associations are included. 157 of them have been detected in Spain; 41 of them are new (reported for the first time). 834 samples from Spain have been included in the statistical study of the main paper, 398 of them previously published (included in papers detailed in Table S1.73).

225 additonal samples or references included in the literature are taken into account but not included into the statistic study. In total, 1059 reports of interactions Zygentoma-ants in the West Palaearctic Region have been considered for conclusions of this work.

Tab. S1.73: Papers where samples of silverfish with ants in Spain have been previously reported by the authors. All of them are considered for the analysis of the main paper, together with new data given in this Appendix. (* = geographic coordinates and/or maps are given in the paper).

References	Number of localities sampled	Number of samples of silverfish studied (with / without ants)
GAJU-RICART & BACH DE ROCA (1986) and BACH DE ROCA & GAJU-RICART (1987)	18*	39 / 11
GAJU-RICART, BACH DE ROCA & MOLERO-BALTANÁS (1987)	11*	6 / 13
MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART (1992)	214*	66 / 246
BACH, GAJU, MENDES & MOLERO (1993)	1	5 / 29
MOLERO-BALTANÁS, GAJU-RICART, BACH DE ROCA & MENDES (1994a)	2	0 / 2
MOLERO-BALTANÁS, GAJU-RICART, BACH DE ROCA & MENDES (1994b)	52*	32 / 29
MOLERO-BALTANÁS, MENDES, GAJU-RICART & BACH DE ROCA (1994c)	16*	20 / 0
MOLERO-BALTANÁS, R., BACH DE ROCA, C. & GAJU-RICART, M. (1995a)	3*	2 / 2
MOLERO-BALTANÁS, R., GAJU-RICART, M. & BACH DE ROCA, C. (1995b)	13	13 / 3
MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART (1996)	62	69 / 69
MOLERO-BALTANÁS, BACH DE ROCA & GAJU-RICART (1998a)	6	7 / 7
MOLERO-BALTANÁS, GAJU-RICART, BACH DE ROCA & MENDES (1998b)	174*	190 / 7

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Appendix S2: Sampling myrmecophilic Zygentoma in Spain.

Table S2.1: Detailed data on the Zygentoma-Formicidae association in Spain (more comments below). Abbreviations of Zygentoma species (as in Table 4 of the main paper): Av: *Atelura valenciana*. Pp: *Proatelurina pseudolepisma*. Lb: *Lepisma baetica*. Lc: *L. chlorosoma*. Ls: *L. saccharina*. Nb: *Neoasterolepisma balearica*. Ncr: *N. crassipes*. Ncu: *N. curtiseta*. Nd: *N. delator*. Nf: *N. foreli*. Ng: *N. gauthieri*. Nh: *N. hesperica*. Nl: *N. lusitana*. Np: *N. pallida*. Nso: *N. soerenseni*. Nsp: *N. spectabilis*. Nw: *N. wasmanni*. Ta: *Tricholepisma aurea*. Ti: *T. indalica*.

Ant species	Av	Pp	Lb	Lc	Ls	Nb	Ncr	Ncu	Nd	Nf	Ng	Nh	Nl	Np	Nso	Nsp	Nw	Ta	Ti
Aphaenogaster dulciniae		4																	
Aphaenogaster gibbosa	2	7			**1**			**2**	1			1		1		**1**	1		
Aphaenogaster iberica		5		**1**	**1**		**1**	**11**	2			2		5		**1**	2		
Aphaenogaster senilis		1						6	1	1		8	**1**			1			
Aphaenogaster subterranea		1							1										
Aphaenogaster sp.			1						1			2							
Bothriomyrmex sp.		1		1															
Camponotus aethiops		5						**4**									2		
Camponotus cruentatus		14						22				1	**2**	1			1		
Camponotus cf. *micans*								1								1			
Camponotus pilicornis		5						3	1								1		
Camponotus sicheli		1																	
Camponotus sylvaticus	2	10					**1**	5						2			1		2
Camponotus sp.		2		1				2								1			
Cataglyphis hispanica		1						**7**								**1**			
Cataglyphis iberica								**2**											
Cataglyphis velox (or cf. *velox*)								**2**											
Crematogaster auberti			2	3									**1**						
Crematogaster laestrygon			**1**																
Crematogaster sp.				1															
Formica gerardi		1												1					
Formica rufibarbis								**1**											
Formica subrufa		8						28					2	1					
Lasius alienus		1																	
Lasius brunneus		5																	
Lasius emarginatus		1																	
Lasius flavus		1																	
Lasius niger	1	6			**1**							1					1		
Lasius sp.								1											
Linepithema humile		3																	
Messor barbarus	2	17				3	29	4	1	32	12		38	1	11	78	21	3	
Messor bouvieri		3				2	3	**5**		3						17	6		
Messor capitatus		8				1	**8**	13		2	**1**		7			16	5		
Messor hispanicus		5						**3**		**1**	**1**		**3**			**6**			
Messor structor		6		**1**		1	**10**	**2**		1			3			10	6	1	
Messor sp.		10			**1**		3	8		2			6		1	16	2		
Pheidole pallidula		44	2	9										1					

Plagiolepis pygmaea		1																	
Tapinoma erraticum		1		**1**															
Tapinoma nigerrimum		4																	
Tapinoma sp.		1																	
Temnothorax sp.		2	2										1			1			
Tetramorium caespitum		5		**2**	**1**												1		
Tetramorium forte		12		**6**	**1**														
Tetramorium cf. *meridionale*		1																	
Tetramorium semilaeve	1	4	**3**	3														**1**	
Tetramorium sp.		4																	

A) Results of the sampling carried out in Spain for the quantitative analysis

Data registered in Table S2.1 correspond to the number of nests of each species of ants where each species of Zygentoma was found. Nests in which the species of Zygentoma were not identified at the specific level are not included in this Table (for example, those in which the silverfish was only identified as *Neoasterolepisma* sp.).

Overall, 156 different associations are registered. Those highlighted in bold characters and grey background are new associations (i.e., reported for the first time in this work). Additionally, one association has been detected but not included in this table: the finding of *Neoasterolepisma* sp. in a nest of *Goniomma blanci* (because the silverfish of the sample could not be identified at species level, the association has not been included in this table). In this sample (see reference in Table S1.38 of the Appendix S1), the specimens were in poor condition. This is the first time that *Goniomma* is reported with silverfish, so we can account it as association number 157 and it is included in Table 5 of the main document, where all colonies with silverfish were considered.

B) Reasons to group species of ants by genus (Table 2 of the main document)

Formicidae species were grouped by genus:

- To provide the best significance to analyses;
- to obtain an ecological network with a higher level of connectance.
- Some ant species are not abundant but grouped by genus; they are frequent enough to make the assumption of their overall availability for silverfish choice along the territory (see later in this appendix).
- This grouping is possible because in biological terms, it makes sense, since the species of the same genus are evolutionarily related, show similar biological trends and seem to be preferred in the same way for silverfish species, as the correspondence analysis confirms.

C) Complementary sampling used for testing the influence of the relative abundance of ants in the preference of silverfish

Methods: The sampling was made in eight localities of Spain (LOC 1 to LOC8), following the same method described in the section “Material and methods” of the main text of our paper, with some differences:

1) All ant colonies found were counted, those where Zygentoma were found (WZ) and those without any silverfish (NO-Z).
2) Ants were identified at the generic level in the field but silverfish were not identified. When the identification was possible in situ, ants were not collected.
3) The duration of each sampling was 80 minutes (more time than usual samplings in order to add the time for recording the additional data).

Results: Data are presented in Tables S2.2, S2.3, S2.4 and S2.5.

The proportion and contingency table Chi squared test was made from the total numbers of the eight localities because the number of nests per locality was not high enough for separate testing. Nevertheless, the sample size is insufficient to give a definitive conclusion. The data included here must be taken as trends to be confirmed with greater samples.

As Table S2.2 shows, the total WZ column shows a higher number of nests of *Messor* compared with the rest of ant genera found, even when *Messor* are not more abundant than other genera, as the total absolute frequencies of most localities or the total NO-Z column indicate.

To state whether the distribution of ant nests is homogeneous between NO-Z and WZ categories, a Chi squared test should be done to the respective contingency table, and to state if the proportion of *Messor* nests with silverfish is significantly higher than in any other ant genus, a proportion test should be made. However, in both cases, the expected frequencies are too low to consider the significance definitive.

Despite the previous consideration, several trends can be observed: some abundant ants as *Pheidole* (15.9% of the total), *Tapinoma* (13.7% of the total) and the category “Others” (17.2% of the total; see Table S2.3) host silverfish in very low rates, as can be seen in Table S2.4. Only 11.1% of *Pheidole* nests hosted silverfish, and none of *Tapinoma*. Moreover, the Total category shows also very low percentages compared with *Messor*, *Cataglyphis*, *Aphaenogaster* or *Formica*, all of them less abundant in the sampling but occupied by Zygentoma in greater proportions.

These remarks are supported by Table S2.4 and allow the results to be considered a probable trend: the relative abundance of ants does not have an influence in silverfish preferences for choosing a certain ant genus. We started our samplings assuming that the nests of most ant genera are available throughout most of the territory to the choice of silverfish.

The present study is focused on the detection of different degrees of specialisation and on different modes of the Zygentoma-ant association and not in other considerations that can be important for mutualistic networks. From this point of view, if results are biased by silverfish preferences, it is not important to make an account of all colonies in a locality, but only those where the association is detected. Compared with the more studied plant-pollinators networks, the aim of our work is not to know how many flowers (nests) of a given species/genus of plants (ants) are available for a pollinator (silverfish) species, but how many are actually visited (occupied). In our quantitative “symbiotic” network, numbers (especially those of *Messor*) do not reflect ant abundance, but silverfish preferences (conditioned by some features of ant and silverfish biology, but not by demographic factors of ants).

Table S2.2: Results, in absolute numbers, of the complementary sampling of 8 localities (LOC 1 to LOC 8) and total nests of each genus of ants. The number of nests with (WZ) or without Zygentoma (No-Z) is distinguished in separate columns. Details of localities are given in Table S2.6.

Ant genus	**LOC 1**		**LOC 2**		**LOC 3**		**LOC 4**		**LOC 5**		**LOC 6**		**LOC 7**		**LOC 8**		**Subtotal**		**Total**
	No-Z	**WZ**	**No-Z**	**WZ**	**No-Z**	**WZ**	**No-Z**	**WZ**	**No-Z**	**WZ**	**No-Z**	**WZ**	**No-Z**	**WZ**	**No-Z**	**WZ**	**No-Z**	**WZ**	
Aphaenogaster	1	0	4	0	4	0	4	1	1	2	3	0	2	2	0	1	**19**	**6**	**25**
Camponotus	0	1	3	0	2	0	1	0	3	0	5	1	4	1	1	0	**19**	**3**	**22**
Cataglyphis	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	**3**	**1**	**4**
Crematogaster	1	0	0	0	0	0	1	1	5	0	1	0	4	0	1	0	**13**	**1**	**14**
Formica	0	0	0	0	3	1	0	0	1	1	1	0	0	0	8	2	**13**	**4**	**17**
Lasius	1	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	**5**	**0**	**5**
Messor	1	0	2	1	1	3	2	4	0	0	1	1	2	1	0	2	**9**	**12**	**21**
Pheidole	9	2	6	1	3	0	2	1	1	0	2	0	6	0	3	0	**32**	**4**	**36**
Tapinoma	6	0	10	0	6	0	5	0	0	0	2	0	2	0	0	0	**31**	**0**	**31**
Tetramorium	2	0	0	0	5	0	4	1	1	0	0	0	0	0	0	0	**12**	**1**	**13**
Others	14	1	1	0	6	0	0	1	6	0	2	0	5	1	2	0	**36**	**3**	**39**
Total	35	5	26	2	35	4	19	9	20	3	17	2	25	5	15	5	**192**	**35**	**227**

Table S2.3: Proportions of ant nests of each genus relative to the total sample size.

Ant genus	**No-Z**	**WZ**	**Total**
Aphaenogaster	0.084	0.026	0.110
Camponotus	0.084	0.013	0.097
Cataglyphis	0.013	0.004	0.018
Crematogaster	0.057	0.004	0.062
Formica	0.057	0.018	0.075
Lasius	0.022	0.000	0.022
Messor	0.040	0.053	0.093
Pheidole	0.141	0.018	0.159
Tapinoma	0.137	0.000	0.137
Tetramorium	0.053	0.004	0.057
Others	0.159	0.013	0.172
Total	**0.846**	**0.154**	**1.000**

Table S2.4: Proportions of ant nests with and without Zygentoma by genus of ants. All the genera show higher proportions in No-Z column except *Messor*.

	No-Z	**WZ**
Aphaenogaster	0.760	0.240
Camponotus	0.864	0.136
Cataglyphis	0.750	0.250
Crematogaster	0.929	0.071
Formica	0.765	0.235
Lasius	1.000	0.000
Messor	0.429	0.571
Pheidole	0.889	0.111
Tapinoma	1.000	0.000
Tetramorium	0.923	0.077
Others	0.923	0.077
Total	**0.846**	**0.154**

Table S2.5: Proportions of ant nests relative to No-Z and WZ totals, compared with P (the proportion of each ant genus). In the No-Z category, Others, *Pheidole*, *Tapinoma* have the greater abundance, with no great differences among them. In WZ category, there is a clear difference favourable to *Messor*.

	No-Z	**WZ**	**P**
Aphaenogaster	0.099	0.171	0.110
Camponotus	0.099	0.086	0.097
Cataglyphis	0.016	0.029	0.018
Crematogaster	0.068	0.029	0.062
Formica	0.068	0.114	0.075
Lasius	0.026	0.000	0.022
Messor	0.047	0.343	0.093
Pheidole	0.167	0.114	0.159
Tapinoma	0.161	0.000	0.137
Tetramorium	0.063	0.029	0.057
Others	0.188	0.086	0.172
Total	1.000	1.000	1.000

Table S2.6: Data of the sampling localities for this complementary study.

	Locality	Geographical coordinates	Date
1.	Colas del Embalse de Bornos, Cádiz	36° 51’ N, 5° 40’ W	31-3-2015
2.	Punta Camarinal, Cádiz	36° 05’ N, 5° 48’ W	1-4-2015
3.	Venta de Cárdenas, Ciudad Real	38° 24’ N, 3° 30’ W	4-4-2015
4.	Polígono de Las Quemadas, Córdoba	37° 54’ N, 4° 43’ W	12-4-2015
5.	Cerro Muriano, Córdoba	37° 58’ N, 4° 46’ W	14-4-2015
6.	Sierrezuela, Lucena (Córdoba)	37° 25’ N, 4° 30’ W	19-4-2015
7.	Valdeganga (Albacete)	39° 08’ N, 1° 40’ W	30-4-2015
8.	Tébar (Cuenca), oak-tree forest	39° 30’ N, 2° 08’ W	31-5-2015

Appendix S3

Table S3.1: States of characters for cladistic study of Spanish Lepismatinae (*Lepisma*, *Neoasterolepisma*, and *Tricholepisma*).

Species	C.1	C.2	C.3	C.4	C.5	C.6	C.7	C.8	C.9	C.10	C.11	C.12	C.13	C.14	C.15	C.16	C.17	C.18	C.19	C.20	C.21	C.22	C.23	C.24
N. balearica	1	2	1	2	1	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	0	0	0	0
N. hesperica	1	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
N. pallida	1	1	0	2	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
T. aurea	1	2	1	2	1	1	1	1	0	0	1	1	0	1	0	1	1	0	1	1	0	0	0	0
N. crassipes	1	2	1	2	1	0	1	0	1	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0
N. curtiseta	1	2	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
N. delator	1	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
N. foreli	1	2	1	1	1	1	1	0	1	1	0	0	0	1	0	1	1	0	0	1	0	0	0	0
N. gauthieri calva	1	2	1	2	1	1	1	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
N. soerenseni	1	2	1	2	1	1	–	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
N. spectabilis	1	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
N. wasmanni	1	2	1	2	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
N. myrmecobia	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
N. lusitana	1	2	1	2	1	1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0
N. inexpectata	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
N. vulcana	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
N. caeca	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
T. indalica	1	2	1	2	1	0	0	1	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0
L. baetica	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
L. chlorosoma	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
L. saccharina	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allacrotelsa krae-pelini (outgroup)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table S3.2: Characters and states. * The number 1 has been used for the apomorphic condition, but in those characters where gradual differences can be distinguished, two states have been indicated with numbers 1 and 2.

Character	Plesiomorphic condition (0)	Apomorphic condition (1 and 2)*
C.1. Isolated macrosetae in urotergites	Absent (macrosetae arranged in combs)	Present
C.2. Body shape	Fusiform (thorax slightly wider than abdomen)	Slightly limuloid (thorax very wide respect to abdomen base) (1) or very limuloid (paranotal lobes very developed) (2)
C.3. Yellowish epidermic pigment	Absent	Present
C.4. Golden scales	Absent (most scales silvery grey, black or brown)	Present, but in most specimens most scales are greyish (1) or all scales are golden (only they sometimes get dark before molt) (2)
C.5. Asteriform sensilla in antennae	Absent	Present
C.6. Asteriform sensilla of antennae arranged in pairs in some joints	No	Yes
C.7. Hind tibiae of males modified in shape	No	Yes
C.8. Hind border of nota with isolated macrosetae	No	Yes
C.9. Urosternites with pseudostyli	No	Yes
C.10. Shape of dorsal scales	Rounded	Rounded and acute
C.11. Hind border of posterior urosternites with spiniform macrosetae	No	Yes
C.12. Chaetotaxy in urotergites (except infra-lateral group)	2 x (1+1+1)	Modified
C.13. Chaetotaxy of the labial palp in the male	Normal	Modified
C.14. Hind tibiae of males with ciliar setae	No	Yes
C.15. Infralateral group of macrosetae with a fine outer setae	Yes	No
C.16. Isolated setae in urotergite I	1+1	More than 1+1
C.17. Isolated setae in urotergite IX	Absent	Present
C.18. Number of macrosetae in infralateral groups	2+2 (or more)	1+1
C.19. Spiniform setae in hind tibiae of the male	No	Yes
C.20. Paramera	Big, very developed	Small, reduced
C.21. Rows of white scales on hind borders of nota	No	Yes
C.22. Lost of pigment on eyes	No	Yes
C.23. Reduction of size	No	Yes
C.24. Number of macrosetae of the infralateral group of urotergites	Two (or more)	One

We included all the features that we could. None of the characters that allow distinguishing between Lepismatinae species has been discarded. Usually, these are included in descriptions and identification keys of this group of insects, as can be seen in the taxonomic works included in Table S1.73 in Appendix 1. Among them, some can be considered general traits and others have a putative relevance for living with ants. All the morphologic characters that can be used to reconstruct the evolution of this group have been included. Therefore, there is no reason to infer that the cladogram of Figure 12 is biased. The outgroup (*Allacrotelsa*) is a clearly primitive genus of Lepismatidae found in Palaearctic and

Nearctic regions (and in Baltic amber), whilst the remaining genera and species are exclusive of the Old World (evolved after the break-up of Gondwana).

In relation to the evolutionary significance of the 24 characters listed in the Tables of this Appendix, we can establish the following hypotheses:

- The significance of some of these characters in order to associate with ants is not clear (i.e., characters 1, 8, 13, 16, 17, 18, 21, and 24).
- The apomorphic condition of some of them (i.e., 1, 8, 20, 22, and 23) is shared with non-myrmecophile Zygentoma, suggesting that they must be related with other evolutionary trends of silverfish.
- The apomorphic condition of some of them probably represents a usual adaptation of Zygentoma to live with ants, since they are shared with most Atelurinae (i.e., 2, 3, and 4), but not all myrmecophile Lepismatinae develop this condition.
- One of these features might be considered a pre-adaptation related to living with ants (5), since it is present in non-myrmecophile species of the genus *Neoasterolepisma*, but its role is not clear.
- The apomorphic state of some other traits is not present in all myrmecophile Lepismatinae, but only shared by several *Messor* and *Aphaenogaster* specialists (i.e., 7 and 14) or by few species of *Messor* specialists (i.e., 9, 10, and 11). It is likely that some of these latter characteristics are not important for adapting to life with ants but to live in nests where parabiosis is verified (recognition of species that inhabit the same nest), since they imply sexual dimorphism.