Fauna Europaea: Diptera – Brachycera

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Fauna Europaea: Diptera - Brachycera

Thomas Pape†, Paul Beuk§, Adrian Charles Pont¶, Anatole I. Shatalkin⁵, Andrey L. Ozerov⁶, Andrzej J. Woźniac⁷, Bernhard Merz⁸, Cezary Bystrowski⁹, Chris Raper⁺, Christer Bergström⁺⁺, Christian Kehlmaier⁺⁺, David K. Clements¹, David Greathead⁺⁺⁺, Elena Petrovna Kameneva¹, Emilia Nartshuk⁷, Frederik T. Petersen⁹, Gisela Weber⁴, Gerhard Bächli⁴, Fritz Geller-Grimm⁴, Guy Van de Weyer⁴, Hans-Peter Tschorsnig⁷, Herman de Jong⁷, Jan-Willem van Zuijlen⁸, Jaromír Vaňhara⁹, Jindřich Roháček⁹, Joachim Ziegler¹⁰, József Majer¹¹, Karel Hürka†, Kevin Holston†⁺, Knut Rognes‡‡, Lita Greve-Jensen‖, Lorenz Hoppe‡‡‡, Michel Martinez‡‡§, Miguel Carles-Tolrà†‴, Mihály Földvárí, Milan Chvála‡, Miroslav Barták‴, Neal L. Evenhuis矼, Peter J. Chandler⁷(CC), Pierfilippo Cerretti⁴, Rudolf Meier‡‡, Rudolf Rozkosny⁴, Sabine Prescher‡, Stephen D. Gaimari⁵, Tadeusz Zatwarnicki†, Theo Zeegers‡‡, Torsten Dikow⁷, Valery A. Korneyev⁶, Vera Andreevna Richter¹⁰, Vitali N. Tanasijtshuk⁵, Wayne N. Mathis⁷, Zdravko Hubenov⁷, Yde de Jong‡‡‡, Naples, Italy

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Abstract

Fauna Europaea provides a public web-service with an index of scientific names (including important synonyms) of all extant multicellular European terrestrial and freshwater animals and their geographical distribution at the level of countries and major islands (east of the Urals and excluding the Caucasus region). The Fauna Europaea project comprises 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. Fauna Europaea represents a huge effort by more than 400 contributing taxonomic specialists throughout Europe and is a unique (standard) reference suitable for many user communities in science, government, industry, nature conservation and education. The
Diptera–Brachycera is one of the 58 Fauna Europaea major taxonomic groups, and data have been compiled by a network of 55 specialists.

Within the two-winged insects (Diptera), the Brachycera constitute a monophyletic group, which is generally given rank of suborder. The Brachycera may be classified into the probably paraphyletic 'lower brachyceran grade' and the monophyletic Eremoneura. The latter contains the Empidoidea, the Apystomyioidea with a single Nearctic species, and the Cyclorrhapha, which in turn is divided into the paraphyletic 'aschizan grade' and the monophyletic Schizophora. The latter is traditionally divided into the paraphyletic 'acalyptrate grade' and the monophyletic Calyptratae. Our knowledge of the European fauna of Diptera–Brachycera varies tremendously among families, from the reasonably well known hoverflies (Syrphidae) to the extremely poorly known scuttle flies (Phoridae). There has been a steady growth in our knowledge of European Diptera for the last two centuries, with no apparent slow down, but there is a shift towards a larger fraction of the new species being found among the families of the nematoceran grade (lower Diptera), which due to a larger number of small-sized species may be considered as taxonomically more challenging.

Most of Europe is highly industrialised and has a high human population density, and the more fertile habitats are extensively cultivated. This has undoubtedly increased the extinction risk for numerous species of brachyceran flies, yet with the recent re-discovery of Thyreophora cynophila (Panzer), there are no known cases of extinction at a European level. However, few national Red Lists have extensive information on Diptera.

For the Diptera–Brachycera, data from 96 families containing 11,751 species are included in this paper.

**Keywords**

Biodiversity Informatics, Fauna Europaea, Taxonomic indexing, zoology, biodiversity, taxonomy, Diptera, Brachycera

**Introduction**

In 1998 the European Commission published the European Community Biodiversity Strategy, providing a framework for the development of Community policies and instruments in order to comply with the Convention on Biological Diversity. The Strategy recognised the current incomplete state of knowledge at all levels of biodiversity, a state which makes a successful implementation of the Convention difficult. Fauna Europaea was conceived to contribute to this Strategy by supporting one of the main themes: to identify and catalogue the components of the European biodiversity, with the cataloguing implemented as a taxonomic and faunistic database serving as a basic tool for scientific documentation and discovery, environmental management, and conservation policies/priorities.
With regard to biodiversity in Europe, science and policies depend on sufficient knowledge of the relevant components. The assessment of biodiversity, including monitoring changes and ensuring sustainable exploitation, as well as much legislative work, depend upon a validated taxonomic overview, in which *Fauna Europaea* will play a major role by providing a web-based information infrastructure with an index of scientific names (including the most important synonyms) of all living European multicellular terrestrial and freshwater animals, their geographical distribution at the level of countries and major islands, and some relevant additional information.

*Fauna Europaea* (FAEU) kicked off in 2000 as an EC-FP5 four-year project, delivering its first release in 2004 (de Jong et al. 2014). This online-only version has continuously been updated, and after a further decade of steady progress, to efficiently disseminate the results of *Fauna Europaea* and to properly credit the *Fauna Europaea* contributors, modern e-publishing tools are being applied to prepare data papers on all 58 major taxonomic groups. For this purpose a special *Biodiversity Data Journal Series* has been compiled, called *Contributions on Fauna Europaea* (see also: Pensoft News item 17 Dec 2014). This work was initiated during the ViBRANT project and is further supported by the recently started EU BON project. This paper is the first publication from the *Fauna Europaea* Diptera–Brachycera data sector as a BDJ data paper in the *Fauna Europaea* series, and further contributions should be expected when warranted by major updates.

In the EU BON project (Hoffmann et al. 2014) further steps will be made to implement *Fauna Europaea* as a basic tool and standard reference for biodiversity research and as a means to facilitate taxonomic expertise evaluation and management in Europe. The *Fauna Europaea* data papers will contribute to a quality assessment on biodiversity data by providing estimates on gaps in our taxonomic information and knowledge.

**General description**

**Purpose:** *Fauna Europaea* is a database of the scientific names and distributions (at national or in some cases regional level) of all currently known extant multicellular European terrestrial and freshwater animal species. The database has been assembled by a large network of taxonomic specialists. 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.

The Diptera–Brachycera is one of the 58 *Fauna Europaea* major taxonomic groups, covering 11,751 species (Table 1), and the data have been gathered by a network of 55 specialists (Tables 1, 3).
Table 1.
Taxonomic specialists per family for Diptera–Brachycera and their responsibilities. Expert replacements to be implemented for coming versions are given in Table 2. The actual numbers of databased species are given per family. For most families is also given an indication of the actual number of known/described species (showing a potential information gap) plus an estimate of the total number of existing species (i.e., described/known plus undescribed/undiscovered) for Europe.

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Table 2.
Changes in group coordinatorship and taxonomic specialists for Diptera–Brachycera, which will take effect from Version 3.
Diptera are usually classified into the 'nematoceran grade' or 'lower Diptera' and the monophyletic 'Brachycera'. The Brachycera may in turn be classified into the probably paraphyletic 'lower Brachycera' and the monophyletic Eremoneura. The latter contains the Empidoidea, the Apystomyioidea with a single Nearctic species, and the Cyclorrhapha, which in turn are divided into the paraphyletic 'aschizan grade' and the monophyletic Schizophora. The latter are traditionally divided into the paraphyletic 'acalyptrate grade' and the monophyletic Calyptratae (Yeates and Wiegmann 1999, Wiegmann et al. 2011, Lambkin et al. 2013). Diptera increase in the relative proportion of the insect fauna at increasing altitude as well as at higher latitudes, whether counting the number of species or the number of individuals. In Europe, Diptera are surpassed only by the Hymenoptera in the total number of species, but Diptera are the predominant insect group in high montane, subarctic, and arctic environments. Europe lies mainly in the temperate climate zone, and its species diversity is relatively poor, being heavily influenced by the Quaternary glaciations. With some 12,000 species of Brachycera and 7,000 species of the
nematoceran grade (lower Diptera), the European fauna of Diptera is comparable to those of the Nearctic (ca. 22,000), Afrotropical (ca. 20,000), Oriental (ca. 23,000) and Australasian (ca. 19,000) regions (Pape et al. 2009). The knowledge of the taxonomic composition of the European Diptera fauna may therefore be considered as far more complete than for any other major region. This relates to historical circumstances, with Europe having a much longer taxonomic tradition and with relatively more funding being available to the European taxasphere. The number of species added to the European Diptera fauna has been remarkably constant over time, and the species accumulation curve shows to date no signs of levelling off (Pape 2009, Fontaine et al. 2012, Pape, unpubl.). Among the Brachycera, the most species-rich families in the European fauna are the Agromyzidae, Dolichopodidae, Empididae, Syrphidae and Tachinidae. Much remains to be discovered, and especially the Phoridae stand out as potentially vastly more diverse than suggested by the current count.

Brachycera are ecologically very diverse (Hövemeyer 2000). Many of the 'lower Brachycera' are predatory in the larval stage, with the parasitic Acroceridae, Bombyliidae and Nemestrinidae as significant exceptions. The Empidoidea include a large assemblage of species with predatory adult and larval stages. Many lineages within the species-rich Cyclorrhapha have adapted to a saprophagous larval life, but also parasitism and predation have evolved numerous times within this group, e.g., millipede parasitising Phaeomyiidae and Muscidae (in part: Eginia Robineau-Desvoidy); mollusc parasitising Siciomyzidae and Calliphoridae (in part, e.g., Melanomyinae); insect parasitising Cryptochetidae, Pipunculidae, Pyrgotidae, Tachinidae and Sarcophagidae (in part, e.g., Blaesoxipha Loew); woodlouse parasitising Rhinophoridae; mammal parasitising Oestridae; plant parasitising Agromyzidae, Tephritidae, Anthomyiidae (in part), Chloropidae (in part) and Scathophagidae (in part); and insect predating Chamaemyiidae, Chloropidae (in part), Muscidae (in part), Odiniidae (in part) and Syrphidae (in part). The genera Nephrocerus Zetterstedt (Pipunculidae) and Admontia Brauer & Bergenstamm and Siphona Meigen (both Tachinidae) deserve special mention because they contain species that are parasitoids of other Diptera (in this case Tipulidae), and Nephrocerus spp. may be the only European fly species that parasitise adult Diptera (Koenig and Young 2007). The Phoridae present a remarkable diversity of life habits, ranging from extreme specialisations like the ladybird parasitising species of Phalacrotophora Enderlein to the 'omnivorous' Megaselia scalaris (Loew), which has been bred from an astonishingly broad range of organic materials even including shoe polish and paint (Disney 1994). Shore flies (Ephydridae) are magnificently tolerant of extreme environments, such as hot springs, saline and alkaline waters, and even crude oil (references in Mathis and Zatwarnicki 1995). The Syrphidae are well known for the mimetism of many adults and the multitude of larval life forms, with some of the more classic examples including rat-tails living in putrid water, free-living aphid predators, bulb miners, and inquilines and scavengers in nests of ants, bees and social wasps (Thompson and Rotheray 1998).

Brachyceran flies contain several important agricultural pests, like cabbage flies (Delia spp., Anthomyiidae), shoot flies (Atherigona spp., Muscidae), frit flies [Oscinella frit (Linnaeus), Chloropidae], and fruit flies [e.g., Ceratitis capitata (Wiedemann) and
**Bactrocera oleae** (Rossi), Tephritidae; others are blood-sucking, like the horn fly [*Haematobia irritans* (Linnaeus), Muscidae] and the false stable fly [*Muscina stabulans* (Fallén) Muscidae]; or vectors of various diseases like the bovine filariasis transmitted by some species of *Musca* Linnaeus (Krafsur and Moon 1997). Flies may be a nuisance when occurring in vast numbers around landfills, garbage dumps, or dung-heaps (Howard 2001). Particularly remarkable cases of mass occurrences are given by the chloropid fly *Thaumatomyia notata* (Meigen), specimens of which, possibly guided by a species-specific male pheromone, seek suitable places for overwintering and in extreme cases may enter buildings in such numbers that they darken the ceilings and create bucket-loads of dead bodies when they die in the dry indoor climate (Nartshuk 2000). On the beneficial side, many Brachycera are efficient decomposers and play an important role in cleaning sewage and recycling organic waste (McLean 2000); some hover flies (Syrphidae) and grass flies (Chloropidae) are predators on pest aphids (Ismay and Nartshuk 2000, Thompson and Rotheray 1998) and larvae of the long-legged fly genus *Medetera* (Dolichopodidae) feed on all stages of bark beetles (Curculionidae, Scolytinae) (Hulcr et al. 2005); and blow flies (Calliphoridae) may serve as forensic indicators (Catts and Goff 1992, Byrd and Castner 2000, Rivers and Dahlem 2014) and even improve human health through the treatment of complicated wounds (Sherman 2001, Sherman 2002, Sherman 2003). *Drosophila melanogaster* Meigen (Drosophilidae) has become the archetype of a geneticists laboratory animal, and the multitude of genetic studies performed on this species has had a profound impact on our understanding of gene expression, gene regulatory mechanisms, mutations, etc. (see references in Courtney et al. 2009).

One European brachyceran recently considered as extinct (Fontaine et al. 2007, Pape 2009) was rediscovered in Spain in this decade (Carles-Tolrà et al. 2010, Martín-Vega et al. 2010, Zaldivar Ezquerro et al. 2011, Carles-Tolrà and Canete Saiz 2012): the bone-skipper *Thyreophora cynophila* (Panzer) (Piophilidae: Thyreophorinae) was, around 1800, frequently encountered on larger carrion like dogs, mules, and horses in very early spring (Séguy 1950). The present-day rareness of this morphologically quite conspicuous species may be due to changes in livestock management and improved carrion disposal following the Industrial Revolution in Europe. The growth in human population and the associated reduction in the number of large predators may also have played a part, as this has meant fewer large carcasses with partly crushed long bones, which appears to be one of the favoured breeding media for *T. cynophila*.

The distributional pattern of European Brachycera keeps changing, and the underlying causes may not always be evident. For example, the cold-adapted species *Scoliocentra nigrinervis* (Wahlgren) (Heleomyzidae) has been newly recorded from areas in Central Europe where it was previously unrecorded (Preisler and Roháček 2012, Soszyńska-Maj and Woźnica 2012). This is in contrast to the current climate change related to global warming during recent decades. Another species, *Prosopantrum flavifrons* (Enderlein) (Cnemospathididae) was probably accidentally introduced from South Africa by bird migrations to one of the British Isles (Ismay and Smith 1994, Cole 1996), and being a parthenogenetic species with larvae developing in bird guano, it has spread to one of the East Frisian Islands (Stuke and Merz 2005).
Project description

Title: This BDJ data paper includes the taxonomic indexing efforts in Fauna Europaea on European Diptera–Brachycera covering the first two versions of Fauna Europaea (up to version 2.6).

Personel: The taxonomic framework of Fauna Europaea includes scientists from the 34 partner institutes, which together with a number of citizen scientists provide the taxonomic expertise and faunistic quality assurance and take care of data collation.

Every taxonomic group is covered by at least one Group Coordinator responsible for the supervision and integrated input of taxonomic and occurrence data of a particular group. For Diptera–Brachycera the responsible Group Coordinators are Thomas Pape (versions 1 & 2) and Paul Beuk (version 2).

The Fauna Europaea checklist would not have reached its current level of completion without the input from several taxonomic specialists. The formal responsibility of collating and delivering the data for relevant families has resided with the appointed Taxonomic Specialists (see Table 1), while Associate Specialists deserve due credit for their important contributions at various levels, including particular geographic regions or (across) taxonomic groups (see Table 3).

Data management tasks were taken care of by the Fauna Europaea project bureau. During the project phase (until 2004) a network of principal partners took care of 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 (Newly Associated States [NAS] extension). From the formal termination of the project in 2004 to 2013, all tasks were taken over by the Zoological Museum Amsterdam.

Figure 1.
Fauna Europaea on-line (browser interfaces) and off-line (spreadsheets) data entry tools.
**Study area description:** The study area covers the western Palaearctic, including the European mainland, Great Britain, the Macaronesian islands, Cyprus, Faroe Islands, Iceland, Svalbard, Franz Josef Land and Novaya Zemlya, but excluding Turkey, the Caucasus, western Kazakhstan, the Arabian Peninsula and North Africa (see Fig. 3).

![Figure 2. Fauna Europaea TDWG areas.](image)

**Design description:** **Standards.** Group Coordinators and taxonomic specialists have been delivering the (sub)species names according to strict standards. The names provided by *Fauna Europaea* 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 (sub)species, (3) relevant synonyms, and (4) the correct nomenclature. The *Fauna Europaea* Guidelines for Group

![Figure 3. Fauna Europaea geographic coverage ('minimal Europe').](image)
Coordinators and Taxonomic Specialists' (Suppl. material 1) include the standards, protocols, scope and geographical limits and provide the instructions for the more than 400 taxonomic specialists contributing to the project.

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. Since 2013 the data servers are hosted at the Museum für Naturkunde in Berlin, and an updated data entry tool is under development.

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 the level of country or major island), global distribution (only for European species), taxonomic reference (optional), occurrence reference (optional).

Funding: Fauna Europaea a 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). Continued 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).

Additional support for preparing the Diptera–Brachycera data set was received through the numerous institutions allowing for the proper allocation of time by the taxonomic specialists.

Sampling methods

Study extent: See relevant sections on coverage.

Sampling description: Fauna Europaea data have been assembled by the principal taxonomic specialists based on their individual expertise, which includes studies of the literature, collection research, and field sampling. In total 476 taxonomic specialists 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 were built, well integrated within an underlying central Fauna Europaea transaction database (see Fig. 1). This included 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 data management system worked well until its replacement in 2013.

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

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

Further, all Fauna Europaea data sets have been intensively reviewed at regional and thematic validation meetings, at review sessions at 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 spellings was effected by the validation office at the National Museum of Natural History in Paris.

Checks on technical and logical correctness of the data were implemented by the data entry tools, including around 50 'Taxonomic Integrity Rules'. This validation tool proved to be of considerable value for both the taxonomic specialists and project management, and significantly contributed to the preparation of a remarkably clean and consistent data set.

This thorough review procedure makes Fauna Europaea the most scrutinised data set in its domain. In general we expected to get taxonomic data for 99.3% of the known European fauna directly after the initial release of Fauna Europaea (de Jong et al. 2014). The faunistic coverage is not quite as good, but is nevertheless 90-95% of the total fauna. Currently, for the Diptera–Brachycera the taxonomic completeness is considered to be around 93% (see Table 1).

To optimise the use and implementation of a uniform and correct nomenclature, a cross-referencing of the Fauna Europaea Diptera data-set with relevant nomenclators, including Systema Dipterorum, is recommended, following the global efforts on establishing a so-called 'Global Names Architecture' (Pyle and Michel 2008).

Step description: By evaluating team structure and procedures (data-entry, validation, updating, etc.), clear definitions of roles of users and user-groups in relation to the taxonomic classification were established, including ownership and read/write privileges. In addition, guidelines on common data exchange formats and codes have been issued (see also Suppl. material 1).
Geographic coverage

**Description:** Species and subspecies distributions in *Fauna Europaea* are registered at least at the level of (political) country. For this purpose the FaEu geographical system basically follows the [TDWG standards](#) (see Fig. 2). The area studied covers the western Palaearctic, including the European mainland, Great Britain, the Macaronesian islands, Cyprus, Faroe Islands, Iceland, Svalbard, Franz Josef Land and Novaya Zemlya, but excluding Turkey, the Caucasus, western Kazakhstan, the Arabian Peninsula and North Africa (see Fig. 3).

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

**Coordinates:** Mediterranean and Arctic Islands Latitude; Atlantic Ocean (Mid-Atlantic Ridge) and Ural Longitude.

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*Fauna Europaea* Diptera–Brachycera species per family. See Table 1 for family statistics. For full resolution see Suppl. material 2.
Taxonomic coverage

**Description:** The *Fauna Europaea* database contains the scientific names of all living European land and freshwater animal species, including numerous groups at various hierarchical levels, and the most important synonyms. More details about the conceptual background of *Fauna Europaea* and standards followed are described above.

This data paper covers the Diptera–Brachycera content of *Fauna Europaea*, including 96 families, 11,751 species, 179 subspecies and 2,233 (sub)specific synonyms (see Fig. 4). Higher ranks are given below, the species list can be downloaded from the Fauna Europaea portal (see: Data resources).

Some recent changes in the classification of Diptera–Brachycera will be effectuated in the next version. This includes the merging of the families Canacidae and Tethinidae into a single family, Canacidae (the older family group name) (McAlpine 2007, Munari and Mathis 2010) and the splitting of the Calliphoridae (s.lat.) into Calliphoridae (s.str.) and Rhiniidae in accordance with what is now current practice (Pape et al. 2011, Pape and Evenhuis 2013).

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**Temporal coverage**

**Living time period:** 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..

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**Data resources**

**Data package title:** Fauna Europaea - Diptera-Brachycera  
**Resource link:** [http://www.faunaeur.org/Data_papers/FaEu_Diptera-Brachycera_2.6.2.zip](http://www.faunaeur.org/Data_papers/FaEu_Diptera-Brachycera_2.6.2.zip)  

**Number of data sets:** 2  
**Data set name:** Fauna Europaea - Diptera-Brachycera version 2.6.2 - species  
**Character set:** UTF-8  
**Download URL:** [http://www.faunaeur.org/Data_papers/FaEu_Diptera-Brachycera_2.6.2.zip](http://www.faunaeur.org/Data_papers/FaEu_Diptera-Brachycera_2.6.2.zip)

**Data format:** CSV

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<td>The authorship information for the scientificName formatted according to the conventions of the applicable nomenclaturalCode (<a href="http://rs.tdwg.org/dwc/terms/scientificNameAuthorship">http://rs.tdwg.org/dwc/terms/scientificNameAuthorship</a>).</td>
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<tr>
<td>namePublishedInYear</td>
<td>The four-digit year in which the scientificName was published (<a href="http://rs.tdwg.org/dwc/terms/namePublishedInYear">http://rs.tdwg.org/dwc/terms/namePublishedInYear</a>).</td>
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<tr>
<td>Brackets</td>
<td>Annotation if authorship should be put between parentheses.</td>
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<td>nomenclaturalCode</td>
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**Data set name:** Fauna Europaea - Diptera-Brachycera version 2.6.2 - hierarchy

**Character set:** UTF-8

**Download URL:** [http://www.faunaeur.org/Data_papers/FaEu_Diptera-Brachycera_2.6.2.zip](http://www.faunaeur.org/Data_papers/FaEu_Diptera-Brachycera_2.6.2.zip)

**Data format:** CSV

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Additional information

In the very last phase of the Diptera-Brachycera paper preparation, we received the sad news that one of our respected Fauna Europaea experts on Tachinidae and co-author of this paper, Vera Andreevna Richter, passed away at the age of 79 years. A short obituary can be found here: Suppl. material 3.

Acknowledgements

Many people have generously shared their expertise and contributed to the checklist by supplying miscellaneous taxonomic and/or faunistic data to one or more of the taxonomic specialists. This input is highly appreciated, and the contributors are here listed in alphabetical order: S. Andersen (Copenhagen), H. Andersson (Lund), M. Báez (La Laguna), V. Beschovski (Sofia), R.M. Blackith (Dublin), Javier Blasco-Zumeta (Zaragoza), R. Contreras-Lichtenberg (Vienna), R. Danielsson (Lund), M. Dempewolf (Amsterdam), J.A. Dils (Hoevenen), R.H.L. Disney (Cambridge), A. Draber-Mońko (Warszawa), P. Dyte (Datchet), A. Freidberg (Tel Aviv), P. Gatt (Rabat), D. González-Mora (Madrid), I. Grichanov (St Petersburg), P. Grootaert (Brussels), M.J.R. Hall (London), B. Herting (Stuttgart), J. Ismay (Oxford), T. Jonassen (Stjernarøy), I. MacGowan (Battleby), H. Meuffels (Vilt), H. Meyer (Kiel), B. Mocek (Hradec Králové), J.E. O’Hara (Ottawa), J. Olejnicek (Ceské Budejovice), L. Papp (Budapest), C. Parvu (Bucharest), R. Richet (Boulogne-sur-mer), A.I. Shatakin (Moscow), L.E.N. Sijstermans (Amsterdam), J.H. Skevington (Ottawa), A. Stark (Halle/Saaale), K. Szpila (Toruń), A.G.B. Thomas (Toulouse), M. Vandenbosch (Tervuren), D. Ventura Peréz (Barcelona), Yu.G. Verves (Kiev), D. Whitmore (London).

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Supplementary materials

**Suppl. material 1: Fauna Europaea Guidelines for Group Coordinators and Taxonomic Specialists**

Authors: Nicolas Bailly, Verner Michelsen, Yde de Jong
Data type: pdf
Filename: FaEu_Guidelines_v4.0.1.pdf - Download file (555.77 kb)

**Suppl. material 2: FaEu Diptera-Brachycera stats**

Authors: Yde de Jong
Data type: png
Brief description: This is a high-resolution version of Figure 4.
Filename: FaEu_Diptera-Brachycera_stats.png - Download file (2.44 MB)

**Suppl. material 3: Vera Andreevna Richter short obituary**

Authors: Dr. B.A. Korotyaev; Dr. O.G. Ovtshinnikova; Dr. V.A. Krivokhatsky
Data type: pdf
Filename: Vera_Andreevna_Richter_short_obituary.pdf - Download file (4.26 MB)