Fauna Europaea: Hymenoptera - Apocrita (excl. Ichneumonoidea)

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Abstract

Fauna Europaea provides a public web-service with an index of scientific names (including important 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. 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.

Hymenoptera is one of the four largest orders of insects, with about 130,000 described species. In the Fauna Europaea database, ‘Hymenoptera - Apocrita (excluding Ichneumonoidea)’ comprises 13 superfamilies, 52 families, 91 subfamilies, 38 tribes and 13,211 species. The paper includes a complete list of taxa dealt with, the number of species in each and the name of the specialist responsible for data acquisition. As a general conclusion about the European fauna of Hymenoptera, the best known countries in terms of recorded species are those from northwestern Europe, with the least known fauna probably in the more eastern and southeastern parts of Europe.

Keywords

Biodiversity informatics, Hymenoptera, Apocrita, Fauna Europaea, taxonomic indexing

Introduction

The European Commission published the European Community Biodiversity Strategy, providing a framework for development of Community policies and instruments in order 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 knowledge of its components. The assessment of biodiversity, monitoring changes, sustainable exploitation of biodiversity, and much legislative work depends 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. In this sense the Fauna Europaea
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database provides a unique reference for many user-groups such as scientists, governments, industries, conservation communities and educational programs.

*Fauna Europaea* kicked-off in 2000 as an EC-FP5 four years project, delivering its first release in 2004 (Jong et al. 2014). After thirteen years of steady progress, in order to efficiently disseminate the 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. For this purpose a special Biodiversity Data Journal Series has been compiled, called Contributions on Fauna Europaea. This work was initiated during the VIBRANT project and is further supported by the recently started EU BON project. This paper holds the first publication of the Fauna Europaea Hymenoptera - Apocrita (excluding Ichneumonoidea) data sector as a BDJ data paper.

Within the EU BON project further steps will be made to implement *Fauna Europaea* as a basic tool and standard reference for biodiversity research and to evaluate taxonomic expertise capacity in Europe. The *Fauna Europaea* data-papers will contribute to a quality assessment on biodiversity data by providing estimates on gaps in taxonomic information and knowledge.

**General description**

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

The Hymenoptera - Apocrita (excluding Ichneumonoidea) is one of the 58 *Fauna Europaea* major taxonomic groups, covering 13,211 species (Fig. 2) and represented by a network of 20 specialists (Table 1). The current data-paper respects the organization of the animal groups present in the *Fauna Europaea* database.

**Additional information:** Hymenoptera is one of the four largest orders of insects (beside Coleoptera, Diptera and Lepidoptera), with about 130,000 described species. Their success is probably due to the tremendous range of ecological and behavioral adaptations. Two main groups (usually treated as suborders) are generally recognized within Hymenoptera: the paraphyletic Symphyta (sawflies and hornetails) and the monophyletic Apocrita (bees, ants and wasps). Traditionally, Apocrita is divided in the paraphyletic Parasitica (the ovipositor retains its primitive role in egg-laying) and the monophyletic Aculeata (the ovipositor is modified for stinging) (Vilhelmsen 2001, Schulmeister et al. 2002, Heraty et al. 2011).
**Table 1.**
Responsible specialists per family in Hymenoptera - Apocrita (excluding Ichneumonoidea). The actual numbers of databased species are given per family. For most families also an indication of the actual number of known/described species (showing a potential information gap) is given plus an estimate of the total number of existing species (i.e., described/known plus undescribed/undiscovered) for Europe.

* At present, Fauna Europaea lists 135 accepted chrysidid subspecies. We estimate that at least 50 subspecies could be considered as valid species, and future molecular analysis will prove it as in the case of the *Chrysis ignita* group (Soon et al. 2014). Based on recent unpublished findings, northern African species have been collected in the Iberian peninsula and S Italy, whereas Transcaucasian species are expected in Eastern Europe. Lastly, fifty-five European species and subspecies have been described after the publication of the world checklist of the Chrysididae by Kimsey & Bohart (Kimsey and Bohart 1990) and we expect around 50 species to be described in the next future, based on the material examined in different collections.

| TAXONOMY    | FAMILY      | SPECIALIST(S)          | DATABASED SPECIES (Fauna Europaea) | TOTAL DESCRIBED SPECIES (information-gap) | TOTAL ESTIMATED SPECIES (knowledge-gap) |
|-------------|-------------|------------------------|------------------------------------|------------------------------------------|----------------------------------------|
| Agaonidae   | Mircea-Dan Mitroiu | 5                      | 5                                  |                                          |                                        |
| Ampulicidae | Yvan Barbier | 5                      | 5                                  |                                          |                                        |
| Aphelinidae | Andrew Polaszek | 193                    |                                    |                                          |                                        |
| Apidae      | Andrew Polaszek | 2066                   |                                    |                                          |                                        |
| Aulacidae   | Michael Madl  | 11                     |                                    |                                          |                                        |
| Bethylidae  | Andrew Polaszek | 226                    |                                    |                                          |                                        |
| Bradynobaenidae | Guido Pagliano | 5                     |                                    |                                          |                                        |
| Ceraphronidae | Andrew Polaszek | 102                   |                                    |                                          |                                        |
| Chalcididae | Lucian Fusu  | 93                     | 99                                 |                                          |                                        |
| Chrysididae | Oliver Niehuis / Paolo Rosa & Villu Soon | 483                  | 486                                | 550-600 *                                 |
| Crabronidae | Yvan Barbier | 664                    | 664                                |                                          |                                        |
| Cynipidae   | Fredrik Ronquist & Mattias Forshage | 339                | 365                                |                                          |                                        |
| Diapriidae  | Norman Johnson | 781                    |                                    |                                          |                                        |
| Dryinidae   | Massimo Olmi  | 107                    | 114                                |                                          |                                        |
| Embolemidae | Massimo Olmi  | 4                      | 5                                  |                                          |                                        |
| Family               | Author                      | First Page | Last Page |
|----------------------|-----------------------------|------------|-----------|
| Encyrtidae           | Lucian Fusu                 | 769        | 769       |
| Eucharitidae         | Mircea-Dan Mitroiu          | 15         | 15        |
| Eulophidae           | Mircea-Dan Mitroiu          | 1193       | 1193      |
| Eupelmidae           | Lucian Fusu                 | 105        | 118       |
| Eurytomidae          | Mircea-Dan Mitroiu          | 352        | 353       |
| Evaniidae            | Michael Madl                | 5          |           |
| Figitidae            | Fredrik Ronquist & Mattias Forshage | 425       | 440       |
| Formicidae           | Alexander Radchenko         | 637        |           |
| Gasteruptiidae       | Michael Madl                | 30         |           |
| Heloridae            | Norman Johnson              | 4          |           |
| Heterogynaidae       | Yvan Barbier                | 1          | 1         |
| Ibalidae             | Fredrik Ronquist & Mattias Forshage | 3          | 3         |
| Leucospidae          | Lucian Fusu                 | 8          | 8         |
| Megaspilidae         | Andrew Polaszek             | 140        |           |
| Mutilidae            | Aleksandar Cetkovic & Guido Nonveiller | 154       | 154       |
| Mymaridae            | Lucian Fusu                 | 457        | 457       |
| Mymarommatidae       | Lucian Fusu                 | 1          | 1         |
| Ormyridae            | Mircea-Dan Mitroiu          | 25         | 25        |
| Perilampidae         | Mircea-Dan Mitroiu          | 67         | 67        |
| Platygastridae       | Norman Johnson              | 518        |           |
| Pompilidae           | Raymond Wahis               | 284        |           |
| Proctotrupidae       | Norman Johnson              | 59         |           |
| Pteromalidae         | Mircea-Dan Mitroiu          | 1389       | 1391      |
| Sapygidae            | Josef Gussenleitner         | 10         | 10        |
| Scelionidae          | Norman Johnson              | 587        |           |
| Sclerogibbidae       | Massimo Olmi                | 5          | 5         |
| Scoliidae            | Till Osten                  | 22         |           |
| Signiphoridae        | Lucian Fusu                 | 10         | 11        |
The ecology and biology of the species from the above families are extremely diverse. In their larval stage most species are carnivorous, feeding mainly on other insects or spiders, but some groups are specialized on other diets such as nectar and pollen (e.g. Apidae), vegetable tissues (e.g. Cynipidae), or are omnivorous (e.g. Formicidae). Among the carnivorous species, most are parasitoids i.e. the free-living adult usually searches a host (the egg, larva, pupa, or even the adult of mostly another insect) and its larva (solitary parasitoid) or larvae (gregarious parasitoid) will then develop inside (endoparasitoid) or outside (ectoparasitoid) that host, almost invariably killing it.
The group contains many species of parasitoids frequently used in biological control e.g. *Trichogramma* spp. (Chalcidoidea: Trichogrammatidae), but also the smallest known insect, the wingless male of *Dicopomorpha echmepterygis* Mockford (Chalcidoidea: Mymaridae), an egg parasitoid of only 0.13 mm in length, and the smallest winged insect, some females of *Kikiki huna* Huber & Beardsley (Chalcidoidea: Mymaridae) being only 0.16 mm in length. Members of Apoidea are among the most important pollinator agents in ecosystems containing flowering plants. A few species are regarded as pests (some sawflies, ants, and wasps).
In the *Fauna Europaea* database, Hymenoptera - Apocrita (excluding Ichneumonoidea) comprises 13 superfamilies, 54 families and 91 subfamilies (see taxonomic coverage). Some recent changes in the classification of Hymenoptera Apocrita will be included in the next version, such as the treatment of Scelionidae as a subfamily of Platygastridae (Scelioninae) (Sharkey 2007), the inclusion of *Cratomus* Dalman and *Panstenon* Walker (Pteromalidae: Cratominae, Panstenoninae) in Pteromalinae, the inclusion of Epichrysomallinae in Pteromalidae (Heraty et al. 2013), etc. A different classification system for Apoidea (such as the one in *Checklist of the Western Palaearctic Bees*) will also be considered following a consensus decision of bee specialists.

**Fig. 4**

*Polistes* sp. (Vespoidea: Vespidae) nest.

**Gap estimates in Fauna Europaea:** Despite recent progress, it is important to note that we still know very little of the fauna of Hymenoptera for Europe. It is almost certain (if we use the UK fauna - by far the best known in Europe - as a guide and extrapolate from there) that the order Hymenoptera, in terms of species richness, would be far greater than that for Coleoptera. Currently the British Isles fauna of Hymenoptera stands at 7761 species, being the largest insect order in the region, ahead of Coleoptera and Diptera (Broad 2014).

Estimated gaps in terms of described species that are known from Europe, but are not currently included in the database are presented in Table 1. They range from zero for many families up to about 5-10% for other groups, and are expected to be filled in the next version of the database. Country gaps are not included in this analysis, but are expected to be higher in south-eastern European countries, where studies of Hymenoptera Apocrita fauna are still scarce compared with the north-western countries. The best known countries in Europe are probably UK (<80%), Sweden (<50%), ex Czechoslovak Republic (<50%), Germany (<50%), Italy (<50%), France (<30%), and Spain (<30%), with the least known
fauna probably in the more eastern and southeastern parts of Europe such as Romania, Bulgaria, or Greece (probably all <20%) (Noyes, unpublished data).

With regard to the undescribed taxa, it would be generally highly speculative to estimate the potential number of new species for most families, especially for highly diverse groups containing minute species, such as Chalcidoidea, where possibly hundreds of new species await discovery. For other better studied groups such as Chrysidae, it is estimated that a large number of subspecies could be erected to species level, thus increasing the total number of valid taxa with about 50 species. In other groups it is also possible that the number of new synonyms will prove to be approximately equal to the number of newly described taxa, so that the total number of taxa will not become significantly higher.

Fig. 5

In addition, the number of taxonomists is continuously decreasing: unfortunately some excellent specialists are either deceased (Dr Till Osten and Dr Guido Nonveiller) or are retired and inactive (Table 2). If young taxonomists will not fill up these gaps, we will eventually end up not being able to identify most of the European biodiversity.

Table 2.
Fauna Europaea Hymenoptera Apocrita excluding Ichneumonoidea expertise network status and changes.

| FAMILY NAME | EXPERTS VERSIONS 1 & 2 (current) | Comment |
|-------------|----------------------------------|---------|
| Ampulicidae, Crabronidae, Heterogynaidae, Sphecidae | Yvan Barbier | active |
| Tiphidae | Mario Boni Bartalucci | active |
## Project description

**Title:** This BDJ data paper includes the taxonomic indexing efforts in *Fauna Europaea* on European Hymenoptera - Apocrita 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 managing 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 Hymenoptera - Apocrita the responsible Group Coordinators were John Noyes (version 1) and Mircea-Dan Mitroiu (version 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 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 carried out by the *Fauna Europaea* project bureau. During the project phase (until 2004) a network of principal partners took responsibility for various 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). Once the formal end of the project ended (2004-2013) all tasks were taken over by the Zoological Museum Amsterdam.

**Study area description:** The study area covers the European mainland (Western Palaearctic), including the Macaronesian islands, excluding the Caucasus, Turkey, Arabian Peninsula and Northern Africa.

**Design description:** Standards. Group coordinators and taxonomic specialists have to 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 the all accepted species, (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 of the more than 400 specialists contributing to the project.

Data management. The data 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. 1). Since 2013 the data servers are hosted at the Museum für Naturkunde in Berlin (migrated from ZMA-UvA).

**Data set.** The *Fauna Europaea* basic data set consists of: accepted (sub)species names (including authorship), synonymous names (including authorship), taxonomic hierarchy / classification, misapplied names (including misspellings and alternative taxonomic views), homonym annotations, expert details, European distribution (at country level), Global distribution, taxonomic reference (optional), 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 (EVK2-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).

For preparing the Hymenoptera - Apocrita (excluding Ichneumonoidea) data-paper additional support was received from a grant of the Romanian National Authority for Scientific Research, CNCS–UEFISCDI, project number PN–II–RU–TE–2012–3–0057 to MDM.

**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. In total no fewer than 476 experts contributed taxonomic and/or faunistic information for Fauna Europaea. The vast majority of these 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. 1). 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 worked well until its replacement in 2013.

The Fauna Europaea index via the web-portal was firstly released on 27th September 2004, the most recent release (version 2.6.2) was launched on 29th August 2013. An overview of Fauna Europaea releases can be found here: [http://www.faunaeur.org/about_fauna_versions.php](http://www.faunaeur.org/about_fauna_versions.php).

Fig. 6
Quality control: Fauna Europaea data are unique in the 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 on the web-portal. Additional validation on gaps and correct spelling was effected at the validation office in Paris.

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 sets in its domain.

In conclusion (see above), recognised gaps in Hymenoptera - Apocrita (excluding Ichneumonoidea) include: slow up-dating of data-sets (with both faunistic and taxonomic information) for several groups e.g. Apidae or Cynipoidea; and few faunistic data for some groups e.g. Chalcidoidea, Platygastroidea or Proctotrupoidea, especially in south-eastern European countries.

To optimise the use and implementation of a uniform and correct nomenclature, also following the global efforts on establishing a so-called 'Global Names Architecture' (Pyle and Michel 2008, Patterson et al. 2010), a cross-referencing of the Fauna Europaea Hymenoptera - Apocrita (excluding Ichneumonoidea) data-set with relevant nomenclators, including the Universal Chalcidoidea Database, is recommended as well as a connection with relevant name services (like Hymenoptera Name Server). In addition, a interlinkage
with relevant Hymenoptera information services (like Hymenoptera Online, Atlas Hymenoptera, BWARS and HymIS), regional data portals (like Forum Entomologi Italiani and eBiodiversity) and databases dedicated to smaller groups (like Chrysis.net, Bombus, Palaearctic Osmiine Bees and Checklist of the Western Palaearctic Bees) is proposed.

Fig. 7

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 write 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' document).

Geographic coverage

Description: Species and subspecies distributions in Fauna Europaea are registered at least at country level, defined politically. For this purpose the FaEu geographical system basically follows the TDWG 2.0 standards. The covered area includes the European mainland (Western Palaearctic), plus the Macaronesian islands (excl. Cape Verde Islands), Cyprus, Franz Josef Land and Novaya Zemlya. Western Kazakhstan and the Caucasus are excluded (see Fig. 3).

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 Urals (E 60°) Longitude.

Taxonomic coverage

Description: The Fauna Europaea database contains the scientific names of all living European land 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 (Jong et al. 2014).

This data paper covers the Hymenoptera - Apocrita (excluding Ichneumonoidea) content of Fauna Europaea, including 52 families, 13,211 species, 826 subspecies and 5,676 (sub)species synonyms (see Fig. 2). Higher ranks are given below, the species list can be downloaded from the Fauna Europaea portal (see: Data resources).

The classification used in the Fauna Europaea database and consequently in this data-paper follows the opinions of the experts listed above. Readers should be aware that other classifications may exist. For example, regarding the Apidae, some specialists prefer to use several families instead of one (i.e. Andrenidae, Apidae, Colletidae, Halictidae, Megachilidae and Melittidae) (e.g. Patiny et al. 2009).

Taxa included:

| Rank         | Scientific Name |
|--------------|-----------------|
| kingdom      | Animalia        |
| subkingdom   | Eumetazoa       |
| phylum       | Arthropoda      |
| subphylum    | Hexapoda        |
| class        | Insecta         |
| order        | Hymenoptera     |
| suborder     | Apocrita        |
| superfamily  | Apoidea         |
| family       | Ampulicidae     |
| tribe        | Ampulicini      |
| tribe        | Dolichurini     |
| family       | Apidae          |
| family       | Crabronidae     |
| subfamily    | Astatinae       |
| subfamily        | Tribe                  |
|------------------|------------------------|
| Bembicinae       | Alyssontini            |
|                  | Bembicini              |
|                  | Nyssonini              |
| Crabroninae      | Crabronini             |
|                  | Larrini                |
|                  | Miscophini             |
|                  | Oxybelini              |
|                  | Palarini               |
|                  | Trypoxylini            |
| Dinetinae        |                        |
| Mellininae       |                        |
| Pemphredoninae   |                        |
| Entomosericini   |                        |
| Pemphredonini    |                        |
| Psenini          |                        |
| Philanthinae     |                        |
| Cercerini        |                        |
| Philanthini      |                        |
| Pseudoscoliini   |                        |
| Heterogynaidae   |                        |
| Sphecidae        |                        |
| Ammophilini      |                        |
| Sceliphrini      |                        |
| Sphecini         |                        |
| Ceraphronoidea   |                        |
| Ceraphronidae    |                        |
| Megaspliidae     |                        |
| Chalcidoidea     |                        |
| Agaonidae        |                        |
| Subfamily            | Family           |
|----------------------|------------------|
| Agaoninae            | Aphelinidae      |
| Epichrysomallinae    | Aphelininae      |
| Sycoryctinae         | Azotinae         |
| Calesinae            | Chalcididae      |
| Coccophaginae        | Chalcidinae      |
| Eretmocerinae        | Dirhininae       |
| Eriaporinae          | Epitraninae      |
| Haltichellinae       | Encyrtidae       |
| Tetracneminae        | Eucharitidae     |
| Tetrastichinae       | Eucharitinae     |
| Eupelmidae           | Eulophidae       |
| Calosotinae          | Entedoninae      |
| Eupelminae           | Euderinae        |
| Eulophinae           | Eulophinae       |
| Eupelminae           | Eupelminae       |
| Neanastatinae        | Eurytomidae      |
| Eurytominae          |                 |
| subfamily   | family              |
|------------|---------------------|
| Rileyinae  | Leucospidae         |
| family     | Mymaridae           |
| family     | Ormyridae           |
| family     | Periliampidae       |
| subfamily  | Chrysolampinae      |
| subfamily  | Periliampinae       |
| subfamily  | Philomidinae        |
| family     | Pteromalidae        |
| subfamily  | Asaphinae           |
| subfamily  | Ceinae              |
| subfamily  | Cerocephalinae      |
| subfamily  | Cleonyminae         |
| subfamily  | Colotrechninae      |
| subfamily  | Cratominae          |
| subfamily  | Diparinae           |
| subfamily  | Eunotinae           |
| subfamily  | Herbertiinae        |
| subfamily  | Macromesinae        |
| subfamily  | Miscogasterinae     |
| subfamily  | Neodiparinae        |
| subfamily  | Ormocerinae         |
| subfamily  | Panstenoninae       |
| subfamily  | Pireninae           |
| subfamily  | Pteromalinae        |
| subfamily  | Spalangiinae        |
| family     | Signiphoridae       |
| family     | Tetracampidae       |
| subfamily  | Platynocheilinae    |
| subfamily  | Tetracampinae       |
| family     | Torymidae           |
| Taxonomic Level | Subdivision     |
|----------------|-----------------|
| superfamily    | Megastigminae   |
| superfamily    | Toryminae       |
| family         | Trichogrammatidae |
| superfamily    | Chrysidioidea   |
| family         | Bethylidae      |
| family         | Chrysididae     |
| subfamily      | Chrysidinae     |
| tribe          | Chrysidini      |
| tribe          | Elampini        |
| tribe          | Parnopini       |
| subfamily      | Cleptinae       |
| family         | Dryinidae       |
| family         | Embolemidae     |
| family         | Sclerogibbidae  |
| superfamily    | Cynipoidea      |
| family         | Cynipidae       |
| tribe          | Aylacini        |
| tribe          | Cynipini        |
| tribe          | Diplolepidini   |
| tribe          | Pediaspini      |
| tribe          | Synergini       |
| family         | Figitidae       |
| subfamily      | Anacharitinae   |
| subfamily      | Aspicerinae     |
| subfamily      | Charipinae      |
| tribe          | Alloxystini     |
| tribe          | Charipini       |
| subfamily      | Eucoilinae      |
| subfamily      | Figitinae       |
| subfamily      | Parnipinae      |
| family         | Ibaliidae       |
| Superfamily      | Family               |
|-----------------|----------------------|
| Evanioidae      | Aulacidae            |
|                 | Evaniidae            |
|                 | Gasteruptiidae       |
|                 | Gasteruptiinae       |
| Mymarommatoidae | Mymarommatidae       |
|                 | Platygastroidea      |
|                 | Platygastridae       |
|                 | Scelionidae          |
| Proctotrupoidea | Diapriidae           |
|                 | Heloridae            |
|                 | Proctotrupidae       |
|                 | Vanhorniidae         |
| Stephanoidea    | Stephanidae          |
|                 | Stephaninae          |
| Trigonoidae     | Trigonidae           |
|                 | Trigonalyinae        |
| Vespoidea       | Bradynobaenidae      |
|                 | Formicidae           |
|                 | Aenictinae           |
|                 | Dolichoderinae       |
|                 | Dorylinae            |
|                 | Formicinae           |
|                 | Leptanillinae        |
|                 | Myrmicinae           |
|                 | Ponerinae            |
| Family       | Subfamily                  | Tribe         |
|--------------|----------------------------|---------------|
| Mutiliidae   | Mutililinae                |               |
| Myrmillinae  |                            |               |
| Myrmosinae   |                            |               |
| Pseudophotopsidinae |                    |               |
| Sphaeropthalminae |                        |               |
| Ticoplinae   |                            |               |
| Pompilidae   | Ceropalinae                |               |
| Pepsinae     |                            |               |
| Ageniellini  |                            |               |
| Pepsini      |                            |               |
| Pompilinae   |                            |               |
| Aporini      |                            |               |
| Homonotini   |                            |               |
| Pompilini    |                            |               |
| Psammoderini |                            |               |
| Sapygidae    |                            |               |
| Scoliidae    |                            |               |
| Proscoliinae |                            |               |
| Scoliinae    |                            |               |
| Campsomerini |                            |               |
| Scoliini     |                            |               |
| Tiphilidae   |                            |               |
| Methochinae  |                            |               |
| Myzininae    |                            |               |
| Tiphiiinae   |                            |               |
| Vespidae     |                            |               |
| Eumeninae    |                            |               |
| Masarinae    |                            |               |
| Vespinae     |                            |               |
Temporal coverage

Living time period: Currently living (extant).

Notes: Currently living animals in stable populations, largely excluding (1) rare / irregular immigrants, intruder or invader species, (2) accidental or deliberate releases of exotic (pet)species, (3) domesticated animals, (4) foreign species imported and released for bio-control or (5) foreign species largely confined to hothouses.

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Data resources

Data package title: Fauna Europaea - Hymenoptera - Apocrita

Resource link: http://www.faunaeur.org/Data_papers/FaEu_Hymenoptera-Apocrita_2.6.2.zip

Alternative identifiers: http://www.faunaeur.org/experts.php?id=662

Number of data sets: 2

Data set name: Fauna Europaea - Hymenoptera - Apocrita version 2.6.2 - species

Character set: UTF-8

Download URL: http://www.faunaeur.org/Data_papers/FaEu_Hymenoptera-Apocrita_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](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](http://purl.org/dc/terms/rights)).                        |
| Term                           | Description                                                                                                                                 |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| rightsHolder                 | A person or organization owning or managing rights over the resource ([http://purl.org/dc/terms/rightsHolder](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](http://purl.org/dc/terms/accessRights)). |
| taxonID                      | An identifier for the set of taxon information ([http://rs.tdwg.org/dwc/terms/taxonID](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](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](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](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](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](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](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](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](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](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/taxonRank](http://rs.tdwg.org/dwc/terms/taxonRank)). |
| scientificNameAuthorship     | The authorship information for the scientificName formatted according to the conventions of the applicable nomenclaturalCode ([http://rs.tdwg.org/dwc/terms/scientificNameAuthorship](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](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 - Hymenoptera - Apocrita version 2.6.2 - hierarchy

Character set: UTF-8

Download URL: http://www.faunaeur.org/Data_papers/FaEu_Hymenoptera-Apocrita_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). |
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Author contributions

All of the authors of this paper have contributed to the datasets for the Hymenoptera - Apocrita (excluding Ichneumonoidea) part of the Fauna Europaea database. Yde de Jong and Mircea-Dan Mitroiu presented these data in the current form.

References

• Broad G (2014) Checklist of British and Irish Hymenoptera - Introduction. Biodiversity Data Journal 2: e1113. DOI: 10.3897/bdj.2.e1113
• Heraty J, Ronquist F, Carpenter J, Hawks D, Schulmeister S, Dowling A, Murray D, Munro J, Wheeler W, Schiff N, Sharkey M (2011) Evolution of the hymenopteran megadiversity. Molecular Phylogenetics and Evolution 60 (1): 73-88. DOI: 10.1016/j.ympev.2011.04.003
• Heraty J, Burks R, Cruaud A, Gibson GP, Liljeblad J, Munro J, Rasplus J, Delvare G, Janšta P, Gumovsky A, Huber J, Woolley J, Krogmann L, Heydon S, Polaszek A, Schmidt S, Darling DC, Gates M, Mottern J, Murray E, Molin AD, Triapitsyn S, Baur H, Pinto J, Noort Sv, George J, Yoder M (2013) A phylogenetic analysis of the megadiverse Chalcidoidea (Hymenoptera). Cladistics 29 (5): 466-542. DOI: 10.1111/cla.12006
• Jong Yd, Verbeek M, Michelsen V, de Place Bjørn P, Los W, Steeman F, Bailly N, Basire C, Chylarecki P, Stliokal E, Hagedorn G, Wezel F, Glöckler F, Kroupa A, Korb G, Hoffmann A, Häuser C, Kohlbecker A, Müller A, Güntsch A, Stoef P, Penev L (2014) Fauna Europaea – all European animal species on the web. Biodiversity Data Journal 2: e4034. DOI: 10.3897/bdj.2.e4034
• Kimsey L, Bohart R (1990) The Chrysidid Wasps of the World. Oxford University Press, New York, i–ix + 652 pp.
• Ohl M (2013) Till Osten (1944–2012). Hamuli 4 (1): 8-10. URL: http://hymenopterists.org/newsletters/hamuli/HamuliVol4Issue1.pdf
• Patiny S, Rasmont P, Michez D (2009) A survey and review of the status of wild bees in the West-Palaearctic region. Apidologie 40 (3): 313-331. DOI: 10.1051/apido/2009028
• Patterson DJ, Cooper J, Kirk PM, Pyle RL, Remsen DP (2010) Names are key to the big new biology. Trends in Ecology & Evolution 25 (12): 686-691. DOI: 10.1016/j.tree.2010.09.004

• Pyle R, Michel E (2008) Zoobank: Developing a nomenclatural tool for unifying 250 years of biological information. Zootaxa 1950: 39-50. URL: http://www.mapress.com/zootaxa/2008/f/zt01950p050.pdf

• Schulmeister S, Wheeler W, Carpenter J (2002) Simultaneous analysis of the basal lineages of Hymenoptera (Insecta) using sensitivity analysis. Cladistics 18 (5): 455-484. DOI: 10.1016/s0748-3007(02)00100-7

• Sharkey MJ (2007) Phylogeny and classification of Hymenoptera. Zootaxa 1668: 521-548.

• Soon V, Budrys E, Orlovskytė S, Paukkunen J, Odegaard F, Ljubomirov T, Saarma U (2014) Testing the validity of Northern European species in the species group (Hymenoptera: Chrysididae) with DNA Barcoding. Zootaxa 3786 (3): 301. DOI: 10.11646/zootaxa.3786.3.4

• Vilhelmsen L (2001) Phylogeny and classification of the extant basal lineages of the Hymenoptera (Insecta). Zoological Journal of the Linnean Society 131 (4): 393-442. DOI: 10.1006/zjls.2000.0255