



Ten years inventorying the Iberian fauna: results and perspectives

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Abstract. The Iberian Peninsula is one of the richest European regions in animal species diversity. Since 1988, the objective of the nationally funded Fauna Ibérica project has been to carry out a well-documented inventory of the animal biodiversity in the Iberian-Balearic region. After 10 years of taxonomic work, this project has produced 20 monographs, which have reviewed and inventoried around 11% of the animal species that inhabit the Iberian territory. It has also described 418 new species and 519 species formerly unknown in the Iberian-Balearic region. Considering all the new Iberian species described, we estimate that the researchers involved in this project have so far completed one third of all Iberian taxonomic work. At this rate it would take at least 75 years to finish the taxonomic review of the Iberian fauna. We recommend: (i) uninterrupted public logistical and financial support for taxonomy; (ii) the promotion of a plan for the training of new specialists in the taxonomically little-known groups; (iii) the elaboration of checklists as a way to inventory the Iberian animal biodiversity more rapidly; and (iv) the use of computerized approaches to species inventories taxonomy.

Key words: biodiversity information, Iberian Fauna, Portugal, Spain, taxonomy

Introduction

Among the numerous environmental problems at the end of this century, the acceleration in the rate of species extinction associated with human activities is undoubtedly the most serious, as it involves an irreversible loss of biological information with unpredictable consequences (Wilson 1988; May et al. 1995).

The United Nations' Conference on Environment and Development held in Rio de Janeiro in 1992 focused attention on this problem, and on the parallel loss of taxonomic expertise, and launched the Convention on Biological Diversity (CBD) as a response. Signatory countries were urged to establish a strategy for encouraging greater knowledge, conservation and sustainable use of biodiversity as the framework for developing policies and instruments to comply with the CBD. All national biodiversity strategies published to date recognise that policies on biodiversity depend on good knowledge of its components. The assessment of biodiversity, the monitoring of changes, the sustainable exploitation of biodiversity and much environmental

legislative work depends upon an accurate overview of taxonomic biodiversity. To gather the required information it is necessary to summarise and manage all the available data (Murphy 1990; Soule 1991; Lubchenco et al. 1991; Reid et al. 1992; Systematics Agenda 2000, 1994). This means: (i) significantly increasing the effort expended on the compilation, determination and taxonomic study of plants and animals; (ii) analyzing the species distribution in any given region to estimate the location of the areas with greater biodiversity; and (iii) establishing a baseline of current conditions against which future conditions can be compared.

These scientific objectives should prioritise those areas rich in species and endemic species. In the western Palaearctic region, the Iberian Peninsula constitutes an area of special interest for animal biodiversity. However, the selection of protected areas in Spain or Portugal has been established without the support of adequate knowledge of the flora and fauna and its geographical distribution (see nevertheless the recent paper of Araujo 1999). Though the inventory of the animal diversity in this area should have begun long ago, as in many other European countries, only recently has a nationally funded project existed with this objective: the Fauna Ibérica project. Ten years after the beginning of Fauna Ibérica, this paper reviews its contribution to Iberian-Balearic taxonomy. Giving an estimate of the Iberian animal biodiversity and of the background and expertise of the available taxonomic workforce, we have evaluated the work already carried out and that which is still needed. Finally, the efficiency of the Fauna Ibérica project in compiling an inventory of Iberian animal biodiversity is discussed, and new initiatives for the future are suggested.

The Iberian-Balearic richness

Europe is one of the regions where knowledge on animal diversity is reasonably good. From the end of the 19th century and the first half of the 20th century, countries like France, Germany, Denmark, Great Britain, Italy, Hungary, Czechoslovakia, Poland, etc. began to compile inventories of fauna (Ramos 1997). The situation in Spain and Portugal was very different. Even though at the beginning of the century an initiative to inventory the Iberian fauna existed (Ramos 1990), various historical circumstances stopped this project and subsequent ones.

Apart from most of the vertebrate groups, there is no accurate estimate of the number of species in the Iberian Peninsula (see the zoological list of Iberian-Balearic Fauna: <http://www.fauna-iberica.mncn.csic.es/htmlfauna/faunibe/zoolist/zoolist.html>). Although in the last few years, some published studies compiled and analysed data on the new taxa described in the Iberian Peninsula (Templado et al. 1995; Fernández 1996; Esteban and Sanchiz 1997), we do not know the total number of species described for most groups of invertebrates. At the moment, it is only possible to estimate the total number of animal species (Table 1). In vertebrates, the number of species

Table 1. Estimated number of animal species described in the world, in the Mediterranean basin, and in the Iberian Peninsula. Data from Major (1988), Balleto and Casale (1991), Hammond (1992), Oosterbroek (1994), Cheylan and Poitevin (1994) and Fauna Ibérica project.

	Estimated number of animal species					
	World		Mediterranean Basin		Iberian Peninsula	
Insects	1110,000	(79.6)	150,000	(81.2)	46,900	(80.7)
Arthropods not insects	125,000	(9.0)	16,900*	(9.2)	5280*	(9.1)
Others invertebrates	116,000	(8.3)	15,680*	(8.5)	4900*	(8.4)
Vertebrates	44,000	(3.1)	2,120	(1.1)	1068	(1.8)
Total	1395,000		184,700		58,148	

Values in parantheses indicate respective percentage for the most important animal groups.

* Approximate estimates taking into account the ratio between the world number of species in this group and the total number of insect species. For Vertebrates continental and marine fishes are included. Only nidificant and resident birds are considered.

described coincides basically with the estimated total number of species, although this ratio can vary slightly according to the taxonomic criteria employed. Using the known figures for the various groups of vertebrates for the European countries (Groombridge 1992a,b), we can see that Spain is the country with the highest number of described species and endemic species (Table 2). Thus, the Iberian Peninsula constitutes without doubt, the richest and most diversified region in Western Europe.

However, the greatest contribution to the total inventory of animal species lies in the invertebrates and, more specifically, in the insects. About 97% of the total described species on the planet are invertebrates and about 80% are insects. It is estimated that this group includes the great majority of species, which are still unknown to science (Wilson 1988). In Spain our estimates show similar values: about 98% of the total Iberian fauna are invertebrates, and roughly 81% are insects (Table 1). Estimates made in France and Italy indicate around 34,600 and 37,300 species of insects respectively (Martínez and Gauvrit 1997; Minelli 1996). In these countries the ratio between the number of insect species and the number of vertebrate species (excluding fish) ranges between 81.6 and 83.6. If the same ratio is applied to the Iberian Peninsula, this would mean that between 46,350 and 47,500 species of insects should be found here, a number slightly higher than the species richness estimated by Martín-Piera (1997). With regard to the rest of the invertebrate groups, the estimates are still more problematic and provisional. Taking into account the ratio between the invertebrate species number world-wide and the insect species number, we extrapolated that the Iberian Peninsula should have around 5300 species of other arthropod groups and 4900 species of other invertebrate groups.

Table 2. Number of described species and number of endemic species for the four better known Vertebrate groups in the European countries with higher biodiversity.

Countries	Number of species				Total
	Mammals	Birds	Reptiles	Amphibians	
Spain	118	368	56	26	568
Italy	118	232	58	38	446
France	93	267	32	32	424
Greece	95	244	51	15	405
Ex-Yugoslavia	95	245	41	23	404
Rumania	84	249	25	19	377
Bulgaria	81	242	33	17	373
Germany	76	237	12	20	345
Austria	83	227	14	20	344
Ex-Czechoslovakia	81	227	12	19	339
Albania	68	215	31	13	327
Portugal	63	214	29	17	323
Number of endemic species					
Spain	12	5	19	9	45 (7.92)
Italy	4	0	3	12	19 (4.26)
France	0	9	0	3	12 (2.83)
Greece	2	0	4	1	7 (1.73)
United Kingdom	0	13	0	0	13 (1.50)
Portugal	1	2	1	0	4 (1.24)
Ex-Yugoslavia	2	0	2	0	4 (0.99)

Values in parentheses indicate the percentage of endemic species over the total number of species in each country.

Spanish data of Ministerio de Medio Ambiente (1999) and Blanco and González (1992). Italian data of Amori et al. (1993) and Minelli (1996). Data for the other countries from Groombridge (1992a,b).

The Fauna Ibérica project

Since 1988 the Dirección General de Investigación Científica y Técnica (DGICYT) has aided taxonomic research by means of several national projects in what has been called the 'Biodiversity Program of the Iberian Peninsula'. Fauna Ibérica is one of these projects and is coordinated by the National Museum of Natural Sciences (CSIC). The organization and management of the project is described in detail in Ramos et al. (in press).

The Fauna Ibérica project was approved in November 1988 and since then has passed through four successive phases, which constitute consecutive and related projects within the framework of the Programa Sectorial de Promoción General del Conocimiento. Fauna Ibérica coordinates the current knowledge on systematic zoology in the Iberian Peninsula, its main function being to draw up a well-documented inventory of animal biodiversity in the Iberian-Balearic area. Specific objectives are:

(i) to draft and to edit scientific monographs on all known Iberian species; (ii) to document and scientifically analyze the information generated in order to improve knowledge on the patterns and causes of Iberian biodiversity; and (iii) to spread and communicate that information to the scientific community and the general public.

Fauna Ibérica is, without doubt, the most ambitious taxonomic project than ever existed in the Iberian Peninsula and the only one capable at present of bringing together all the necessary resources to produce an inventory of the animal diversity in the Iberian Peninsula. As it is now 10 years since the beginning of Fauna Ibérica, we believe it necessary to evaluate the obtained results in order to determine the future of the project.

Results

The 'Fauna Ibérica' monographs have been the main practical result of the project. These monographs synthesize the available knowledge on the Iberian-Balearic fauna. Each monograph gives keys to identification of species and summarises current scientific knowledge on them: morphology, geographical distribution and other aspects of its biology, including nomenclatural status, synonymies, original illustrations and a complete bibliography.

Seventy-two monographs (Table 3) on animal groups belonging to 11 phyla are edited, in press or in preparation. These cover a total of around 11,400 species, which represents 20% of the entire estimated animal species in the Iberian Peninsula and Balearic Islands (Table 1).

At present, almost a quarter of these species (2518 species) have been studied and described in the 20 monographs already published or in press (Tables 3 and 4) and about 4000 additional species have been reviewed and inventoried in the volumes still in preparation. Thus, all the taxonomic work so far carried out has, in this 10-year period, documented approximately 57% of the total species under study and around 11% of the estimated total species for the Iberian Peninsula.

A total of 165 taxonomists, working in 51 scientific institutions (88%) or in private companies (12%) have worked on the Fauna Ibérica project. Almost half of these researchers are entomologists (45%). On average, 3.0 ± 0.3 taxonomists participate in each monograph and each monograph reviews 203 ± 19 species. By looking at the estimated number of species in the Iberian Peninsula (Table 1) and the number of taxonomists per animal group (Table 3), we can see that relatively well-known taxa with few species, like vertebrates, are studied by a higher number of scientists because of a traditionally more specialized approach in these groups.

The results of this research have not only been published in the Fauna Ibérica series but also in more than 650 scientific papers. The treatment in these publications of different animal groups shows that more publications have been made in groups with a higher number of taxonomists.

Table 3. New genera (gen) and species (sp) and new citations for the Iberian Peninsula described by Fauna Ibérica; estimated number of species being studied in the Iberian Peninsula (A); number of updated species already published or in press in the Fauna Ibérica project (B); number of taxonomists in the project (N. Tax.); number of monographs edited (E), in press (P) or in preparation (IP) and published papers supported by the project for each one of the principal animal groups (Pub).

Phylum	New taxa		New citations		A	B	N. Tax.	Monographs			Pub
	gen	sp	gen	sp				E	P	IP	
Annelida	2	10	–	14	400	0	6	–	–	2	5
Porifera	2	40	–	15	330	0	4	–	–	1	21
Nematoda	2	36	–	14	150	0	2	–	–	1	51
Platyhelminthes	–	42	–	58	200	0	4	–	–	1	7
Mollusca	2	72	12	74	1490	152	31	1	1	10	126
Sipuncula	–	–	–	1	35	35	1	1	–	–	5
Arthropoda:											
Crustacea	3	16	–	29	1191	111	10	1	–	3	30
Insecta	22	186	33	236	6232	1570	74	6	6	27	336
Arachnida	3	2	–	4	574	574	4	2	1	–	22
Bryozoa	–	7	–	8	60	0	1	–	–	1	6
Cnidaria	2	1	–	12	350	0	3	–	–	2	10
Tunicata	–	–	–	–	150	0	4	–	–	1	14
Chordata	–	6	–	54	246	76	21	1	1	2	18
Total	38	418	45	519	11,408	2518	165	12	9	51	651

One of the main results of the research done by the Fauna Ibérica project during the last 10 years has been the discovery of 418 new species and the verification of the presence of another 519 species previously unknown in the Iberian-Balearic territory (Table 3). So 14% of the species already analysed by the project (6500 species) are new to science or new to the area. From this, we estimate that, when all the monographs currently being worked on are published, the Fauna Ibérica project will have described about 730 new species and more than 900 new citations in the Iberian Peninsula.

Obviously, this project does not carry out all the taxonomic research in the Iberian Peninsula. To estimate its contribution to the Spanish taxonomical research we used the Iberian taxonomist directory (DIRTAX; García-Valdecasas et al. 1994), updated from the project researchers database. A total of 919 taxonomists working on some Iberian-Balearic animal group were found, which means that around 18% of Spanish taxonomists are involved in the project. Obviously it is not possible, or necessary, that all the specialists on a given animal group participate in the inventory of Iberian Fauna. The percentage of zoologists that appear in DIRTAX and that are assigned to the project is very low for the taxonomically better known taxa, such as Chordata (12%); but it is quite high in the case of less well-known taxa such as Molluscs (24%), Arthropods (20%) or Annelids (24%).

In our opinion, the best way to assess the taxonomic capacity of Fauna Ibérica is probably from its contribution to extending the inventory of Iberian Biodiversity.

Table 4. Published monographs in the Fauna Ibérica project.

Vol. 0. FOREWORD. Wilson, E.O. FAUNA IBÉRICA: NECESIDAD DE UN PROYECTO. Ramos, M.A. COLEOPTERA, PTINIDAE, GIBBIINAE. Bellés, X. 1990. 43 pp.
Vol. 1. MOLLUSCA, CEPHALOPODA. Guerra, A. 1992. 327 pp.
Vol. 2. COLEOPTERA, ANOBIIDAE. Español, F. 1992. 195 pp.
Vol. 3. ACARI, ORIBATEI, PORONOTA. Pérez-Íñigo, C. 1993. 320 pp.
Vol. 4. SIPUNCULA. Saiz Salinas, I. 1993. 200 pp.
Vol. 5. COLEOPTERA, OEDEMERIDAE, PYROCHROIDAE, PYTHIDAE, MYCTERIDAE. Vázquez, X. 1993. 181 pp.
Vol. 6. HYMENOPTERA, CHRYSIDIDAE. Mingo, E. 1994. 255 pp.
Vol. 7. CRUSTACEA, BRANCHIOPODA. Alonso, M. 1996. 486 pp.
Vol. 8. COLLEMBOLA, PODUROMORPHA. Jordana, R., J. Arbea, C. Simón and M.J. Lucíañez. 1997. 807 pp.
Vol. 9. ACARI, ORIBATEI, GYMNONOTA I. Pérez-Íñigo, C. 1997. 374 pp.
Vol. 10. REPTILES. Andreu, A., A. Bea, F. Braña, P. Galán, L. F. López-Jurado, V. Pérez-Mellado, J.M. Pleguezuelos and A. Salvador 1998. 705 pp.
Vol. 11. INSECTA, HEMIPTERA, APHIDIDAE. I. Nieto Nafría, J.M. and M.P. Mier Durante.
* INSECTA, COLEOPTERA, CERAMBYCIDAE. Vives, E.
* INSECTA, COLEOPTERA, CHRYSOMELIDAE. I. Petitpierre, E.
* COLEOPTERA SCARABAEOIDEA. I. Martín Piera, F. and J. I. López Colón
* HYMENOPTERA, CYNIPIDAE. Nieves Aldrey, J.L.
* ACARI, ORIBATEI, GYMNONOTA II. Subías, L.S. and A. Arillo.
* MOLLUSCA, TERRESTRIA NUDA. Castillejo, J., C. Garrido and J. Iglesias
* INSECTA, DIPTERA, TABANIDAE. Portillo, M.
* INSECTA, COLEOPTERA, HISTERIDAE. Yélamos, T.
* AMPHIBIA. M. García-París, Montori, A. and P. Herrero

* Monographs in press or in preparation.

We have checked the database of new Iberian-Balearic species (<http://www.fauna-iberica.mncn.csic.es/faunai/faunai/newsp.html>) for the period 1990–1997. During this period 1.109 new species were described, and 379 of them (34%) were published by taxonomists involved in the Fauna Ibérica project, the remaining 39 species (418–379; see Table 3) will probably be published in the next few years. Thus, the Fauna Ibérica project has been responsible for the description of about a third of the new Iberian species in recent years.

Perspectives and conclusions

The Fauna Ibérica project has allowed us to review approximately 20% of all the estimated animal species that inhabit the Iberian Peninsula. Ten years after the beginning of this project, 57% of this taxonomic work has been completed, at a review rate of 650 species per year. At this rate, more than 75 years will be needed to complete the description of all Iberian animal taxa. This figure illustrates the quantity of effort that yet must be accomplished. It is true that the use of improved computerized technology to manage taxonomic information (Dallwitz 1980; see for

example <http://kaw.keil.ukans.edu/delta>) may reduce the required time to complete the description of the Iberian animal taxa. However, the taxonomic groups for which there is no specialist or for which the available information is very limited could be more difficult to study and therefore might take even longer time. Therefore, in order to plant and to make profitable the outstanding taxonomic work still needed might be wiser in the future to use the limited funds to study those latter groups of more human and ecosystem relevance.

It is evident that Fauna Ibérica constitutes a vital project for the promotion of the zoological knowledge in this region. This project is the only one which attempts a complete inventory of Iberian animal diversity, thus providing support for further development of the Clearing House Mechanism of the Convention on Biological Diversity, the prime vehicle for international information exchange on biodiversity. However, two-thirds of the Iberian taxonomic work is probably done by taxonomist not yet included in the Fauna Ibérica project. Thus, it would seem sensible to encourage the collaboration of a greater number of taxonomists. Fauna Ibérica should continue to support and encourage new monographs to summarize and clarify the taxonomy of the different taxonomic groups. However, it is essential that taxonomic research dealing with little known groups or groups with no specialist taxonomist in the Iberian Peninsula receive special financial support, specially for those groups that could be relevant in the functioning of the ecosystems. In spite of the current reduction in available resources for taxonomy (Cotterill 1995), the training of taxonomists and the creation of new jobs in taxonomy should be a top priority. The drawing up of simple species lists, which require less scientific effort and a greater participation of taxonomists also seems necessary. In order to ensure that information is progressively checked, added to and updated, as well as to facilitate access by the user community, these species checklists should be implemented in an electronic format (see the pilot project in <http://www.fauna-iberica.mncn.csic.es/>).

To summarise and from the experience gained in this project, we make the following recommendations: (i) uninterrupted public logistical and financial support for taxonomy; (ii) the promotion of a plan for the training of new specialists in the taxonomically little-known groups; and (iii) the thinking up of new strategies to help finish the inventory of Iberian animal biodiversity as soon as possible. These three needs must be met if we want to discover extent and distribution of Iberian biodiversity.

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