J. Entomol. Res. Soc., 12(3): 57-69, 2010 *ISSN:1302-0250*

The Genus *Ferdinandea* Rondani, 1844 (Diptera, Syrphidae) in the Iberian Peninsula: First Records and New Breeding Sites

Antonio RICARTE[1] Zorica NEDELJKOVIĆ[2] Javier QUINTO[1]
María Ángeles MARCOS-GARCÍA[1]

[1] Centro Iberoamericano de la Biodiversidad (CIBIO), University of Alicante, 03690 San Vicente del Raspeig, Alicante, SPAIN, e-mails: ricarte24@gmail.com, javier.quinto@ua.es, marcos@ua.es

[2] Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 2, 21000 Novi Sad, SERBIA, e-mail: zoricaned@hotmail.com

ABSTRACT

Following a review of all the available Iberian material belonging to the genus *Ferdinandea* Rondani, 1844, results show that the fauna of the Iberian Peninsula have all the four species recorded in the Palaearctic region: *F. aurea* Rondani 1844*, F. cuprea* (Scopoli, 1763)*, F. fumipennis* Kassebeer, 1999, and *F. ruficornis* (Fabricius, 1775). Examined material of *F. ruficornis* represents the first record from the Iberian Peninsula. A revised key to the Iberian *Ferdinandea* species is provided, as well as updated distribution maps for each of the species. Breeding sites for *F. aurea* and *F. ruficornis* are reported, in the case of *F. aurea* as the first known (in *Quercus faginea* and *Quercus pyrenaica*), and in the case of *F. ruficornis* as the first in *Q. pyrenaica*. Special attention should be paid to the conservation of *F. ruficornis*, highly restricted in its Iberian range and threatened with extinction in different European countries.

Key words: Ferdinandea ruficornis, key to species, life cycle, *Quercus*, conservation, species distribution, Iberian Peninsula

INTRODUCTION

The genus *Ferdinandea* Rondani, 1844 (Syrphidae: Eristalinae) comprises medium-sized hoverflies with strong black bristles on the thorax and scutellum, as well as dark spots on the wings (Thompson & Rotheray, 1998; Van Veen, 2004). Peck (1988) listed five *Ferdinandea* species from the Palaearctic region, *F. aurea* Rondani, 1844, *F. cuprea* (Scopoli, 1763), *F. ruficornis* (Fabricius, 1775), *F. nigrifrons* (Egger, 1860) and *F. sziladyi* Drensky, 1934, despite the taxonomic status of the latter two being unclear today (Speight, 2010). Marcos-García *et al*. (2002) and Ricarte & Marcos-García (2007) reported the occurrence of three *Ferdinandea* species in the Iberian Peninsula: *F. aurea*, *F. cuprea* and *F. fumipennis* Kassebeer 1999.

The preferred habitats of the *Ferdinandea* adults are deciduous forests, where their saproxylic larvae live in sap-runs of generally over-mature trees, mainly *Quercus*, but also in sap-runs associated with the tunnelling activity of the caterpillar of *Cossus cossus* (Linnaeus, 1758) (Rotheray, 1993). Early stages of *F. cuprea* and *F. fumipennis* are described (Hartley, 1961; Ricarte *et al*., 2007), and their breeding sites are reported (compilation of original references in Speight, 2010). *F. ruficornis* early stages are not described and breeding site data are poor and dispersed (Speight, 2010); no data for *F. aurea* are available in this respect. According to Speight (2010), *F. ruficornis* should be regarded as a threatened species at least over western Europe. The status of *F. ruficornis* in this European region seems to be related to the forestry practices that negatively influence the existence of *C. cossus* and the continuance of over-mature trees in forests (Speight, 2010). In The Danish Red Data Book *F. ruficornis* is catalogued as "Regionally Extinct" (Bygebjerg, 2007) and in countries such as Belgium, France and Germany is threatened with extinction (Speight *et al*., 2010). Taxonomy, biology, and distribution of *F. ruficornis* need to be ascertained in order to establish adequate conservation strategies.

In this study we update the knowledge of the genus *Ferdinandea* in the Iberian Peninsula by compiling all published data and examining all the available specimens from this geographic region. A taxonomic key to the Iberian *Ferdinandea* species, including the first-recorded *F. ruficornis*, is also provided, as well as other revised data on taxonomy, biology, distribution, and conservation of the species.

MATERIAL AND METHODS

Examined specimens came from different localities and belonged to the collections referred to in the text with the following acronyms: CEUA = Colección Entomológica Universidad de Alicante, University of Alicante, Spain; MNCN = Museo Nacional de Ciencias Naturales, Madrid, Spain; NS = Department of Biology and Ecology, Entomological Collection, University of Novi Sad, Serbia; RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium. Most of the specimens examined are deposited in the CEUA. Thus, to avoid unnecessary repetition, the repository of specimens is only mentioned when the material studied does not belong to CEUA. All specimens from CEUA are bar-code labelled according to a GBIF protocol and are recorded in a data base available in the Centro Iberoamericano de la Biodiversidad (CIBIO), at the University of Alicante.

Examination of specimens was complemented with a review of published data and taxonomic information from correspondence with other specialists (see "acknowledgements"). Thus the examined material of each species is divided into published (Andorran/Portuguese/Spanish specimens), new (Spanish specimens) and additional (data on non-Andorran/Portuguese/Spanish specimens, published or not, useful to perform the taxonomic study). A detailed description of the examined material is provided for new data and for some additional data, as well as for the material of MNCN, which was published several decades ago. For specimens with detailed data, the catching method was hand net (specific date), Malaise trap (period of time), and emergence trap (when specified in the text).

Authors identified the specimens based on keys and descriptions in Kassebeer (1999), Van Veen (2004) and Speight & Sarthou (2010). As a result of the taxonomic study, a revised key to the Iberian species of *Ferdinandea* is provided. Terminology on adult morphology broadly follows Thompson (1999), except for genitalia characters, which follow Kassebeer (1999). Additionally, the following sections with updated data are presented for each species: taxonomic notes, biology, world distribution, and conservation (Europe and Iberian Peninsula). Species biology, distribution and conservation status in Europe follows Speight (2010) and Speight *et al*. (2010). Criteria followed by Speight *et al*. (2010) to establish the conservation status of the species are detailed in Speight & Castella (2010). Maps were made with the software ArcView GIS 3.3®.

RESULTS

Key to adults of the Iberian species of the genus *Ferdinandea*

1. Face with a dark brown to black vitta.....*F. aurea*

- Face pale-coloured overall, without vitta.....2

2. Antennal arista orange; each of the 2nd and 3rd terga shiny except for some dull areas centrally and laterally, in both cases on the posterior part of the tergum, shiny along the full length of the posterior margin; male genitalia: ventral lobe of distiphallus with a conspicuously-elongated pointing process (about 3× longer than basiphallus).. .....*F. ruficornis*

-Antennal arista dark brown to black; each of the 2nd and 3rd terga shiny anteriorly, dull along the full length of the posterior margin; male genitalia: ventral lobe of distiphallus with a moderately-elongated pointing process (about 1.5× longer than basiphallus).....3

3. Wing membrane hyaline in veins R_{2+3} and R_{4+5} distally; antennae orange (basoflagellomere may be black apically), with dark brown to black arista; scutum with a pair of medial grey-pollinose vittae reaching the posterior margin; scutellum yellow, with lateral angles black (the black areas together occupy about 1/4 of the scutellum width in dorsal view); male genitalia: ventral lobe of distiphallus flat; dorsal lobe of basiphallus diverging for a section of about half of its total length…….....*F. cuprea*

- Wing membrane brown-pigmented in veins R_{2+3} and R_{4+5} distally; antennae black including arista; scutum with a pair of medial grey-pollinose vittae not reaching the posterior margin, or faintly reaching; scutellum yellow, with lateral angles black (the black areas together usually occupy about 1/3 of the scutellum width in dorsal view); male genitalia: ventral lobe of distiphallus conical; dorsal lobe of basiphallus diverging for a section of about 1/4 of its total length.....*F. fumipennis*

F. aurea Rondani, 1844

F. aurea Rondani, 1844: 198

Distribution: Palaearctic species confined to southern Europe: central and southern Spain, including Balearic Islands (Fig. 1), southern France, Italy and Greece.

Material examined:

Published: SPAIN: from the provinces of Cáceres, Salamanca (Marcos-García, 1985), Ciudad Real (Ricarte & Marcos-García, 2008; Ricarte, 2008) and Mallorca (Gil Collado, 1930; Compte-Sart, 1958).

New: SPAIN: Alicante: Agres: 5♂♂, Caveta del Voltor (30SYH161937, 1200m), 11.IX.2001; 1♂, 11-25.IX.2001; 1♂, 10-24.IX.2002; 2♂♂, 24.IX-7.X.2002; 1♂, Foia Ampla (30SYH169931, 1060m), 11-25.IX.2001; 1♂, 10-24.IX.2002, leg. C. Pérez-Bañón, M.A. Marcos-García & S. Rojo; Alcoy: 1♀, Font Roja, 10-24.IX.1992; 2♂♂, 8-22.X.1992, leg. F. Luna; 25♂♂ and 4♀♀, 21.IX.1993; 1♂, 29.IX.1993, leg. P.M. Isidro; 1♀, El Menejador (30SYH143819, 1350m), 27.VIII-10.IX.2002; 1♂, 22.IX.2004, leg. A. Ricarte; Jijona: 1♂, Venta de la Carrasqueta (30SYH191770, 980m), 11-26.IX.2001; 4♂♂ and 1♀, 10/24-IX-2002; 1♂, 7-21.X.2002, leg. C. Pérez-Bañón, M.A. Marcos-García & S. Rojo; 1♂ and 1♀, Mas de Sant Ignaci (30SYH187766, 1020m), 17-31.VII.2001; 2♂♂, 11-26.IX.2001, leg. C. Pérez-Bañón, M.A. Marcos-García & S. Rojo; 1♂, Mas de Cano (30SYH201775, 940m), 10-24.IX.2002, leg. C. Pérez-Bañón, M.A. Marcos-García & S. Rojo; Ciudad Real: 1♀ from larva collected in a root hole of a *Q. faginea* tree in "P.N. de Cabañeros, valle de Canalejas, 1.V.2005 by T. Jover (puparium/30.V.2005, adult/¿?, puparium was not preserved)"; collected by emergence trap: 4♂♂, Valle Santiago, trap 7, 24.9.2009, in a hole of *Q. pyrenaica*; 4♂♂ and 1♀, Valle Santiago, trap 16, 26.10.2009, in a hole of *Q. pyrenaica*; 2♀♀, trap 16, 26.10.2009, in a hole of *Q. faginea*, leg.: Micó, Quinto & Briones, det. Z. Nedeljković; 11♀♀, trap 16, in a hole of *Q. faginea*, leg.: Micó, Quinto & Briones, det.: A. Ricarte. Salamanca: 1♂, Las Veguillas, 12.IX.1979, leg. M.A. Marcos-García; Valencia: Chelva: 2♂♂, Fuente de la Esparraguera (XJ6289, 990m), 6.X.1993; 10♂♂ and 1♀, Mas de Caballero (XJ6190, 1000m), 24.IX-8.X.1994; 12♂♂ and 5♀♀, 8-22.X.1994; 7♂♂ and 2♀♀, 22.X-5.XI.1994, leg. C. Pérez-Bañón; Utiel: 1♂ and 3♀♀, Casas Medina (XJ5787, 920m), 17.X.1993; 2♂♂, Atalaya del Remedio (XJ6088, 1310m), 24.IX.1994.

Taxonomic notes

The type material of *F. aurea* was collected in Italy and is deposited in the Museo di Storia Naturale, University of Florence, Sezione "La Specola", Italy. Rondani did not designate a holotype, and described this species based on multiple specimens (Christian F. Thompson, pers. com.).

This species is unequivocally distinguished by the presence of a dark brown to black facial vitta extending from the mouth edge to the base of the antennae. The male genitalia are similar to *F. ruficornis* genitalia.

Biology (Table 1)

The preferred habitats of this species are over-mature forests of *Quercus pubescens* Willd, *Quercus ilex* L. or *Quercus suber* L. Despite larva not being described, T. Jover collected an early stage (larva or puparium) of this species in a root hole of an old *Q. faginea* Lam tree in Cabañeros National Park, Spain (puparium not preserved). Moreover, specimens collected by emergence trap in the same locality allowed an association between this *Ferdinandea* species and *Q. pyrenaica* to be established. These are the first known breeding site data on *F. aurea*. Flight period (Iberian Peninsula): mid July to beginning of December.

Conservation

Europe. Exhibiting a moderate decrease of populations. It is threatened with extinction in the Continental region *sensu* Romau (1996).

Iberian Peninsula. Although *F. aurea* populations seem to be decreasing in Europe, profuse samplings in some localities of the Iberian Peninsula have shown its high

abundance; for instance, it is the most abundant saproxylic hoverfly in Cabañeros National Park (Ricarte *et al*., 2009) and, as shown by our results, it is widespread in some protected areas of south-eastern Spain (Caveta del Voltor, Foia Ampla, El Menejador, Venta de la Carrasqueta, Mas de Sant Ignaci, Mas de Cano; all these localities belong to the Sierra de Mariola and Font Roja natural parks). Despite abundant in some localities, further studies to assess the status of *F. aurea* populations in the rest of its Iberian range are in need. The provided data on breeding sites contribute in focusing on *Quercus* forests, if protection for this species was required.

***F. cuprea* (Scopoli, 1763)**

Conops cupreus Scopoli, 1763: 355

Distribution: Palaearctic species distributed from Fennoscandia south to southern Spain (Fig. 2) and North Africa (Algeria) and round the Mediterranean through southern Europe to Turkey; from Ireland eastwards through central/northern parts of Eurasia to the Pacific coast of Siberia and Japan.

Material examined:

Published: ANDORRA: Carles-Tolrà (2006); PORTUGAL: from the former province of Minho (Corti, 1903); SPAIN: from the provinces of Vizcaya (Seebold, 1903), Asturias, Huesca, Madrid, Segovia (Arias, 1912; Gil Collado, 1930), Barcelona (Navás, 1901; Gil Collado, 1930), Cáceres, Salamaca (Marcos-García, 1985) [part as *F. nigrifrons* (Egger, 1860), except for the specimens re-identified as *F. fumipennis* in Ricarte & Marcos-García (2007)], León [Marcos-García (1990), as *F. nigrifrons*]; data on the specimens deposited in MNCN, all pre-identified as *F. cuprea*: 2♂♂, Panticosa, Escalera (MNCN_Ent Nº Cat. 41243 and 41207); 1♂ and 1♀, Escorial, Arias Encobet, Mercet, VII.1905 (MNCN_Ent Nº Cat. 41255 and 41214); 1♀, Paular (MNCN_Ent Nº Cat. 41236); 1♀, Covadonga, IIV 928 J. Dusmet (MNCN_Ent Nº Cat. 41208); 1♀, La Granja, Arias Encobet, *F. cuprea* Scop J. Gil det. (MNCN_Ent Nº Cat. 41220).

New: SPAIN: Ciudad Real: collected by emergence traps: 2♀♀, P.N. Cabañeros, El Brezoso, 23.4.2009, in a hole of *Q. pyrenaica*; 1♂, Valle Santiago, 8², 26.6.2009, in a hole of *Q. pyrenaica*, leg.: Micó, Quinto & Briones.

Additional: FRANCE: 1♂, Rambt, 30.5.04, "Coll. J. Villeneuve", *F. ruficornis* F, R.M.H.N.Beig. 15.392; 1♀, Rambouillet, 24.V.10, "Coll. J. Villeneuve", *F. ruficornis* F, R.M.H.N.Beig. 15.392; 1♀, Broût·Vernet, H. du Buysson, "Coll. J. Villeneuve", *F. ruficornis* F, R.M.H.N.Beig. 15.392 [RBINS]. All specimens deposited in RBINS were re-identified by A. Ricarte. SERBIA: specimens published in Vujić et al. (1998) and Vujić & Šimić (1994) [NS]. NON-LOCATED: 1♂, Visf., juin 80, "Collection Maurissen", Van der Wulp det.: *F. ruficornis* F.; 1♀, Aidderf, Aug 67, "Collection Maurissen", Van der Wulp det.: *F. ruficornis* F. [RBINS].

Taxonomic notes

The type specimen of *F. cuprea* was collected in "Carniola", the current province of Kranjska, Slovenia. This specimen is lost because Scopoli's collection was destroyed (Christian F. Thompson, pers. com.).

Regarding its identification: in spite of the antenna being mostly orange (antennal arista is always dark brown to black), some specimens have the basoflagellomere black apically; the scutum has four silvery-pollinose vittae and the medial pair reaches the posterior margin of the scutum; the scutellum is yellow with black corners (up

to 1/4 of the scutellum width in dorsal view is black); setae on scutellum are mostly black; both the 2nd and 3rd terga have a dull band reaching the posterior margin; some specimens show dull areas in the central and lateral parts of each of the 2nd and 3rd terga posteriorly, but in other specimens the dull areas only occur in the lateral parts posteriorly; pilosity on both posterior anepisternum and 4th sternum ranges from completely yellow to partly black.

Biology (Table 1)

The preferred habitats of this species are deciduous forests with over-mature trees, including alluvial forests of *Populus-Salix*, *Carpinus-Quercus*, acidophilous *Quercus* forests and *Q. pubescens* and *Betula* forests. Larvae are found in semi-aqueous material in *Populus* trees damaged by *C. cossus* L. They have also been collected in tree wounds and sap runs on the trunks of living deciduous trees (*Quercus, Acer, Aesculus, Betula, Malus, Populus, Salix and Ulmus*). We report a hole in *Q. pyrenaica* as a new breeding site for this species. Flight period (Iberian Peninsula): March-September, not found in June.

Conservation

Europe. Widespread and unthreatened.

Iberian Peninsula. Restricted exclusively to the northern half of the Peninsula (Fig. 2). It is not as locally-abundant as *F. aurea* or *F. fumipennis* (e.g., see Ricarte *et al*., 2009), even in northern localities (Marcos-García, 1985). There are no enough data to regard *F. cuprea* as threatened in the Iberian Peninsula but it appear to be rarer than *F. aurea* and *F. fumipennis*.

Table 1. New and reviewed data on associations *Ferdinandea*-tree. Bold lettering identifies new *Ferdinandea*-tree associations.

***Ferdinandea* species**	**Breeding tree**
F. aurea	***Quercus pyrenaica, Q. faginea***
F. cuprea	*Acer*, *Aesculus*, *Betula*, *Malus*, *Populus*, *Quercus* (including *Q. pubescens* and ***Q. pyrenaica***), *Salix*, *Ulmus*
F. fumipennis	*Q. pyrenaica*
F. ruficornis	reared from sappy material in the burrows of *Cossus cossus* caterpillars in *Quercus*; ***Q. pyrenaica***

***F. fumipennis* Kassebeer, 1999**

F. fumipennis Kassebeer, 1999: 155

Distribution: Ibero-Maghreb endemic reported from Spain, including Balearic Islands (Fig. 3), Morocco and Tunisia.

Material examined:

Published: SPAIN: from the provinces of Alicante, Ciudad Real, Mallorca, Murcia, Salamanca and Valencia (Ricarte & Marcos-García, 2007; Ricarte *et al*., 2007; Carles-Tolrà & Lencina, 2010).

New: SPAIN: Alicante: Jijona: 1♂, Venta de la Carrasqueta, 10-23.IV.2002 [NS]; 1♂, 23.IV-15.V.2002, leg. C. Pérez-Bañón, M.A. Marcos-García & S. Rojo; 1♀, Alcoy, Font Roja, 15.III.1994, leg. P.M. Isidro; Ciudad Real: P.N. Cabañeros: 1♀, maJ2 (*Q. pyrenaica* forest, 30S371749-4359712), 5-29.X.2004; 1♂,

18.III-12.IV.2005; 1♂, maF1 (riparian forest of *Fraxinus angustifolia*, 30S365590-4367922), 26.II-19.III.2005; 1♂, maF2 (riparian formation of *F. angustifolia*, 30S365590-4367922), 28.X-18.XI.2004; 1♀, 19.III-13.IV.2005, leg. A. Ricarte; Salamanca: 2♀♀, Dehesa campanario de Azaba, 13.IV.2010, leg.: M.A. Marcos-García (1♀, "point 8, ovipositing in *Q. pyrenaica*"; 1♀, "encina E_19_1, white sap run").

Taxonomic notes

The holotype of *F. fumipennis* was collected in Morocco and, according to Kassebeer (1999), belongs to the collection abbreviated as "DID" (?). The holotype is lost, probably belonging to the private collection of Christian F. Kassebeer. Kassebeer (1999) states that there are several male and female paratypes from Morocco and Tunisia deposited in the Zoological Museum, Natural History Museum of Denmark, Copenhagen, but there is no record of this material in the checklist of the Syrphidae types from this museum (http://zoologi.snm.ku.dk/english/).

Regarding its identification: this species is very similar to *F. cuprea*; to separate the females of both species, the wing pigmentation is a key character, since in *F. fumipennis* the wing presents dark brown pigmentation on the membrane close to veins R_{2+3} and R_{4+5} distally; some body parts (antennae, scutellum, etc.) are darker in *F. fumipennis* males than in *F. cuprea* males, and the genitalia are the only distinctive character to separate the males of both species; *F. fumipennis* has black antenna, including arista, and the black areas of the scutellum are usually larger than in *F. cuprea*; additionally, the pair of medial silvery-pollinose vittae on the scutum does not reach, at least so conspicuously, the posterior margin. Kassebeer (1999) figured the male genitalia and he remarked that the main difference between these two closely-related species is the structure of the hypopygium, especially in the basiphallus and the distiphallus. In *F. fumipennis* the dorsal lobe of the basiphallus diverges along 1/4 of its total length, but in *F. cuprea* along 1/2 of its total length; in *F. fumipennis* the ventral lobe of the distiphallus is a rounded cone in shape, but in *F. cuprea* it is flat; in *F. fumipennis* the dorsal lobe of the distiphallus is a tapering pointing-at-the-apex process engrossed basally, but in *F. cuprea* it is either not engrossed or only gently engrossed.

Biology (Table 1)

The preferred habitats of this species are acidophilous oak forests of *Q. pyrenaica* Willd and riparian forests of *Fraxinus angustifolia* Vahl. Larvae have been found in material collected from a sap-run on the trunk of a live *Q. pyrenaica* (Ricarte *et al*., 2007). Flight period (Iberian Peninsula): late February to mid November, not found in June and August.

Conservation

Europe. Unthreatened species, despite being restricted to the Iberian Peninsula.

Iberian Peninsula. *F. fumipennis* is an Ibero-Maghreb endemic occurring in the southern half of the Iberian Peninsula and in the Balearic Islands (Fig. 3). It is locally more abundant than the closely related *F. cuprea* and appears to be the second most common species, after *F. aurea*. Despite abundant, the conservation of *F. fumipennis* in the Iberian Peninsula stays relevant because this region represents its only known European redoubt.

***F. ruficornis* (Fabricius, 1775)**

Syrphus ruficornis Fabricius, 1775: 769

First record for the Iberian Peninsula

Distribution: From Denmark south to central Spain (Fig. 4); from Britain eastwards through central and southern Europe into European Russia and the Caucasus, and through Siberia and Uzbekistan to the Pacific; northern China.

Material examined:

New: SPAIN: Ciudad Real: P.N. Cabañeros: 1♀, maJ1 (*Q. pyrenaica* forest, 30S371749-4359712), 1-24.VIII.2004; 2♂♂ and 1♀, 18.III-12.IV.2005; 1♀, 30.V-10.VI.2004; 1♀, maJ2 (*Q. pyrenaica* forest, 30S371749-4359712), 24.VIII-12.IX.2004; 1♂, 18.III-12.IV.2005, leg.: A. Ricarte; xPa1, 1♀, 8.IV.2005 (30S379778-4357230, flying around a mature *Q. pyrenaica* tree), leg.: E. Galante [as *F. fumipennis* in Ricarte and Marcos-García (2007)]; collected by emergence trap: 2♂♂ and 4♀♀, El Brezoso (*Q. pyrenaica* forest, 30S383132-4357017, 750m), 26.X.2009, in a hole of *Q. pyrenaica* (this trunk hole contained a sap run exuding and flowing into the hole), leg.: Micó, Quinto & Briones.

Additional: FRANCE: 1♀, Rambouillet, 10.8.04, "Coll. J. Villeneuve": *F. ruficornis* F, R.M.H.N.Beig. 15.392 [RBINS]. All specimens deposited in RBINS were re-identified by A. Ricarte 2010. SERBIA: specimens published in Vujić & Šimić (1994) [NS]. NETHERLANDS: 1♀, Nedlth, 10/6 86, "Collection Maurissen", Van der Wulp det.: *F. ruficornis* F [RBINS]. NON-LOCATED: 1♀, *Chrys. ruficornis* Fbr., "Coll. J. Villeneuve": *F. ruficornis* F, R.M.H.N.Beig. 15.392 [RBINS].

Taxonomic notes

Fabricius did not designated a holotype nor indicate the number of specimens forming the type series (Christian F. Thompson, pers. com.). The only known type specimen of *F. ruficornis* is a female collected in Dania (Denmark), deposited in the collection of the Natural History Museum of Denmark, Zoological Museum, Copenhagen, Denmark. This specimen is in poor condition because it has been attacked by *Anthrenus* (Thomas Pape, pers. com.) and only wings plus head and a part of the thorax remain; antennae are partially missing and no arista is preserved.

Regarding its identification: *F. ruficornis* has the characteristically orange to light brown arista, but it is never as black as in *F. fumipennis* (sometimes in *F. cuprea*); scutellum has mostly yellow setae; both the 2nd and 3rd terga have shiny areas centrally and laterally, but also have dull areas centrally and postero-laterally; the posterior margin of each of the 2nd and 3rd terga is shiny.

The examined Iberian specimens have only yellow hairs on 2nd and 3rd terga, except for one specimen from Cabañeros that has a few black hairs on the 3rd tergum posteriorly. Some additional specimens from Great Britain and the Czech Republic presented black hairs on 2nd and 3rd terga, sometimes only on 3rd tergum. Also a specimen from Sweden with black hairs on 3rd tergum is known (Wouter van Steenis, in lit.). Specimens with black hairs at least on 3rd tergum also have black hairs on 3rd and 4th sterna. In specimens without black hairs on terga, there are no black hairs on sterna.

Biology (Table 1)

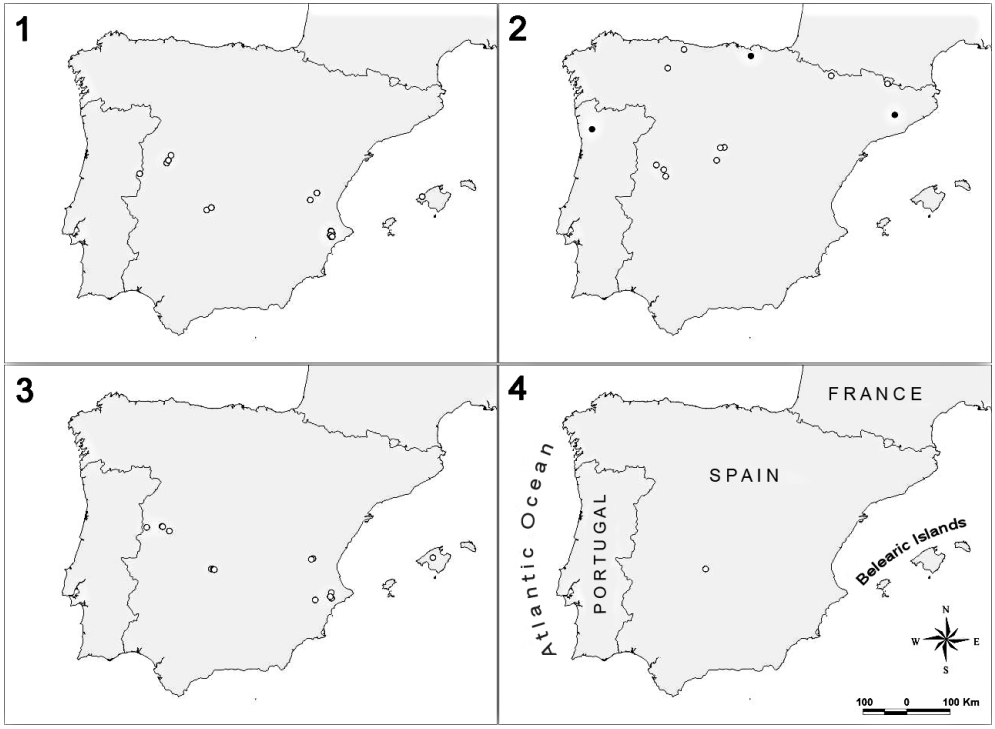
The preferred habitats of this species are *Quercus* forests and alluvial hardwood forests. The larva is not described, but has been reared from sappy material in the

burrows of *C. cossus* caterpillars. We report *Q. pyrenaica* as a breeding site of this species. Flight period (Iberian Peninsula): mid March to October, not found in July.

Conservation

Europe. Threatened with extinction, but in a more alarming situation at regional level in different states of western Europe. The high dependence of *F. ruficornis* on the declining moth *C. cossus* and on over-mature trees ensures the hoverfly's scarcity.

Iberian Peninsula. Despite *Ferdinandea* hoverflies have been recorded throughout the Iberian Peninsula, *F. ruficornis* is only known from the locality provided in this study (Cabañeros National Park). It certainly is a rare species, probably threatened with extinction at Iberian level. According to our results, Iberian populations of *F. ruficornis* highly depend on over-mature forests of *Q. pyrenaica*.



Figs 1–4. Distribution of the *Ferdinandea* species in the Iberian Peninsula and Balearic Islands. 1. *F. aurea*; 2. *F. cuprea*; 3. *F. fumipennis*; 4. *F. ruficornis*. In Fig. 2 a black circle indicates the locality of a published *F. cuprea* specimen which was unavailable for the authors of this study.

CONCLUSIONS AND DISCUSSION

Following this study, the four species cited for the Palaearctic region result in forming the *Ferdinandea* fauna of the Iberian Peninsula: *F. aurea, F. cuprea, F. fumipennis* and *F. ruficornis*. The first record for the Iberian Peninsula of *F. ruficornis* is provided, as well as the first records of *F. aurea* for each of the Mediterranean Spanish provinces of

Alicante and Valencia. Especially relevant are the records of *F. ruficornis*, threatened with extinction in different European areas (Speight *et al.*, 2010). *F. ruficornis* appears to be a species with a very restricted distribution in the Iberian Peninsula and certainly could be considered of special relevance at conservation level, since it has only been found in a protected area in central Spain (Cabañeros National Park). In Cabañeros, all the Iberian *Ferdinandea* species have been collected in different localities of several habitat types (Ricarte & Marcos-García, 2008), but *F. ruficornis* only was collected in a couple of *Q. pyrenaica* forests, which in some ways suggests a degree of association with this tree species in the Mediterranean region. The specimens of *F. ruficornis* collected by emergence trap in *Q. pyrenaica* trees indicate that larva lives in rot-holes of this tree species. These new data about *F. ruficornis* contribute to the conservation value of the *Q. pyrenaica* forests, which have been shown as one of the most species-rich habitats in Cabañeros (Ricarte & Marcos-García, 2008). Thus *Q. pyrenaica* forests are each time more and more consolidated as one of the priority habitats for conservation in central Spain.

At taxonomic level, *F. ruficornis* shows a marked intra-specific variability in some characters. For instance, there are specimens with black hairs, at least, on 3rd tergum, but other specimens have only yellow hairs on terga. This fact explains the non-adjustment of most of the Iberian specimens to the key in Speight & Sarthou (2010), which is based only on specimens with black hairs on 2nd and 3rd terga. The variability is not only in the tergal hairs but also in the sternal hairs, which are from all yellow to partly black. Differences in these characters suggest the possibility to test the unity of this taxon by future molecular analyses, and by assessing new characters studied in recent works such as that in Doczkal & Pape (2009). These analyses may show the presence of cryptic species within *F. ruficornis*, as has been reported in other Eristalinae hoverflies (e.g. Mengual *et al*., 2006; Ståhls *et al*., 2009).

The type of *F. cuprea* is apparently lost forever; then a neotype may be designated to fix the concept of *F. cuprea*, not so evident after the recent description of closely-related species such as *F. fumipennis*, and the high variability in colouration reported for *Ferdinandea* species (Kassebeer, 1999). In spite of *F. aurea* seems to be a distinctive species, a holotype should also be designated amongst the specimens that Rondani used to base the original description (Ricarte *et a*l., in prep).

Data on the breeding trees of *F. aurea* (rot-holes in *Q. faginea* and *Q. pyrenaica* trees; Table 1) are important because it is the first known information on the life cycle of this hoverfly species. Despite *Q. faginea* also being present in north-Africa, its European distribution is restricted to the south of the Iberian Peninsula, and also the south of France and Italy, in accordance with a similar distribution of *F. aurea*. *Q. pyrenaica* seem to be a broadly used tree species for breeding by *Ferdinandea* species, as the larvae of all the Iberian species live on it (Table 1).

According to the maps provided, the Mediterranean character is evident of both *F. aurea* and *F. fumipennis*, which are distributed in the southern half of the Iberian Peninsula. *F. cuprea* is distributed in the northern half of the Iberian Peninsula, but central Spain represents a connecting area between both faunas. We remark the

high relevance of Cabañeros as a protected area in this connecting region of the Iberian Peninsula.

An extra effort should be made to find the early stages of *F. aurea* and *F. ruficornis*. This is to know their full life cycles and ecological requirements, and provide a more robust base to conserve a typically-Mediterranean species and an endangered species, respectively (Speight *et al*., 2010). In the same line, the taxonomy of *F. ruficornis* at Palaearctic level should be definitively clarified to assess its real conservation status. The present paper means a first approach to the taxonomy of the genus *Ferdinandea* by studying the Iberian material of this genus and remarking some of the taxonomic problems to be solved in the future (Ricarte *et al*., in prep).

ACKNOWLEDGEMENTS

We kindly thank to Dr. Martin Speight and Dr. Wouter Dekoninck for arranging loans of specimens, as well as to Menno Reemer, Martin Speight, Christian F. Thompson, and Henri Dirickx for providing useful information on the studied species. Financial support was provided by the Spanish “Ministerio de Ciencia e Innovación” (GBIF project, CGL2008-03310-E/BOS; CGL2009-09656-BOS), “Ministerio de Educación” (CGL2008-04472), the Serbian Ministry of Science and Tehnological Development (scholarship 451-03-0814/2008-02/365; project 143037) and the European Union (Life/NAT/E/000762).

REFERENCES

Arias, J., 1912, Datos para el conocimiento de la distribución geográfica de los Dípteros de España. *Memorias de la Real Sociedad Española de Historia Natural*, 7: 204-209.

Bygebjerg, R., 2007, *Ferdinandea ruficornis* (Fabricius, 1775). *In* The Danish Red Data Book on line, http://www2.dmu.dk/1_Om_DMU/2_Tvaer-funk/3_fdc_bio/projekter/redlist/redlist_en.asp (07.10.2010).

Carles-Tolrà, M., 2006, Sírfidos nuevos para Andorra y la Península Ibérica (Diptera: Syrphidae). *Heteropterus Revista de Entomología*, 6: 145-156.

Carles-Tolrà, M., Lencina, J. L., 2010, Algunos dípteros capturados en la Región de Murcia, y otras provincias españolas, mediante trampas de interceptación de vuelo (España) (Insecta, Diptera). *Boletín de la Sociedad Entomológica Aragonesa*, 46: 483-489.

Compte-Sart, A., 1958, Los sírfidos de las Islas Baleares. *Boletín de la Sociedad de Historia Natural de Baleares*, 4: 25-49.

Corti, E., 1903, (Some Dipterans from Portugal). *Rendiconti dell'Istituto Lombardo di Scienze e Lettere*, 36 (2): 1068-1077. (In Italian)

Doczkal, D., Pape, T., 2009, *Lyneborgimyia magnifica* gen. et sp.n. (Diptera: Syrphidae) from Tanzania, with a phylogenetic analysis of the Eumerini using new morphological characters. *Systematic Entomology*, 34: 559-573.

Gil Collado, J., 1930, *Monografía de los sírfidos de España*, Trabajos del Museo Nacional de Ciencias Naturales, Serie Zoológica, núm. 54, Spain, Madrid, 376.

Hartley, J. C., 1961, A taxonomic account of the larvae of some British Syrphidae. *Proceedings of the Zoological Society of London*, 136: 505-573.

Kassebeer, C. F., 1999, Eine neue Art der Gattung *Ferdinandea* Rondani, 1844 (Diptera: Syrphidae) aus Nordafrika. *Dipteron*, 2: 153-162.

Marcos-García, M. A., 1985, Los Syrphidae (Dip.) de las sierras occidentales del Sistema Central español. Subfamilias: Eristalinae, Lampettiinae, Microdontinae, Milesiinae y Cerianinae). *Boletín de la Asociación española de Entomología*, 9: 187-210.

Marcos-García, M. A., 1990, Catálogo preliminar de los Syrphidae (Diptera) de la Cordillera Cantábrica (España). *EOS-Revista Española de Entomología*, 66(2): 83-100.

Marcos-García, M. A., Rojo, S., Pérez-Bañón, C., 2002, *Family Syrphidae*. *In* Sociedad Entomológica Aragonesa (SEA) (Ed.). Catálogo de los Dípteros de España, Portugal y Andorra (Insecta). Zaragoza (España), Monografias SEA, 8:132-136.

Mengual, X., Ståhls, G., Vujić, A., Marcos-García, M. A., 2006, Integrative taxonomy of Iberian *Merodon* species (Diptera, Syrphidae). *Zootaxa*, 1377: 1-26.

Navás, L., 1901, Dípteros de España, por el P. Gabriel Strobl. (Nota bibliográfica). Boletín de la Sociedad Española de Historia Natural, 1: 226.

Peck, L. V., 1988, *Syrphidae*. *In*: Soos A, Papp L (Eds.). Catalogue of Palaearctic Diptera, 8. Akad. Kiado, Budapest, 11-230.

Ricarte, A., 2008, *Biodiversidad de sírfidos (Diptera: Syrphidae) y conservación de los hábitats en el Parque Nacional de Cabañeros, España* [Digital], Universidad de Alicante, 244.

Ricarte, A., Marcos-García, M. A., 2007, *Ferdinandea fumipennis* Kassebeer, 1999 (Diptera: Syrphidae), nueva especie para el continente europeo. *Boletín de la Asociación española de Entomología*, 31: 205-208.

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., Pérez-Bañón, C., Rotheray, G. E., 2007, The early stages and breeding sites of four rare saproxylic hoverflies (Diptera: Syrphidae) from Spain. *Journal of Natural History*, 41: 1717-1730.

Ricarte, A., Jover, T., Marcos-García, M. A., Micó, E., Brustel, H., 2009, Saproxylic beetles (Coleoptera) and hoverflies (Diptera: Syrphidae) from a Mediterranean forest: towards a better understanding of their biology for species conservation. *Journal of Natural History*, 43: 583-607.

Romau, C., 1996, *Interpretation Manual of European Union habitats*, version EUR 15, European Commission, Brussels, 102.

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

Seebold, T., 1903, Dípteros de los alrededores de Bilbao. *Boletín de la Sociedad Española de Historia Natural*, 3: 145-148.

Speight, M. C. D., 2010, *Species accounts of European Syrphidae (Diptera) 2010*, Syrph the Net, the database of European Syrphidae, vol. 59, Syrph the Net publications, Dublin, Ireland, 285.

Speight, M. C. D., Castella, E., 2010, *StN Database: content and glossary of terms. 2010*. Syrph the Net, the database of European Syrphidae, Syrph the Net publications, Dublin, Ireland, 61: 83.

Speight, M. C. D., Sarthou, J. P., 2010, *StN keys for the identification of adult European Syrphidae (Diptera) 2010/Clés StN pour la détermination des adultes des Syrphidae Européens (Diptères) 2010*. Syrph the Net, the database of European Syrphidae, Syrph the Net publications, Dublin, Ireland, 60: 113.

Speight, M. C. D., Monteil, C., Castella, E., Sarthou, J. P., 2010, StN 2010. *Syrph the Net on CD, The database of European Syrphidae*, *In*: Speight, M. C. D., Castella, E., Sarthou, J.- P. & Monteil, C. (Eds.). Syrph the Net Publications, Dublin, *Issue 7.*

Ståhls, G., Vujić, A., Pérez-Bañón, C., Rojo, S., Petanidou, T., 2009, COI barcodes for identification of *Merodon* hoverflies (Diptera, Syrphidae) of Lesvos Island (Greece). *Molecular Ecology Resources*, 9: 1431-1438.

Thompson, F. C., 1999, A key to the genera of the flower flies of the Neotropical Region with the description of two new genera and eight new species. *Contributions on Entomology, International*, 3: 319-378.

Thompson, F. C., Rotheray, G. E., 1998, *Family Syrphidae. In*: Papp, L., Darvas, B. (Eds.). Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance). Higher Brachycera 3. Science Herald, Budapest, 81-139.

Van Veen, M., 2004, *Hoverflies of Northwest Europe.* KNNV Publishing, Utrecht, Netherlands, 254.

Vujić, A., Šimić, S., 1994, *(Syrphidae (Insecta: Diptera) of the Vršačke Planine Mts, Monograph on Vršačke Planine)*. Matica Srpska, Novi Sad, Serbia, 163. (in Serbian)

Vujić, A., Šimić, S., Milankov, V., Radović, D., Radišić, P., Radnović, D., 1998, *(The fauna of Syrphidae (Insecta: Diptera) of Obedska Bara. Importance and needs for protection)*. Zavod za zaštitu prirode Srbije, Beograd, Serbia, 71. (in Serbian)

Received: July 12, 2010 *Accepted: October 19, 2010*