



Fauna Europaea: Coleoptera 2 (excl. series Elateriformia, Scarabaeiformia, Staphyliniformia and superfamily Curculionoidea)

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Abstract

Fauna Europaea provides a public web-service with an index of scientific names (including synonyms) of all living European land and freshwater animals, their geographical distribution at country level (up to the Urals, excluding the Caucasus region), and some additional information. The Fauna Europaea project covers about 230,000 taxonomic names, including 130,000 accepted species and 14,000 accepted subspecies, which is much more than the originally projected number of 100,000 species. This represents a huge effort by more than 400 contributing specialists throughout Europe and is a unique (standard) reference suitable for many users in science, government, industry, nature conservation and education.

Coleoptera represent a huge assemblage of holometabolous insects, including as a whole more than 200 recognized families and some 400,000 described species worldwide. Basic information is summarized on their biology, ecology, economic relevance, and estimated number of undescribed species worldwide. Little less than 30,000 species are listed from Europe. The Coleoptera 2 section of the Fauna Europaea database (Archostemata, Myxophaga, Adepaga and Polyphaga excl. the series Elateriformia, Scarabaeiformia,

Staphyliniformia and the superfamily Curculionoidea) encompasses 80 families (according to the previously accepted family-level systematic framework) and approximately 13,000 species. Tabulations included a complete list of the families dealt with, the number of species in each, the names of all involved specialists, and, when possible, an estimate of the gaps in terms of total number of species at an European level. A list of some recent useful references is appended. Most families included in the Coleoptera 2 Section have been updated in the most recent release of the Fauna Europaea index, or are ready to be updated as soon as the FaEu data management environment completes its migration from Zoological Museum Amsterdam to Berlin Museum für Naturkunde.

Keywords

Biodiversity Informatics, Coleoptera, Fauna Europaea, Taxonomic indexing.

Introduction

In 1998 the European Commission published the European Community Biodiversity Strategy, providing a framework for the development of Community policies and instruments to comply with the Convention on Biological Diversity. The Strategy recognises the current incomplete state of knowledge at all levels concerning biodiversity, which is a constraint on the successful implementation of the Convention. *Fauna Europaea* contributes to this Strategy by supporting one of the main themes: to identify and catalogue the components of European biodiversity into a database to serve as a basic tool for science and conservation policies. In regard to biodiversity in Europe, science and policies depend on the knowledge of its components. Biodiversity assessments, monitoring changes, sustainable exploitation of biodiversity, and much legislative work depend upon a validated overview of taxonomic biodiversity, in which *Fauna Europaea* plays a major role, providing a web-based information infrastructure with an index of scientific names (including important synonyms) of all living European land and freshwater animals, their geographical distribution at country level and some additional optional information (like references and species annotations). Thus the Fauna Europaea database provides a unique reference for many user-groups such as scientists, governments, industries, conservation communities and educational programs.

Fauna Europaea (FaEu) began in 2000 as an EC-FP5 four year project, delivering its first release in 2004 (de Jong et al. 2014). After thirteen years of steady progress to efficiently disseminate Fauna Europaea results and to increase the acknowledgement of the Fauna Europaea contributors, novel e-Publishing tools have been applied to prepare data papers of all major taxonomic groups (see below).

Most families included in the Coleoptera 2 Section (ca. 13,000 species) have been updated in the most recent release of the Fauna Europaea index, or are ready to be updated as soon as the FaEu data management environment completes its migration from Zoological

Museum, Amsterdam to Berlin Museum für Naturkunde. Adopted systematics follows that used in the first release of the database (2004). Recent changes in family-level systematics of beetles introduced by Bouchard et al. 2011 (although not all were accepted by specialists) are foreseen to be implemented as soon as the FaEu data management environment completes its migration. For example, in *Fauna Europaea* the classic treatment of Chrysomelidae Galerucinae and Alticinae as separate subfamilies was used instead of the current view of Alticini as a tribe in Galerucinae, and the current families Megalopodidae and Orsodacnidae are not used, the European species being listed in subfamilies Zeugophorinae and Orsodacninae. The same is true for some other families which changed for different reasons their present-day taxonomic rank (e.g., Anobiidae vs. Ptinidae, Carabidae Rhysodinae vs. Rhysodidae, etc.).

Data-papers & gap-analysis

To improve the dissemination and citation of *Fauna Europaea* and to increase the acknowledgement of the *Fauna Europaea* contributors, a special [Biodiversity Data Journal](#) (BDJ) Series has been compiled, using novel e-Publishing tools, called [Contributions on Fauna Europaea](#), preparing data-papers of all major *Fauna Europaea* taxonomic groups. This work was initiated during the [ViBRANT](#) project and is further supported by the recently started [EU BON](#) project. This paper represents the first publication of the *Fauna Europaea* Coleoptera (excl. Elateriformia, Scarabaeiformia, Staphyliniformia) data sector as a BDJ data paper.

Further steps will be made on implementing *Fauna Europaea* in the [EU BON](#) project as a basic tool and standard reference for biodiversity research in Europe, and to evaluate the status of European taxonomic expertise. The *Fauna Europaea* data-papers will contribute to a quality assessment on biodiversity data by providing estimates on gaps in taxonomic information and knowledge (see Table 1).

Table 1.

Responsible specialists per family in Coleoptera

FAMILY	NUMBER OF SPECIES IN FAEU (in case of estimated gaps: potential numbers in brackets)	SPECIALIST(S)
Acanthocnemidae	1	Gianfranco Liberti
Aderidae	27	Gianluca Nardi
Alexiidae	32 (≈ 40)	Wioletta K. Tomaszewska
Anobiidae	419 (≈ 430)	Petr Zahradnik
Anthicidae	314	Gianluca Nardi
Biphyllidae	5	Josef Jelínek (resigned)
Boridae	1	Xavier Vazquez-Albalade

Bostrichidae	42 (≈ 45)	Gianluca Nardi
Bothrideridae	106 (≈120)	Adam Slipinski
Byturidae	3	Josef Jelínek (resigned)
Carabidae	3738 (≈ 3900)	Augusto Vigna Taglianti
Cerambycidae	677 (≈ 680)	Gianfranco Sama
Cerylonidae	14	Adam Slipinski
Chrysomelidae	1758 (≈ 1800)	Maurizio Biondi, Ron Beenen, Michael Schmitt, Renato Regalin, David Sassi, Stefano Zoia, Horst Kippenberg & Marcello Franco Zampetti
Ciidae	76 (≈ 80)	Josef Jelínek & Paolo Audisio
Clambidae	22	Ivan Löbl
Cleridae	68 (≈ 70)	Roland Gerstmeier
Coccinellidae	215 (≈ 220)	Claudio Canepari
Corylophidae	37 (≈ 40)	Paolo Audisio
Crowsoniellidae	1	Paolo Audisio
Cryptophagidae	257 (≈ 260)	Carlos Otero
Cucujidae	6 (≈ 8)	Adam Slipinski
Cybocephalidae	26 (≈ 30)	Josef Jelínek & Paolo Audisio
Dascillidae	381 (390)	Manfred Jäch
Dermestidae	197 (≈ 200)	Roustem D. Zhantiev
Derodontidae	5	Jirf Háva
Dytiscidae	375 (≈ 400)	Anders Nilsson (first release), Saverio Rocchi & Fabio Cianferoni (future updating)
Endecatomiidae	1	Gianluca Nardi
Endomychidae	79 (≈ 80)	Wioletta K. Tomaszewska
Erotylidae	29	Piotr Wegrzynowicz
Eucinetidae	8	Paolo Audisio
Gietellidae	2	Gianfranco Liberti
Gyrinidae	17	Paolo Mazzoldi
Haliplidae	34	Saverio Rocchi & Fabio Cianferoni
Hydroscaphidae	2	Ivan Löbl
Hygrobiidae	1	Anders Nilsson (first release), Saverio Rocchi & Fabio Cianferoni (future updating)

Jacobsoniidae	2	Ivan Löbl
Kateretidae	29 (30)	Paolo Audisio & Josef Jelínek
Laemophloeidae	29	Adam Slipinski
Languriidae	14	Piotr Wegrzynowicz
Latridiidae	192 (\approx 200)	Wolfgang H. Rucker
Lyctidae	13	Gianluca Nardi
Lymexylidae	3	Paolo Audisio
Malachiidae	327 (\approx 330)	Robert Constantin
Melandryidae	53	Nikolai Nikitsky
Meloidae	181 (\approx 185)	Marco Alberto Bologna
Melyridae	18	Gianfranco Liberti
Micromalthidae	1	Paolo Audisio
Monotomidae	34	Josef Jelínek & Paolo Audisio
Mordellidae	256 (\approx 270)	Jan Horak
Mycetophagidae	31	Nikolai Nikitsky
Mycteridae	3	Paolo Audisio
Nitidulidae	248 (\approx 250)	Paolo Audisio & Josef Jelínek
Nosodendridae	1	Jiri Hava
Noteridae	4	Anders Nilsson (first release), Saverio Rocchi & Fabio Cianferoni (future updating)
Oedemeridae	93 (\approx 95)	Xavier Vazquez-Albalate
Passandridae	1	Adam Slipinski
Phalacridae	56	Zdenek Svec
Phloeostichidae	1	Adam Slipinski
Phloiophilidae	1	Gianfranco Liberti
Prionoceridae	1	Gianfranco Liberti
Prostomidae	1	Paolo Audisio
Pyrochroidae	9	Gianluca Nardi
Pythidae	5	Xavier Vazquez-Albalate
Rhipiceridae	2	David Kral
Ripiphoridae	17	Federica Turco & Marco Alberto Bologna
Salpingidae	19	Xavier Vazquez-Albalate

Scirtidae	94	Maciej Sapiejewski (deceased), proposed follow-up Rafal Rita
Scraptiidae	102 (≈ 110)	Jan Horak
Silvanidae	40	Adam Slipinski
Sphaeriusidae	3	Ivan Lobl
Sphindidae	4	Josef Jelínek (resigned)
Stenotrachelidae	2	Paolo Audisio
Tenebrionidae	1392 (≈1400)	Simone Fattorini
Tetatomidae	10	Nikolai Nikitsky
Thanerocleridae	1	Roland Gerstmeier
Trachypachidae	1	Saverio Rocchi & Fabio Cianferoni
Trogossitidae	25	Jan Kolibac
Zopheridae	128 (≈ 130)	Adam Slipinski

General description

Purpose: Fauna Europaea is a database of the scientific names and distribution of all living, currently known multicellular European land and fresh-water animal species assembled by a large network of experts. An extended description of the Fauna Europaea project can be found in de Jong et al. 2014. A summary is given in the sections below.

Coleoptera is the largest of the 58 *Fauna Europaea* major taxonomic groups, covering nearly 29,000 species in Europe [its Coleoptera 2 Section includes > 13,000 species (Fig. 1) and is represented by a network of more than 40 specialists (Table 1)].

Additional information: Coleoptera [Group Coordinators: Paolo Audisio (Coleoptera 2), Miguel Angel Alonso-Zarazaga (Coleoptera 1)]

Coleoptera are the most diverse order of all living animals, and comprise between 360,000 and 400,000 named species worldwide (Chapman 2009; Slipinski et al. 2011; Zhang 2013; Audisio unpublished data), some 100,000 in the Palaeartic Region, and nearly 30,000 in European-Mediterranean areas. Beetles are the dominating insect group in all terrestrial environments, with the single exception of freshwater habitats, where Diptera are represented by a markedly larger number of species. Even using a conservative estimate, there are likely one to three million beetle species on the Earth. Coleoptera are ecologically diverse (Crowson 1981). Most members of the largest 'basal' suborder, Adephaga, are predatory in both the larval and imaginal stage, while most members of the huge suborder Polyphaga are phytosaprophagous, mycetophagous, predaceous, phytophagous, or xylophagous. The 'basal' suborder Archostemata is represented by a small number of

families and species, mostly distributed in tropical areas, and usually associated with saproxylic habitats. The only known W Palaearctic autochthonous species, *Crowsoniella relictata* Pace from central Italy, exhibits an unknown biology, but it was collected, only once, in hypogeous habitats among tree roots, in carbonatic soils (Ge et al. 2011). In the suborder Adephaga, the largest family is represented by Carabidae, almost all of them having a predaceous life style in terrestrial habitats (relatively few species are seed-eating or myrmecophilous), while other families (e.g., Dytiscidae) inhabit freshwater habitats, where they are mostly predators of other aquatic organisms, only the family Haliplidae includes phytophagous species. The problematic suborder Myxophaga, recently considered questionable from a phylogenetic point of view (Beutel and Haas 2000; Friedrich et al. 2009), is represented by relatively few species mostly associated with mud and wet habitats, chiefly in thermal localities. The huge suborder Polyphaga (including about 90% of Coleoptera worldwide) is a large assemblage of families where both adults and larvae exhibit very diverse life styles. Among members of the large 'basal' superfamily Staphylinoidea, there is a prevalence of predaceous beetles. About one-fifth of Staphylinidae however can be characterized as mycetophagous or saprophagous. A smaller part of them (about 10% of European species) may be characterized as phytophagous or myrmecophilous. Most Staphylinoidea are terrestrial, but in a few families (e.g., Hydraenidae) nearly all species are adapted to an aquatic or semi-aquatic life style, even in very peculiar habitats such as hyperhaline marine rock-pools (Antonini et al. 2010; Audisio et al. 2010; Sabatelli et al. 2013). Most Elateroidea are predators, xylosaprophagous, or xylophagous. Cucujoidea are a large and highly diverse superfamily including species which are mostly saprophagous, mycetophagous, predaceous, phytophagous, or xylophagous, with a few families (e.g., Meloidae, Ripiphoridae) known as specialized parasitoids of other insects (Bologna 1991; Bologna et al. 2008; Bologna et al. 2010; Bologna and Di Giulio 2011; Lawrence et al. 2010). Scarabaeoidea include thousands of species mostly associated with dung of vertebrates, or having rhizophagous or xylosaprophagous larvae, whereas adults are mostly floricolous. Chrysomeloidea include thousands of species within the main families Chrysomelidae and Cerambycidae, mostly phyllophagous and/or floricolous, or with xylophagous larvae (Biondi et al. 2013; Bouchard et al. 2009). Finally, the most speciose superfamily Curculionoidea, feeding on various plant matter, includes many important pests of cultivated crops and forest habitats as well as some important biological control agents of invasive weeds too (e.g., Ceutorhynchini) (Alonso-Zarazaga and Lyal 1999; Oberprieler et al. 2007). About 29,000 species of Coleoptera are listed for Europe (including more than 4,000 Adephaga, and little less than 25,000 Polyphaga); the taxonomic composition of this fauna is far better known than that of any other major region. But the species numbers occurring in the Afrotropical, Indo-Malayan and Neotropical regions are markedly higher, each of them with an estimated number of 70-90,000 named species. Most families of Coleoptera (at least in the largest suborder Polyphaga) are, in fact, largely represented in tropical and subtropical countries. However, the number of species annually added to the European beetle fauna (including autochthonous species new to Science, or firstly discovered in Europe) is relatively constant over time, while the introduction of alien species is continuously increasing, chiefly among the guilds associated with fruit, timber, stored and cultivated products, and ornamental plants (DAISIE 2008). The species accumulation curve, as in

other large groups of insects such as Diptera, shows no signs of levelling off (Fontaine et al. 2012; Audisio unpublished data). Among the Adepnaga, the most species rich families in the European fauna are Carabidae and Dytiscidae, with nearly 3,800 and 400 species respectively. Among the Polyphaga, the most species rich families in the European fauna are Staphylinidae s.l. (ca. 6,000 species), Curculionidae (> 4,500 species), Chrysomelidae (ca. 1,700 species), Tenebrionidae (> 1,400 species), Leiodidae (ca. 1,200 species), Elateridae and Cerambycidae (ca. 700 species each), Cantharidae (> 500 species), Dytiscidae, Hydraenidae, and Buprestidae (> 400 species each). Much remains certainly to be discovered, because especially Curculionidae, Staphylinidae and some small groups (such as, e.g., Bothrideridae, Alexiidae) were poorly studied by modern taxonomists and are much more diverse than suggested by their current count. Coleoptera are among the most important agricultural pests, attacking all parts of living plants as well as stored products such as woody matter, processed fibers and grains (BUSS and Fasulo 2006). Some of them are among the most serious pests of of beehives (Marini et al. 2013), while other groups are active predators or parasitoids (e.g., Carabidae, Coccinellidae, Meloidae, Cleridae) and play a fundamental role in both natural and cultivated environments, as important biological controllers that regulate the number of aphids, scale insects, wood borer species and locusts. On the other hand, beetles are active decomposers and play a major role in recycling organic waste, chiefly vertebrate dung and carcasses, decaying fruit, fungi and dead wood in forest habitats. Many beetles are, in fact, saproxylic, and are considered excellent indicators of woodland quality (Speight 1989; Nieto and Alexander 2010), several being well-known indicators of old-growth forests. Some flagship- and/or umbrella-species of forest habitats are recognized among the large-sized Lucanidae, Cetoniidae, Cerambycidae, and Cucujidae, which also are target species for biodiversity conservation efforts, and priority species included in annexes II and IV of the EU Habitat Directive. Some of them, like the rare but popular *Osmoderma eremita*, drives most of the European and local policies on invertebrate conservation biology and forest management (Chiari et al. 2013, Chiari et al. 2014). Other beetles are excellent indicators of quality (Trizzino et al. 2013), and several studies have been aimed to the use of this group as a tool for river quality assessment, for the management of lotic ecosystems (Trizzino et al. 2015), and for the evaluation/prediction of Climate Change's effects. Finally, the use of certain groups of terrestrial Coleoptera such as ground beetles (Carabidae) and darkling beetles (Tenebrionidae) in the evaluation of the biological quality of the soil is covered by a vast literature (Kotze et al. 2011).

Several species among those in Coleoptera 2 Section have been also included in European Red Lists, such as the recent (although markedly incomplete) IUCN Saproxylic Beetles Red List of Neto & Alexander (Nieto and Alexander 2010). A number of other national, local, and European red lists have been recently published or are in preparation, and the role of *Fauna Europaea* as a standard reference for all these initiatives is more and more evident. The same is true for a number of pest species, quarantine species, and alien species (chiefly in Nitidulidae, Chrysomelidae, Coccinellidae, Cryptophagidae, Cerambycidae, Curculionidae, and others), whose introduction into Europe, as discussed above, is continuously increasing (Buss and Fasulo 2006; DAISIE 2008; Baviera and Audisio 2014; Audisio et al. 2014).

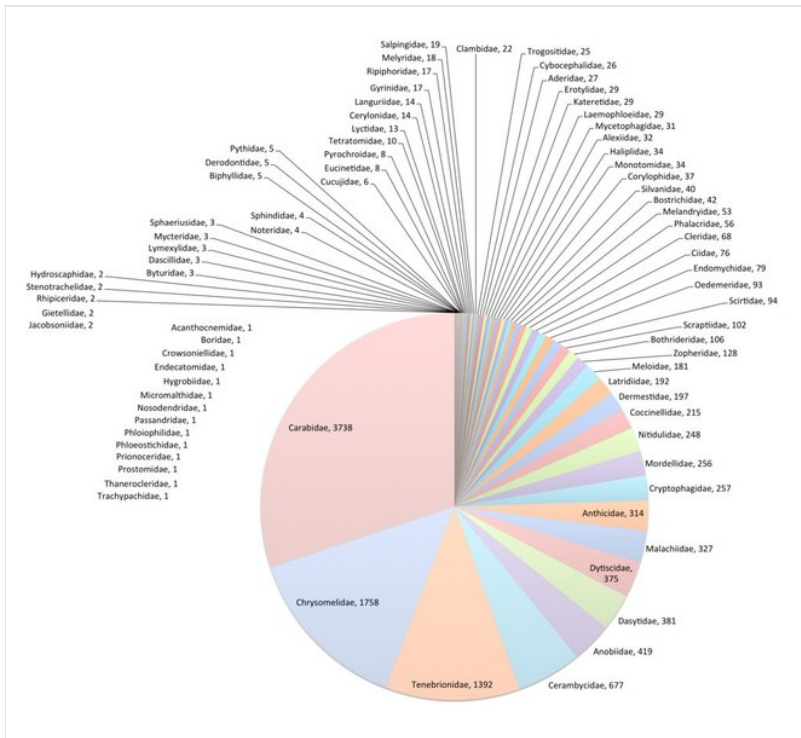


Figure 1.

FaEu Coleoptera species per family. See Table 1 for family statistics. For full resolution see Suppl. material 1.

As shown in Table 1, the taxonomic coverage of Coleoptera 2 Section of the FaEu database is generally good, with few remaining gaps (most of them should be filled in the next upcoming phase of data base updating, probably in Summer 2015). However, certain groups like Ciidae, Cybocephalidae, Cryptophagidae, Bothriideridae, Scaptiidae, and Mordellidae, need the activity of a larger number of specialists both in the field and in museum collections, in order to significantly improve our present-day knowledge in taxonomy and distribution, chiefly in the most potentially species-rich countries of southern Europe. Among the specialists' network, almost all explicitly or implicitly confirmed their participation to the project, although financial support to the project was interrupted some ten years ago. Only a couple of specialists resigned (e.g. in Hydroadephaga) and were replaced during the running activity of file updating, or have recently received the aid of "new" specialists and cooperators of the Group Coordinator PA. Generally speaking, the European network of specialists involved in the Coleoptera 2 Section of the *Fauna Europaea* Project seems to be relatively consolidated, and open to new (welcome) entries, although there is evidence that in most recent years the European beetle taxonomy community, chiefly at a professional level, has been going through a significant "crisis of vocations", only partially and insufficiently facilitated by the scientific support of a lot of (mostly not young) amateur entomologists (Fontaine et al. 2012). A more extensive and

better addressed public financial support, at both European and local levels, should be foreseen in the next years, to prevent the risk of a future dramatic "taxonomic impediment" in the scientific management of European insect biodiversity.

Project description

Title: This BDJ data paper includes the taxonomic indexing efforts in Fauna Europaea on European Coleoptera covering the first two versions of Fauna Europaea worked on between 2000 and 2013 (up to version 2.6).

Personel: The taxonomic framework of Fauna Europaea includes [partner institutes](#), providing taxonomic expertise and information, and expert networks maintaining data collation.

Every taxonomic group is covered by at least one Group Coordinator responsible for the supervision and integrated input of taxonomic and distributional data of a particular group. For Coleoptera 2 the responsible Group Coordinator is Paolo Audisio (versions 1 & 2).

The Fauna Europaea checklist would not have reached its current level of completion without the input from several groups of specialists. The formal responsibility of collating and delivering the data of relevant families has resided with the below appointed Taxonomic Specialists (see Table 1), while Associate Specialists deserve credit for their important contributions at various levels, including particular geographic regions or (across) taxonomic groups.

Data management tasks are taken care primarily by the Fauna Europaea project bureau. During the project phase (until 2004) a network of principal partners managed the diverse management tasks: [Zoological Museum Amsterdam](#) (general management & system development), [Zoological Museum of Copenhagen](#) (data collation), [National Museum of Natural History in Paris](#) (data validation) and [Museum and Institute of Zoology in Warsaw](#) (NAS extension). Since the formal project ending (2004-2013) all tasks have been taken over by the Zoological Museum Amsterdam.

Study area description: The area studied (Fig. 2) covers the European mainland (Western Palearctic), including the Macaronesian islands, excluding the Caucasus, Turkey, Arabian Peninsula and Northern Africa.

Design description: Standards. Group coordinators and taxonomic specialists deliver the (sub)species names according to strict standards. The names provided by FaEu are scientific names. The taxonomic scope includes issues like, (1) the definition of criteria used to identify the accepted species-group taxa, (2) the hierarchy (classification scheme) for the accommodation of all accepted species and (3), relevant synonyms, and (4) the correct nomenclature. The Fauna Europaea '[Guidelines for Group Coordinators and Taxonomic Specialists](#)', include the standards, protocols, scope, and limits that provide the instructions for all more than 400 specialists contributing to the project.

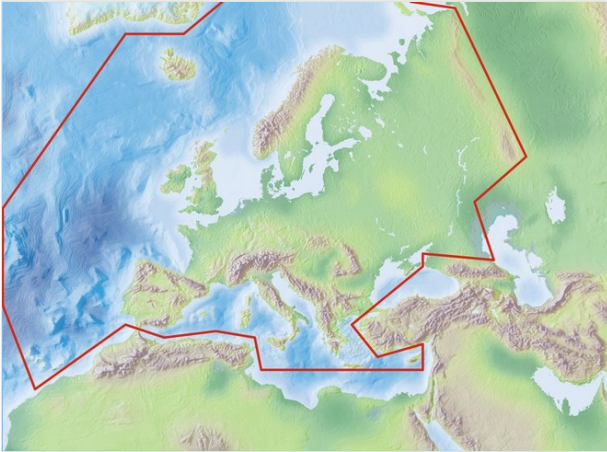


Figure 2.
Fauna Europaea geographic coverage ('minimal Europe').

Data management. The data records could either be entered offline into a preformatted MS-Excel worksheet or directly into the Fauna Europaea transaction database using an online browser interface (see: Fig. 3). Since 2013, the data servers are hosted at the [Museum für Naturkunde](#) in Berlin.

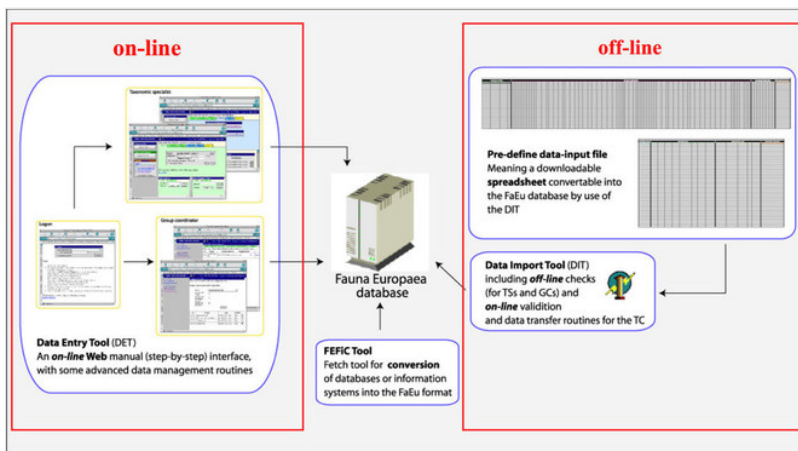


Figure 3.
Fauna Europaea on-line (browser interfaces) and off-line (spreadsheets) data entry tools.

Data set. The Fauna Europaea basic data set consists of: accepted (sub)species names (including authorship), synonyms (including authorship), taxonomic hierarchy / classification, misapplied names (including misspellings and alternative taxonomic views), homonym annotations, expert details, European distribution (at country level), Global

distribution (only for European species), taxonomic reference (optional), and occurrence reference (optional).

Funding: Fauna Europaea was funded by the European Commission under the Fifth Framework Programme and contributed to the Support for Research Infrastructures work programme with Thematic Priority Biodiversity (EVR1-1999-20001) for a period of four years (1 March 2000 - 1 March 2004), including a short 'NAS extension', allowing EU candidate accession countries to participate. Follow-up support was given by the EC-FP5 [EuroCAT](#) project (EVR1-CT-2002-20011), by the EC-FP6 [ENBI](#) project (EVR2-CT-2002-20020), by the EC-FP6 [EDIT](#) project (GCE 018340), by the EC-FP7 [PESI](#) project (RI-223806) and by the EC-FP7 [ViBRANT](#) project (RI-261532). Continuing management and hosting of the Fauna Europaea services was supported by the [University of Amsterdam](#) (Zoological Museum Amsterdam) and [SARA/Vancis](#). Recently the hosting of Fauna Europaea was taken over by the [Museum für Naturkunde](#) in Berlin, supported by the EC-FP7 [EU BON](#) project (grant agreement №308454).

Sampling methods

Study extent: See spatial coverage and geographic coverage descriptions.

Sampling description: Fauna Europaea data have been assembled by principal taxonomic experts, based on their individual expertise, including literature study, collection research, and field observations. No less than 476 experts contributed taxonomic and/or faunistic information for Fauna Europaea. The vast majority of the experts are from Europe (including EU non-member states). As a unique feature, Fauna Europaea funds were set aside for paying/compensating for the work of taxonomic specialists and group coordinators (around five Euro per species).

To facilitate data transfer and data import, sophisticated on-line (web interfaces) and off-line (spreadsheets) data-entry routines have been built, well integrated within an underlying central Fauna Europaea transaction database (see Fig. 3). This includes advanced batch data import routines and utilities to display and monitor the data processing within the system. In retrospect, it seems that the off-line submission of data was probably the best for bulk import during the project phase, while the on-line tool was preferred to enter modifications in later versions. This system works well until its supposed replacement in 2013.

A first release of the Fauna Europaea index via the web-portal has been presented at 27th of September 2004. The most recent release (version 2.6.2) was launched at 29 August 2013. An overview of Fauna Europaea releases can be found here: http://www.faunaeur.org/about_fauna_versions.php.

Quality control: Fauna Europaea data are unique in a sense that they are fully expert based. Selecting leading experts for all groups included a principal assurance of the systematic reliability and consistency of the Fauna Europaea data.

Further all Fauna Europaea data sets are intensively reviewed at regional and thematic validation meetings, at review sessions on taxonomic symposia (for some groups), by Fauna Europaea Focal Points (during the FaEu-NAS and PESI projects) and by various end-users sending annotations using the web form at the web-portal. Additional validation on gaps and correct spelling was effected at the validation office in Paris.

In conclusion, we expect to get taxonomic data for 99.3% of the known European fauna. The faunistic coverage is not quite as good, but is nevertheless 90-95% of the total fauna. Recognised gaps in Coleoptera includes some tribes of Staphylinidae, some minor tribes of Curculionidae, and a few minor families of Polyphaga, chiefly in SE Europe and in European Russia.

Checks on technical and logical correctness of the data have been implemented in the data entry tools, including around 50 "[Taxonomic Integrity Rules](#)". This validation tool proved to be of huge value for both the experts and project management, and significantly contribute(d) to preparation of a remarkably clean and consistent data set.

This thorough reviewing makes Fauna Europaea the most scrutinised data set in its domain.

Step description: By evaluating team structure and life cycle procedures (data-entry, validation, updating, etc.), clear definitions of roles of users and user-groups, according to the taxonomic framework were established, including ownership and read and writes privileges, and their changes during the project life-cycle. In addition, guidelines on common data exchange formats and codes have been issued (see also the '[Guidelines for Experts](#)' document).

Geographic coverage

Description: Species and subspecies distributions in Fauna Europaea are registered at least a country level, meaning political countries. For this purpose the FaEu geographical system basically follows the TDWG standards. The covered area includes the European mainland (Western Palearctic), plus the Macaronesian islands (excl. Cape Verde Islands), Cyprus, Franz Josef Land and Novaya Zemlya. Western Kazakhstan and the Caucasus are excluded (see Fig. 2).

The focus is on species (or subspecies) of European multicellular animals of terrestrial and freshwater environments. Species in brackish waters, occupying the marine/freshwater or marine/terrestrial transition zones, are generally excluded.

Coordinates: Mediterranean (N 35°) and Arctic Islands (N 82°) Latitude; Atlantic Ocean (Mid-Atlantic Ridge) (W 30°) and Ural (E 60°) Longitude.

Taxonomic coverage

Description: The Fauna Europaea database contains the scientific names of all living European lands and freshwater animal species, including numerous infra-groups and synonyms. More details about the conceptual background of Fauna Europaea and standards followed are described in the project description papers (Figs 4, 5, 6, 7, 8, 9).



Figure 4.
Scarites buparius (Forster, 1771) – Carabidae – photo by Paolo Audisio



Figure 5.
Rosalia alpina (Linnaeus, 1758) – Cerambycidae – photo by Paolo Audisio



Figure 6.

Amphotis marginata (Fabricius, 1781) – Nitidulidae – photo by Christoph Benisch – www.kerbtier.de



Figure 7.

Cucujus haematodes Erichson, 1845 – Cucujidae – photo by Antonio Mazzei



Figure 8.

Temnochila caerulea (Olivier 1790) – Trogossitidae – photo by Antonio Mazzei



Figure 9.

Meloe decorus Brandt & Erichson, 1832 – Meloidae – photo by Christoph Benisch – www.kerbtier.de

This data paper covers the Coleoptera content of Fauna Europaea, including 80 Families 12,425 species, 3,663 subspecies and 6,660 (sub)species synonyms. Higher ranks are given below, the species list can be downloaded from the Fauna Europaea portal (see: Data resources).

Taxa included:

Rank	Scientific Name
kingdom	Animalia
subkingdom	Eumetazoa
phylum	Arthropoda
subphylum	Hexapoda
class	Insecta
order	Coleoptera
suborder	Adephaga
suborder	Archostemata
suborder	Myxophaga
suborder	Polyphaga
infraorder	Bostrichiformia
infraorder	Cucujiformia
superfamily	Bostrichoidea
superfamily	Caraboidea
superfamily	Chrysomeloidea
superfamily	Clavicornia
superfamily	Cleroidea
superfamily	Cucujoidea
superfamily	Cupedoidea
superfamily	Dascilloidea
superfamily	Dermestoidea
superfamily	Derodontoidea
superfamily	Heteromera
superfamily	Lymexyloidea
superfamily	Sphaeriusoidea
superfamily	Tenebrionoidea
family	Acanthocnemidae
family	Aderidae
family	Alexiidae

family	Anobiidae
family	Anthicidae
family	Biphyllidae
family	Boridae
family	Bostrichidae
family	Carabidae
family	Cerambycidae
family	Cerylonidae
family	Chrysomelidae
family	Ciidae
family	Clambidae
family	Cleridae
family	Coccinellidae
family	Colydiidae
family	Corylophidae
family	Crowsoniellidae
family	Cryptophagidae
family	Cucujidae
family	Cybocephalidae
family	Dascillidae
family	Dasytidae
family	Dermestidae
family	Derodontidae
family	Diphyllidae
family	Dytiscidae
family	Scirtidae
family	Endecatomidae
family	Endomychidae
family	Erotylidae
family	Eucinetidae
family	Gietellidae

family	Gyrinidae
family	Haliplidae
family	Hydroscaphidae
family	Hygrobiidae
family	Jacobsoniidae
family	Kateretidae
family	Laemophloeidae
family	Lagriidae
family	Languriidae
family	Latridiidae
family	Lyctidae
family	Lymexyliidae
family	Melandryidae
family	Meloidae
family	Melyridae
family	Micromalthidae
family	Monotomidae
family	Mordellidae
family	Mycetophagidae
family	Mycteridae
family	Nitidulidae
family	Nosodendridae
family	Noteridae
family	Oedemeridae
family	Passandridae
family	Phalacridae
family	Phloeostichidae
family	Phloiophilidae
family	Prionoceridae
family	Prostomidae
family	Pyrochroidae

family	Pythidae
family	Rhipiceridae
family	Rhipiphoridae
family	Ripiphoridae
family	Salpingidae
family	Scirtidae
family	Scraptiidae
family	Serropalpidae
family	Silvanidae
family	Sphaeriusidae
family	Sphaerosomatidae
family	Sphindidae
family	Stenotrachelidae
family	Tenebrionidae
family	Tetratomidae
family	Thanerocleridae
family	Trachypachidae
family	Trogossitidae
family	Zopheridae
subfamily	Agabinae
subfamily	Agleninae
subfamily	Agnathinae
subfamily	Alfieriellinae
subfamily	Alleculinae
subfamily	Alticinae
subfamily	Anamorphinae
subfamily	Anaspidinae
subfamily	Anobiinae
subfamily	Anthicinae
subfamily	Apotominae
subfamily	Atomariinae

subfamily	Berginiinae
subfamily	Bostrichinae
subfamily	Brachiniinae
subfamily	Broscinae
subfamily	Bruchinae
subfamily	Calopodinae
subfamily	Calyptomerinae
subfamily	Carabinae
subfamily	Carpophilinae
subfamily	Cassidinae
subfamily	Cerambycinae
subfamily	Ceryloninae
subfamily	Chaetomalachinae
subfamily	Chilocorinae
subfamily	Chlaeniinae
subfamily	Chrysomelinae
subfamily	Cicindelinae
subfamily	Cillaeinae
subfamily	Clambinae
subfamily	Clerinae
subfamily	Coccidulinae
subfamily	Coelometopinae
subfamily	Colydiinae
subfamily	Colymbetinae
subfamily	Copelatinae
subfamily	Corticariinae
subfamily	Corylophinae
subfamily	Criocerinae
subfamily	Cryptarchinae
subfamily	Cryptocephalinae
subfamily	Cryptophaginae

subfamily	Cryptophaginae
subfamily	Cryptophilinae
subfamily	Cyclosominae
subfamily	Dacninae
subfamily	Danaceinae
subfamily	Dascillinae
subfamily	Dasytinae
subfamily	Diaperinae
subfamily	Dinoderinae
subfamily	Donaciinae
subfamily	Dorcatominae
subfamily	Dryophilinae
subfamily	Dryptinae
subfamily	Dytiscinae
subfamily	Elaphrinae
subfamily	Encaustinae
subfamily	Endomychinae
subfamily	Enopliinae
subfamily	Epilachninae
subfamily	Epuraeinae
subfamily	Ernobiinae
subfamily	Esarcinae
subfamily	Eucradinae
subfamily	Eumolpinae
subfamily	Eustrophinae
subfamily	Euxestinae
subfamily	Galerucinae
subfamily	Gibbiinae
subfamily	Gyrininae
subfamily	Hallomeninae
subfamily	Harpalinae

subfamily	Hispiinae
subfamily	Holoparamecinae
subfamily	Hydroporinae
subfamily	Hypocoprinae
subfamily	Korynetinae
subfamily	Laccophilinae
subfamily	Lagriinae
subfamily	Lamiinae
subfamily	Lamprosomatinae
subfamily	Latridiinae
subfamily	Lebiinae
subfamily	Leiestinae
subfamily	Lepturinae
subfamily	Licininae
subfamily	Lissodeminae
subfamily	Loricarinae
subfamily	Lycoperdininae
subfamily	Lyctinae
subfamily	Macratriinae
subfamily	Malachiinae
subfamily	Melaeninae
subfamily	Meligethinae
subfamily	Meloinae
subfamily	Merophysiinae
subfamily	Mesocoleopodinae
subfamily	Murmidiinae
subfamily	Mycetaeinae
subfamily	Mycetophaginae
subfamily	Nacerdinae
subfamily	Nebriinae
subfamily	Necydalinae

subfamily	Nemognathinae
subfamily	Nitidulinae
subfamily	Noterinae
subfamily	Odacanthinae
subfamily	Oedemerinae
subfamily	Omophroninae
subfamily	Oodinae
subfamily	Orsodacninae
subfamily	Ortaliinae
subfamily	Orthoperinae
subfamily	Palorinae
subfamily	Panagaeinae
subfamily	Parandrinae
subfamily	Patrobinae
subfamily	Paussinae
subfamily	Pedilinae
subfamily	Pelecotominae
subfamily	Peltinae
subfamily	Perigoninae
subfamily	Phalacrinae
subfamily	Phrenapatinae
subfamily	Pimeliinae
subfamily	Platyninae
subfamily	Pleganophorinae
subfamily	Polycaoninae
subfamily	Prioninae
subfamily	Promecognathinae
subfamily	Psolinae
subfamily	Psydrinae
subfamily	Pterostichinae
subfamily	Ptilinae

subfamily	Ptilophorinae
subfamily	Ptininae
subfamily	Pyrochroinae
subfamily	Rhadalinae
subfamily	Rhysodinae
subfamily	Ripidiinae
subfamily	Ripiphorinae
subfamily	Rypobiinae
subfamily	Salpinginae
subfamily	Scaritinae
subfamily	Scraptiinae
subfamily	Scymninae
subfamily	Setariolinae
subfamily	Siagoninae
subfamily	Spondylidinae
subfamily	Steropinae
subfamily	Sticholotidinae
subfamily	Synetinae
subfamily	Tarsosteninae
subfamily	Telmatophilinae
subfamily	Tenebrioninae
subfamily	Tetratominae
subfamily	Tillinae
subfamily	Tomoderinae
subfamily	Toraminae
subfamily	Trachypachinae
subfamily	Trechinae
subfamily	Tritominae
subfamily	Trogossitinae
subfamily	Vesperinae
subfamily	Xenoscelinae

subfamily	Xyletininae
subfamily	Zeugophorinae
subfamily	Zopherinae
tribe	Abacetini
tribe	Aciliini
tribe	Adeliini
tribe	Adesmiini
tribe	Adoxini
tribe	Agabini
tribe	Akidini
tribe	Alfieriellini
tribe	Alphitobiini
tribe	Amauronioidini
tribe	Amblicerini
tribe	Anaspidini
tribe	Anisodactylini
tribe	Anthicini
tribe	Apatini
tribe	Apenini
tribe	Apotomini
tribe	Asclerini
tribe	Asidini
tribe	Atomariini
tribe	Belopini
tribe	Bembidiini
tribe	Berginini
tribe	Bidessini
tribe	Blaptini
tribe	Bolitophagini
tribe	Bostrichini
tribe	Brachinini

tribe	Broscini
tribe	Bruchini
tribe	Bulaeini
tribe	Caenoscelini
tribe	Calleidini
tribe	Callistini
tribe	Calopodini
tribe	Carabini
tribe	Cassidini
tribe	Ceratanisini
tribe	Cerocomini
tribe	Chilocorini
tribe	Chlaeniini
tribe	Cicindelini
tribe	Clivinini
tribe	Clytrini
tribe	Cnemeplatiini
tribe	Coccidulini
tribe	Coccinellini
tribe	Coelometopini
tribe	Colymbetini
tribe	Conaliini
tribe	Copelatini
tribe	Corsyrini
tribe	Corylophini
tribe	Cossyphini
tribe	Cossyphodini
tribe	Crypticini
tribe	Cryptocephalini
tribe	Cryptophagini
tribe	Cybistrini

tribe	Cychnini
tribe	Cyclosomini
tribe	Cymbionotini
tribe	Cymindidini
tribe	Cynegetini
tribe	Cynegetini
tribe	Dalyatini
tribe	Demetriadini
tribe	Dendarini
tribe	Diaperini
tribe	Dicaelini
tribe	Ditomini
tribe	Dityliini
tribe	Dromiini
tribe	Dryptini
tribe	Dyschiriini
tribe	Dytiscini
tribe	Elaphrini
tribe	Elenophorini
tribe	Endomiini
tribe	Epicautini
tribe	Epilachnini
tribe	Epitragini
tribe	Eretini
tribe	Erodiini
tribe	Esarcini
tribe	Eumolpini
tribe	Eurychorini
tribe	Formicomini
tribe	Galerucini
tribe	Gloeosomatini

tribe	Gyrinini
tribe	Harpalini
tribe	Helopini
tribe	Hydaticini
tribe	Hydrocanthini
tribe	Hydroporini
tribe	Hydrovatini
tribe	Hygrotini
tribe	Hyperaspidini
tribe	Hyphidriini
tribe	Hypocoprini
tribe	Hypophloeini
tribe	Kytorhinini
tribe	Laccophilini
tribe	Laccommiini
tribe	Lacnogyini
tribe	Lagriini
tribe	Lebiini
tribe	Leichenini
tribe	Lestignathini
tribe	Licinini
tribe	Lionychini
tribe	Litoborini
tribe	Loricerini
tribe	Luperini
tribe	Lyctini
tribe	Lyttini
tribe	Macrosiagonini
tribe	Masoreini
tribe	Megacephalini
tribe	Melanimini

tribe	Meloini
tribe	Methlini
tribe	Microhorini
tribe	Microweiseini
tribe	Microweiseini
tribe	Mordellini
tribe	Mordellistenini
tribe	Morionini
tribe	Mycetophagini
tribe	Mylabrini
tribe	Myrmexchixenini
tribe	Nacerdini
tribe	Nebriini
tribe	Nemognathini
tribe	Nodinini
tribe	Noterini
tribe	Notiophilini
tribe	Notoxini
tribe	Noviini
tribe	Odacanthini
tribe	Oedemerini
tribe	Omophronini
tribe	Omphreini
tribe	Oodini
tribe	Opatrini
tribe	Orectochilini
tribe	Pachybrachini
tribe	Pachymerini
tribe	Pachypterini
tribe	Panagaeini
tribe	Parmulini

tribe	Patrobini
tribe	Paussini
tribe	Pedinini
tribe	Pelophilini
tribe	Pentariini
tribe	Perigonini
tribe	Phaleriini
tribe	Phrenapatini
tribe	Pimeliini
tribe	Platynaspidini
tribe	Platynini
tribe	Platynotini
tribe	Platyopini
tribe	Platyscelini
tribe	Pogonini
tribe	Pseudotrechini
tribe	Psydrini
tribe	Psylloborini
tribe	Pterostichini
tribe	Pycnomerini
tribe	Rhaebini
tribe	Rhysodini
tribe	Ripiphorini
tribe	Rypobiini
tribe	Scaphidemini
tribe	Scaritini
tribe	Scaurini
tribe	Scaptiini
tribe	Scymnini
tribe	Sepidiini
tribe	Serangiini

tribe	Serangiini
tribe	Sericoderini
tribe	Sermylini
tribe	Siagonini
tribe	Singilini
tribe	Sinoxylini
tribe	Somotrichini
tribe	Sphodriini
tribe	Stenaliini
tribe	Stenoderini
tribe	Stenolophini
tribe	Stenosini
tribe	Stenostomatini
tribe	Stethorini
tribe	Sticholotidini
tribe	Stomini
tribe	Strongyliini
tribe	Stylosomini
tribe	Telmatophilini
tribe	Tenebrionini
tribe	Tentyriini
tribe	Teplinini
tribe	Tetrabrachini
tribe	Thaneroclerini
tribe	Trachypachini
tribe	Trachyscelini
tribe	Trechini
tribe	Triboliini
tribe	Trogoxylini
tribe	Typhaeini
tribe	Tytthaspididini

tribe	Ulomini
tribe	Xyloperthini
tribe	Zabrini
tribe	Zophosini
tribe	Zuphiini
subtribe	Acanthoscelidina
subtribe	Aepina
subtribe	Amblicerina
subtribe	Amblystomina
subtribe	Anillina
subtribe	Aptinina
subtribe	Atranopsina
subtribe	Aulacophorina
subtribe	Bembidiina
subtribe	Brachinina
subtribe	Broscina
subtribe	Bruchina
subtribe	Calathina
subtribe	Calosomatina
subtribe	Carabina
subtribe	Caryedonina
subtribe	Chlaeniina
subtribe	Cicindelina
subtribe	Clinidiina
subtribe	Clivinina
subtribe	Cymindidina
subtribe	Diabroticina
subtribe	Ditomina
subtribe	Dolichina
subtribe	Harpalina
subtribe	Kytorhinina

subtribe	Lionychina
subtribe	Luperina
subtribe	Mastacina
subtribe	Megacephalina
subtribe	Molopina
subtribe	Myadina
subtribe	Odacanthina
subtribe	Omoglymniina
subtribe	Oodina
subtribe	Panagaeina
subtribe	Paussina
subtribe	Perileptina
subtribe	Pheropsophina
subtribe	Poecilina
subtribe	Pseudomasoreina
subtribe	Psydina
subtribe	Pterostichina
subtribe	Reicheiina
subtribe	Rhaebina
subtribe	Rhysodina
subtribe	Scaritina
subtribe	Sphodrina
subtribe	Synuchina
subtribe	Tachyina
subtribe	Trechina
subtribe	Trechodina
subtribe	Trichina
family	Byturidae

Temporal coverage

Living time period: Currently living.

Notes: Currently living multicellular, terrestrial and freshwater animals in stable populations, largely excluding (1) rare / irregular immigrants, (2) alien / invasive species, (3) accidental or deliberate releases of exotic (pet)species, (4) domesticated animals, (5) non-native species imported and released for bio-control or (6) non-native species largely confined to hothouses.

Usage rights

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Data resources

Data package title: Fauna Europaea - Coleoptera - 2

Resource link: http://www.faunaeur.org/Data_papers/FaEu_Coleoptera-2_2.6.2.zip

Alternative identifiers: <http://www.faunaeur.org/experts.php?id=18>

Number of data sets: 2

Data set name: Fauna Europaea - Coleoptera 2 (excl...) version 2.6.2 - species

Character set: UTF-8

Download URL: http://www.faunaeur.org/Data_papers/FaEu_Coleoptera-2_2.6.2.zip

Data format: CSV

Column label	Column description
datasetName	The name identifying the data set from which the record was derived (http://rs.tdwg.org/dwc/terms/datasetName).
version	Release version of data set.
versionIssued	Issue data of data set version.
rights	Information about rights held in and over the resource (http://purl.org/dc/terms/rights).
rightsHolder	A person or organization owning or managing rights over the resource (http://purl.org/dc/terms/rightsHolder).

accessRights	Information about who can access the resource or an indication of its security status (http://purl.org/dc/terms/accessRights).
taxonID	An identifier for the set of taxon information (http://rs.tdwg.org/dwc/terms/taxonID)
parentNameUsageID	An identifier for the name usage of the direct parent taxon (in a classification) of the most specific element of the scientificName (http://rs.tdwg.org/dwc/terms/parentNameUsageID).
scientificName	The full scientific name, with authorship and date information if known (http://rs.tdwg.org/dwc/terms/scientificName).
acceptedNameUsage	The full name, with authorship and date information if known, of the currently valid (zoological) taxon (http://rs.tdwg.org/dwc/terms/acceptedNameUsage).
originalNameUsage	The original combination (genus and species group names), as firstly established under the rules of the associated nomenclaturalCode (http://rs.tdwg.org/dwc/terms/originalNameUsage).
family	The full scientific name of the family in which the taxon is classified (http://rs.tdwg.org/dwc/terms/family).
familyNameID	An identifier for the family name.
genus	The full scientific name of the genus in which the taxon is classified (http://rs.tdwg.org/dwc/terms/genus).
subgenus	The full scientific name of the subgenus in which the taxon is classified. Values include the genus to avoid homonym confusion (http://rs.tdwg.org/dwc/terms/subgenus).
specificEpithet	The name of the first or species epithet of the scientificName (http://rs.tdwg.org/dwc/terms/specificEpithet).
infraspecificEpithet	The name of the lowest or terminal infraspecific epithet of the scientificName, excluding any rank designation (http://rs.tdwg.org/dwc/terms/infraspecificEpithet).
taxonRank	The taxonomic rank of the most specific name in the scientificName (http://rs.tdwg.org/dwc/terms/infraspecificEpithet).
scientificNameAuthorship	The authorship information for the scientificName formatted according to the conventions of the applicable nomenclaturalCode (http://rs.tdwg.org/dwc/terms/scientificNameAuthorship).
authorName	Author name information
namePublishedInYear	The four-digit year in which the scientificName was published (http://rs.tdwg.org/dwc/terms/namePublishedInYear).
Brackets	Annotation if authorship should be put between parentheses.

nomenclaturalCode	The nomenclatural code under which the scientificName is constructed (http://rs.tdwg.org/dwc/terms/nomenclaturalCode).
taxonomicStatus	The status of the use of the scientificName as a label for a taxon (http://rs.tdwg.org/dwc/terms/taxonomicStatus).
resourceDescription	An account of the resource, including a data-paper DOI (http://purl.org/dc/terms/description)

Data set name: Fauna Europaea - Coleoptera 2 (excl...) version 2.6.2 - hierarchy

Character set: UTF-8

Download URL: http://www.faunaeur.org/Data_papers/FaEu_Coleoptera-2_2.6.2.zip

Data format: CSV

Column label	Column description
datasetName	The name identifying the data set from which the record was derived (http://rs.tdwg.org/dwc/terms/datasetName).
version	Release version of data set.
versionIssued	Issue data of data set version.
rights	Information about rights held in and over the resource (http://purl.org/dc/terms/rights).
rightsHolder	A person or organization owning or managing rights over the resource (http://purl.org/dc/terms/rightsHolder).
accessRights	Information about who can access the resource or an indication of its security status (http://purl.org/dc/terms/accessRights).
taxonName	The full scientific name of the higher-level taxon
scientificNameAuthorship	The authorship information for the scientificName formatted according to the conventions of the applicable nomenclaturalCode (http://rs.tdwg.org/dwc/terms/scientificNameAuthorship).
taxonRank	The taxonomic rank of the most specific name in the scientificName (http://rs.tdwg.org/dwc/terms/infraspecificEpithet).
taxonID	An identifier for the set of taxon information (http://rs.tdwg.org/dwc/terms/taxonID)
parentNameUsageID	An identifier for the name usage of the direct parent taxon (in a classification) of the most specific element of the scientificName (http://rs.tdwg.org/dwc/terms/parentNameUsageID).
resourceDescription	An account of the resource, including a data-paper DOI (http://purl.org/dc/terms/description)

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Author contributions

Authors Paolo Audisio and Yde de Jong organized and wrote the main text of the paper, which has been reviewed, corrected and improved by all other co-authors.

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Supplementary material

Suppl. material 1: FaEu Coleoptera 2 stats

Authors: Yde de Jong & Paolo Audisio

Data type: png

Brief description: This is a high-resolution version of Figure 3.

Filename: FaEu_Coleoptera_2_stats.png - [Download file](#) (1016.49 kb)