An exploratory survey and assessment of the hoverfly diversity (Diptera: Syrphidae) from the Pyrenees of Girona, Spain

Authors: Ricarte, Antonio, Nedeljković, Zorica, and Marcos-García, Ma Ángeles

Source: Revue suisse de Zoologie, 128(2) : 381-398

Published By: Muséum d'histoire naturelle, Genève

URL: https://doi.org/10.35929/RSZ.0052

Revue suisse de Zoologie (September 2021) 128(2): 381-398 ISSN 0035-418

An exploratory survey and assessment of the hoverfly diversity (Diptera: Syrphidae) from the Pyrenees of Girona, Spain

Antonio Ricarte[1*], Zorica Nedeljković[1,2], Mª Ángeles Marcos-García[1]

[1] *Research Institute CIBIO (Centro Iberoamericano de la Biodiversidad), Science Park, University of Alicante, Ctra. San Vicente del Raspeig s/n, E-03690 San Vicente del Raspeig (Alicante), Spain.*

[2] *BioSense Institute-Research Institute for Information Technologies in Biosystems, University of Novi Sad, Dr Zorana Đinđića 1, Novi Sad 21000, Serbia.*

* *Corresponding author: ricarte24@gmail.com*

Abstract: Syrphidae are pollinators, pest predators and decomposers in European ecosystems. Camprodon (Girona province, Spain) is a valley with rich vegetation and high habitat diversity in the eastern Pyrenees. However, hoverfly biodiversity in this valley was poorly known. To explore the high potential of this area for Syrphidae, a survey with hand-net was undertaken in July/August 2020 in the valley. The list of Syrphidae species from the valley increases to 88, whilst that of the Girona province now extends to 119 species. *Chrysotoxum lessonae* Giglio-Tos, 1890 is reported for the first time from the Iberian Peninsula. The specimens of *Xylota tarda* Meigen, 1822 and *Cheilosia hypena* (Becker, 1894) represent the first documented records of these species for the Iberian Peninsula and Spain, respectively; i.e. these two species were known to occur in the Iberian Peninsula and Spain but without further locality details. A total of 19 species were new to the region of Catalonia and 23 to the Girona province. *Cheilosia* Meigen, 1822 was the genus with the highest number of species recorded, as expected from the combination of mountains, diversity of forest vegetation, and presence of rivers/streams of the Camprodon valley. Faunistic results from this fieldwork are relevant to knowledge of Diptera from Catalonia, a region of Spain where this insect family is understudied.

Keywords: Flowerflies - *Cheilosia hypena* - *Chrysotoxum lessonae* - distribution - Catalonia - Camprodon valley - checklist.

INTRODUCTION

As popular pollinators and pest predators (Rojo *et al.*, 2003; Marshall, 2012; Doyle *et al.*, 2020), Syrphidae are often surveyed at the local scale (e.g. Sommaggio & Corazza, 2006; Sánchez-Heredia *et al.*, 2017; Miličić *et al.*, 2018; Lorenzo *et al.*, 2020). Local surveys are relevant to the understanding of biodiversity in complex ecosystems and contribute to knowledge of regional species lists. Regional lists provide a framework for expert systems to assess the conservation of habitats (Speight & Castella, 2001; Monteil, 2010; Speight *et al.*, 2020).

The massif of the Pyrenees extends east-west over 440 km, forming a natural border between France and Spain, in southwestern Europe. With 19 000 km^2 and a maximum altitude of 3404 m, the Pyrenees are a complex ecosystem with many mountains, U-shaped glaciated valleys, rivers, lakes and a diverse flora and fauna. The Pyrenees can be divided into three parts, Eastern, Central, and Western. North to south, they are divided into the axial or medial Pyrenees, and the pre-Pyrenean or external mountains (Guixé & Llobet, 2016). The north slope of the Pyrenees (France, and the 'Vall d'Aran' in Spain) is more humid, less continental, and with typically Eurosiberian forest, whilst the south slope (Spain) has a Mediterranean influence, with less diverse and more reduced forest (Vázquez & Fernández-Prieto, 2002). In Spain, the Pyrenees are divided into five provinces, with the easternmost part in the Girona province, Catalonia (Ricarte & Marcos-García, 2017).

The studies of Diptera in Catalonia are scattered, both temporally and geographically, and Pyrenean hoverflies are not an exception. Apart from the consequences for our ecological understanding of the Pyrenees, this scattered knowledge has also prevented the popularisation of hoverflies, as shown by their absence from field guides to

Manuscript accepted 09.06.2021
DOI: 10.35929/RSZ.0052

the regional fauna (Guixé & Llobet, 2016). Cuní (1881) was the first to record hoverflies from the Catalonian Pyrenees. Diptera were poorly studied in Catalonia throughout the 20th century (Pujade-Villar, 2011), with only a little fieldwork undertaken in the Pyrenees to collect hoverflies (van Doesburg, 1951; Leclercq, 1971; Lucas, 1976). The 21st century brought new hoverfly records to light from the Catalonian Pyrenees, but most of these were based on specimens collected earlier, usually in the 1970s (Marcos-García *et al.*, 2007, 2011; van Steenis & Lucas, 2011; Ricarte & Nedeljković, 2020).
Camprodon is one of the most popular valleys of the eastern Pyrenees, with diverse vegetation and habitats (Sacasas-i-Lluís, 2009). The first hoverfly records from this valley are those of the Rev. José Andreu from 1926. However, just over a dozen species were reported from this valley prior to the present sampling (Andreu, 1926; Gil Collado, 1930; Lucas, 1976; Barkalov & Ståhls, 1997; Marcos-García *et al.*, 2007, 2011; van Steenis & Lucas, 2011; Ricarte & Nedeljković, 2020). The aim of the present study was to improve our knowledge of the hoverflies from the Girona province by undertaking an exploratory survey and faunistic assessment in its Pyrenean part (Camprodon valley) and reviewing all the available literature.

MATERIAL AND METHODS

Study area

Camprodon valley ('Valle de Camprodón' in Spanish) is located in the axial eastern Pyrenees. This hilly valley is in the eastern part of the Ripollès region, Girona province (abbreviated as 'GI' hereinafter), Spain. The climate is typical Pyrenean, humid and rainy. The Ter river, which rises at high altitudes in this valley, is also the main water course in it. All along the valley, there are some scattered small villages and there is a ski resort at about 2000 m asl. The diverse vegetation of the Camprodon valley is dominated by a mosaic of woodlands and grasslands as a result of a long history of human use. The montane and subalpine altitudinal zones are represented in the valley. Montane vegetation (700-1600 m asl) consists mainly of deciduous forest of *Quercus* spp. and *Fagus sylvestris* L., as well as forest of red pine (*Pinus sylvestris* L.). The dominant species in the understory of the montane forest is the common box (*Buxus sempervirens* L.). Montane vegetation of riversides includes *Salix*, *Populus* and *Alnus* trees. Subalpine vegetation (1600-2300 m asl) is dominated by forests of black pine (*Pinus uncinata* Ramond ex A. DC.) that are usually more open at higher altitudes, with alpenrose (*Rhododendron ferrugineum* L.) in the understory. Grasslands are also typical of the subalpine zone (Sacasas-i-Lluís, 2009). The sampling sites of the present study within the Camprodon valley are detailed in Table 1. Sites belong to four different villages, Camprodon, Llanars, Setcases, and Vilallonga de Ter.

Fieldwork and hoverfly identification

Adult hoverflies were collected by Antonio Ricarte and Zorica Nedeljković using hand-nets, from 29 July to 3 August 2020. Vegetation and especially flowers (e.g. *Heracleum sphondylium* L., *Hypericum* sp., *Eupatorium cannabinum* L., *Knautia* sp., *Pastinaca* sp.) were inspected for hoverflies in sunny areas, and also on some hilltops (S3, S14). Specimens were kept in tubes in the freezer until defrosting in the lab for preparation. Specimens were pinned and labelled following the usual techniques (Galante & Marcos-García, 2004). A bar code label was assigned to each specimen and the information databased in an Excel file. Bar code numbers were written for each specimen (as a single code) or series of specimens (as a range of codes) in the examined material. Every code starts with 'CEUA' plus a number of zeros and then the actual code number (e.g. CEUA00050300), but only the number is indicated in the list of examined material.
Specimens were identified to the species level by Antonio Ricarte and Zorica Nedeljković, except otherwise stated. The literature used for identification is Nielsen (1970), Violovitsh (1974), Dušek & Láska (1976), Goeldlin de Tiefenau (1976), Marcos-García & Láska (1983), Vujić (1992), Vujić & Šimić (1995-1998), Goeldlin de Tiefenau (1996), Barkalov & Ståhls (1997), Verlinden (1999), Vujić (1999), van Steenis (2000), Hippa *et al.* (2001), Sommaggio (2001), Claussen & Ståhls (2007), Ståhls *et al.* (2008), Barkalov (2009), Bartsch *et al.* (2009a, b), Ricarte *et al.* (2010), van Veen (2010), van Steenis & Lucas (2011), Nedeljković *et al.* (2013), Vujić *et al.* (2013), Haarto & Ståhls (2014), van Steenis *et al.* (2016), Speight & Sarthou (2017), Vujić *et al.* (2017), Nedeljković *et al.* (2018), and van Steenis *et al.* (2020).
When it was necessary to confirm the species identification, male genitalia were dissected with entomological pins. They were cleared in a hot solution of KOH for up to 5 min, immersed in acetic acid to remove excess KOH, washed in 70% alcohol, and stored in microvials containing glycerine. When specimens were dry, they were first relaxed in a humid chamber before genitalia removal. All specimens are deposited in the CEUA-CIBIO collection, University of Alicante, Spain.
Hoverflies were photographed in the field by Antonio Ricarte (except where otherwise stated) with a camera Canon® PowerShot SX730 HS. A pinned specimen of *Chrysotoxum* Meigen, 1803 was illustrated (Fig. 1) with photos produced as stacks of individual images made with a camera (Leica DFC 450) attached to a binocular stereomicroscope (Leica M205 C). Stacks were made in Leica Application Suite X (LAS X) ®, v. 3.0.4.16529.

Taxonomic and faunistic assessments

For the collected hoverflies, the faunistic novelty of each species (Appendix) was assessed on the basis

Table 1. Sampling sites in the eastern Pyrenees of Girona province (Spain) during July/August 2020 field work. The dates when each site was visited is also presented.

Site code	Site	Latitude	Longitude	Altitude (m)	Date/s
S1	Camprodon, 'Roureda de can Pascal' and vicinity	42.313253°	2.386996°	975	01.08.2020
S2	Llanars, L'Escón guesthouse	42.321504°	2.343851°	998	29.07.2020
S3	Llanars, La Creueta	42.324524°	2.339819°	1138	29.07.2020
S4	Llanars, riverside of 'la Riera de Feitús', near 'Font del tir', on flowers of *Heracleum sphondylium*	42.329624°	2.346578°	1007	29.07.2020
S5	Llanars, route Llanars-Camprodon, Ter riverside	42.317926°	2.350075°	964	29.07.2020
S6	Setcases, track up to the water store	42.381322°	2.301701°	1317	30.07-02.08.2020
S7	Setcases, Vallter 2000 sky centre	42.422851°	2.267581°	2000-2100	30.07.2020
S8	Setcases, Vall de Querlat, crossroads with the Espinavell track	42.394433°	2.289479°	1460	30.07.2020
S9	Vilallonga de Ter, track to La Abella	42.328649°	2.311320°	1055	03.08.2020
S10	Vilallonga de Ter, Vilallonga-Setcases road, roadside vegetation	42.354237°	2.292147°	1161	
S11	Vilallonga de Ter, 'Ribera de Tregurà' riverside	42.336798°	2.289106°	1157	31.07.2020
S12	Vilallonga de Ter, Ter riverside, near Vilallonga-Setcases road	42.357085°	2.292184°	1166	01-02.08.2020
S13	Vilallonga de Ter, Ribera de Tregurà, on flowers of *Pastinaca* at the roadsides	42.341194°	2.296101°	1113	31.07.2020
S14	Vilallonga de Ter, Tregurà de Dalt, near aerial	42.347625°	2.281892°	1557	31.07.2020

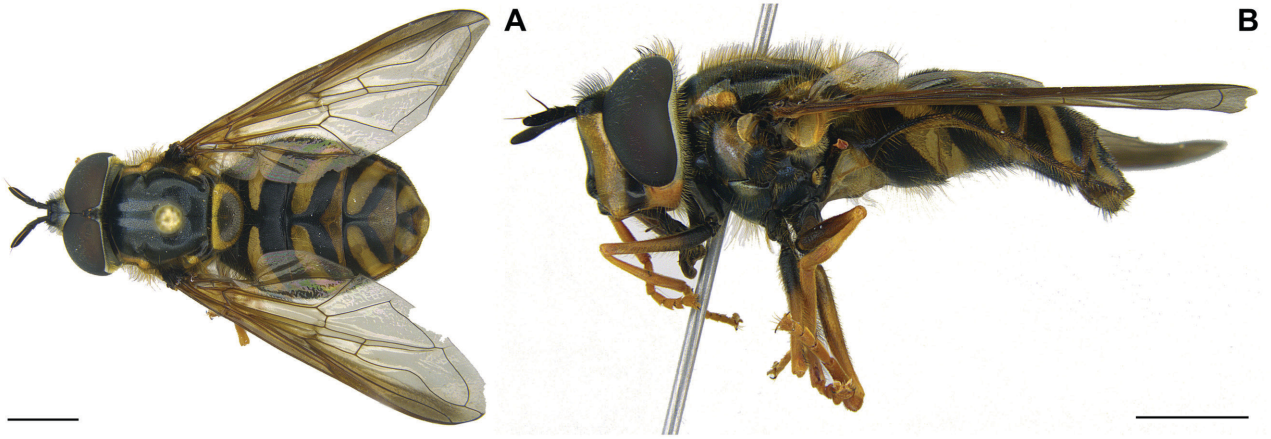

Fig. 1. *Chrysotoxum lessonae* male, from Camprodon valley, Girona province, Spain. (A) Dorsal view. (B) Lateral view. Scale bar = 2 mm.

of Ricarte & Marcos-García (2017) plus all other subsequent faunistic references. The Iberian Peninsula is here interpreted as the unit encompassing the mainland parts of Spain and Portugal together, plus Andorra. First documented records are also indicated in order to make locality details available for those species that had imprecise records in previous literature. A full list of material examined is provided for each species by using the site codes of Table 1. Collection dates are written in the examined material lists only for the specimens caught in S6 and S12, because these sites were visited on more than one day. For the taxonomic classification of the species collected, the arrangement of subfamilies used – indicated after each species name – follows Mengual *et al.* (2015). Genus and species names generally follow Speight (2020).

Checklist of Girona hoverflies

The species collected in this study are also presented in the broader frame of an updated checklist of the hoverflies from Girona province. Localities and references are provided for every species in the checklist. The following localities are listed, based on both literature and the present study: L1, Arbucias; L2, Blanes; L3, Caldes de Malavella; L4, Camprodon; L5, Caralps; L6, Cerdaña; L7, Empalme; L8, Figueras; L9, Flassa; L10, La Bisbal; L11, La Molina; L12, Llanars; L13, Massanas; L14, Massanet de la Selva 'Maçanet-Massanes station'; L15, Mollo; L16, Nuria; L17, Pals; L18, Puigcerdà; L19, Ribas; L20, Ribas de Freser; L21, Rosas; L22, San Cristóbal de Tosas; L23, San Juan de las Abadesas; L24, San Marsal; L25, Sant Ilari de Sacalm; L26, Sarriá; L27, Setcases; L28, Sils; L29, Torroella; L30, Viladrau; L31, Vilallonga de Ter; L32, 'Between Campodron and Setcases'; L33, 13 km south to Girona city. Locality L4 includes the sampling site S1 of the present study; L12 includes S2, S3, S4, S5; L27 includes S6, S7, S8; L31 includes S10, S11, S12, S13, S14 (Table 1).

The following references were reviewed (numbers are used in the checklist to identify each individual reference): 1, Cuní (1880); 2, Cuní (1881); 3, Cuní (1885); 4, Antiga, 1888; 5, Andreu (1926); 6, Gil Collado (1930); 7, Leclercq (1963); 8, Leclercq (1971); 9, Lucas (1974); 10, Lucas (1976); 11, Goeldlin de Tiefenau (1989); 12, Barkalov & Ståhls (1997); 13, Marcos-García *et al.* (2002); 14, Marcos-García *et al.* (2007); 15, van Eck (2010); 16, Marcos-García *et al.* (2011); 17, van Steenis & Lucas (2011); 18, Álvarez-Fidalgo *et al.,* 2018; 19, van Steenis *et al.* (2020); 20, Ricarte & Nedeljković (2020). Marcos-García *et al.* (1998) is not included in the list of references because it does not provide information on the localities within provinces. Dirickx (1994) also omits locality details for species but does provide maps with distribution points, so is not cited in this checklist, except for comments on the distribution of certain species.

Regarding specific references, the following questions should be noted: *a)* Cuní (1881) reported hoverflies from the Spanish Cerdaña, which is divided between the Lleida and Girona provinces and he did not specify where each species was collected. Since he was based on Puigcerdà (Girona) for fieldwork, we assume here that all species belong to GI. *b)* Gil Collado (1930) reports hoverflies from 'Ribas' and 'Rivas', one from Madrid (Rivas?) and other from GI (Ribas? i.e. Ribas de Freser? Ribas valley?), however both names are written as 'Ribas' in the locality index of Gil Collado (1930), and Ribas/Rivas also appear to be inconsistently used throughout his monograph. Thus, we include Ribas in the present checklist when there were enough grounds to believe that the species was collected in the Ribas of GI.

All species are numbered and presented in alphabetical order, including the species reported in the present work (indicated as 'present study'). Genus and species names in the checklist follow Speight (2020), which can be consulted together with Peck (1988) for authority and year of each taxon. Where species names used in the historical literature under review have been superceded, those are given after the current name and are preceded by (=).

RESULTS

New hoverfly records from the Camprodon valley

Baccha elongata (Fabricius, 1775) (Syrphinae)
Examined material: 108852; 1 male; S5. – 108851; 1 male; S6; 31.07.2020.

Ceriana conopsoides (Linnaeus, 1758) (Eristalinae)
Examined material: 108188; 1 male; S6; 31.07.2020; on flowers of *Heracleum sphondylium*.

Cheilosia aerea Dufour, 1848 (Eristalinae)
Examined material: 108792; 1 male; S6; 31.07.2020.

Cheilosia barbata Loew, 1857 (Eristalinae)
Examined material: 108791, 108790, 108809; 3 males; 108801, 108814, 108816-108818; 5 females; S6; 30.07.2020. – 108804-108808; 5 males; 108800, 108820; 2 females; S6; 31.07.2020. – 108803; 1 male; 108813; female; 02.08.2020. – 108812, 108819; 2 females; S9. – 108811; 1 female; S10.

Cheilosia hypena Becker, 1894 (Eristalinae)
Examined material: 108320; 1 male; S6; 30.07.2020. – 108325-108328; 4 males; S6; 108321-108324; 4 females; S6; 31.07.2020; 108778, 108779; 2 males; S6; 02.08.2020. – 108310; 1 male; 108329; 1 female; S5. – 108777; 1 female; S1. – 108776 (1 female); S11.

Cheilosia illustrata (Harris, 1776) (Eristalinae)
Examined material: 108770; 1 male; 108772, 108789; 2 females; S6; 30.07.2020; on flowers of *Heracleum sphondilium*. – 108771; 1 male; S6; 02.08.2020; on flowers of *Heracleum sphondylium*.

Cheilosia laticornis Rondani, 1857 (Eristalinae)
Examined material: 108785; 1 male; 108784; 1 female; S6; 30.07.2020.

Cheilosia latifrons (Zetterstedt, 1843) (Eristalinae)
Examined material: 108810; 1 female; S6; 30.07.2020. – 108829; 1 female; S6; 02.08.2020; 108828; 1 female; S9. – 108802; 1 female; S1.

Cheilosia longula (Zetterstedt, 1838) (Eristalinae)
Examined material: 08773; 1 male; S11; det. I. Ballester.

Cheilosia proxima (Zetterstedt, 1843) (Eristalinae)
Examined material: 108788; 1 male; S3.

Cheilosia scutellata (Fallén, 1817) (Eristalinae)
Examined material: 108826; 1 male; 108824; 1 female; S5. – 108827, 1 male; S4. – 108825; 1 female; S6; 30.07.2020.

Cheilosia variabilis (Panzer, 1798) (Eristalinae)
Examined material: 108787; 1 female; S6; 30.07.2020. – 108786; 1 female; S7.

Cheilosia vernalis (Fallén, 1817) (Eristalinae)
Examined material: 108794, 108795; 2 males; S6; 31.07.2020. – 108793; 1 female; S12.

Cheilosia vicina (Zetterstedt, 1849) (Eristalinae)
Examined material: 108775; 1 male; S6; 30.07.2020. – 108774; 1 female; S7.

Cheilosia vulpina (Meigen, 1822) (Eristalinae)
Examined material: 108780; 1 male; S3. – 108798; 1 male; S5. – 108797; 1 female; S4. – 108799; 1 male; 108796; 1 female; S13.– 108783, 108782; 2 males; S6; 31.07.2020. – 108781; 1 male; 108802; 1 female; S1; 01.08.2020.

Chrysogaster solstitialis (Fallén, 1817) (Eristalinae)
Examined material: 108234; 1 male; 108269, 108268; 2 females; S3. – 108236; 1 male; 10830-108232, 108240; 4 females; S6; 30.07.2020. – 108237, 108233; 2 males; 10841-108244; 4 females; S6; 31.07.2020; 108235; 1 male; S10. – 108267; 1 female; S9.

Chrysotoxum arcuatum (Linnaeus, 1758) (Syrphinae)
= *Chrysotoxum fasciatum* (Müller, 1764)
Examined material: 108548; 1 female; S6; 31.07.2020.

Chrysotoxum bicinctum (Linnaeus, 1758) (Syrphinae)
Examined material: 108549; 1 male; S11. – 108530; 1 female; S9.

Chrysotoxum elegans Loew, 1841 (Syrphinae)
Examined material: 108546; 1 male; S4; 108547; 1 male; S6; 30.07.2020. – 108545; 1 male; S6; 31.07.2020. – 108544; 1 male; S13.

Chrysotoxum festivum (Linnaeus, 1758) (Syrphinae)
Examined material: 108295; 1 female; S9.

Chrysotoxum lessonae Giglio Tos, 1890 (Syrphinae) (Fig. 1)
Examined material: 108296-108298; 3 males; S12.

Chrysotoxum volaticum Séguy, 1961 (Syrphinae)
Examined material: 108531; 1 female; S14.

Dasysyrphus albostriatus (Fallén, 1817) (Syrphinae)
Examined material: 108887; 1 female; S11; 108888; 1 male; S12. – 108885; 1 male; 108886; 1 female; S9.

Episyrphus balteatus (de Geer, 1776) (Syrphinae)
Examined material: 108834; 1 female; S5. – 108833; 1 male; S11.

Eristalinus sepulchralis (Linnaeus, 1758) (Eristalinae)
Examined material: 108208; 1 female; S1.

Eristalinus taeniops (Wiedemann, 1818) (Eristalinae)
Examined material: 108206; 1 male; S9.

Eristalis arbustorum (Linnaeus, 1758) (Eristalinae)
Examined material: 108170; 1 male; S13.

Eristalis interrupta (Poda, 1761) (Eristalinae)
= *Eristalis nemorum* Linnaeus, 1758
Examined material: 108211; 1 female; S6; 30.07.2020; 108212; 1 male; 01.08.2020. – 108149; 1 female; S5. – 108210; 1 female; S11. – 108142; 1 female; S12.

Eristalis jugorum Egger, 1858 (Eristalinae)
Examined material: 108152; 1 female; S8. – 108167; 1 male; S6; 30.07.2020. – 108311; 1 male; S6; 02.08.2020. – 108141, 108312, 108313; 3 females; S10.

Eristalis lineata (Harris, 1776) (Eristalinae)
= *Eristalis horticola* (de Geer, 1776)
Examined material: 108133; 1 female; S6; 30.07.2020.

Eristalis pertinax (Scopoli, 1763) (Eristalinae) (Fig. 2A)
Examined material: 108143, 108144, 108148; 3 males; 108147; 1 female; S4. – 108150, 108216, 108215; 3 males; S1. – 108169; 1 male; S10. – 108158, 108214; 2 males; S6; 30.07.2020. – 108213; 1 male; 108140; 1 female; S6; 02.08.2020.

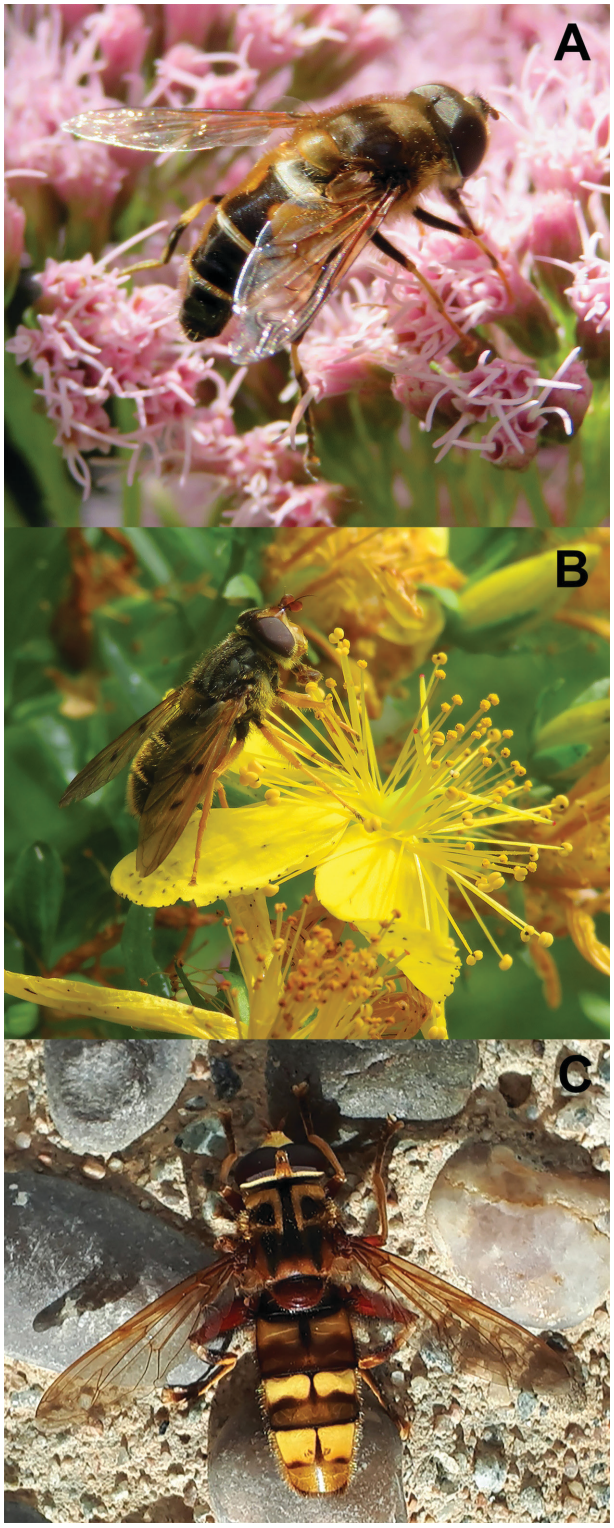

Fig. 2. Hoverfly species from Camprodon valley, Girona, Spain. (A) *Eristalis pertinax*, male, flowers of *Eupatorium cannabinum*, Setcases. (B) *Ferdinandea cuprea*, female, flowers of *Hypericum* sp., Vilallonga de Ter. (C) *Milesia crabroniformis*, male, Camprodon. Photos A, B by Antonio Ricarte, C by M. Carbonell.

Eristalis similis (Fallén, 1817) (Eristalinae)
Examined material: 108131; 1 male; S3. – 108130; 1 female; S5. – 108145, 108146; 2 males; S4. – 108156; 1 male; 108137; 1 female; S7. – 108134, 108135, 108153, 108157, 108159; 5 males; 108136; 1 female; S6; 30.07.2020. – 108155; 1 male; S6; 31.07.2020. – 108151; 1 female; S1. – 108168; 1 male; S12; 01.08.2020. – 108543; 1 male; S14.

Eristalis tenax (Linnaeus, 1758) (Eristalinae)
Examined material: 108132, 108120; 2 males; S3; 108138; 1 male; 108154; 1 female; S7. – 108139; 1 male; S6; 30.07.2020.

Eumerus grandis Meigen, 1822 (Eristalinae)
Examined material: 108275; 1 male; S6; 30.07.2020. – 108274; 1 male; S6; 02.08.2020.

Eumerus ornatus Meigen, 1822 (Eristalinae)
Examined material: 108229; 1 male; 108222, 108223; 2 females; S12. – 108227; 1 male; 08221; 1 female; S6; 30.07.2020. – 108224-108226, 108228; 4 males; S6; 31.07.2020.

Eupeodes corollae (Fabricius, 1794) (Syrphinae)
Examined material: 108832; 1 male; S7. – 108830, 108831; 2 females; S6; 30.07.2020. – 108849; 1 female; S11. – 108848; 1 female; S9.

Eupeodes luniger (Meigen, 1822) (Syrphinae)
Examined material: 108844; 1 male; S6; 30.07.2020. – 108842, 108843; 2 males; S6; 31.07.2020. – 108841; 1 female; S11. – 108840; 1 male; S9.

Eupeodes latifasciatus (Macquart, 1829) (Syrphinae)
Examined material: 108847; 1 male; S6; 02.08.2020.

Ferdinandea cuprea (Scopoli, 1763) (Eristalinae) (Fig. 2B)
Examined material: 108204, 108200; 2 males; 108218; 1 female; S12; 02.08.2020. – 108202; 1 female; S1; 01.08.2020; 108201; 1 male; S10. – 108219, 108217; 2 females; S9. – 108203; 1 male; S6; 02.08.2020.

Helophilus pendulus (Linnaeus, 1758) (Eristalinae)
Examined material: 108162; 1 female; S6; 31.07.2020. – 108161; 1 male; S4. – 108160, 108179; 2 males; 108178; 1 female; S5. – 108178; 1 female; S11.

Lapposyrphus lapponicus (Zetterstedt, 1838) (Syrphinae)
Examined material: 108845; 1 male; S6; 30.07.2020. – 108846; 1 male; S6; 31.07.2020.

Leucozona glaucia (Linnaeus, 1758) (Syrphinae)
Examined material: 108884; 1 female; S6; 30.07.2020; on flowers of *Heracleum sphondylium*. – 108883;

1 female; S6; 31.07.2020; on flowers of *Heracleum sphondylium*.

Melangyna compositarum (Verrall, 1873) (Syrphinae)
Examined material: 108869; 1 female; S6; 31.07.2020.

Melangyna umbellatarum (Fabricius, 1794) (Syrphinae)
Examined material: 108850; 1 female; S10.

Melanostoma mellinum (Linnaeus, 1758) (Syrphinae)
Examined material: 108520; 1 male; S3. – 108523, 108522; 2 females; S2. – 108539; 1 male; 108521; 1 female; S6; 30.07.2020.

Melanostoma scalare (Fabricius, 1794) (Syrphinae)
Examined material: 108538; 1 male; 108533; 1 female; S3. – 108535; 1 male; 108534; 1 female; S5. – 108536, 108537; 2 males; 108532; 1 female; S6; 30.07.2020.

Meligramma cincta (Fallén, 1817) (Syrphinae)
Examined material: 108868; 1 female; S7; 30.07.2020. – 108867; 1 female; S8. – 1088661; 1 female; S6; 31.07.2020.

Meliscaeva auricollis (Meigen, 1822) (Syrphinae)
Examined material: 108863; 1 male; S2. – 108860, 108870, 108878; 3 males; 108861, 108862, 108871, 108876, 108879; 5 females; S6; 30.07.2020. – 108874; 1 female; S6; 31.07.2020. – 108875; 1 female; S6; 01.08.2020. – 108877, 108889; 2 males; S7. – 108873, 108872; 2 females; S8.

Meliscaeva cinctella (Zetterstedt, 1843) (Syrphinae)
Examined material: 108865; 1 female; S7. – 108864; 1 male; S6; 31.07.2020.

Myathropa florea (Linnaeus, 1758) (Eristalinae)
Examined material: 108165; 1 male; 108166, 108164; 2 females; S4. – 108163; 1 male; S6; 30.07.2020. – 108205; 1 male; S1.

Orthonevra nobilis (Fallén, 1817) (Eristalinae)
Examined material: 108263; 1 male; S6; 30.07.2020. – 108265, 108264; 2 males; S6; 31.07.2020.

Paragus haemorrhous Meigen, 1822 (Syrphinae)
Examined material: 108836; 1 male; S12; 02.08.2020. – 108835; 1 male; S6; 30.07.2020.

Paragus pecchiolii Rondani, 1857 (Syrphinae)
Examined material: 108837; 1 male; S12; 02.08.2020.

Paragus tibialis (Fallén, 1817) (Syrphinae)
Examined material: 108821-108823, 108838, 108839; 5 males; S3.

Parasyrphus vittiger (Zetterstedt, 1843) (Syrphinae)
Examined material: 108510, 108524; 2 males; 108525-108529; 5 females; S7.

Pipiza festiva Meigen, 1822 (Pipizinae)
Examined material: 108273; 1 male; S9.

Pipiza noctiluca (Linnaeus, 1758) (Pipizinae)
Examined material: 108272; 1 male; S6; 30.07.2020.

Pipizella viduata (Linnaeus, 1758) (Pipizinae)
Examined material: 108288; 1 male; 108287, 108285, 108284; 3 females; S6; 31.07.2020. – 108286; 1 male; S6; 30.07.2020. – 108282, 108281; 2 males; 108283, 108280, 108299; 3 females; S10.

Platycheirus albimanus (Fabricius, 1781) (Syrphinae)
Examined material: 108515; 1 male; S7. – 108514; 1 male; S6; 30.07.2020. – 108513; 1 male; S6; 02.08.2020. – 108511; 1 female; S13. – 108512; 1 male; S9.

Scaeva dignota (Rondani, 1857) (Syrphinae)
Examined material: 108882; 1 male; S9.

Scaeva pyrastri (Linnaeus, 1758) (Syrphinae)
Examined material: 108516; 1 female; S6; 30.07.2020. – 108518; 1 female; S14. – 108517; 1 female; S9.

Scaeva selenitica (Meigen, 1822) (Syrphinae)
Examined material: 108519; 1 male; S6; 31.07.2020. – 108880; 1 female; S6; 02.08.2020. – 108881; 1 female; S9.

Sericomyia bombiforme (Fallén, 1810) (Eristalinae)
Examined material: 108172, 108171; 2 males; S6; 30.07.2020. – 108180; 1 male; 108181; 1 female; S12, on flowers of *Knautia* sp.; 02.08.2020.

Sphaerophoria scripta (Linnaeus, 1758) (Syrphinae)
Examined material: 108854; 1 female; S2. – 108853; 1 male; S5.

Sphegina elegans Schummel, 1843 (Eristalinae)
Examined material: 108266; 1 male; S10; 01.08.2020.

Spilomyia manicata (Rondani, 1865) (Eristalinae)
Examined material: 108189; 1 male; S6; 30.07.2020; on flowers of *Heracleum sphondilium*.

Syritta pipiens (Linnaeus, 1758) (Eristalinae)
Examined material: 108198, 108199; 2 males; S3; 108197; 1 male; S5.

Syrphus ribesii (Linnaeus, 1758) (Syrphinae)
Examined material: 108315; 1 male; S3; 108316; 1 female; S7. – 108314; 1 female; S6; 02.08.2020.

Syrphus torvus Osten-Sacken, 1875 (Syrphinae)
Examined material: 108302, 108301; 2 males; 108304-108306; 3 females; S7. – 108300, 108317, 108318; 3 males; 108303, 108319; 2 females; S6; 30.07.2020.

Syrphus vitripennis Meigen, 1822 (Syrphinae)
Examined material: 108307; 1 male; S4. – 108308; 1 female; S7. – 108309; 1 female; S13.

Triglyphus primus Loew, 1840 (Pipizinae)
Examined material: See Ricarte & Nedeljković (2020).

Volucella bombylans (Linnaeus, 1758) (Eristalinae)
Examined material: 108177; 1 female; S3.

Volucella inanis (Linnaeus, 1758) (Eristalinae)
Examined material: 108176; 1 male; S6; 31.07.2020. – 108187; 1 male; S6; 01.08.2020. – 108185, 108184; 2 males; S10. – 108186; 1 male; S12; 02.08.2020.

Volucella pellucens (Linnaeus, 1758) (Eristalinae)
Examined material: 108173; 1 male; 108175; 1 female; S8; 108174; 1 female; S6; 31.07.2020. – 108182; 1 female; S12; 02.08.2020.

Volucella zonaria (Poda, 1761) (Eristalinae)
Examined material: 108183; 1 male; S6; 01.08.2020.

Xanthandrus comtus (Harris, 1776) (Syrphinae)
Examined material: 108858, 108859; 2 females; S6; 31.07.2020. – 108857; 1 female; S6; 02.08.2020.– 108856; 1 male; 108855; 1 female; S12; 02.08.2020.

Xanthogramma citrofasciatum (de Geer, 1776) (Syrphinae)
Examined material: 108292; 1 female; S12; 02.08.2020. – 108294, 108293; 2 males; S14.

Xanthogramma dives (Rondani, 1857) (Syrphinae)
Examined material: 108290; 1 male; S10. – 108291; 1 male; S9.

Xylota segnis (Linnaeus, 1758) (Eristalinae)
Examined material: 108191, 108195; 2 males; 108194; 1 female; S6; 31.07.2020. – 108192, 108193; 2 males; S6; 02.08.2020.

Xylota sylvarum (Linnaeus, 1758) (Eristalinae)
Examined material: 108196; 1 male; S6; 31.07.2020.

Xylota tarda Meigen, 1822 (Eristalinae)
Examined material: 108190; 1 female; S9. – 108209; 1 male; S12; 02.08.2020.

Taxonomic and faunistic assessment of the new hoverfly records from Camprodon valley

Excluding the records of *Triglyphus primus* Loew, 1840, which represented the first finding of this genus from Spain (Ricarte & Nedeljković, 2020), one (*Chrysotoxum lessonae*) species is new to the Iberian Peninsula, 19 are new to Catalonia, and 23 to GI. First documented records from Spain and the Iberian Peninsula are given for *Cheilosia hypena* and *Xylota tarda*, respectively, meaning that their presence in Spain and the Iberian Peninsula was previously reported in the literature, but without locality details (Appendix).
A total of 81 hoverfly species of 38 genera were identified. The two main subfamilies (Eristalinae and Syrphinae) had a similar number of genera recorded (16 and 19 respectively). Of all genera, 34 were represented by only 1-3 species, while the genus *Cheilosia* Meigen, 1822 had the highest number of species in the study (13 spp.), followed by *Eristalis* Latreille, 1804 (7 spp.) and *Chrysotoxum* Meigen, 1803 (6 spp.).
Taking into consideration the altitudinal zoning indicated in the study area section and Table 1, most species represented in the study were absent from the subalpine zone, where the only exclusive species was *Parasyrphus vittiger*. All species except *P. vittiger* were found in the montane zone. Twelve species were shared between the two sampled altitudinal zones (Fig. 3).

Hoverfly checklist of the Girona province (Table 2)

See the meaning of the locality and reference codes in the Material and Methods section.

Species	Locality (reference/s)
Baccha elongata = *Bacha obscuripennis* = *Baccha obscuripennis*	L1 (1; 4; 6), L12, L27 (present study)
Ceriana conopsoides	L27 (present study)
Ceriana vespiformis	L19 (6)
Cheilosia aerea	L27 (present study)
Cheilosia albitarsis	L19, L23 (5; 6)
Cheilosia barbata	L27, L32 (present study)
Cheilosia flavipes	L5 (5; 6)
Cheilosia fraterna	L18, L19 (5; 6)
Cheilosia impressa	L19 (5; 6)
Cheilosia hypena	L4, L12, L27, L32 (present study)
Cheilosia illustrata	L27 (present study)
Cheilosia laticornis	L14 (15), L27 (present study)
Cheilosia latifrons	L4, L27, L32 (present study)
Cheilosia longula	L32 (present study)
Cheilosia mutabilis	L17 (7)

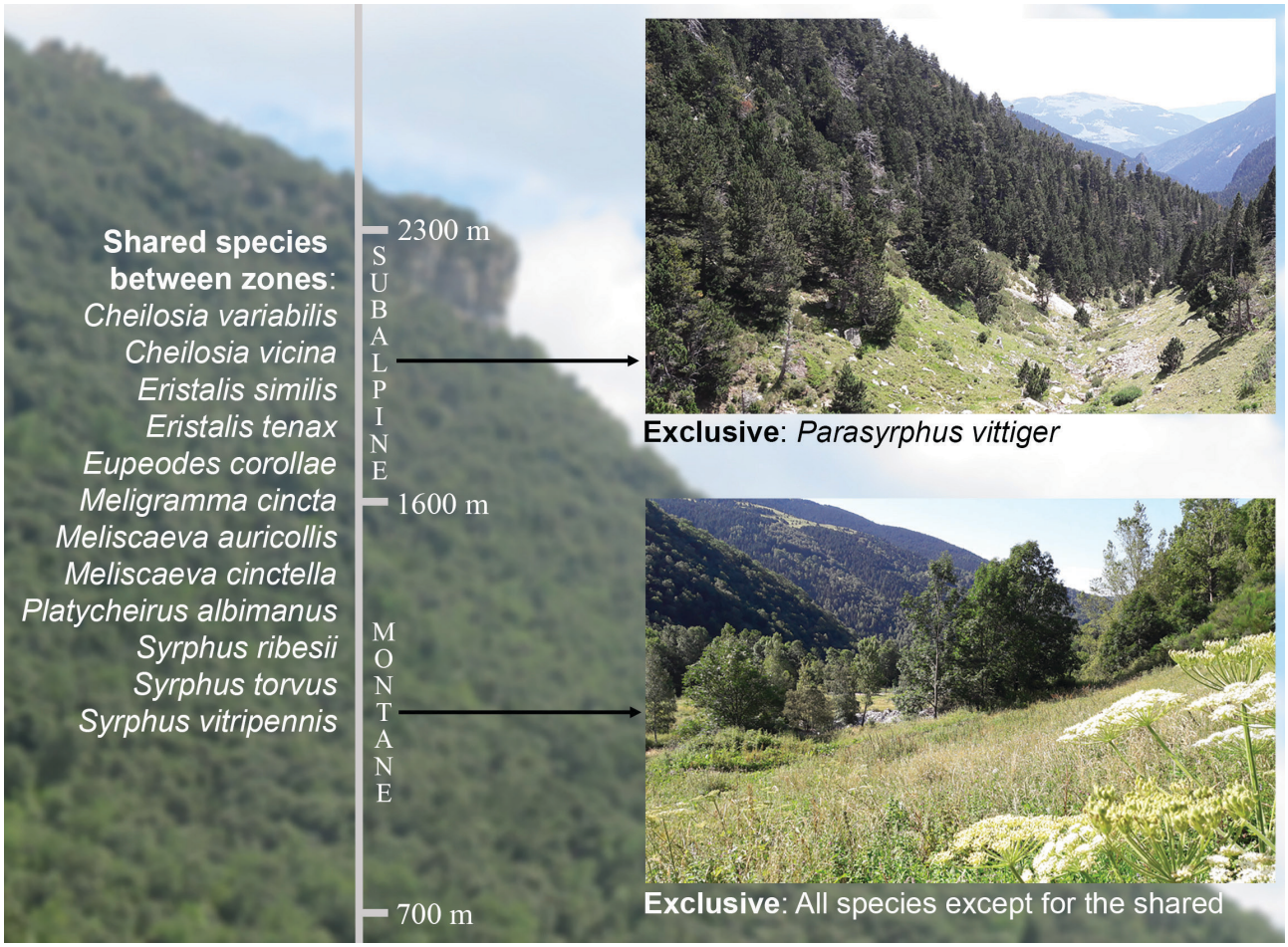

Fig. 3. Distribution of hoverfly species by altitudinal zones (subalpine and montane) from the catch in Camprodon valley, eastern Pyrenees (Spain) in July/August 2020. For each zone, an on-site picture of the representative landscape/vegetation is shown. Species shared between zones are listed on left. Species exclusive of each zone on right.

Species	Locality (reference/s)
Cheilosia personata	L32 (12)
Cheilosia proxima	L12 (present study)
Cheilosia scutellata	L7 (3; 4; 6), L12, L27 (present study)
Cheilosia soror	L14 (15), L19 (5)
Cheilosia variabilis	L27 (present study)
Cheilosia vernalis	L27 (present study), L31 (5; 6), L32 (present study)
Cheilosia vicina	L27 (present study)
Cheilosia vulpina	L12 (present study), L19 (5; 6), L27, L32 (present study).
Chrysogaster coemiteriorum = *Chrysogaster chalybeata*	L1 (4), L27 (5; 6)
Chrysogaster solstitialis	L1, L6 (6), L12, L27, L32 (present study) *Notes*. Cuní (1880, 1881) listed *C. coemiteriorum* from Arbucias and Cerdaña, but Gil Collado (1930) listed instead *C. solstitialis* from these two localities, and *C. coemiteriorum* (as *C. chalybeata*) only from Setcases. Here, we follow Gil Collado (1930) until Cuní's material can be studied.
Chrysotoxum arcuatum	L27 (present study)
Chrysotoxum bicinctum	L27 (19), L32 (present study)
Chrysotoxum elegans	L12, L27, L32 (present study)
Chrysotoxum festivum	L32 (present study)
Chrysotoxum intermedium	L8 (8)
Chrysotoxum lessonae	L32 (present study)

Species	Locality (reference/s)
Chrysotoxum volaticum	L15, L20, L25 (19), L32 (present study)
Dasysyrphus albostriatus = *Syrphus albostriatus* var. *confusus*	L31 (5; 6), L32 (present study)
Episyrphus balteatus = *Syrphus balteatus*	L12 (present study), L17 (7), L21 (3), L32 (present study)
Eristalinus aeneus = *Eristalis aeneus* = *Eristalis (Lathyrophthalmus) aeneus*	L21 (3), L8 (8), L19, L21 (6)
Eristalinus sepulchralis = *Eristalis sepulchralis*	L4 (present study), L9, L10, L29 (7)
Eristalinus taeniops	L32 (present study)
Eristalis arbustorum	L6 (2), L32 (present study), L34 (8)
Eristalis lineata = *Eristalis horticola*	L4 (6), L27 (present study), L31 (5; 6)
Eristalis interrupta	L12, L27, L32 (present study)
Eristalis jugorum	L27, L32 (present study)
Eristalis pertinax	L4, L12, L32 (present study)
Eristalis similis	L4, L12, L27, L32 (present study)
Eristalis tenax	L1 (1), L12 (present study), L3 (3), L6 (2), L27 (present study)
Eumerus grandis	L27 (present study)
Eumerus ornatus	L27, L32 (present study)
Eumerus ovatus = *Eumerus bicolor*	L24 (4; 6)
Eumerus sogdianus	L20, L32 (9)
Eupeodes corollae = *Syrphus corollae* var. *fulvifrons*	L27, L32 (present study), L31 (5; 6)
Eupeodes latifasciatus	L27 (present study) *Notes*. Marcos-García *et al.* (1998) also reports this species from the province of Girona as a pers. com. of Levy.
Eupeodes luniger = *Syrphus luniger*	L4 (6), L27 (present study), L31 (5), L32 (present study) *Notes*. Although this species was reported from Viladrau by Andreu (1926), Gil Collado (1930) omits this record for reasons unknown to us.
Ferdinandea cuprea	L4, L27, L32 (present study)
Helophilus trivittatus	L10 (7), L19 (6)
Helophilus pendulus	L12, L27, L32 (present study)
Lapposyrphus lapponicus	L27 (present study)
Lejogaster metallina = *Chrysogaster (Liogaster) metallina*	L6 (2; 6)
Lejogaster tarsata = *Chrysogaster splendidus* = *Chrysogaster (Liogaster) splendida*	L3 (3; 4; 6)
Leucozona glaucia	L27 (present study), L30 (18)
Melangyna compositarum	L27 (present study)
Melangyna umbellatarum	L32 (present study)
Melanostoma mellinum = *Melanostoma mellina*	L1 (1; 6), L3, L21 (3; 6), L6 (2; 6), L12, L27 (present study)
Melanostoma scalare = *Melanostoma gracilis*	L1 (1; 6), L6 (2; 6), L12, L27 (present study), L31 (5; 6)
Meligramma cincta	L27 (present study)
Meliscaeva auricollis	L12, L27 (present study)
Meliscaeva cinctella	L27 (present study)
Merodon avidus A sensu Marcos-García *et al.* (2007)	L13 (14)
Merodon clavipes	L24 (4)
Merodon funestus	L33 (14)
Merodon rufus	L5, L20, L27 (16)
Merodon unguicornis	L27 (14)
Milesia crabroniformis (Fig. 2C)	L1 (1; 4), L4 (present study)
Myathropa florea = *Helophilus floreus* = *Myiatropa florea*	L3 (3; 6), L4 (present study), L6 (2; 6), L12 (present study), L17 (7), L27 (present study), L31 (5)
Neoascia podagrica	L19 (6)
Orhtonevra nobilis	L27 (present study)
Paragus albifrons	L1 (1; 4; 6)
Paragus haemorrhous = *P. tibialis* var. *triangu-liferus*	L31 (5; 6), L32 (present study)
Paragus pecchiolii = *P. majoranae*	L8 (13), L32 (present study)
Paragus strigatus	Unknown. *Notes*. Marcos-García *et al.* (1998) reports this species from the province of Girona as a pers. com. of Levy. The record from Palafolls (Barcelona province) by van Eck (2010) is here excluded, because it was incorrectly linked to the Girona province.
Paragus tibialis	L1 (1; 6), L4 (6), L12 (present study), L21 (3; 6)
Parasyrphus vittiger	L27 (present study)
Pipiza festiva	L32 (present study)
Pipiza noctiluca	L27 (present study)
Pipizella annulata	L16 (17)
Pipizella brevis	L16 (9; 17)
Pipizella pennina = *Pipizella microapicalis*	L15, L27, L32 (9; 17)

Species	Locality (reference/s)
Pipizella viduata	L27, L32 (present study)
Pipizella zeneggenensis = *Pipizella lata*	L4, L11, L18, L22 (10), L27 (10; 17), L32 (10)
Platycheirus albimanus	L27, L32 (present study)
Platycheirus ambiguus = *Melanostoma ambigua* = *Melanostoma ambiguum*	L3 (3; 6)
Platycheirus fulviventris	Unknown. *Notes*. Marcos-García *et al.* (1998) reports this species from the province of Girona as a pers. com. of Levy.
Platycheirus manicatus	L16 (5; 6)
Riponnensia splendens = *Chrysogaster splendens*	L31 (5; 6)
Scaeva dignota	L32 (present study)
Scaeva pyrastri = *Catabomba pyrastri* = *Lasyophticus pyrastri* = *Syrphus pyrastri*	L5 (5; 6), L6 (2; 6), L27, L32 (present study), L34 (8)
Scaeva selenitica = *Catabomba selenitica* = *Lasyophticus seleniticus*	L27 (present study), L31 (5; 6), L32 (present study)
Sericomyia bombiforme	L27, L32 (present study)
Sphaerophoria interrupta = *Melithreptus menthastri* = *Sphaerophoria menthastri*	L1 (1; 6), L6 (2; 4; 6)
Sphaerophoria laurae	L5, L16 (11)
Sphaerophoria rueppellii = *S. flavicauda*	L17 (7), L31 (5; 6)
Sphaerophoria scripta = *Melithreptus scriptus* = *S. scripta* (var. *nigricoxa,* var. *nitidicollis,* var. *scripta*)	L9 (7), L12 (present study), L17 (7), L21 (3), L26, L29, (7), L31(5), L34 (8)
Sphaerophoria taeniata = *Melithreptus taeniatus* = *Sphaerophoria menthastri* var. *taeniata*	L6 (2; 6)
Sphegina elegans	L32 (present study)
Spilomyia manicata	L27 (present study)
Syritta pipiens	L1 (1), L6 (2), L12 (present study)
Syrphus excisus	L19 (6), L28 (5)
Syrphus ribesii	L6 (2; 6), L12, L27 (present study)
Syrphus torvus	L27 (present study)
Syrphus vitripennis = *S. ribesii* var. *vitripennis*	L12 (present study), L27 (present study), L31 (5; 6), L32 (present study)
Triglyphus primus	L27 (20)
Volucella bombylans = *V. bombylans* var. *plumata*	L12 (present study), S27 (5; 6)
Volucella elegans	L31 (6)
Volucella inanis	L6 (2; 6), L27 (present study), L31 (5; 6), L32 (present study)
Volucella pellucens	L27, L32 (present study)
Volucella zonaria	L1 (1), L3 (3), L6 (2), L27 (present study)
Xanthandrus comtus	L27, L32 (present study)
Xanthogramma citrofasciatum = *Xanthogramma festiva*	L4 (6), L32 (present study)
Xanthogramma dives	L2 (14), L32 (present study). *Notes*. For this species, we follow the criteria of Ricarte & Marcos-García (2017), who consider as valid only the identifications of *X. dives* after Speight & Sommaggio (2010).
Xylota segnis	L27 (present study)
Xylota sylvarum	L27 (present study)
Xylota tarda	L32 (present study)

Doubtful records

Platycheirus europaeus Goeldlin de Tiefenau, Maibach & Speight, 1990
Notes. Speight (2020) states that *P. europaeus* is present in Spain, without further precision. Dirickx (1994) provides a distribution map for this species with a presence dot in Catalonia, but the position of this dot is also imprecise.

Sphegina clavata (Scopoli, 1763) & *Sphegina clunipes* (Fallén, 1816)
Notes. Thompson & Torp (1986) and Dirickx (1994) each provide a distribution map with a presence dot in Catalonia for these two species. The position of this dot is imprecise, but is likely to be within the province of Girona.

Sphegina elegans
Notes. Thompson & Torp (1986) provide a distribution map with a presence dot in Catalonia, very close to the French/Spanish border, and apparently in the Girona province. However, Dirickx (1994) provides a different map without the above-mentioned dot, but with another dot clearly placed on the French side of the Pyrenees. Provenance data for examined material would be necessary to discern whether the dots in Thompson & Torp (1986) and Dirickx (1994) are the same or not.

DISCUSSION

As a result of this short survey in the Camprodon valley, 81 hoverfly species were identified, including *T. primus,* the discovery of which was reported by Ricarte & Nedeljković (2020). The number of known species to this valley now stands at 85, plus *Milesia crabroniformis* (Fabricius, 1775), which is known to the authors of the present paper by a photo taken in Camprodon, on 4 October 2020, by M. Carbonell (Fig. 2C). In addition,

there are also records of a species of *Merodon* Meigen, 1803 and a species of *Rhingia* Scopoli, 1763 collected in the course of this fieldwork but not included in the Results because they are still under taxonomic scrutiny (Ricarte *et al.,* in prep.). In total, 88 species are known for the Camprodon valley. The checklist of hoverflies from the Girona province expands from 73 to 119 species as a result of the new records from Camprodon valley. Girona is now one of the best-known Spanish provinces in terms of number of hoverfly species recorded (Ricarte & Marcos-García, 2017).

Leclercq (1971) provided records of 49 hoverflies collected in the Pyrenees, mainly of the Huesca province, from July/August, i.e. the same period of the year when our sampling took place. More than half (55%) of the species reported by Leclercq (1971) and all genera were shared with our 2020 list. *Cheilosia* was the genus with the highest number of species reported by Leclercq (1971). From the seven *Cheilosia* species reported by him, just one was shared with the 2020 sampling in Camprodon. On the one hand, differences in species composition might be due to the fact that many species of Leclercq (1971) were collected in early July, whilst the 2020 sampling was in late July. On the other hand, detected differences in species composition may actually respond to differences between the surveyed Pyrenean valleys and habitats of Huesca and Girona. Specifically, *Cheilosia* hoverflies are known to be sensible to changes in the woodland landscape (Popov *et al.*, 2017), in part because their larvae, according to species, feed on different plants and fungi (Rotheray, 1993).

From the 81 species reported from the Camprodon valley in 2020, eight were saproxylic, i.e. with larvae dependent on trees (*Ceriana* Rafinesque, 1815, *Ferdinandea* Rondani, 1844, *Myathropa* Rondani, 1845, *Sphegina* Sack, 1928, *Spilomyia* Meigen, 1803, and *Xylota* Meigen, 1822). The proportion of saproxylic species (11%) is unexpectedly low from the Camprodon valley, where forests form a significant element of the vegetation. Although the present study only provides a partial overview of the hoverfly biodiversity of the Camprodon valley, we suggest that land use changes due to the expansion of urban areas and the road network, as well as promotion of agricultural and tourism activities may have had an effect in the woodlands of this popular valley, with reduction of forest cover (mainly in the lower parts of the valley, and around the ski resort), and mature trees becoming scarcer and more isolated; mature trees are crucial for the development of a rich saproxylic community (Micó, 2018).

Hoverfly genera with aquatic larvae such as *Eristalis* Latreille, 1804 (Rotheray, 1993) appear to flourish in the montane ecosystem of the valley (e.g. 7 species of *Eristalis*), where water courses are abundant and water flow is slower than at higher altitudes. In these conditions, breeding sites for *Eristalis* are abundant. However, in the subalpine zone, only *Eristalis similis* and the cosmopolitan *Eristalis tenax* were reported, possibly due to the lower availability of breeding sites in this altitudinal zone of the valley. In the subalpine zone, water courses are smaller and their water flow is faster, due to steeper slopes (pers. obs. of Antonio Ricarte). The only hoverfly species found exclusively in the subalpine was *P. vittiger* (Fig. 3), being in accordance with its preferred environment, the conifer forest, which is dominant at these altitudes (Sacasas-i-Lluís, 2009). The larva of *P. vittiger* feeds mainly on conifer aphids and this is why its presence is correlated with conifers. Nonetheless, *P. vittiger* can occasionally be found in deciduous forest (Speight, 2020).

The genus with the highest number of species found was *Cheilosia*. Hoverflies of this genus prefer mountains, forests and the proximity of rivers and streams (Vujić, 1996), just as in the Camprodon valley. The only species of *Cheilosia* found in the subalpine zone were *C. variabilis* and *C. vicina*, both already recorded from the Pyrenees of Huesca province (Leclercq, 1971; Marcos-García, 1985). The species *C. vicina* belongs to the subgenus *Nigrocheilosia* Shatalkin, 1975, which is typical of high altitudes (Vujić, 1996). *Cheilosia variabilis* is an abundant species in southern parts of its range and occurs in a wide variety of forest types (Vujić, 1996). In addition, the presence of *Cheilosia hypena* is here confirmed from the Spanish Pyrenees. Speight (2020) mentioned that this species was present in this massif but there was no published record from Spain known to us. The finding of *Cheilosia proxima* is also important from a faunistic point of view. Séguy (1961) indicated that this species was present in Catalonia, but without further precision. Apart from this, the only published records of *C. proxima* known to us are from the León and Guipúzcoa provinces (Marcos-García, 1989, 1990a, b; Kehlmaier, 2002). Records of other *Cheilosia* species such as *C. vulpina*, which were previously reported only from 4-5 provinces of Spain (Ricarte & Marcos-García, 2017), are also important to better understand the true distribution of these species in the Iberian Peninsula.

Even though the 2020 sampling was short, faunistic results were remarkable in comparison with studies using longer periods of hand-net sampling in other parts of Spain. For example, in Cabañeros National Park, 82 species were collected by hand-netting during 468 hours of sampling in 13 months (Ricarte & Marcos-García, 2008). The reasons for such a similar result after such different sampling efforts might be due to the sampling designs, which resulted from different research aims, but could also be due to an effect of the diversity of the hoverfly community in each study area. Nonetheless, the results presented here suggest that short surveys conducted by experienced collectors during periods of high insect activity may suffice in the purpose of rapidly evaluating the biodiversity interest of a poorly studied area and/or for taking quick conservation decisions in threatened ecosystems or insect groups with well known

requirements. Further fieldwork in other periods of the year are necessary to complete the inventory of species present in the biodiverse Camprodon valley.

ACKNOWLEDGEMENTS

We are grateful to Mercè Navarro Heras and Gitti Bahl Zemsauer for guiding us into the Camprodon valley of Girona. We would also like to thank Ante Vujić for loaning specimens of *Cheilosia* that were useful for identification of the Pyrenean material. Thanks also to Iván Ballester for interesting discussions about the identity of some *Cheilosia* species. Segundo Ríos assisted in plant identification from photos taken on-site. English was kindly revised by Stephen Hewitt. Antonio Ricarte's position (Ref. UATALENTO17-08) at the University of Alicante is funded by the "Vicerrectorado de Investigación y Transferencia del Conocimiento". This research was funded by the Fauna Iberica Project PGC2018-095851-A-C65 of the Spanish Ministry of Science, Innovation and Universities.

REFERENCES

Álvarez-Fidalgo M., Álvarez-Fidalgo P., Ricarte A., Marcos-García M. A. 2018. The genus *Leucozona* Schiner, 1860 on the Iberian Peninsula, including the first records of *Leucozona laternaria* (Müller, 1776) (Diptera: Syrphidae). *BV News Publicaciones Científicas* 7(98): 128-141.

Andréu J. 1926. Notas dipterológicas. Una lista de Sírfidos para contribuir al conocimiento de los dípteros de España. *Boletín de la Sociedad entomológica de España* 9(5): 98-126.

Antiga P. 1888. Contribución a la Fauna de Cataluña. Catálogo de los Dípteros observados en diferentes sitios del Principado. *Imprenta de Viuda e Hijos de J. Subirana, Barcelona*, 16 pp.

Barkalov A. 2009. A Key to Hover Flies of the Genus *Cheilosia* Mg. (Diptera, Syrphidae) of Kazakhstan. *Entomological Review* 89(9): 1157-1176.

Barkalov A.V., Ståhls G.1997. Revision of the Palaearctic bare-eyed and black-legged species of the genus *Cheilosia* Meigen (Diptera, Syrphidae). *Acta Zoologica Fennica* 208: 1-74.

Bartsch H., Binkiewicz E., Rådén A., Nasibov E. 2009a. Blomflugor: Syrphinae. Nationalnyckeln till Sveriges flora och flora, DH53a. *Artdatabanken, SLU, Uppsala,* 406 pp.

Bartsch H., Binkiewicz E., Klintbjer A., Rådén A., Nasibov E. 2009b. Blomflugor: Eristalinae & Microdontinae. Nationalnyckeln till Sveriges flora och flora, DH 53b. *Artdatabanken, SLU, Uppsala*, 478 pp.

Becker T. 1894. Revision der Gattung *Chilosia* Meigen. *Nova acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum* 62(3): 194-521.

Claussen C., Ståhls G. 2007. A new species of *Cheilosia* Meigen from Thessaly/Greece, and its phylogenetic position (Diptera: Syrpidae). *Volucella* 8: 45-62.

Cuní M. 1880. Excursión entomológica y botánica a San Miguel de Fay. *Anales de la Sociedad Española Historia Natural* 9: 204-242.

Cuní M. 1881. Excursión entomológica y botánica á la Cerdaña Española (Cataluña). *Anales de la Sociedad Española de Historia Natural* 10: 367-389.

Cuní M. 1885. Excursión entomológica a varias localidades de la provincia de Gerona. *Acta de la Sociedad espanola de Historia Natural* 14: 51-73.

de Geer C. 1776. Mémoires pour servir à l'histoire des insectes. *P. Hesselberg, Stockholm*. Vol. 6, viii + 523 pp., 30 pls.

Dirickx H.G. 1994. Atlas des Diptères syrphides de la région méditerranéenne. *Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussel,* 317 pp.

Doyle T., Hawkes W.L.S., Massy R., Powney G.D., Menz M.H.M., Wotton K.R. 2020. Pollination by hoverflies in the Anthropocene. *Proceedings of the Royal Society B* 287: 20200508.

Dufour L. 1848. Histoire des Métamorphoses du *Cheilosia aerea*. *Annales des Sciences Naturelles, Zoologie* (3) 9: 205-209.

Dušek J., Láska P. 1976. European species of *Metasyrphus*: key, descriptions and notes. *Acta Entomologica Bohemoslovaca* 73: 263-282.

Egger J. 1858. Dipterologische Beiträge. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich* 8: 701-716.

Fabricius J.C. 1775. *Systemaentomologiae, sistensinsectorumclasses, ordines, genera, species, adiectissynonymis, locis, descriptionibus, observationibus*. Kortii, Flensbvrgiet Lipsiae [= Flensburg & Leipzig]. [32] + 832 pp.

Fabricius J.C. 1781. *Species insectorum. Vol. 2,* C. E. Bohnii, Hamburgi et Kilonii [= Hamburg and Kiel], 494 pp.

Fabricius J.C. 1794. *Entomologia systematica emendata etaucta*. C. G. Proft, Hafniae [= Copenhagen], Vol. 4, [6] + 472 + [5] pp.

Fallén C.F. 1810. *Specim. entomolog. novam Diptera disponendi methodum exhibens*. Berlingianis, Lund. 26 pp.

Fallén C.F. 1816-1817. *Syrphici Sveciae*. *Berlingianis, Lundae [= Lund],* 1-14 [08.06.1816], 15-22 [08.06.1816], 23-30[10-05.1817], 31-42 [20.05.1817], 43-54 [21.05.1817], 55-62 [22.05.1817] pp.

Galante E., Marcos-García M.A. 2004. Métodos de preparación y conservación (pp. 47-54). *In*: Barrientos J.A. (ed). Curso práctico de entomología. *Manuals de la Universitat Autònoma de Barcelona, Barcelona*, 947 pp.

Giglio-Tos E. 1890. Le specie europee del genere *Chrysotoxum* Meig. *Atti della R. Accademia delle Scienze di Torino* 26: 134-165.

Gil-Collado J. 1930. Monografía de los Sírfidos de España. *Trabajos del Museo Nacional de Ciencias Naturales (Serie Zoológica)*, 54, 376 pp.

Goeldlin de Tiefenau P. 1976. Révision du genre *Paragus* (Dipt., Syrphidae) de la région paléarctique occidentale. *Bulletin de la Société Entomologique Suisse* 49: 79-108.

Goeldlin de Tiefenau P. 1989. Sur plusieurs espèces de *Sphaerophoria* (Dipt., Syrphidae) nouvelles ou méconnues des régions paléarctique et néarctique. *Bulletin de la Société Entomologique Suisse* 62: 41-66.

Goeldlin de Tiefenau P. 1996. On several new European species of *Syrphus* (Diptera, Syrphidae) and key for the Palearctic species of the genus. *Bulletin de la Société Entomologique Suisse* 69: 157-171.

Goeldlin de Tiefenau P., Maibach A., Speight M.C.D. 1990. Sur quelques espèces de *Platycheirus* (Diptera: Syrphidae) nouvelles ou méconnues. *Dipterist's Digest* 5: 19-43

Guixé D., Llobet T. 2016. Vida salvaje de los Pirineos. *Gallocanta ediciones*, 143 pp.

Haarto A., Ståhls G. 2014. When mtDNA COI is misleading: congruent signal of ITS2 molecular marker and morphology for North European *Melanostoma* Schiner, 1860 (Diptera, Syrphidae). *ZooKeys* 431: 93-134.

Harris M. 1776-1780. An exposition of English insects...Robson Co., London, 1776. Decad I, pp. 1-40, 2 pls + pls 1-10 [1776]; Decad II, pp. 41-72, pls 11-20[1778]; Decads III, IV, pp. 73-99, 100-138, pls 21-30, 31-40 [after 24.12.1779]; Decad V, pp. 139-166, pls 41-50+ 1 pl. [1780].

Hippa H., Nielsen T., van Steenis J. 2001. The West Palaearctic species of the genus *Eristalis* Latreille (Diptera, Syrphidae). *Norwegian Journal of Entomology* 48: 289-327.

Kehlmaier C. 2002. Hoverflies (Diptera, Syrphidae) from northern Spain, with notes on *Pelecocera tricincta* Meigen, 1822. *Volucella* 6: 139-153.

Latreille P.A. 1804. Tableau méthodique des insectes [pp. 129-200]. *In:* Latreille P.A. (ed.). Société de Naturalistes et d'Agriculteurs, Nouveau dictionnaire d'histoire naturelle... Tome 24. [Section 3]: *Tableaux méthodiques d'histoire naturelle. Deterville, Paris*, 84 + 4 + 85 + 238 + 18 + 34 pp.

Leclercq M. 1963. Syrphidae de España (Diptera). *Graellsia* 20: 125-129.

Leclercq M. 1971. Syrphidae (Diptera) des Pyrénées (Huesca, Lérida, Andorra, Gerona). *Pirineos* 102: 21-25.

Linnaeus C. 1758. *Systema naturae*. Ed. 10, Vol. 1. 824 pp. L. Salvii, Holmiae [= Stockholm].

Loew H. 1840. Bemerkungen über die in der Posener Gegend einheimischen Arten mehrerer Zweiflugler = Gattungen. *[Zu der] offentlichen Prufung der Schuler des Koniglichen Friedrich-Wilhelms-Gymnasiums zu Posen*, 40 pp.

Loew H. 1841. Ueber die Gattung *Chrysotoxum*. *Stettiner Entomologische Zeitung* 2: 136-141, 155-160.

Loew H. 1857. Die europäischen Arten der Gattung *Cheilosia*. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich (Abhandl.)* 7: 579-616.

Lorenzo D., Ricarte A., Nedeljković Z., Nieves-Aldrey J.L., Marcos-García M.A. 2020. Hoverflies (Diptera: Syrphidae) of El Ventorrillo Biological Station, Madrid province, Spain: a perspective from a late twentieth century inventory. *Revue suisse de Zoologie* 127(2): 393-412.

Lucas J.A.W. 1974. Syrphiden in de jaren 1969-1972. *Entomologische Berichten* 34: 48-51.

Lucas J.A.W. 1976. New species of the genus *Pipizella* Rondani, 1856 (Diptera, Syrphidae). Pubicatiës van het natuur-historisch gennootschap in Limburg, Maastricht 26: 5-13.

Macquart P.J.M. 1829. Insectes diptères du nord de la France. *Syrphies*, Lille. «1827» 223 pp., 4 pls.

Marcos-García M.A. 1985. Contribución al conocimiento de la sirfidofauna del Pirineo del Alto Aragón I (Diptera, Syrphidae). *Boletim da Sociedade Portuguesa de Entomologia (Actas do II Congresso Iberico de Entomologia)* 1: 511-520.

Marcos-García M.A. 1989. Nuevas species de *Cheilosia* (Meigen, 1822) para la entomofauna ibérica (Diptera, Syrphidae). *Fragmenta Entomologica* 21(2): 145-151.

Marcos-García M.A. 1990a. Catálogo preliminar de los Syrphidae (Diptera) de la Cordillera Cantábrica (España). *Eos* 66: 81-235.

Marcos-García M.A. 1990b. El género *Cheilosia* Meigen, 1822, en la Cordillera Cantábrica (Diptera: Syrphidae). *Mediterránea, Serie de Estudios Biológicos* 12: 113-138.

Marcos-García M.A., Láska P. 1983. Description of *Metasyrphus lucasi* sp.n. (Diptera, Syrphidae). *Nouvelle Revue d'Entomologie* 13(1): 113-116.

Marcos-García M.A., Isidro P.M., Rojo S., Pérez-Bañón C. 1998. Catálogo y distribución geográfica de los sírfidos iberobaleares (Diptera, Syrphidae) I.- Syrphinae y Microdontinae. *Boletín de la Asociación española de Entomología* 22(3-4): 37-61.

Marcos-García M.A., Rojo S., Pérez-Bañon C. 2002. Family Syrphidae (pp. 132-136). *In*: Monografías S.E.A. Sociedad Entomológica Aragonesa (ed.). Catálogo de los Dípteros de España, Portugal y Andorra (Insecta). *Sociedad Entomológica Aragonesa (SEA), Zaragoza*, VIII+ 323 pp.

Marcos-García M.A., Vujić A., Mengual X. 2007. Revision of Iberian species of the genus *Merodon* (Diptera: Syrphidae). *European Journal of Entomology* 104: 531-572.

Marcos-García M.A., Vujić A., Ricarte A., Ståhls G. 2011. Towards an integrated taxonomy of the *Merodon equestris* complex (Diptera: Syrphidae) including description of a new species, with additional data on Iberian *Merodon*. *Canadian Entomologist* 143: 332-348.

Marshall S.A. 2012. Flies: the natural history and diversity of Diptera. *Firefly Books Ltd, USA and Canada*, 616 pp.

Meigen J.W. 1803. Versuch einer neuen Gattungs-Eintheilung der europäischen zweiflügeligen Insekten. *Magazin für Insektenkunde* 2: 259-281.

Meigen J.W. 1822. Systematische Beschreibung der bekannten europaischen zweiflügeligen Insekten. *Dritter Theil. Schulz-Wundermann, Hamm.* x + 416 pp., pls 22-32.

Mengual X., Ståhls G., Rojo S. 2015. Phylogenetic relationships and taxonomic ranking of pipizine flower flies (Diptera: Syrphidae) with implications for the evolution of aphidophagy. *Cladistics* 31(2015): 491-508.

Micó E. 2018. Saproxylic Insects in Tree Hollows (pp. 693-727). *In:* Ulyshen M. (eds), Saproxylic Insects. Zoological Monographs, vol 1. *Springer, Cham.* 904 pp. DOI: 10.1007/978-3-319-75937-1_21

Miličić M., Janković M., Tot T., Nedeljković Z., Popov S., Ivošević B., Radenković S., Vujić A. 2018. New findings of hoverfly fauna (Diptera: Syrphidae) of the western part of Serbia (Zlatibor and Raška districts). *Acta entomologica serbica* 23(2): 43-66.

Monteil C. 2010. A Species Selection Tool for the "Syrph the Net" database. *In*: Speight M.C.D., Castella E., Sarthou J.-P., Monteil, C. (eds), Syrph the Net on CD, Issue 7. *The database of European Syrphidae. Syrph the Net Publications, Dublin.*

Müller O.F. 1764. *Favna insectorvm Fridrichsdalina ...* xxiv + 96 pp. *Io. Frid. Gleditschii, Hafniae et Lipsiae [= Copenhagen and Leipzig]*.

Nedeljković Z., Ačanski J., Vujić A., Obreht D., Đan M., Ståhls G., Radenković S. 2013. Taxonomy of *Chrysotoxum festivum* Linnaeus, 1758 (Diptera: Syrphidae) – an integrative approach. *Zoological Journal of the Linnean Society* 169: 84-102.

Nedeljković Z., Ricarte A., Šašić Zorić Lj., Đan M., Obreht Vidaković D., Vujić A. 2018. The genus *Xanthogramma* Schiner, 1861 (Diptera: Syrphidae) in southeastern Europe, with descriptions of two new species. *Canadian Entomologist* 150: 440-464.

Nielsen T. 1970. *Cheilosia sootryeni* n.sp. (Diptera, Syrphidae), a Norwegian Species Resembling Ch. Vernalis Fallén. *Norsk entomologisk Tidsskrift* 17: 115-118.

Osten-Sacken C.R. 1875. On the North American species of the genus *Syrphus* (in the narrowest sense). *Proceedings of the*

Boston Society of Natural History (1875-1876) 18: 135-153.

Panzer G.W.F. 1798. Favnae insectorvm germanicae initia oder Deutschlands Insecten. Heft 60. *H. Felsecker, Nürnberg* 6, 24 pp.

Peck L.V. 1988. Syrphidae (pp. 11-363). *In:* Soos A., Papp, L. (eds), Catalogue of Palaearctic Diptera. *Akadémiai Kiadó, Budapest*, 8: 363 pp.

Poda von Neuhaus N. 1761. *Insecta musei Graecensis, quae in ordines, genera et species juxta Systema Naturae Caroli Linnaei digessit. Widmanstadii, Graecii [=Graz]* 127 + [xii] pp., 2 pls.

Popov S., Miličić M., Diti I., Oskar M., Sommaggio D., Markov Z., Vujić A. 2017. Phytophagous hoverflies (Diptera: Syrphidae) as indicators of changing landscapes. *Community Ecology* 18(3): 287-294.

Pujade-Villar J. 2011. Aproximació a la història de l'estudi entomològic-faunístic als Països Catalans i algunes reflexions sobre el present i el futur de la ciència dels hexàpodes. *Butlletí de la Institució Catalana d'Història Natural* 76: 5-46.

Rafinesque C.S. 1815. Analyse de la nature ou tableau de l'univers et des corps organisés. *[Privately printed], Palermo*. 224 pp.

Ricarte A., Marcos-García M.A. 2008. Los sírfidos (Diptera: Syrphidae) del Parque Nacional de Cabañeros (España): una herramienta para la gestión. *Boletín de la Asociación Española de Entomología* 32(1-2): 19-32.

Ricarte A., Marcos-García M.A. 2017. A checklist of the Syrphidae (Diptera) of Spain, Andorra and Gibraltar. *Zootaxa* 4216(5): 401-440.
DOI: 10.11646/zootaxa.4216.5.1

Ricarte A., Nedeljković Z. 2020. *Triglyphus primus* Loew, 1840 (Diptera, Syrphidae), new to Spain. *Boletín de la Asociación Española de Entomología* 44(3-4): 567-570.

Ricarte A., Nedeljković Z., Quinto J., Marcos-García M.A. 2010. The Genus *Ferdinandea* Rondani, 1844 (Diptera, Syrphidae) in the Iberian Peninsula: First Records and New Breeding Sites. *Journal of the Entomological Research Society* 12(3): 57-69.

Rojo S., Gilbert F., Marcos-García M.A., Nieto J.M., Mier M.P. 2003. A world review of predatory hoverflies (Diptera, Syrphidae: Syrphinae) and their prey. *Alicante: Centro Iberoamericano de la Biodiversidad*, 319 pp.

Rondani C. 1844. Species Italicae Generis Callicerae ex insectis Dipteris, distinctae et descriptae; Fragmentum octavum ad inserviendum Dipterologiae Italicae. *Annales de la Société entomologique de France* (2) 2: 61-68.

Rondani C. 1845. *Species Italicae generis Chrysotoxi insectis Dipteris, observatae et distinctae. Fragmentum decimumad inserviendum dipterologiae Italicae. Annales de la Société entomologique de France* (2) 3: 193-203.

Rondani C. 1857. *Dipterologiae italicae prodromus.* Vol: II. *Species italicae ordinis dipterorum in genera characteribus defi nita, ordinatim collectae, methodo analitica distinctae, et novis vel minus cognitis descriptis. Pars prima. Oestridae: Syrpfhidae: Conopidae. A. Stocchi,* Parmae [= Parma], 264 pp.

Rondani C. 1865. *Diptera Italica non vel minus cognita descripta vel annotata observationibus nonnullis additis.* Fasc. I. Oestridae-Syrphidae-Conopidae; Fasc. II. Muscidae. *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano* 8: 127-146 [May 1865]; 193-231 [May 1865].

Rotheray G.E. 1993. Colour guide to hoverfly larvae (Diptera, Syrphidae) in Britain and Europe. *Dipterists Digest* 9: 1-156.

Sacasas-i-Lluís J. 2009. El Ripollès. Territori i Paisatge. *Publicacions de l'Abadia de Montserrat: Barcelona*, 94 pp.

Sack P. 1928-1932. Die Fliegen der Palaerktischen Region, 31. Syrphidae. *Stuttgart (Schweizerbart)*, 451 pp.

Sánchez-Heredia E.M., Aniorte N., Ricarte A., Marcos-García M.A. 2017. Diversidad de sírfidos (Diptera: Syrphidae) de la Estación Biológica de Torretes (Alicante, España). *Cuadernos de Biodiversidad* 52: 38-45.

Schummel T.E. 1843. Verzeichniss und Beschreibung der bis jetzt in Schlesien gefangenen Zweiflügler der Syrphen Familie. Übersicht der Arbeiten und Veränderungen der Schlesischen Gesellschaft für vaterländische Kultur *im Jahre* 1842: 163-170.

Scopoli J.A. 1763. *Entomologia carniolica ...* I. T. Trattner, Vindobonae [=Vienna]. [36] + 420 + [1] pp.

Séguy E. 1961. Diptères Syrphides de l'Europe occidentale. *Mémoires du Muséum National d'Histoire Naturelle. Nouvelle Série, A, Zoologie* 23: 248 pp.

Shatalkin A.I. 1975. Taxonomic analysis of the family Syrphidae (Diptera). II. *Entomologicheskoe Obozrenie* 54: 899-909.

Sommaggio D. 2001. The species of the genus *Chrysotoxum* Meigen, 1822 (Diptera, Syrphidae) described by Giglio Tos. *Bollettino Museo Regionale di Scienze Naturali Torino* 18(1): 115-126.

Sommaggio D., Corazza C. 2006. Contributo alla conoscenza dei Sirfidi (Diptera Syrphidae) della città di Ferrara. *Quaderni della Stazione di Ecologia, Museo Civico di Storia Naturale, cita di Ferrara* 16: 5-20.

Speight M.C.D. 2020. Species accounts of European Syrphidae, *2020. Syrph the Net, the database of European Syrphidae (Diptera)*. *Syrph the Net publications, Dublin* 104: 1-314.

Speight M.C.D., Castella E. 2001. An approach to interpretation of lists of insects using digitised biological information about the species. *Journal of Insect Conservation* 5: 131-139.

Speight M.C.D., Sarthou J.-P. 2017. StN keys for the identification of the European species of various genera of Syrphidae 2017/Clés StN pour la détermination des espèces européennes de plusieurs genres de Syrphidae 2017. *Syrph the Net, the database of European Syrphidae (Diptera)*. *Syrph the Net publications, Dublin* Vol. 99, 139 pp.

Speight M.C.D., Sommaggio D. 2010. On the presence in Switzerland of *Microdon myrmicae* Schönrogge et al., 2002, *Xanthogramma dives* (Rondani, 1857) and *X. stackelbergi* Violovitsh, 1975 (Diptera: Syrphidae). *Entomo Helvetica* 3: 139-145.

Speight M.C.D., Castella E., Sarthou J.-P. 2020. StN 2020. *In:* Speight M.C.D., Castella E., Sarthou J.-P., Vanappelghem C. (eds), Syrph the Net on CD, Issue 12. *Syrph the Net Publications, Dublin.*

Ståhls G., Vujić A., Milankov V. 2008. *Cheilosia vernalis* (Diptera, Syrphidae) complex: molecular and morphological variability. *Annales Zoologici Fennici* 45: 149-159.

Thompson F.C., Torp E. 1986. Synopsis of the European species of *Sphegina* Meigen (Diptera: Syrphidae). *Fauna Entomologica scandinavica* 17: 235-268.

van Doesburg P.H. 1951. Syrphidae de Banyuls et environs. 10me communication sur les diptères syrphides. *Vie et milieu* 2(4): 481-487.

van Eck A. 2010. Poorly recorded Syrphidae (Diptera) from

Spain including species new to its fauna. *Boletín de la Sociedad Entomológica Aragonesa*, 46: 299-300.

van Steenis 2000. The West-Palaearctic species of *Spilomyia* Meigen (Diptera: Syrphidae). *Bulletin de la Société Entomologique Suisse* 73: 143-168.

van Steenis J., Lucas J.A.W. 2011. Revision of the West-Palaearctic species of *Pipizella* Rondani, 1856 (Diptera, Syrphidae). *Dipterists Digest* 18: 127-180.

van Steenis J., Ricarte A., Vujić A., Birtele D., Speight M.C.D. 2016. Revision of the West-Palaearctic species of the tribe Cerioidini (Diptera, Syrphidae). *Zootaxa* 4196 (2): 151-209.

van Steenis J., van Zuijen M.P., Ricarte A., Marcos-García M.A., Doczkal D., Ssymank A., Mengual X. 2020. First records of *Chrysotoxum volaticum* Séguy, 1961 from Europe and *Platycheirus marokkanus* Kassebeer, 1998 from Spain (Diptera: Syrphidae) together with additional records of Spanish *Chrysotoxum* Meigen, 1803. *Bonn zoological Bulletin* 69(1): 141-155.

van Veen M. 2010. Hoverflies of Northwest Europe: identification keys to the Syrphidae. *KNNV Publishing, Utrecht, Netherlands,* 247 pp.

Vázquez V.M., Fernández-Prieto J.A. 2002. El bosque Atlántico (pp. 48-69). *In:* Reyero J.M. (ed), La Naturaleza de España. *Ministerio de Medio Ambiente, Madrid*, 381 pp.

Verlinden L. 1999. *Cheilosia hypena* Becker, 1894 (Diptera, Syrphidae) - description of the male, re-description of the female and its separation from *Cheilosia frontalis* Loew, 1857. *Volucella* 4(1/2): 85-92.

Verrall G.H. 1873. Additions and correction to the list of British Syrphidae. *Entomologist's Monthly Magazine* 9: 251-256.

Violovitsh N.A. 1974. A review of the Palaearctic species of the genus *Chrysotoxum* Mg. (Diptera, Syrphidae). *Entomologocskoc obozrenie (Entomological Review)* 53: 196-217.

Vujić A. 1992. Taksonomski položaj i zoogeografska analiza roda *Cheilosia* Meigen, 1822 i srodnih rodova (Diptera: Syrphidae) na Balkanskom poluostrvu. *PhD thesis, University of Novi Sad, Serbia,* 260 pp.

Vujić A. 1996. Genus *Cheilosia* Meigen and related genera (Diptera: Syrphidae) on the Balkan Peninsula. *Monographs of Matica Srpska, Novi Sad*, 194 pp.

Vujić A. 1999. The tribe Chrysogasterini (Diptera: Syrphidae) in the Balkan Peninsula, with the description of three new cryptic species. *Studia dipterologica* 6(2): 405-423.

Vujić A., Nedeljković A., Hayat R., Demirözer O., Mengual X., Kazerani F. 2017. New data on the genus *Chrysotoxum* Meigen (Diptera: Syrphidae) from North-East Turkey, Armenia, Azerbaijan and Iran including descriptions of three new species. *Zoology in the Middle East* 63(3): 250-268.

Vujić A., Radenković S., Trifunov S., Nikolić T. 2013. Key for European species of the *Cheilosia proxima* group (Diptera, Syrphidae) with a description of a new species. *ZooKeys* 269: 33-50.

Vujić A., Ståhls G., Ačanski J, Bartsch H., Bygebjerg R., Stefanović A. 2013. Systematics of Pipizini and taxonomy of European *Pipiza* Fallén: molecular and morphological evidence (Diptera, Syrphidae). *Zoologica Scripta* 42(3): 288-305.

Vujić A., Šimić S. 1995-1998. Genus *Eumerus* Meigen 1822 (Diptera: Syrphidae) in area of former Jugoslavia. *Glasnik Prirodnjackog Muzeja u Beogradu* B 49-50: 173-190.

Wiedemann C.R.W. 1818. Neue Insecten vom Vorgebirge der guten Hoffnung. *Zoologisches Magazin* 1(2): 40-48.

Zetterstedt J.W. 1838. *Dipterologis Scandinaviae.* Sect. 3: Diptera, pp. 477-868. *Insecta Lapponica, Lipsiae [= Leipzig],* vi + 1, 140 pp.

Zetterstedt J.W. 1842-1860. *Diptera Scandinaviae, Officina Lundbergiana, Lundae [= Lund.],* Vol. 1, [before 06.09.1842]; vol. 2, pp. 441-894 [02.05.1843]; vol. 3, pp. 895-1012 [20.03.1844], 1013-1280 [09.04.1845]; vol. 4, pp. 1281-1738 [11.06.1845]; vol. 5, pp. 1739-2162[03.09.1846]; vol. 6, pp. 2163-2580 [09.06.1847]; vol. 7, pp. 2581-2934 [13.09.1848]; vol. 8, pp. 2935-3366 [12.09.1849]; vol. 9, pp. 3367-3710 [1850]; vol. 10, pp. 3711-4090 [1851]; vol. 11, pp. 4091-4545[10.03.1852]; vol. 12, pp. xx + 4547-4942 [July 1855]; vol. 13, pp. xvi+ 4943-6190 [01.091859 preface]; vol. 14, pp. iv + 6191-6609 [12.12.1860], pp. iii-xvi+440.

APPENDIX

First faunistic data on the hoverflies from the eastern Pyrenees of Girona province (Spain) collected in July/August 2020. (*) indicates the first documented record of a species for a geographical unit, i.e. the species was known from a geographical unit but without further locality details and this is the first time that locality details are provided. *Triglyphus primus* is omitted from this list because its records were advanced in a different publication.

	Nested geographical units in ascending order			
New to:	Girona	Catalonia	Spain	Iberian Pen.
Chrysotoxum lessonae				
*Xylota tarda**				
*Cheilosia hypena**				
Ceriana conopsoides				
Cheilosia aerea				
Cheilosia barbata				
Cheilosia illustrata				
Cheilosia longula				
*Cheilosia proxima**				
Cheilosia vicina				
Chrysotoxum arcuatum				
Chrysotoxum elegans				
Eristalis similis				
Eumerus grandis				
Eumerus ornatus				
Helophilus pendulus				
Melangyna umbellatarum				
Meligramma cincta				
Meliscaeva cinctella				
Sericomyia bombiforme				
Scaeva dignota				
*Sphegina elegans**				
Cheilosia latifrons				
Cheilosia variabilis				

		Nested geographical units in ascending order			
	New to:	**Girona**	**Catalonia**	**Spain**	**Iberian Pen.**
Chrysotoxum festivum		—			
Eristalinus taeniops		—			
Eristalis interrupta		—			
Eristalis jugorum		—			
Eristalis pertinax		—			
Ferdinandea cuprea		—			
Lapposyrphus lapponicus		—			
Melangyna compositarum		—			
Meliscaeva auricollis		—			
Orthonevra nobilis		—			
Parasyrphus vittiger		—			
Pipiza festiva		—			
Pipiza noctiluca		—			
Pipizella viduata		—			
Platycheirus albimanus		—			
Spilomyia manicata		—			
Syrphus torvus		—			
Volucella pellucens		—			
Xanthandrus comtus		—			
Xylota segnis		—			
Xylota sylvarum		—			