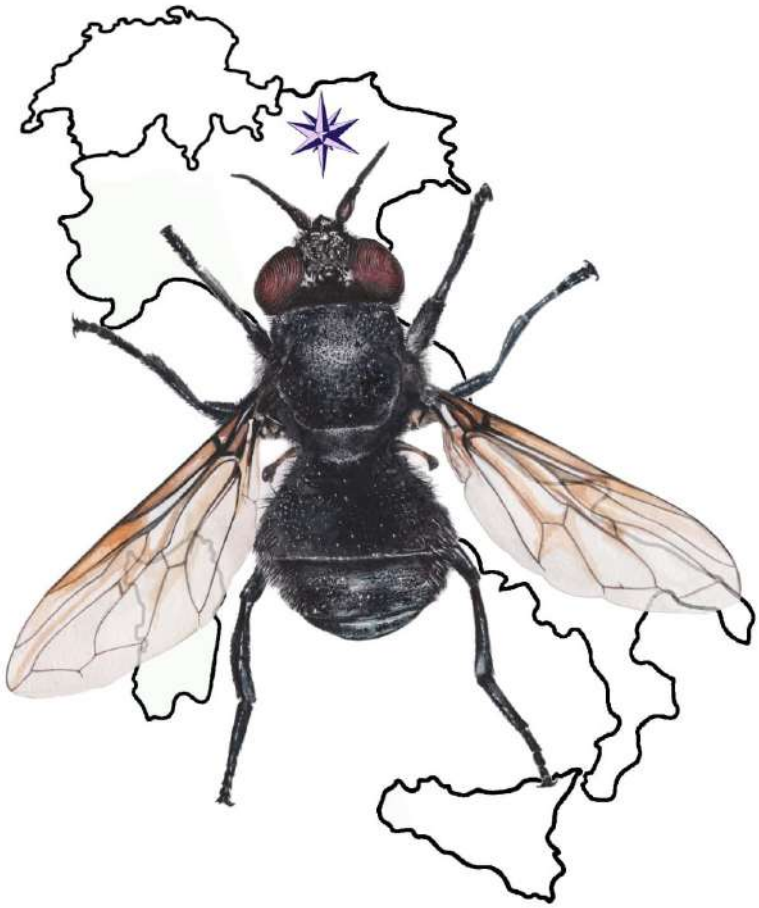
13th International Symposium on Syrphidae

22 – 27 June 2026

Primiero San Martino di Castrozza, Italy



BOOK OF ABSTRACTS

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Introduction

Twenty-five years after its first edition in Stuttgart, the International Symposium on Syrphidae reaches its thirteenth edition. For the first time in the history of the Symposium, and in the spirit of collaboration that has always characterised our community, this edition is jointly organised by two countries: Italy and Switzerland.

The aim of the Symposium is to bring together the broad and collaborative community of syrphid researchers, providing a forum to share ideas, projects, and results on this remarkable and ecologically important group of insects. This year's meeting takes place in an area of outstanding natural and scenic value: the Paneveggio – Pale di San Martino Natural Park, in the heart of the Dolomites, a region long appreciated by syrphidologists for its exceptional biodiversity.

This is the most extensive edition to date, both in terms of participants and scientific contributions. A total of 96 attendees from across the world — predominantly from Europe, but also from Canada, the USA, Algeria, Hong Kong, and Colombia — reflects the vitality and international reach of our community.

The scientific programme is rich and diverse, covering topics ranging from syrphid phylogeny to their role as pollinators, from faunistics to sampling methodologies. It includes 39 talks, 4 keynote speakers, and 31 posters, complemented by 12 presentations from European projects forming a special session that reflects the growing attention of policy makers and institutions toward syrphids and their ecological importance.

We warmly thank all participants and all those who contributed to the organisation of this event. Our special thanks go to the Paneveggio – Pale di San Martino Natural Park for hosting us. We are confident that these days together will offer a valuable opportunity for discussion, collaboration, and scientific advancement on this extraordinary family of insects.

Welcome to the 13th International Symposium on Syrphidae.

The Organizing Committee

Programme

Monday, 22 June 2026

15.30–17.30	Arrival and Registration
17.30–18.30	**Walking Tour** in Fiera di Primiero
19.30	**Welcome Dinner** (Hotel El Mondin)

Tuesday, 23 June 2026

8.00–8.45	Registration and Poster installation
8.45–9.15	Welcome Speech

SESSION 1: FAUNISTICS AND BIOGEOGRAPHY

Session chairs: Menno Reemer / Axel Ssymank

9.15–9.45	KURT JORDAENS: Towards a new catalogue of the Syrphidae (Diptera) of the Afrotropical region
9.45–10.00	THOMAS ROMIG: Syrphidae of Armenia
10.00–10.15	SANDER BOT: The hoverflies of Azerbaijan: New records and insights into the fauna
10.15–11.00	Coffee Break
11.00–11.15	SNEŽANA RADENKOVIĆ: A contribution to the *Eumerus* Meigen, 1822 (Diptera: Syrphidae) fauna of South Africa
11.15–11.30	DANIELE SOMMAGGIO: Old data, new information: Syrphidae of Italy, one tool to rule all knowledge of Italian hoverflies
11.30–11.45	HINATEA ARIEY: Hoverfly Atlas of Luxembourg
11.45–12.00	KELVIN K. L. WU: Hoverflies of Hong Kong
12.00–12.15	ANA GRKOVIĆ: First European records of two non-native *Eumerus* Meigen species (Diptera: Syrphidae) and taxonomic updates to the European *Eumerus* fauna
12.15–12.30	FRANK VAN DE MEUTTER: Drinking site surveys yield a distinct hoverfly assemblage enriched in arboreal species
12.30–14.15	**Lunch** (Hotel Brunet)

SESSION 2: ECOSYSTEM SERVICES

Session chairs: Giovanni Burgio / Snežana Popov

14.15–14.45	MARÍA ÁNGELES MARCOS-GARCÍA: Silent allies: The dual role of Syrphids in sustainable agriculture
14.45–15.00	FRANCIS GILBERT: Do predatory syrphids control pests?
15.00–15.15	FRANCESCO LUNARDELLI: Increase hoverfly (Diptera: Syrphidae) functional biodiversity to improve ecological services in agroecosystems

15.15–15.30	GIOELE TOSELLI: Evaluation of hoverfly (Diptera: Syrphidae) communities in contrasting agricultural landscapes using three different sampling methods
15.30–15.45	AGATA MORELLI: Understanding the local habitat and landscape drivers of urban hoverfly communities
15.45–16.30	Coffee Break
16.30–16.45	SERENA MAGAGNOLI: Syrphidae (Diptera) within insect pollinator communities under climate change: Insights from a pollen metabarcoding study in a Northern Italian national park
16.45–17.00	LISA CABIDDU: A hoverfly perspective on pesticide toxicity: *Sphaerophoria rueppellii*
17.00–17.15	LAURA ZAVATTA: Differential compatibility of essential oil nanoemulsions with aphid predators: High selectivity towards Syrphidae compared to Ladybugs and Lacewings
17.15–17.30	ALEKSANDRA ĐORĐEVIĆ: Flower-Insect Timed (FIT) counts within Pollinator Monitoring Scheme (PoMS) in Serbia
17.30–17.45	Poster Presentation
17.45–18.30	Poster Session
From 20.30	Discussion on transect walks methodology with WOUTER VAN STEENIS

Wednesday, 24 June 2026

SESSION 3: TAXONOMY AND PHYLOGENY

Session chairs: Gunilla Ståhls / Tamara Tot

9.00–9.30	XIMO MENGUAL: Systematics and phylogenetics of Syrphidae: A 20-years overview
9.30–9.45	KEVIN MORAN: The limits of the subfamily Eristalinae revealed at last
9.45–10.00	PABLO AGUADO-ARANDA: Taxonomic diversity in the *Eumerus obliquus* (Fabricius) species group (Diptera: Syrphidae)
10.00–10.15	FRANK VAN DE MEUTTER: A review of the West-Palaearctic species of the *Myolepta vara* subgroup with the description of four new species
10.15–11.00	Coffee Break
11.00–11.15	SANDER BOT: Review of the genus *Cheilosia* Meigen, 1822 (Diptera: Syrphidae) from Mongolia
11.15–11.30	ANĐELA ŠVARC: Revision of Western Palaearctic species of *Merodon geniculatus* group (Diptera: Syrphidae)
11.30–11.45	IVA GORŠE: A genome-wide perspective on taxa boundaries within *Merodon avidus* complex (Diptera: Syrphidae)
11.45–12.00	LAURA LIKOV: Taxonomic updates on the *Merodon fulcratus* and *M. spinitarsis* species groups, with notes on *M. crassicornis* (Diptera: Syrphidae)

12.00–12.15	ANDREA ARACIL: Enhancing hoverfly taxonomy training through gamification: Educational materials from the EPIC-FLY project
12.15–14.00	**Lunch** (Hotel Brunet)

SESSION 4: BIOLOGY AND ECOLOGY

Session chairs: Frank Van de Meutter / Celeste Pérez-Bañón

14.00–14.30	JIŘÍ HADRAVA: Hoverflies in Central European plant-pollinator networks
14.30–14.45	ADRIÁN BOSQUET-NAVARRO: Preliminary insights into ovarian development and oogenesis in *Myathropa florea* (Diptera: Syrphidae) under captive rearing conditions
14.45–15.00	UMBERTO MARITANO: Microbial–saproxylic hoverfly interactions in tree sap runs: Insights from the MICRO-SAPRO project (North-Western Italy)
15.00–15.15	MARIJA MILIČIĆ: European hoverfly trait and distribution data compilation: Achievements and future perspectives
15.15–15.30	ALINE SCHWENDER: Hoverflies in Austria: How habitats shape diversity
15.30–15.45	ANDREW DAYER: Seeing the unseeable- Ultraviolet reflectance, aposematism and mimicry
15.45–16.30	**Coffee Break**
16.30–16.45	ANTONÍN HLAVÁČEK: Migration of hoverflies revisited: Insights from seven years of observations
16.45–17.00	SCOTT C. CLEM: Syrphing the wind: Long-distance seasonal migration in *Eupeodes americanus* hoverflies in eastern North America
17.00–17.15	WOUT OPDEKAMP: Notes on the habitat preferences of *Tropidia fasciata* Meigen, 1822 and *Eumerus ruficornis* Meigen, 1822 in Belgium
17.15–17.30	HELENA PIJÁLKOVÁ: Distribution changes of Andean hoverflies *Dolichogyna* (Diptera: Syrphidae) during late Quaternary
17.30–17.45	SANTOS ROJO: First record of the *Eumerus tricolor* species group (Diptera: Syrphidae) in the Canary Islands, revealing a previously overlooked phytophagous association with holoparasitic broomrapes (Orobanchaceae)
17.45–18.00	**Poster Presentation**
18.00–18.45	**Poster Session**

Thursday, 25 June 2026

SPECIAL SESSION EU PROJECTS

Session chairs: Daniele Sommaggio / Wouter van Steenis

9.00–9.30	VUJADIN KOVACEVIC: A new deal for pollinators for the EU: Knowledge, actions, monitoring
9.30–9.40	CELESTE PÉREZ-BAÑÓN: Capacity building in hoverfly para-taxonomy: EPIC-Fly project
9.40–9.50	MARIJA MILIČIĆ: From data availability to usability: European hoverfly trait and distribution data
9.50–10.00	TAMARA TOT: TETTRIs – Digitizing Balkan pollinator diversity: The Balkan PolliS project
10.00–10.10	ANTONIO RICARTE: INC-STEP: Instigating a national reference collection for Spain's threatened pollinators, 3PP TETTRIs
10.10–10.40	**Coffee Break**
10.40–10.50	ANTE VUJIĆ & LAURA LIKOV: Safeguard – Safeguarding European wild pollinators & IUCN European Red List of Hoverflies
10.50–11.00	GUNILLA STÅHLS: Taxo-Fly – Taxonomic resources for European hoverflies
11.00–11.10	LORENZO MARINI: PollHab – Pollinators typical of habitats protected under the Habitats Directive
11.10–11.20	SNEŽANA POPOV & NIAMH PHELAN: Action Plans for conservation of threatened pollinator species in the EU- IUCN project
11.20–11.30	AXEL SSYMANK: National initiatives – Germany
11.30–11.40	SNEŽANA RADENKOVIĆ: SPAS – Serbian Pollinator Advice Strategy
11.40–11.50	UMBERTO MARITANO: European-funded initiatives on hoverflies (Diptera: Syrphidae) in Italy: From saproxylic ecology to conservation and first national red list IUCN
11.50–12.30	**Plenary Discussion**
12.30–14.15	**Group Photo and Lunch** (Hotel Brunet)

SESSION 4: BIOLOGY AND ECOLOGY: MONITORING

Session chairs: Gabriel Nève / Ana Grković

14.15–14.30	WOUTER VAN STEENIS: Relevance of observation probability for interpretation of transect counts of hoverflies (Diptera: Syrphidae)
14.30–14.45	DAVID BENNETT: Comparison of pollinator species detected with different configurations of InsectDetect camera platforms with conventional monitoring methods
14.45–15.00	JOHANNES UHLER: From design to implementation: Insights from six years of hoverfly (Diptera: Syrphidae) monitoring
15.00–15.15	THEO ZEEGERS: Dutch experiences with monitoring hoverflies (Diptera: Syrphidae) and bees (Hymenoptera: Apoidea)

15.15–15.30	EELKE JONGEJANS: Weather effects in analyses of hoverfly trends and responses to new landscape elements
15.30–16.15	Coffee Break
16.15–16.45	Announcement of winners of best student presentations and posters and announcement of Pollinator Champions
16.45–17.00	Information about excursion
17.00–17.30	Closing remarks and open questions
17.30-19.00	Special event (open to the public) at the town library (held in italian)
	DANIELE SOMMAGGIO: Sentinelle dalla nostra parte. Il sottile confine della biodiversità
19.30	Gala Dinner (Hotel El Mondin)

Friday, 26 June 2026

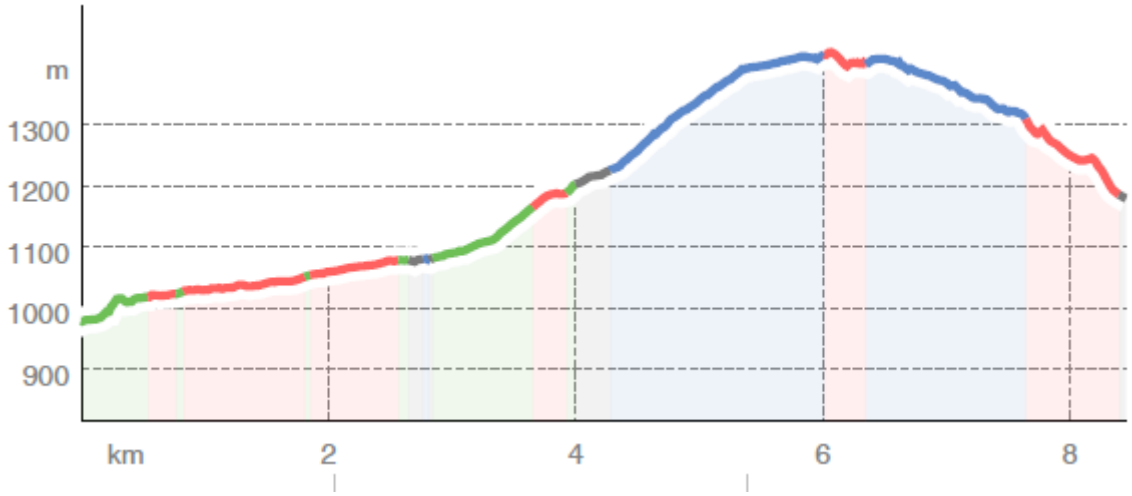
EXCURSION

10.00-17.55	Long Itinerary
11.00-15.50	Short Itinerary

Long Itinerary

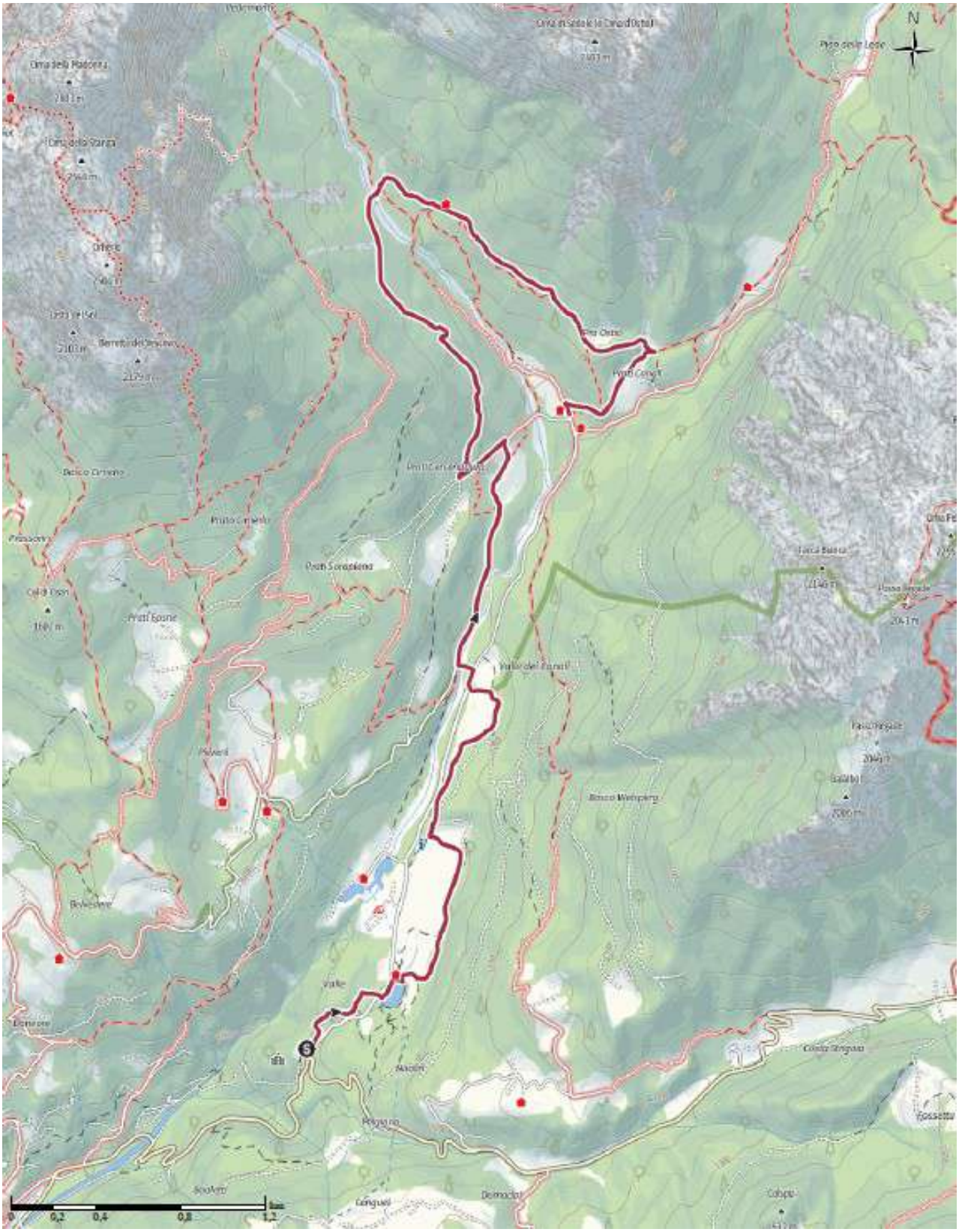
Cesurette – Villa Welsperg – Malga Pradidali – Malga Canali – La Ritonda
Difficulty: **medium**
Distance: **8,5 Km**
Hiking time: **4:15 h**
Ascent: **441 m**
Descent: **240 m**
Highest point: **1,418 m a.s.l.**
Lowest point: **978 m a.s.l.**
Main habitats: **beech forest, spruce forest, hay meadow, carbonate rock outcrops**
Bedrock: **carbonate (Dolomite)**

Altitude Profile



Types of trail surface

Asphalt
Dirt road
Semi-paved trail
Trail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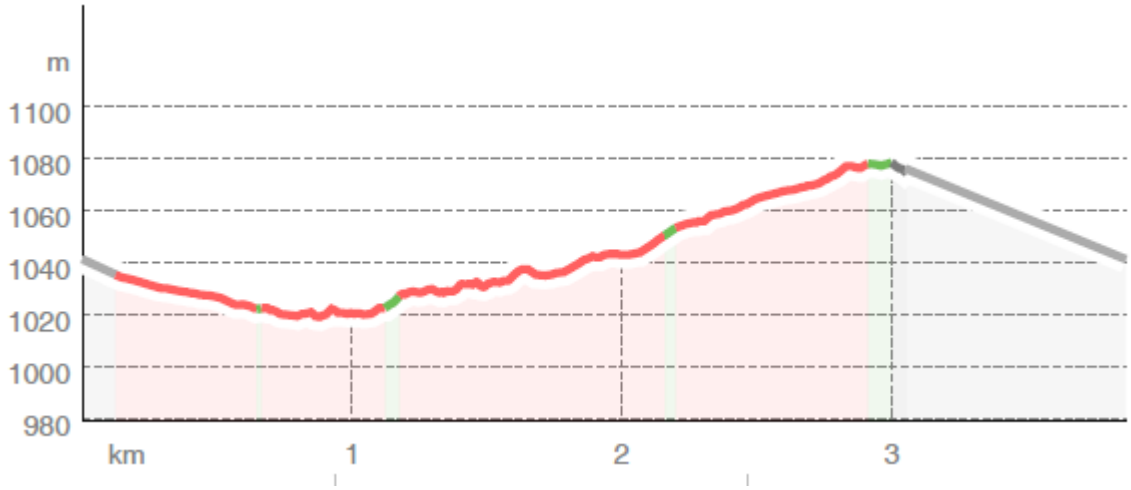
Short Itinerary

Villa Welsperg – Laghetto Welsperg – Camp – Villa Welsperg
Difficulty: **easy**
Distance: **3,9 Km**
Hiking time: **1:30 h**
Ascent: **59 m**
Descent: **59 m**
Highest point: **1,078 m a.s.l.**
Lowest point: **1,019 m a.s.l.**
Main habitats: **hay meadow, carbonate rock outcrops**
Bedrock: **carbonate (Dolomite)**

Altitude Profile



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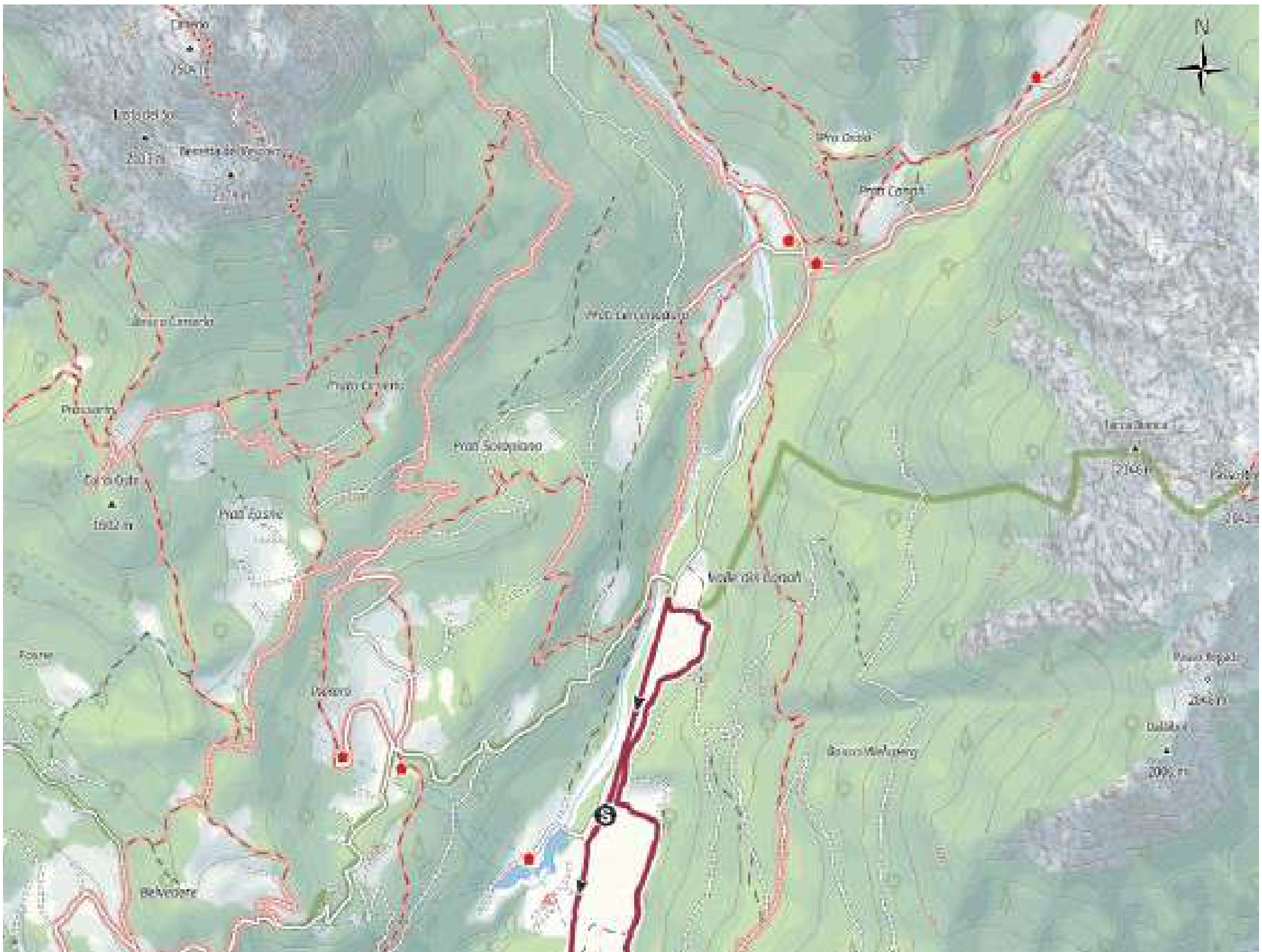
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List of poster presentations

1. Mónica Doblas-Bajo, Alejandro Núñez Carbajal, Laura Torrado-Blanco, Olga Fernández Enríquez, Pablo Aguado-Aranda, Antonio Ricarte, Zorica Nedeljković, Alfredo F. Ojanguren & Germán Orizaola - **Syrphidae (Diptera) of the integral natural reserve of Muniellos: Updated checklist and new records for Asturias (N Spain)**

2. Iván Ballester-Torres, Gunilla Ståhls, Pablo Aguado-Aranda, Zorica Nedeljković & Antonio Ricarte -**Biodiversity and conservation of the *Cheilosia alpina* (Zetterstedt, 1838) group (Diptera: Syrphidae) in the Iberian Peninsula**

3. Dagmāra Čakstiņa, Santa Ieviņa, Līga Pentjuša, Zane Lībiete & Linda Gerra-Inohosa - **Diversity of hoverflies (Diptera: Syrphidae) along different types of forest roads in Latvia**

4. Iva Gorše, Ante Vujić, Gunilla Ståhls, Ljiljana Šašić Zorić, Anđela Švarc & Mihajla Djan - **Limits of classical molecular markers in resolving the *Cheilosia crassiseta* species complex (Diptera: Syrphidae)**

5. Audrey Cécyre, Marc Fournier, Geneviève Labrie & Éric Lucas - ***Eupeodes americanus* as a new biocontrol agent for aphid management in minimally heated greenhouses**

6. Vanessa Couldridge, Pia Addison, John M. Midgley & Kurt Jordaens - **Hoverfly diversity across different land use types in the Western Cape, South Africa**

7. Francesco Lunardelli, Jose Luis Casas, Juan Ramón Guerrero, María López Santos-Olmo & Mª Ángeles Marcos García - **Essential oil nanoemulsions for aphid control: Effects on key biological control predators**

8. Suzana Malidžan, Tamara Tot, Ana Grković, Jelena Ačanski, Milica Ranković Perišić & Ante Vujić - **Hoverflies (Diptera: Syrphidae) of Montenegro: Priority species for conservation**

9. Zlata Markov Ristić, Dušanka Vujanović, Snežana Popov, Aleksandra Veličković, Sonja Mudri-Stojinić & Ante Vujić - **Ecological-economic importance of saproxylic hoverflies: Assessing pollination potential in old forests in Serbia**

10. Marija Miličić, Andrijana Andrić, Ljiljana Šašić Zorić, Jelena Ačanski, Jelena Purać, Danijela Kojić, Mihajla Đan, Iva Gorše, Milica Radenković & Ante Vujić - **Hoverfly research within WildPosh project**

11. Luisa Fernanda Moreno Beltrán, Angela María Montoya Quiroga & Augusto León Montoya - **Interaction networks of hoverflies (Diptera: Syrphidae) and plants in two wetlands in Bogotá, Colombia**

12. Zorica Nedeljković, Pablo Aguado-Aranda & Antonio Ricarte – **A putative new species of the *Chrysotoxum intermedium* Meigen complex (Diptera: Syrphidae)**

13. Gabriel Nève, Clément Beaumont, Claire Bouchot, Elise Buisson, Simon Cavaillès, Elie Gaget, Samuel Hilaire, Coline Jaworski, Arnaud Klein, Xavier Lair, Christophe Lauriaut, Thibault Le Pen, Thomas Lebard, Bastien Louboutin, Michel Martinez, Wout Opdekamp, Alexis Parret & Lise Ropars - **Two hundred years of hoverfly records: The changing fauna of the Bouches-du-Rhône department (France)**

14. Helena Pijálková, Magdalena Gajdošová, Jan Náhlovský, Ely Kosnicki, Zuzana Matějková (†), Ivan Pavle, Jakub Štenc & Jiří Hadrava - **Pollinators of beaver territories: How the return of beavers affects the pollinator spectrum**

15. Snežana Popov, Marija Miličić, Aleksandra Veličković, Zlata Markov Ristić & Ante Vujić - **Safeguarding veteran trees and their hoverfly associates: evidence and expert perspectives on effective conservation practices**

16. Jelena Purać, Danijela Kojić, Milica Radenković, Nikola Krivokuća, Tea Skendžić, *WP2 WildPosh Consortium* & Ante Vujić - **Determination of acute contact LD_{50} and sublethal effects of cypermethrin in *Eristalinus aeneus* (Scopoli, 1763) (Diptera: Syrphidae)**

17. Milica Radenković, Danijela Kojić, Jelena Purać, Nikola Krivokuća, Tea Skendžić, *WP2 WildPosh Consortium* & Ante Vujić - **Acute contact toxicity and sublethal effects of acetamiprid and tebuconazole on *Eristalinus aeneus* (Scopoli, 1763) (Diptera: Syrphidae)**

18. Ljiljana Šašić Zorić, Iva Gorše, Ante Vujić, Snežana Radenković, Gunilla Ståhls-Mäkelä & Mihajla Djan - **Genome-wide data analysis resolved taxonomic confusion within the *Merodon bessarabicus* subgroup (Diptera: Syrphidae)**

19. Federico Somà, Sara Maletti, Mauricio Fernández Otárola, Sergio Jansen-González, Daniele Sommaggio, Lara Maistrello & Gioele Toselli - **Pollinator diversity along an altitudinal gradient in Costa Rica**

20. Daniele Sommaggio & Davide Dal Pos - **Beyond genomics: Why morphology remains essential for syrphid phylogenetics**

21. Axel Ssymank & Ximo Mengual - **A German book project on European hoverfly genera: "Die Schwebfliegen Europas - Gattungen kennenlernen und bestimmen"**

22. Iva Gorše, Ante Vujić, Jelena Ačanski, Anđela Švarc, Aleksandra Stjepanović, Anja Perić & Mihajla Djan - **Taxonomic problems in the genus *Chrysotoxum* (Diptera: Syrphidae) in Europe**

23. Tamara Tot, Snežana Radenković, Ana Grković, Jelena Ačanski, Marina Janković Milosavljević & Ante Vujić - **First record and morphological notes on the female of the rare and endangered species – *Paragus medeae* Stănescu (Diptera: Syrphidae)**

24. Leendert-Jan van der Ent & Menno Reemer - **New data on Syrphidae from Velebit Mountains, Croatia**

25. Frank Van de Meutter, Sander Bot & Ximo Mengual - **A review of the species of the *Platycheirus albimanus* subgroup in Europe, with focus on the species *P. ciliatus*, *P. marokkanus* and *P. muelleri* (Diptera: Syrphidae)**

26. Frank Van de Meutter - **Defining local Syrphidae species richness: Insights from a unique long-term monitoring project**

27. Aleksandra Veličković, Zlata Markov Ristić, Snežana Popov, Tamara Tot & Ante Vujić - **Policy recognition of saproxylic hoverflies (Diptera: Syrphidae) and their key habitats in Serbia**

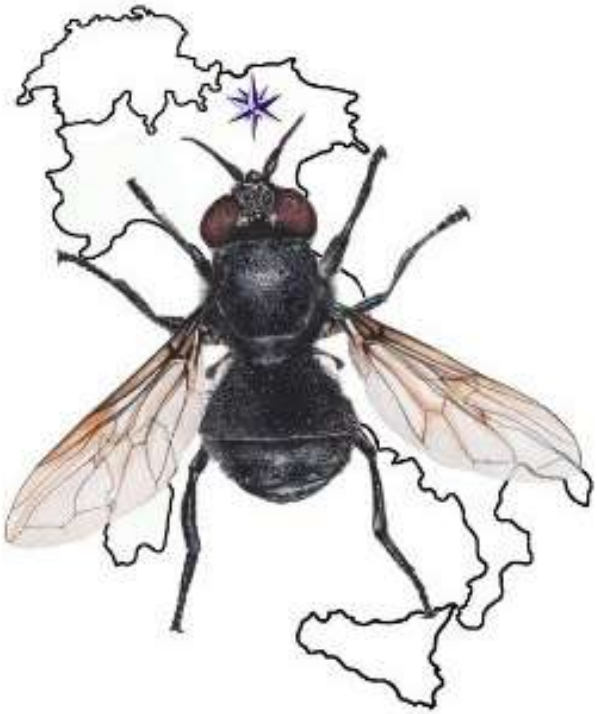
28. Sanja Veselić, Iva Gorše, Ante Vujić, Mihajla Djan, Uroš Živić, Jelena Ačanski & Gunilla Ståhls - **Decoding species boundaries within the subgenus *Convocheila* Barkalov, 2002 (*Cheilosia* Meigen, 1822): Molecular markers distinguishing two evolutionary lineages**

29. Jelena Ačanski, Bojana Vojnović, Jelena Purać, Danijela Kojić, Milica Radenković, Marija Miličić & Ante Vujić - **Early adult exposure to pesticide cypermethrin increases wing fluctuating asymmetry in *Eristalinus aeneus* (Scopoli, 1763)**

30. Iva Vujanić, Ante Vujić & Laura Likov - **Review of genus *Sphaerophoria* (Diptera: Syrphidae) from the Balkan Peninsula**

31. Ante Vujić, Ana Grković, Jelena Ačanski, Marija Stajić, Iva Gorše, Anđela Švarc, Mihajla Djan, Santos Rojo, Celeste Pérez-Bañón, Andrea Aracil & Snežana Radenković - **Species delimitation in *Eumerus etnensis* and *E. purpurariae* (Diptera: Syrphidae): An integrative approach**

Abstracts of Keynote speakers, oral communications and posters



Aguado Aranda

Taxonomic diversity in the *Eumerus obliquus* (Fabricius) species group (Diptera: Syrphidae)

Pablo Aguado-Aranda[1,2], Martin Hauser[3], Simon Cavaillès[4] & Antonio Ricarte[2]

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[4] 39 Rue Chantepluie, 41350 St. Claude de Diray, France

Keywords: Africa, DNA barcode, Israel, male genitalia, Merodontini, new species

With more than 300 described species, *Eumerus* Meigen, 1822 (Eristalinae: Merodontini) is one of the most species-rich genera of hoverflies. Currently, 13 species groups are recognized within the genus (e.g., Aguado-Aranda *et al*. [1]). This study focuses on the species of the *Eumerus obliquus* (Fabricius, 1805) group *sensu* Ricarte *et al.* [2], further refined by Aracil *et al.* [3]. Over the past decade, the number of species assigned to this group has increased from four to nine, suggesting that its actual diversity is underestimated. In this work, the *E. obliquus* group is reassessed through an extensive literature review, examination of entomological collections, and field surveys conducted in Guinea and South Africa (Afrotropical Region), and Israel, Morocco, and Tunisia (Palaearctic Region), between 1995 and 2017. As a preliminary result, five putative new species are discussed based both on the analysis of morphology and DNA barcodes. New species are distinguished by a unique set of morphological characters, illustrated with high resolution figures. In addition, the systematic position of *Eumerus unicolor* Loew, 1848 within the *E. obliquus* group is revised.

References

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Syrphidae (Diptera) of the integral natural reserve of Muniellos: Updated checklist and new records for Asturias (N Spain)

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Keywords: Atlantic forests, catalogue, hoverflies, Iberian Peninsula, species inventory

Hoverflies represent one of the largest families of flies, with around 6,500 species described worldwide. These insects play an essential ecological role as pollinators and bioindicators of habitats of high conservation interest, such as mature forests. The Integral Natural Reserve of Muniellos (Asturias, N Spain) hosts one of the best-preserved Atlantic oak forests in Europe and represents a key site for the study of forest-associated insect fauna. Between 2000 and 2002, a large-scale sampling of invertebrates was conducted. The collected material is preserved in the Zoological Collection of the University of Oviedo (Asturias). Here, we present a comprehensive checklist of the hoverfly species of this campaign. A total of 630 specimens belonging to 39 genera and 70 species were recorded. Among these, seven genera and 17 species were reported for the first time at the regional scale (Asturias), expanding the known distribution of several forest-associated taxa within the Atlantic bioclimatic region of the Iberian Peninsula. Overall, this checklist (1) highlights the key role of Muniellos as a refuge for pollinators and hoverfly diversity associated to Atlantic forest ecosystems in northern Iberia, (2) puts into perspective the long-term scientific value of collections for biodiversity research and conservation, and (3) provides a baseline for future faunistic and ecological studies in Northern Iberia.

Aracil

Enhancing hoverfly taxonomy training through gamification: Educational materials from the EPIC-FLY project

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Keywords: e-learning, H5P, monitoring, Moodle

The EPIC-FLY project, (European Pollinator Identification Courses – Hoverflies) is part of the Capacity Building in Pollinator Taxonomy European programme. The project delivers a continuous training programme in hoverfly taxonomy structured into four levels (see https://epic-fly.dcarn.ua.es). The first three (Basic, Intermediate I, Intermediate II) provide taxonomic skills for hoverfly monitoring and the Advanced level focuses on more complex taxonomic groups such as *Merodon, Cheilosia, Eumerus* or *Platycheirus* genera. One of the main outputs of the project is a set of teaching materials covering genera and species across Europe. These materials include diagnostic features for species identification, largely illustrated with images from the Taxo-Fly project, as well as basic biological information. In addition, we present teaching tools developed to facilitate taxonomy training through gamification, including an "scape-room"-like activity developed using H5P tools integrated into the University of Alicante's Moodle platform. This includes quizzes and interactive exercises (e.g., multiple-choice questions, true/false tasks) arranged sequentially and requiring successful completion to progress. The course is still under development, but some activities have already been tested in Intermediate II courses, and participants feedback will be presented.

Ariey

Hoverfly Atlas of Luxembourg

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Keywords: hoverfly atlas, Luxembourg, mapping, sampling methods

Luxembourg is a small, landlocked country bordered by France, Belgium, and Germany. To date, only checklists, but no atlas, are available for Syrphidae. To fill this gap, the National Museum of Natural History of Luxembourg launched the Hoverfly Atlas project in 2023. Specimens included in the atlas originated from various sources, minimizing unnecessary killing and optimizes resource use. First, hoverfly specimens already held in the Museum's collections prior to 2020 were digitized recorded. Then, specimens collected between 2021 and 2024 using Malaise traps in other projects were sorted from bycatch. Finally, hoverflies were collected using hand nets between 2023 and 2025 on a 5 × 5 km grid, complementing the trap data with a focus on alluvial and deciduous forests. To efficiently process the large number of specimens, identification workflows were structured according to specimen abundance and required taxonomic expertise. Three main levels were defined: easy, advanced, and professional level. Over 85,000 specimens have been recorded since 2021. Half of the identified specimens belonged to the "easy" category. Specimens requiring advanced and professional expertise are still under examination. Several new records for Luxembourg have been identified, and strong collaborations have been established. Atlas compilation will begin in 2027, preceded by the publication of an updated hoverfly checklist in partnership with collaborators. This initiative will provide a comprehensive overview of hoverfly distributions in Luxembourg, supporting future monitoring and conservation efforts. The Atlas will feature an interactive online map, updated with new data from the museum's database and citizen science platforms.

Biodiversity and conservation of the *Cheilosia alpina* (Zetterstedt, 1838) group (Diptera: Syrphidae) in the Iberian Peninsula

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Keywords: DNA barcode, Eristalinae, *Montanocheila*, new species, Spain

The species of the *Cheilosia alpina* (Zetterstedt, 1838) group were revised in the nineties of the past century. Species of this group are found in Europe, and they belong to the monophyletic subgenus *Montanocheila* Barkalov, 2002, which is exclusively associated with montane and alpine habitats. Regarding morphology, all species of the *C. alpina* group are medium to large-sized hoverflies with hairy body, pilose eye, face without long erect hairs, posterior margin of scutellum lacking strong bristles, katepisternum entirely haired without bare areas, bicoloured legs, and gonostylus (postgonite) with a straight or nearly straight ventral lobe. In the Iberian Peninsula, a new species was described in the last decade within this group, *Cheilosia lucense* Ricarte in Ricarte *et al*. 2014, from the western-most end of the Cantabrian Mountains. Here the diversity of the *C. alpina* species group is reassessed in the frame of mainland Spain, with a total of five cited species. Fieldwork took place in various localities of the Spanish Pyrenees, including the Ordesa and Monte Perdido National Park, and different entomological collections were also consulted. The discovery of a new species of the *C. alpina* group from the Spanish Pyrenees is presented. We discuss its morphological diagnostic characters, and its affinities to representatives of the *C. alpina* species group and other *Montanocheila* species in light of DNA barcoding data are shown. The current conservation status of this and other Iberian species of the *C. alpina* group is also discussed.

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Comparison of pollinator species detected with different configurations of InsectDetect camera platforms with conventional monitoring methods

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Keywords: AI, camera traps, non-invasive monitoring, pollinators, Syrphidae

Conventional methods, such as pan traps and transect walks, have long been essential and effective tools in monitoring pollinators. Despite their effectiveness however, some issues remain such as cost and the need to kill the target insects (and often a significant amount of bycatch). One proposed alternative which may help resolve these issues is the use of high-resolution camera systems, supported by machine learning / AI image classifiers. These systems use attractive platforms to lure in insects, which then have their photo automatically taken and identified by a classifier. The insect is then able to leave unharmed. At a site in Cottbus, Germany with a well-explored hoverfly and bee species community we have an ongoing study (from beginning May 2026 to beginning of September 2026 – planned minimum of 30 sampling events) to assess and optimise the effectiveness of the InsectDetect AI pollinator monitoring camera system. We aim to ascertain how much of the species community can be detected with this camera system. We compare InsectDetect with three conventional pollinator monitoring methods: flower-insect timed counts, transect netting walks and tricolour pan traps. We also compare the default design of InsectDetect with two experimental designs: one including a larger and more UV reflective platform design and the other based on 3D printed flowers. In addition, we test whether altering the height of the platform influences the visiting insect community and overall platform attractiveness. Finally, the performance of the AI classifier on the captured images will also be assessed compared to human classification. This includes both its broad level accuracy and precision (particularly concerning whether it can reliably classify to species level). Preliminary results indicate that InsectDetect has significant potential, but also many weaknesses that need to be addressed. In particular, the platform has only attracted part of the resident Syrphidae community, rarely attracts those which fly low in the vegetation, and it is sometimes impossible to get a species-level identification from the captured photographs.

Bosquet Navarro

Preliminary insights into ovarian development and oogenesis in *Myathropa florea* (Diptera: Syrphidae) under captive rearing conditions

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Keywords: ovarian development, ovarioles, saprophagous eristalines

Myathropa florea (Linnaeus, 1758) has a mainly Palaearctic distribution and occurs in a wide range of natural habitats. Larvae develop in water-filled microhabitats such as tree rot holes and, as in other saprophagous eristalines, are associated with decomposing manure, including wet cow dung and compost heaps [1]. Using a rearing methodology developed by our research group at the University of Alicante, we present the first data on ovarian development and oogenesis of this hoverfly to better understand reproductive timing under captive conditions, as it may play an important role as a pollinator. Three experimental conditions were established to evaluate whether the presence of males or an oviposition medium affects the timing of first oviposition. Under controlled abiotic conditions (25 ± 1 °C, 50% RH, 12:12 L:D), females were maintained in three treatments: with oviposition medium and males, without oviposition medium, and without males. As no differences were observed, dissections were restricted to females from the first treatment. Adult females were dissected at 24-hour intervals from emergence until first oviposition (n = 40; 5 per interval). Oogenesis was assessed using a modified version of Bier's [2] criteria, and ovarian development followed the stages described by Branquart and Hemptinne [3]. Preliminary results showed that first oviposition occurred five days after emergence. Ovarioles developed progressively from apical to basal regions, with asynchronous oogenesis. Females had an average of 143 ovarioles, and number of developed follicles increased over time, reaching a maximum of six.

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Bot

The hoverflies of Azerbaijan: New records and insights into the fauna

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Keywords: Azerbaijan, checklist, DNA barcoding, new record, new species

In May 2025 the authors conducted field work in Azerbaijan to better understand the Syrphidae distribution in the region after earlier visits to neighbouring Armenia and Georgia. Focus was mainly on the Talysh Mountains in the Southeast and the Caucasus Mountains in the North, while adding short stops to lowland areas in between. The results of this collection event revealed almost 120 different hoverfly species, including approximately 40 species that have not yet been recorded in Azerbaijan. Especially the Talysh Mountains appeared to be an endemic region, where we collected several undescribed or likely undescribed species from the genera *Cheilosia* Meigen, 1822, *Criorhina* Meigen, 1822, *Eumerus* Meigen, 1822, *Myolepta* Loew, 1864 and *Riponnensia* Maibach, Goeldlin & Speight, 1994. Also seldomly reported and poorly known species were collected like *Brachypalpus zugmayeriae* Mik, 1887, *Caliprobola aurea* (Sack, 1910), *Matsumyia talyshensis* (Stackelberg, 1960), *Myolepta mada* Reemer & Hauser, 2005, *Neoascia inexpectata* Hauser, 1998, *Philhelius maculipennis* (Mik, 1887), *Pipizella barbata* Mortelmans & van Steenis, 2026, *Platycheirus cejensis* Kuznetzov, 1987, *Pocota hyrcanica* Gilasian & Hauser, 2017, and *Xylota talyshensis* Hauser, 1998. Furthermore, a provisional checklist of the Syrphidae of Azerbaijan, based on previously published syrphid records and the findings of our field work is presented.

Bot

Review of the genus *Cheilosia* Meigen, 1822 (Diptera: Syrphidae) from Mongolia

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Keywords: checklist, DNA barcoding, identification key, Mongolia, new species

Since 2014 eight entomological expeditions took place in Mongolia. During these expeditions, many localities throughout the country were visited with collection dates between May 26th and August 13th. Within *Syrphidae* Latreille, 1802, *Cheilosia* Meigen, 1822 is among one of the largest genera, with just over 450 described species worldwide of which approximately 75% has a Palaearctic distribution. In this study, we report the studied specimens of the hoverfly genus *Cheilosia* Meigen, 1822 from the collected material: over 2.500 specimens sampled by 11 different participants. In total, 25 different described species were identified. The most common species were *C. longula* (Zetterstedt, 1838) with 741 specimens, *C. changaica* Peck, 1979 with 339 specimens, and *C. velutina* Loew, 1840 with 307 specimens; these three taxa together comprise over half of the total specimens. Moreover, six species were new to the fauna of Mongolia. Remarkably, four out of six of the new species for the Mongolian fauna belong to the *Cheilosia proxima* group, a relatively small group of species from the nominal subgenus *Cheilosia*, with a wide distribution in the Palaearctic. In addition, three new species for science were discovered: two belonging to the subgenus *Cheilosia* and one to the subgenus *Eucartosyrphus* Barkalov, 2002. A species checklist based on literature research and the results from the entomological expeditions, a species identification key and a Neighbor-Joining tree of all the *Cheilosia* species collected during the expeditions in Mongolia are presented.

A hoverfly perspective on pesticide toxicity: *Sphaerophoria rueppellii*

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Keywords: acute effect, contact and oral exposure, dimethoate, ecotoxicology, flupyradifurone

Hoverflies (Diptera: Syrphidae) are key pollinators in agricultural and semi-natural ecosystems, yet their sensitivity to pesticides remains underrepresented in ecotoxicological studies. Within the Horizon Europe project PollinERA, which aims to develop harmonised protocols for assessing pesticide sensitivity across pollinator taxa, we evaluated the acute toxicity of two insecticides, dimethoate and flupyradifurone, in the hoverfly *Sphaerophoria rueppellii* (Wiedemann, 1820) Diptera: Syrphidae. Acute toxicity assays were conducted on newly emerged adults under laboratory conditions for contact and oral exposure. Dimethoate was tested via both topical and oral routes, while flupyradifurone was assessed through topical application. Lethal doses causing 50% mortality (LD_{50}) were estimated at 24 and 48 hours using dose–response models. Dimethoate, used as a reference compound in ecotoxicological testing, confirmed its high acute toxicity in *S. rueppellii* across both exposure routes, with LD_{50} values of 0.00312 and 0.00307 µg/insect at 24 and 48 h following topical application, and 0.0129 and 0.00692 µg/insect at 24 and 48 h after oral exposure. In contrast, flupyradifurone exhibited substantially lower acute toxicity under the same experimental conditions, with topical LD_{50} values of 9.404 and 8.518 µg/insect at 24 and 48 h, respectively. Sex-related differences in sensitivity were compound-dependent, with males exhibiting greater sensitivity to flupyradifurone via topical exposure and to dimethoate via oral exposure. These results supports *S. rueppellii* suitability as a model species for acute toxicity testing and provide new evidence on pesticide sensitivity in non-bee pollinators. Incorporating hoverflies into ecotoxicological frameworks is essential to improve the ecological relevance of pesticide risk assessment beyond traditional bee-focused approaches.

Diversity of hoverflies (Diptera: Syrphidae) along different types of forest roads in Latvia

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Keywords: abundance, richness, roadsides, Syrphidae

In Latvia, new forest roads are built, and existing ones are reconstructed each year, creating roadside habitats that may support a distinct hoverfly species composition. This aspect has not been analyzed before, therefore, this study aimed to determine the diversity of hoverflies along the different types of forest roads. The fieldwork was conducted at two sites in Latvia over two summer seasons, representing three types of forest roads: two managed road types with different width of verges and one vegetation covered closer to natural road type. Hoverflies were collected using white, blue, and yellow pan traps three times per summer: in May, June, and July, respectively. Overall, more than 90 species were recorded during the study. The most common hoverfly species were *Helophilus pendulus* (Linnaeus, 1758), *Xylota segnis* (Linnaeus, 1758), and *Neocnemodon pubescens* (Delucchi & Pschorn-Walcher, 1955) in the summer of 2024 and *Syrphus torvus* Osten-Sacken, 1875 and *Xylota segnis* in the summer of 2025. Furthermore, the new species for the fauna of Latvia was found *Philhelius dives* (Rondani, 1857). Higher species richness was observed along the managed forest roads. Slight differences in the composition of hoverflies were also observed between the different forest road types and studied sites. Preliminary results indicated that forest roadsides may support a certain species composition of hoverflies. Thus, road verges could play an important role to contribute hoverfly diversity.

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Clem

Syrphing the wind: Long-distance seasonal migration in *Eupeodes americanus* hoverflies in eastern North America

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Keywords: Diptera, isotope analysis, microbial assessments, migratory, population genomics, Syrphidae

Understanding the seasonal behaviors and migratory ecology of hoverflies (Diptera: Syrphidae) is a highly understudied, yet crucially significant area of research. Numerous Palearctic species are well-known to migrate vast distances in response to changing seasonal conditions, but extensive investigations into the migratory ecology of Nearctic hoverflies are severely lacking. The goal of my research is to alleviate this knowledge gap. Here, I use a combination of hydrogen isotopic analyses (δ^2H), population genomics, and microbial community assessments to investigate the migratory propensity of *Eupeodes americanus* (Wiedemann, 1830) and *Allograpta obliqua* (Say, 1823), two species common throughout eastern North America. I gathered these data on nearly 700 specimens collected from over 40 sites across three years (2021–2023). Results reveal that *E. americanus* is highly migratory, and that a single individual can travel upwards to 3,000 km from Canada to the southeastern United States during autumn. *Allograpta obliqua*, in comparison, appears to be highly dispersive (as revealed by low population genetic structuring), but not extensively migratory (as revealed by isotopic and microbial data). Together, these data demonstrate that long-distance hoverfly migration in North America is far from non-existent, and that the migratory behaviors of many species are yet to be realized. Given their roles in pollination, biological control, and decomposition, hoverfly migration in North America is certain to have major ecological and economic consequences.

Seeing the unseeable - Ultraviolet reflectance, aposematism and mimicry

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Keywords: Batesian mimicry, multispectral imaging, specimen collection conservation, Syrphidae, ultraviolet reflectance

Many diurnal terrestrial animals possess ultraviolet (UV)-sensitive vision and UV markings that may play roles in intraspecific communication, foraging, and predator avoidance, yet this signalling is largely invisible to humans. UV reflectance (UVR) imaging has a well-established history in entomology but remains underexploited in taxonomic and phylogenetic studies, likely due to anthropocentric biases and practical challenges. This research focuses on syrphid flies and their putative aposematic models (e.g. social wasps and bees), along with other mimetic taxa such as clearwing moths (*Sesia* spp.). The study assesses whether UVR in these taxa contains previously unrecognised diagnostic and ecologically relevant characters. To this end, I have developed and begun validating a high-resolution multispectral imaging system based on commercially available components. The system captures photogrammetric data across UV and visible spectra, enabling consistent imaging of specimens. This integrative approach aims to enhance understanding of mimicry systems, contribute to robust species delimitation, and support ecological monitoring. Preliminary analyses revealed UVR patterning in syrphid flies in contrast to previous reports, for example Tylor *et al.* [1], while corresponding patterns appear absent in their putative aposematic hymenopteran models. Quantitative analyses of pinned specimens corroborated this pattern but also indicated preservation-related shifts in reflectance signal across UV and visible spectral bands. Recent work quantifying UV and visible reflectance changes from life to preservation in a population of *Eupeodes corollae* is presented.

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Limits of classical molecular markers in resolving the *Cheilosia crassiseta* species complex (Diptera: Syrphidae)

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Keywords: molecular taxonomy, mtDNA COI gene, nuclear ITS2 region, nuclear rRNA gene

Cheilosia Meigen, 1822 (Diptera: Syrphidae) is one of the largest genera of hoverflies, with more than 450 described species worldwide, classified into thirteen subgenera. The subgenus *Taeniochilosia* Oldenberg, 1916 comprises 34 species in Europe, but some taxa remain poorly resolved, with persistent taxonomic uncertainties. This study aimed to highlight the challenges associated with the taxonomy of the *Cheilosia crassiseta* species complex on the Balkan Peninsula. Observed morphological differences suggest the presence of three potential taxa on the Balkans (*Cheilosia crassiseta*, *C.* aff. *crassiseta*, and *C.* aff. *vangaveri*). To achieve a more comprehensive understanding of this species complex and to resolve ambiguous species boundaries, molecular data were incorporated into the analyses. These included mitochondrial (3′ and 5′ fragments of the COI gene) as well as nuclear markers (28S rRNA gene and ITS2 region), including populations from both the Balkans and the Alps. As was expected, molecular data supported the presence of two taxa in Alpine region: *C. crassiseta* and *C. vangaveri*. On the contrary, employed molecular markers did not provide sufficient resolution to delimit the morphologically well-defined taxa from the Balkans. Two of them which occur in Montenegro (representing *C.* aff. *crassiseta* and *C.* aff. *vangaveri*) and show clear morphological and molecular differences to taxa occurring in the Alpine region, could not be mutually delineated. These findings highlight the complexity of species delimitation in morphologically diverse hoverfly groups and demonstrate the necessity of introducing novel approaches to resolve diversity in key pollinator taxa.

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Flower-Insect Timed (FIT) counts within Pollinator Monitoring Scheme (PoMS) in Serbia

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Keywords: citizen science, counting pollinators, flower visitors, pollinator composition

The Flower-Insect Timed Count (FIT Count) method, originally developed by the UK Pollinator Monitoring Scheme [1], has been used in the UK since 2017 as a citizen science tool to encourage wider participation in pollinator monitoring. The protocol involves placing a 50 × 50 cm quadrat around a target flowering plant species and conducting a 10-minute count of flower-visiting insects, supported by photographs, with insects assigned to broad taxonomic groups. In this study, FIT Count data were collected at 30 sites across three seasons (spring, summer, and autumn) during three sampling years (2022–2024) within the SPAS project (Serbian Pollinator Advice Strategy – for the next normal). At each site, the quadrat was placed around the most dominant flowering plant species on the transect, following the standard FIT Count protocol. Consequently, target plant species varied across sampling years and seasons. Flower-visiting insects recorded were classified in nine groups: bumblebees, honeybees, solitary bees, wasps, hoverflies, butterflies, moths, beetles, and a residual category, “other insects”, including all remaining insects. Results indicate that solitary bees (n=770), hoverflies (n=787), honeybees (n=820) and category “other insects” (n=777) were the most frequently recorded pollinator groups, whereas moths were the least represented (n=42). Interannual variation showed that category “other insects” dominated in 2022 (n=270), honeybees in 2023 (n=455), and solitary bees in 2024 (n=288). Seasonally, solitary bees were most abundant in spring (n=365), hoverflies in summer (n=440), and honeybees in autumn (n=255). This study contributes to a better understanding of pollinator abundance under naturally available floral resources, providing insights into seasonal and interannual variation. These patterns likely reflect a combination of temporal dynamics in insect communities and changes in floral resource availability, and may help improve the interpretation of trends in pollinator abundance and support national pollinator monitoring efforts.

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Eupeodes americanus as a new biocontrol agent for aphid management in minimally heated greenhouses

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Keywords: aphids biological control, Syrphidae, winter greenhouse

The long-tailed aphideater hoverfly (*Eupeodes americanus*) is a new biocontrol agent in Canada. Aphid control is challenging especially, in minimally heated greenhouses (5 °C) during winter, as most commercial agents are ineffective below 16 °C. This study evaluated the survival, development, and predation of *E. americanus* at 4, 8, 12, and 24 °C. Thirty eggs were isolated individually in Petri dishes and checked daily until hatching; between 17 to 19 larvae were reared individually with aphids provided *ad libitum* on spinach leaves; between 52 to 49 pupae were isolated individually until adults emerged for each temperature. The efficacy of the second stadium of hoverfly larvae was tested on whole spinach plants infested with 50 green peach aphids. The number of aphids remaining on the plant was counted after 24h and after time required for accumulation of 30 degree-days (DD) by the focal aphid. At 4 °C, no egg hatched, no larva pupated, 21% of larvae were still alive after six weeks, and only 9% of pupae emerged as adults. At 8 °C, 30% of eggs hatched, 29% of larvae pupated, and 79% of pupae emerged. At 12 °C, 70% of eggs hatched, 56% of larvae pupated, and 71% of pupae survived. At all lower temperatures, the larvae significantly reduced the number of aphids on the plant after 24h and after 30 aphid DD. The results demonstrate that the hoverfly is a promising biocontrol agent at low temperatures, but that its development and survival are reduced at 8 °C and lower.

Do predatory syrphids control pests?

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Keywords: biocontrol of pests, field - greenhouse - lab data, Syrphidae

316 studies in the literature are reviewed for evidence of the control of pests (mainly aphids but including many other pest taxa too) by syrphid larvae. There are 179 observational and 137 experimental studies: the latter can be divided into field (99 studies) and greenhouse (25)/lab (6) experiments together with some other types. Many experiments involve cages (86 studies). The first commercial test was done in 1914 to try to control spittlebugs in the sugarcane fields of Trinidad using lab-bred *Salpingogaster nigra* eggs. The first controlled field experiment was done in Kenya in 1926 on the control of the citrus mealybug. The observational evidence is very clear: syrphids are usually the most important natural enemies, but sampling difficulties often prevent proper quantification. Experimental studies are also very clear, that syrphids are very potent natural enemies that can control pests. However, such experiments artificially synchronise pest and predator. The timing of syrphid oviposition in the field is a key issue, but again the evidence is that syrphids are more synchronised than other natural enemies. Syrphids are unique in providing the dual ecosystem services of pollination and biocontrol, and are often highly effective in both, as a number of greenhouse studies show explicitly.

Gorse

A genome-wide perspective on taxa boundaries within *Merodon avidus* complex (Diptera: Syrphidae)

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Keywords: ddRAD-seq, hybridization, molecular taxonomy, NGS

Assessing taxonomy within the genus *Merodon* Meigen, 1803 has been challenging due to its high diversity and overall morphological similarity within species complexes. Although the COI gene has proven to be a powerful tool for distinguishing a good number of species, an increasing number of studies report limitations of the single-gene approach. Evolutionary signals arising from shared ancestral polymorphisms and/or introgressive hybridisation may obscure species boundaries and result in inaccurate estimation of species diversity when relying solely on mitochondrial data. By providing insight into multiple loci across both nuclear and mitochondrial genomes, genome-wide approaches offer great potential to resolve diversity and shed light on the underlying causes of observed mitochondrial variability. In the *M. avidus* complex, *Merodon avidus* (Rossi, 1790) and *M. moenium* Meigen & Wiedemann, 1822 represent a good example of persistent incongruence among morphological, morphometric and molecular data to define them. The mitochondrial COI gene has a limited power in those taxa identification; thus, we analyse genome-wide ddRAD-seq data, with the aim of identifying species boundaries and providing a comprehensive insight into the diversity of these two closely related taxa with partially overlapped distributions. Our results have revealed that a panel of genome-wide ddRAD-seq data represents a valuable molecular tool for elucidating taxa boundaries, clarifying *M. moenium* and *M. avidus* as distinct taxa. Additionally, the presence of interspecific hybrids was detected for the first time, indicating the periodically hybridization events as a potential cause of haplotype sharing, and further emphasizing the utility of genome-wide data for understanding hoverfly diversity.

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Grkovic

First European records of two non-native *Eumerus* Meigen species (Diptera: Syrphidae) and taxonomic updates to the European *Eumerus* fauna

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Keywords: checklist, first European records, ginger maggot, new synonyms, taxonomy

The first European records of two non-native hoverfly species, *Eumerus aurifrons* (Wiedemann, 1824) and *Eumerus figurans* Walker, 1859 (Diptera: Syrphidae) are presented, based on specimens collected in Sicily (Italy). *Eumerus aurifrons*, originally described from India, is widespread in Southeast Asia and has been introduced to Africa, the Americas and Hawaii. *Eumerus figurans* belongs to the *figurans* group, which comprises several Asian and African species and shows morphological affinities with the *obliquus* group. *Eumerus figurans*, also known as the ginger maggot, has previously been recorded from Oriental, Australasian regions and the Hawaiian Islands (USA). These records contribute to current knowledge of non-native *Eumerus* species in Europe and underline the importance of continued monitoring, given the dual nature of the genus, which includes both potentially invasive taxa and rare, conservation-relevant species. The taxonomic status of *Eumerus alpinus* Rondani, 1857 is revised, and the species is re-synonymised with *E. olivaceus* Loew, 1848. Further taxonomic adjustments are proposed, including newly established synonyms and several species treated as doubtful taxa. An updated checklist of European *Eumerus* is provided, comprising a total of 81 valid species. Together, these results refine the present taxonomic framework of European *Eumerus* and provide an improved baseline for future work on the genus.

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Hadrava

Hoverflies in Central European plant-pollinator networks

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Keywords: Diptera, ecosystem stability, functional diversity, pollination efficiency, pollination networks, Syrphidae

Pollination is a key ecosystem service that sustains plant reproduction and biodiversity. Since 2011, we have conducted annual studies on pollination networks in a meadow in Central Bohemia, Czech Republic, focusing on the late-summer peak of flowering. Over this long-term research, we have documented how these networks are dynamic, varying across both time and space. Hoverflies (Diptera: Syrphidae) play a key role in this system. They comprise a diverse array of species, each contributing uniquely to the pollination process. Together, hoverflies ensure reliable pollination of plants, despite the inherently fluctuating conditions of the environment. By transferring substantial amounts of pollen, hoverflies provide an efficient service to plants. However, from a plant's perspective, besides the total amount of pollen transferred, it is also important how reliable each pollinator is and what amount of floral resources they consume in return for their services. This presentation will compare these characteristics across hoverflies and other pollinator groups. I will then scale up these findings to the broader European context, using a database of pollinator-plant interactions to show that hoverflies account for around 17% of flower visits across Central Europe. Although a few hoverfly species dominate pollination, different groups play distinct functional roles. Large hoverflies from the Eristalinae subfamily are highly efficient pollinators of dominant plants, while smaller hoverflies from the Syrphinae subfamily are more numerous but less efficient. These smaller species, however, play an important "back-up" role for a wide range of plant species, supporting pollination when other pollinators are scarce. Together, hoverfly species form a robust and complementary community of pollinators, ensuring that plants continue to receive pollination services despite environmental fluctuations. By examining these dynamics, we gain a deeper understanding of how pollinator networks function and why preserving hoverfly diversity is essential for maintaining ecosystem stability and plant reproduction.

Migration of hoverflies revisited: Insights from seven years of observations

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Keywords: co-migration, conservation, ecomorphology, phenology

Long-distance migration in hoverflies has received increasing attention in recent years, but many aspects of migration remain poorly understood. Our continuous seven-year study of autumn migration in the Červenohorské mountain pass in Czech Republic provides a unique opportunity to assess long-term patterns in abundance, species composition, and migration timing. We show that species differ in their migration timing, likely reflecting differences in flight performance. We also provide new insights into hoverfly ecomorphology, providing the first evidence of interpopulation differences in wing morphology, with migratory populations showing larger wings than resident ones in *E. balteatus*, *E. tenax*, *E. corollae*, *M. mellinum*, and *S. scripta*. We further show that migrant sex ratios in those species vary with latitude and are associated with a higher proportion of mated females. Our results suggest that hoverflies carry pollen for long distances, transferring up to one trillion pollen grains annually across Europe. Finally, migration timing of hoverflies strongly correlated with that of insectivorous birds and was independent of weather conditions, suggesting co-migration. Our work provides a benchmark for a holistic understanding of hoverfly migration ecology and highlights its ecological significance.

Jongejans

Weather effects in analyses of hoverfly trends and responses to new landscape elements

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Keywords: hoverfly activity, precipitation, sampling methods, seasonal patterns, sunshine, temperature, trend analysis

The abundance and species richness of Syrphidae have declined in many ecosystems. To assess temporal trends and effects of new hedgerows and flower strips we investigated Malaise trap contents, transect counts and DIOPSIS camera pictures. While Malaise trap samples are typically collected over 1 or 2 weeks, (automated) counts have a more precise time stamp. However, in both cases it is important to take weather conditions during sampling into account when aiming to uncover abundance trends across years and treatments, along with seasonal phenology and aspects of the sampling set-up like screen orientation. Analyzing Malaise trap data (based on continuous sampling at six locations during 1989 and 2014) and transect count data (from a single transect, during 292 days irregularly distributed over 27 years starting in 1982 up to recent years), we found significant effects of temperature, and sometimes of precipitation or sunshine, at the time of sampling on the number of syrphid flies, and showed the impact of neglecting weather on estimates of abundance declines. In another study we operated Malaise traps for one week during each of eight months at 24 locations where new landscape elements were created or not (i.e. controls). By accounting for seasonal and temperature effects, we obtained a better understanding of the effects of new hedgerows and flower strips on hoverfly abundance and diversity in an already complex agricultural landscape. In contrast to other insect taxa, Syrphidae benefited more from flower strips than from hedgerows. By developing statistical analyses that account for seasonality, weather and screen orientation, we can distil meaningful estimates of hoverfly trends and responses to their changing landscape, especially when sampling times are not standardized within and across years.

Jordaens

Towards a new catalogue of the Syrphidae (Diptera) of the Afrotropical region

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Keywords: Africa, biogeography, checklist, diversity, species distribution

In 1998 Dirickx published the most recent catalogue of Afrotropical Syrphidae (Catalogue Synonymique et Géographique des Syrphidae (Diptera) de la Région Afrotropicale), listing 522 species. Because it was written in French, omitted detailed listings of type material and depositories, and provided largely incomplete species distributions, its usefulness for stimulating further taxonomic research was limited. Over the past two decades many Afrotropical species and genera have been revised and dozens of new species described, prompting us to produce an updated catalogue reflecting current taxonomy. The revised work now lists approximately 650 hoverfly species for the region. For each species we provide a synonymy list, detailed type-material and depository information, and an improved distributional account citing published references or - when unpublished - museum collections where specimens were located. The catalogue also identifies major remaining taxonomic gaps for Afrotropical Syrphidae. We hope this new resource will further stimulate taxonomic and related research on the group in the region.

Hoverfly diversity across different land use types in the Western Cape, South Africa

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Keywords: biodiversity, blueberry, food security, plant-pollinator networks, South Africa

South Africa is highly biodiverse, but much of its invertebrate diversity remains poorly documented. The Cape Floristic Region is a global biodiversity hotspot under threat from urbanization and agricultural expansion. Agriculture, *e.g.*, blueberry and raspberry farms, currently relies heavily on honeybees for pollination, posing risks to food security due to declining bee populations. Other insects, such as non-social bees (Hymenoptera) and flies (Diptera, especially hover flies), could serve as alternative pollinators, especially in areas near natural habitats. However, their diversity is not well studied. This project, which will start in June 2026, aims to document the diversity of pollinating Diptera and non-social Hymenoptera in both natural (Cape Winelands and Kogelberg Man and the Biosphere Reserves, Western Cape, South Africa) and agricultural (blueberry farms) habitats. Using morphological methods and DNA barcoding, it will create a reliable reference system supported by voucher specimens. Natural habitats will provide a baseline to compare with agricultural areas, enabling the identification of key pollinator species. The study will also analyse plant–pollinator interactions across habitats. Findings will help guide agricultural practices and policies to support beneficial insects. Additionally, public participation will be encouraged to assist with data collection and raise awareness about the importance of insect pollinators. A special focus will be placed on hover flies, as they provide additional benefits to farms, including the decomposition of organic waste and the control of pest species such as aphids.

Likov

Taxonomic updates on the *Merodon fulcratus* and *M. spinitarsis* species groups, with notes on *M. crassicornis* (Diptera: Syrphidae)

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Keywords: *Merodon*, morphology, new species, revision

Within the Palaearctic, the Anatolian and Iberian Peninsulas are established centers of diversity for the genus *Merodon* Meigen, 1803. However, recent research highlights the Eastern Mediterranean and the Middle East as also important regions. This study reviews two groups of species found across these regions: the *M. fulcratus* and *M. spinitarsis* groups and provides clarification of the taxonomic status of *M. syriacus* and *M. crassicornis*.The *fulcratus* species group (subgenus *Avidumerodon*) consists of two valid species: *M. dichopticus* Stackelberg, 1968 (recorded from Azerbaijan, Turkey, Israel, Georgia and Iraq), and *M. fulcratus* (Becker, 1913) (known from Iran and Turkmenistan). In *M. fulcratus* a high variability in the shape of male genitalia has been observed, however, genetic analysis revealed no evidence of diversification within this species. The *spinitarsis* species group (subgenus *Auremerodon*) comprises *M. spinitarsis* Paramonov, 1929 (from Bulgaria, Romania, Greece and Turkey), and an undescribed species from Israel. This new species was previously misidentified as *M. syriacus*. Based on our examination of type material, we conclude that *M. syriacus* and *M. crassicornis* Sack, 1913 (recorded in Israel, Syria and Turkey), neither of which belongs to the *spinitarsis* group, are conspecific. *Merodon crassicornis* is, morphologically, most similar to *M. nasicus* Bezzi, 1915 from the Afrotropical *bombiformis* species group. However, without of genetic support, we consider it to have an independent position within the *Auremerodon* subgenus. This study resolves the status of several taxa and highlights the important faunal links between these biogeographical regions.

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Likov

IUCN European Red List of Hoverflies

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The European Red List of Hoverflies was a three-year project (2019-2021) led by IUCN in close cooperation with the Hoverfly Specialist Group of the IUCN Species Survival Commission, and was funded by the European Commission Service Contract 'Status assessment of European Hoverflies (Syrphidae) – European Red List of Hoverflies (EU and pan-Europe)'. This European Red List provides a summary of the conservation status of 892 European species of hoverflies (Diptera: Syrphidae), evaluated according to the IUCN Red List Categories and Criteria. At the European scale only one species was assessed as Regionally Extinct, two species as Critically Endangered (Possibly Extinct), 32 species (3.6%) as Critically Endangered, 204 species (22.9%) as Endangered and 76 species (8.5%) as Vulnerable. A further 61 species (6.9%) were classified as Near Threatened, and over half of hoverfly species in Europe were assessed as Least Concern (52.7%).

Lunardelli

Increase hoverfly (Diptera: Syrphidae) functional biodiversity to improve ecological services in agroecosystems

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Keywords: apple orchards, landscape complexity, Northern Italy, organic and integrated management, pollinator biodiversity

In agricultural landscapes, the maintenance of ecosystem services like pollination and pest control relies heavily on the diversity and abundance of functional entomofauna. Among these, hoverflies (Diptera: Syrphidae) play a dual role as both effective pollinators and biological control agents. This study investigates the dynamics of hoverfly populations within apple orchards in the Friuli-Venezia Giulia region (NE Italy), comparing the impact of both landscape complexity and management strategies on pollinator biodiversity. The research was conducted across 19 apple orchards (10 organic and 9 integrate), distributed throughout the Friulian plain. Hoverflies were collected during two years, from march to september, using sweep netting, Malaise traps, and emergence traps. A total of 98 distinct species of hoverflies were recorded. Some species of high conservation value were detected on orchards located near well-preserved habitats, like *Eumerus ovatus*, reported on the European Red List of Hoverflies as "Endangered", and species associated with woodland habitats such as *Brachyopa bicolor*, *B. scutellaris*, *Brachypalpus valgus*, *Caliprobola speciosa*, *Chalcosyrphus nemorum*, *Criorhina floccosa*, *Ferdinandea cuprea*, *F. ruficornis* and *Myolepta obscura*. Thermophilous species were found in orchards located in proximity to arid environments, such as dry streambeds and Magredi grasslands, and hygrophilous species were found in orchards located near waterbodies. Emergence traps recorded only one species in integrated orchards and seven in organic orchards, all with aphidiphagous larvae, highlighting the effect of management on hoverfly communities. By identifying the key drivers of hoverfly diversity, this work aims to provide practical insights for enhancing ecological services and promoting more resilient agroecosystems.

Essential oil nanoemulsions for aphid control: Effects on key biological control predators

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Keywords: essential oils, integrated pest management, *Myzus persicae*, natural insecticides, selectivity, *Sphaerophoria rueppellii*

Myzus persicae (Hemiptera: Aphididae) is a major pest in greenhouse horticulture. Control options are increasingly limited due to the scarcity of authorized insecticides and stricter EU regulations on synthetic pesticides. This highlights the urgent need for natural, eco-friendly, and IPM-compatible alternatives. Essential oils (EOs) are a promising tool for aphid control. Our previous research (Casas et al., 2025) demonstrated the efficacy of several EOs against aphids and their compatibility with some predators, such as *Sphaerophoria rueppellii* (Diptera: Syrphidae). This study expands that work by evaluating EO compatibility with two additional aphid predators: *Episyrphus balteatus* (Diptera: Syrphidae) and *Adalia bipunctata* (Coleoptera: Coccinellidae), both widely used in commercial biocontrol. We extracted EOs from cypress (*Cupressus sempervirens*), laurel (*Laurus nobilis*) and Aleppo pine (*Pinus halepensis*) leaves. A novel feature of our approach was the formulation of these oils into nanoemulsions, tested for both toxicity and repellency to the three predators. Plant material was collected from the Estación Biológica-Jardín Botánico de la Universidad de Alicante (Ibi, Alicante, Spain), dried, and processed by hydrodistillation using a Clevenger-type apparatus. Nanoemulsions were prepared by mixing EOs and Tween 80 (1:1 v/v), diluted in water, and homogenized via ultrasonication. EO effects varied among species (n = 30 per species). *S. rueppellii* was the most tolerant, showing low mortality (<7%) and no significant repellency. *Adalia bipunctata* was the most affected, showing high mortality with all the EOs, especially laurel (100%). The ingestion of treated aphids affected survival and predatory efficiency in *A. bipunctata*, especially with cypress EO (82% mortality), while only minor effects were observed in hoverflies, which were most affected by Aleppo pine EO (mortality at 19,2% for *E. balteatus* and 10,71% for *S. rueppellii*). Overall, the tested EOs show potential for use in integrated pest management strategies, suggesting compatibility under laboratory conditions by effectively targeting aphids while preserving hoverfly populations; however, their negative impact on *A. bipunctata* highlights the need for species-specific risk assessment.

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Magagnoli

Syrphidae (Diptera) within insect pollinator communities under climate change: Insights from a pollen metabarcoding study in a Northern Italian national park

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Keywords: agro-ecosystem, altitudinal distribution, hoverflies, next generation sequencing

Alpine and mountain ecosystems are highly sensitive to climate change, which can reshape plant–pollinator interactions along altitudinal gradients. We optimized protocols for pollen washing, DNA extraction, and amplification for metabarcoding analyses of pollen collected from syrphid bodies. Syrphids were collected in the Dolomiti Bellunesi National Park (Veneto, Italy) and in agricultural areas of Emilia-Romagna, where flowering strips with known seed mixtures were established as methodological controls. Once protocols were established, the study was expanded to investigate plant–pollinator interactions in the Dolomiti Bellunesi National Park by sampling pollinating insects across three elevations (800, 1600, and 2000 m a.s.l.) and applying pollen metabarcoding to multiple insect pollinator taxa, including syrphids. Metabarcoding, carried out on 123 specimens, revealed pollen from a wide range of plant families and genera across both studies. Syrphids were confirmed to transport anemophilous plants, and several previously undocumented interactions were identified, including those between *Microdon mutabilis/myrmicae* and the genus *Orchis*, as well as between *Xylota jakutorum*, a syrphid that rarely visits flowers, and the plant *Trollius*. If these interactions result from floral visits or from other causes (e.g., wind) cannot be assessed, but the potential role of this species in the pollination of plants cannot be excluded. Pollinator assemblages at the three elevations showed clear altitudinal turnover, with Hymenoptera dominating at lower elevations and Diptera becoming more prevalent at higher elevations. Network analyses indicated moderately low modularity and no significant deviation from null models, suggesting generalized interaction patterns with high overlap among taxa. Connector species played an important role in structuring interactions, although their identities varied along the elevational gradient. Overall, our findings suggest that altitudinal gradients act as strong environmental filters shaping pollinator community composition more than interaction specialization, highlighting the importance of conserving entire elevation ranges under ongoing climate change.

Hoverflies (Diptera: Syrphidae) of Montenegro: Priority species for conservation

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Keywords: syrphids, fauna, Montenegro, conservation, protected species

The hoverfly (Diptera: Syrphidae) fauna of Montenegro is characterized by high richness and a significant number of rare, endemic, and threatened species. Up to now, 397 species from 80 genera have been recorded in the country (Malidžan *et al.* in prep.). Considering the small territory of Montenegro, this number of species is very high compared to larger countries in the region. For example, on the Balkan Peninsula, only Greece (423 species) [1] and Serbia (442 species) have higher diversity. Among the recorded species, 58 are currently officially recognized as threatened (CR, EN, VU) in Europe. In this study, we applied modified criteria to define conservation priorities. These criteria include European threat status, Balkan or Montenegrin endemism, limited distribution within the country (recorded in only 3 to 5 localities), and the age of records for species not seen in recent decades. The result is a catalogue of 107 species, where each species has a clear justification for its conservation importance. Since many recently recorded species in Montenegro are already threatened, we expect this list to grow. This catalogue is intended to provide a basis for future protection and habitat management in Montenegro.

Silent Allies: The dual role of Syrphids in sustainable agriculture

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Keywords: Biological Control, Integrated Pest Management (IPM), Pollination, Syrphidae

Syrphids provide fundamental ecosystem services that support both plant reproductive success and global agricultural productivity. Beyond their well-known ecological roles, these dipterans participate in critical processes such as organic matter decomposition, nutrient cycling, and the maintenance of complex trophic networks. This keynote address focuses on the synergistic role of hoverflies within dual pillar services of modern agroecosystems: pollination and natural pest suppression. The key role of hoverflies in pollination of anemophilous and entomophilous crops has been demonstrated. The fundamental role of hoverflies in pollination has been widely demonstrated to the point that they are already included at European level in the EU Regulation on Nature Restoration (2024/1991). The presentation examines the specialized morphological adaptations and unique behavioural traits that enable syrphid larvae to effectively prey upon soft-bodied hemipterans, particularly aphids. Furthermore, we evaluate the distinct comparative advantages of syrphids over traditional aphidophagous agents currently employed in biological control programs. Evidence presented here demonstrates the high compatibility of syrphids with diversified Integrated Pest Management (IPM) frameworks including Biological Control, Parabiological, Chemical, and Integrated Methodologies. Essentially, we argue that a deep understanding of syrphid biology, grounded in rigorous taxonomic identification, is imperative for the conservation of these silent allies that significantly participate in Pollination and Biological Control in Agroecosystems. Protecting these species is not merely our responsibility but a fundamental requirement for safeguarding global biodiversity and future food security.

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Marini

PollHab – Pollinators typical of habitats protected under the Habitats Directive

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Pollinator decline threatens ecosystem functioning, biodiversity conservation, and the delivery of essential ecosystem services across Europe. Despite their ecological importance, pollinators are still insufficiently considered in habitat assessment and management frameworks, including Natura 2000 planning. PollHab supports the implementation of Action 4.2 of the revised EU Pollinators Initiative within the EU Biodiversity Strategy for 2030, contributing to the integration of pollinator conservation into the management of habitats protected under the Habitats Directive. The project aims to develop a scientifically robust and operational framework to identify pollinator species that are typical of terrestrial Annex I habitats. The project has established harmonised criteria for defining typical pollinator species across butterflies, moths, syrphids and wild bees, considering their ecological fidelity, range distribution overlap, and indicator value. Based on these criteria, a comprehensive list of typical pollinator species will be compiled for all terrestrial Annex I habitats protected under the Habitats Directive. The project integrated available European pollinator databases, literature, and expert knowledge to ensure consistency across biogeographical regions and taxonomic groups. In addition, habitat-specific monitoring and management recommendations will be developed to support Member States in incorporating pollinator conservation objectives into Natura 2000 management plans. The project will ultimately contribute to incorporate typical pollinators in the monitoring of the condition of Annex I habitats.

Maritano

Microbial–saproxylic hoverfly interactions in tree sap runs: Insights from the MICRO-SAPRO Project (North-Western Italy)

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Keywords: biodiversity conservation, forest ecology, mark–recapture, microbial communities, saproxylic insects, Syrphidae

Saproxylic hoverflies are key components of forest ecosystems, yet the ecological drivers shaping their communities remain only partially understood. Within the framework of the MICRO-SAPRO project, funded by the Italian National Recovery and Resilience Plan, we investigated the relationships between microbial communities and saproxylic hoverfly assemblages associated with tree sap runs. Between mid-April and end of June 2025, 35 trees with external sap runs were sampled across the Piedmont region. At each sap run, samples of the decaying sap were collected for microbial analyses, with three temporal replicates per tree, resulting in a total of 105 sampling events. Metabarcoding of microbial communities, including fungi, yeasts, and bacteria, was performed on DNA extracted from decaying sap samples using nanopore sequencing technology. Hoverfly communities were concurrently surveyed on each tree. Our results revealed that fungal communities in decaying sap samples differed significantly among host tree species and were significantly associated with hoverfly assemblage composition, indicating a strong ecological linkage between these taxa. In contrast, bacterial communities showed no significant patterns in relation to either tree species or hoverfly composition. These findings highlight the potential role of fungi as key mediators in saproxylic ecological networks. Additionally, a mark–recapture study on *Sphiximorpha subsessilis* (Illiger in Rossi, 1807) provided novel ecological insights: 170 individuals were marked, revealing local population sizes of up to 35 individuals, maximum longevity of 26 days, and dispersal distances reaching 1.3 km. Notably, the study also led to the rediscovery of the threatened species *Brachyopa maculipennis* Thompson, 1980 within the Italian fauna. Overall, this work underscores the importance of integrating microbial ecology into the study of saproxylic insect communities and provides new perspectives for biodiversity conservation and forest management.

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Maritano

European-funded initiatives on hoverflies (Diptera: Syrphidae) in Italy: From saproxylic ecology to conservation and first national red list IUCN

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In Italy, European and nationally co-funded initiatives on hoverflies (Diptera: Syrphidae) have rapidly increased in recent years, strengthening both research and conservation actions across multiple ecological contexts. Among these, the MICRO-SAPRO project, funded by the Italian National Recovery and Resilience Plan (PNRR; Measure M4C2, Investment 1.4, CUP B63C22000650007), was completed in 2025 and focused on the ecological interactions between saproxylic hoverflies and sap runs. The project investigated microbial community composition within sap flows and its relationship with associated hoverfly assemblages, providing novel insights into microbe–insect interactions in forest ecosystems. In parallel, the International Union for Conservation of Nature (IUCN), through the European Fund for Youth Action on Pollinators, has funded six italian projects for 2026, including the larger one: POLLIN-RED (POLLINator Red-list Evidence & Dissemination) founded to Associazione Naturalistica Piemontese. This nationally relevant initiative aims to support the development of the first Italian Red List of hoverflies and includes a national training bootcamp on flagship species, alongside field activities such as marking and monitoring threatened taxa (*Eumerus tarsalis*, *Brachyopa maculipennis*, *Microdon myrmicae*). Furthermore, two LIFE projects launched in 2025 reinforce conservation actions at broader spatial scales. LIFE POLLINATORS (LIFE24-NAT-IT-ZOO), coordinated by Fondazione Zoom, aims to establish standardized pollinator transects within European zoological institutions. LIFE PolliNetwork (LIFE24-NAT-IT-LIFE), in collaboration with WWF Italy, focuses on habitat restoration and ecological connectivity across agricultural systems, railway infrastructures, and road networks, contributing to the definition of best practices for pollinator conservation at the national level. Together, these initiatives highlight Italy's growing role in advancing hoverfly-focused research and conservation within the European framework.

Ecological-economic importance of saproxylic hoverflies: Assessing pollination potential in old forests in Serbia

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Keywords: ecological economics, ecosystem services, functional traits, old forests, pollination potential, saproxylic hoverflies

Saproxylic hoverflies (Diptera: Syrphidae) are closely associated with old trees and deadwood microhabitats, but the pollination role of adults remains insufficiently quantified. This study assessed the pollination potential proxy (PPP) of saproxylic hoverflies by integrating key biological and ecological traits. The study was based on 81 saproxylic hoverfly species reported for Serbia; five species were excluded due to missing trait data. The proxy was calculated from body size, vestiture, phenology, flower visitation, and mobility. To test whether species retained similar rankings under different weighting assumptions, three alternative models were compared: an equal-weight model and two models assigning greater importance either to biological (body size and vestiture) or to ecological traits (phenology, mobility, and flower visitation). Ranking stability among models was tested using Spearman's rank correlation coefficient calculated between species rankings obtained under different weighting models; and overlap analysis of the highest-ranked species. Spearman's correlation indicated high ranking stability, with all pairwise coefficients exceeding 0.9. Overlap analysis showed that *Brachypalpus chrysites*, *B. valgus*, *Callicera aurata*, *Caliprobola speciosa*, *Criorhina ranunculi*, *Matsumyia berberina*, *Myathropa florea*, and *Xylota segnis* were consistently retained among the top-ranked taxa in all three models. The PPP approach identified clusters of species with low, medium, and high pollination potential. These findings indicate that saproxylic hoverflies are functionally heterogeneous and that species with high estimated pollination potential can be distinguished. From an ecological-economic perspective, veteran trees, tree hollows, and other saproxylic microhabitats represent natural capital supporting pollinator functional diversity, and insurance and option value of long-term pollination in forest ecosystems.

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Mengual

Systematics and phylogenetics of Syrphidae: A 20-years overview

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Keywords: phylogeny, genomics, tree of life

Little by little, piece by piece, we are gathering new information about the evolutionary history of Syrphidae and the relationships of the different lineages. From the initial analyses with two or three genes to large datasets with genomic information, from inference based on a few morphological characters to an integrative approach using multiple datasets, the systematics of Syrphidae has changed enormously in the last two decades. A small journey through major changes and a summary of the last genomic publication will be presented. Evidence and uncertainty about some phylogenetic relationships will be commented and the next soon-to-be-published contributions will be commented.

European hoverfly trait and distribution data compilation: Achievements and future perspectives

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Keywords: data collection, data integration, functional characteristics, large-scale datasets, occurrence records, syrphids

Systematic compilation of trait and distributional data for European hoverflies is essential for understanding their functional roles, ecological requirements, and large-scale biogeographic patterns, as well as supporting evidence-based conservation and environmental assessment. Large international initiatives provide a framework for coordinating such efforts. Recent efforts to compile trait information on hoverflies have resulted in a soon-to-be-published comprehensive dataset encompassing 913 European species and 26 traits, organised into thematic sections covering larval biology, adult morphology, ecology and behaviour, and distribution. Data were compiled from literature and expert knowledge. In a subsequent phase, the database was further refined to better support environmental risk assessment applications by expanding trait coverage, particularly for traits linked to pesticide sensitivity, and incorporating information previously available only for other pollinator groups. Regarding distribution data, the initial phase produced a dataset including at least one record for 886 species, comprising over 1.04 million occurrence records. Data were assembled from literature, biodiversity platforms, and museum and private collections. The dataset is publicly available via Zenodo and formatted according to GBIF standards, facilitating interoperability and future integration. Despite these efforts, assembling a dataset with broad geographic coverage across Europe remains challenging, as data collection is unevenly organised among countries and often fragmented across sources. Continued engagement of the syrphid research community is essential, as current data resources remain incomplete and geographically uneven. Strengthening collaboration, standardising data compilation practices, and improving data integration will be key to developing more comprehensive and representative datasets for ecological and conservation applications.

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Hoverfly research within WildPosh project

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Keywords: exposure pathways, pesticide risk assessment, pollinator health, syrphids, trait-based approaches

Hoverflies are increasingly threatened by pesticide exposure, one of the most pervasive yet insufficiently understood environmental pressures affecting their diversity and ecosystem functions they provide. WildPosh is a multi-actor, transdisciplinary project whose overarching mission and ambition are to significantly improve the evaluation of risk to pesticide exposure of wild pollinators, and enhance the sustainable health of pollinators and pollination services in Europe. Within the WildPosh project, hoverflies represent one of the focal groups for advancing pesticide risk assessment. An integrated monitoring framework is being developed to identify contamination sources and exposure routes by integrating hoverfly sampling with residue analysis of nectar, pollen, and plant material from focal forage plants used by adults and larval stages, across semi-natural habitats located near conventionally managed agricultural fields. Furthermore, pupae and adults of selected test species are evaluated for pesticide sensitivity by assessing short-term mortality, as well as chronic and sublethal effects, including survival to emergence, fluctuating asymmetry, and behavioural disruption, with laboratory and semi-field experiments also addressing larval stages across species with different feeding strategies. RNAseq analyses are conducted to identify pesticide-induced disruption of detoxification and immunity pathways, linking molecular responses to phenotypic sensitivity. In parallel, annotated genomes of umbrella hoverfly species are generated using whole-genome sequencing (WGS). The project also compiles a dedicated trait database reflecting sensitivity and exposure risk, as well as harmonised distributional data for hoverflies at national and continental scales to support large-scale ecological modelling and regulatory applications. Together, these efforts aim to provide a mechanistic and evidence-based foundation for improving pesticide risk assessment frameworks for hoverflies in Europe.

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From data availability to usability: European hoverfly trait and distribution data

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Compiling large-scale trait and distribution datasets for European hoverflies remains challenging despite the increasing availability of biodiversity data. Data assembled from literature, biodiversity platforms, and collections revealed substantial heterogeneity in quality, uneven geographic and taxonomic coverage, and limitations in accessibility and standardisation. Distribution data, in particular, were affected by spatial bias, inconsistent georeferencing, and gaps in coverage, complicating their integration into a single, comprehensive resource, while trait data faced challenges in consistency across sources. These limitations highlight the need for more coordinated and inclusive approaches to future data initiatives within the syrphid research community.

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The limits of the subfamily Eristalinae revealed at last

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Keywords: Eristalinae, Next-Gen Sequencing, phylogenetics, Trans-Antarctic relationships

Targeted enrichment sequencing, combined with the homology-first bioinformatics pipeline SAPPHYRE, resolves the long-standing non-monophyly of the subfamily Eristalinae (Diptera: Syrphidae). SAPPHYRE's evidence-placement approach to ortholog recovery enables the inclusion of pinned museum specimens, extending taxonomic sampling to rarer and historically inaccessible taxa. We present a comprehensive generic-level phylogenetic hypothesis for the subfamily, based on 1291 single-copy orthologous genes sampled across 136 of 145 described genera included in Eristalinae. Eristalinae as traditionally circumscribed is recovered as non-monophyletic, resolving into four reciprocally monophyletic clades: Eristalinae s.s., Cerioidini, Merodontini, and Volucellini. We present the relationships among these clades and their positions relative to Microdontinae, Syrphinae, and Pipizinae, and discuss the taxonomic implications for subfamily-level classification within Syrphidae. A Bayesian divergence time analysis places the origin and diversification of these lineages against Cretaceous and Cenozoic events, providing a temporal framework for interpreting the biogeographic patterns recovered in the tree. Multiple independent Australian-Chilean sister-group relationships are recovered. We use divergence time estimates to evaluate Gondwanan vicariance, Trans-Antarctic connection via Antarctica, and long-distance dispersal as alternative explanations for these relationships.

Morelli

Understanding the local habitat and landscape drivers of urban hoverfly communities

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Keywords: landscape composition and configuration, pollinator declines, Syrphidae, urban agriculture, urban ecology

Urbanisation drives land-cover change, reducing biodiversity and ecosystem function. Yet, urban green spaces can partially offset these impacts by supporting pollinators. Hoverflies (Diptera: Syrphidae), important pollinators and biocontrol agents, remain understudied in urban ecosystems, with their responses to urbanisation varying across contexts and spatial scales. In light of their apparent global declines, we investigated how local habitat features and landscape composition and configuration influence hoverfly richness and abundance across Bologna, Italy. We sampled 15 urban green spaces, including urban farms and parks, once per month throughout the 2023 flowering season using plot observations and pan traps. We recorded 485 individuals belonging to 27 species. Hoverfly richness and abundance increased with local floral richness but declined with greater surrounding urban cover, highlighting strong effects of landscape composition. In contrast, landscape configuration (i.e., the spatial arrangement of green spaces and habitats) had no significant effect, which may reflect hoverflies high mobility and their ability to exploit dispersed resources across fragmented urban environments. Urban farms supported substantially higher richness and abundance of hoverflies than parks, likely due to greater floral resource availability and habitat heterogeneity. From a management perspective, increasing floral diversity and expanding the total area of green space emerge as key strategies to support hoverflies in urban environments. Urban farms should be recognised as valuable components of green infrastructure, complementing parks and other green spaces in sustaining pollinator communities.

Interaction networks of hoverflies (Diptera: Syrphidae) and plants in two wetlands in Bogotá, Colombia

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Keywords: bipartite networks, floral visitors, neotropical syrphids, pollination, urban wetlands

Hoverflies (Diptera: Syrphidae) are important pollinators and bioindicators due to their sensitivity to climatic variation and habitat fragmentation. We evaluated syrphid–plant interaction networks in two urban wetlands in Bogotá (El Burro and Techo, 2550 m a.s.l.), which were historically part of Laguna del Tintal. Three sampling campaigns were conducted in each wetland between September and December 2023. Each of the 10 sampling points per wetland was standardized by recording six flowering plants per point. Syrphids visiting flowers were collected using aspirators and entomological nets between 10:00 and 15:00 h. A total of 301 syrphid individuals (10 genera, 16 species) interacting with 39 plant species (16 families, 35 genera) were recorded. Interactions were mostly generalist, with a preference for open, yellow, disc-shaped flowers. *Asteraceae* accounted for 61.5% of all interactions (185 events). Native Neotropical syrphids predominated, while introduced plant species were common (56%). Network analyses were conducted using standard functions in the R package bipartite. Nestedness (NODF) was similar between sites (Burro = 36.42; Techo = 34.96; overall = 36.61), suggesting structural stability. Network specialization (H2 = 0.49) indicated moderate specialization, with lower stability in Techo (H2 = 0.43) compared to Burro (H2 = 0.48), likely associated with greater habitat fragmentation (11.69 ha total, 5.3 urbanized). Despite low connectivity (0.12), modularity was moderate (Q = 0.43), indicating non-random organization of interactions. This pattern reflects vertical resource partitioning: *Palpada florea* showed 78% of its visits on shrubs and trees, whereas *Toxomerus watsoni* was mainly linked to herbaceous understory plants (71%).

A putative new species of the *Chrysotoxum intermedium* Meigen complex (Diptera: Syrphidae)

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Keywords: *Chrysotoxum*, Iberian Peninsula, adult morphology, mitochondrial marker

Within *Chrysotoxum* Meigen, 1803 hoverflies, *Chrysotoxum intermedium* Meigen, 1822 stands as one of the most questioned taxa with a range of morphological variability that suggests the existence of a complex of species all sharing a basoflagellomere conspicuously longer than the scape+pedicel and abdomens with yellow marks reaching lateral margins of tergites. Meigen's type of *C. intermedium*, from central Europe, is apparently lost and the morphological similarities between *C. intermedium* and *Chrysotoxum lessonae* Giglio-Tos, 1890 complicate the correct interpretation of *C. intermedium*. However, recent fieldwork in south-eastern Spain uncovered eight specimens fitting the current broad concept of *C. intermedium* but with a unique morphology and in co-occurrence with other *C. intermedium* morphotypes. This putative new taxon is here presented and compared with other *Chrysotoxum* species and morphologies of *C. intermedium* in broad sense. Characters other than colouration can be used to separate the new putative species, for example the shape of abdomen, the terminal abdominal segments and the surstylus. Even though the specimens found have a distinctive morphology within the *C. intermedium* complex, the complete COI (Cytochrome c oxidase subunit I) does not appear to delimit this taxon from others and further molecular analysis involving nuclear markers are needed. The taxon appears to be endemic to south-eastern Spain.

Nève

Two hundred years of hoverfly records: The changing fauna of the Bouches-du-Rhône department (France)

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Keywords: Bouches-du-Rhône, distribution, faunistics, historic records, Syrphidae

We gathered over 6000 records of Syrphidae from the Bouches-du-Rhône department (southern France) from the period 1821–2026. Over 90 % of these are our own, collected since 2000, supplemented with data from the Natural History Museums of Dijon, Lyon and Marseille, and a thorough critical literature review. A total of 176 species were recorded, plus a few doubtful ones. The department may be separated into two main ecological zones affecting hoverfly communities: the Rhône delta, in the west, supports numerous species associated with wetlands and riparian forests, while the east of the department is home to species characteristic of Mediterranean scrublands. The first list of hoverfly species found in the Bouches-du-Rhône department was published in 1821, listing 40 species, including two species which have not been recorded there since: *Rhingia rostrata* and the critically endangered *Psarus abdomidalis*. Twenty-one species have not been recorded since 2000 despite our efforts, suggesting either a decline in saproxylic diversity or a need for habitat-specific surveys. Species new to the department are generally elusive species found in the Mediterranean scrublands or in riparian forests, habitats rarely surveyed by the few collectors of the nineteenth and twentieth centuries. *Eristalinus megacephalus* is a new addition to the local fauna likely linked to climate change. Other additions to the local fauna are more likely the result of improved sampling effort rather than recent changes in species presence. Some species still present taxonomic challenges, such as the *Cheilosia latifrons* and *Chrysotoxum intermedium* complexes, which may include several cryptic species.

Opdekamp

Notes on the habitat preferences of *Tropidia fasciata* Meigen, 1822 *and Eumerus ruficornis* Meigen, 1822 in Belgium

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Keywords: Diptera, *Eumerus ruficornis*, Molinion grasslands, *Scorzonera humilis*, Syrphidae, *Tropidia fasciata*

In Europe High nature value (HNV) grasslands are among the most floristically species-rich ecosystems on the continent. In this study we investigated their importance for the two hoverfly species *Tropidia fasciata* Meigen, 1822 and *Eumerus ruficornis* Meigen, 1822 in Belgium. The latter is listed as Endangered on the European red list and was recorded for the first time in Belgium in 2022. Some 460ha (381 parcels, min: 0.02 ha, max: 9.05ha, median: 0.69ha) of HNV-grasslands – mostly in the Walloon region – were visited during the flight period of both species. For each parcel information on the grassland type and its floristic composition were collected. The presence or absence of both hoverfly species and their behaviour was equally noted. Both species were almost exclusively present in Molinion grasslands (EU habitat type 6410). The numbers of both species showed a strong link with the abundance of viper's grass *Scorzonera humilis* L. Behavioural observations (males *T. fasciata* observed active patrolling along rosettes of *S. humilis* and chasing other insects; females *T. fasciata* with a fully extended ovipositor observed descending *S. humilis* stems or crawling on the ground near the base of rosettes) provide additional support for this relation between *T. fasciata* and *S. humilis*. Finally, the future conservation and prospects for both species are discussed.

Capacity building in Hoverfly para-taxonomy: EPIC-Fly project

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The EPIC-FLY project (European Pollinator Identification Courses – Hoverflies) is part of the European Capacity Building in Pollinator Taxonomy programme. Its main objective is to strengthen taxonomic capacity across the 27 EU Member States, thereby supporting the implementation of the EU Pollinator Monitoring Scheme (EU-PoMS) within the framework of the EU Nature Restoration Law. The project delivers a continuous training programme in hoverfly taxonomy, structured into four levels. The first three levels (Basic, Intermediate I, and Intermediate II) provide participants with the essential taxonomic skills required for hoverfly monitoring, enabling them to identify species in the field and to determine which specimens require laboratory confirmation. The Advanced level focuses on more challenging taxonomic groups. EPIC-Fly began in 2024 and will run until the end of 2027. During this period, a total of 44 training courses will be delivered. The main outcomes will include not only the training programme itself, but also the development of standardized training materials and the location of the main reference collections of the countries and preparation of the lists of the materials that they contain.

Pijálková

Distribution changes of Andean hoverflies *Dolichogyna* (Diptera: Syrphidae) during late Quaternary

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Keywords: alpine ecosystem, Andes, *Dolichogyna*, last glacial maximum

Climatic conditions are key drivers of species distributions across spatial and temporal scales, with particularly strong effects in montane ecosystems. Quaternary climate fluctuations caused a significant shift in species ranges in mountain areas, making mountain taxa valuable models for studying habitat suitability under changing conditions. The hoverfly genus *Dolichogyna* (Diptera: Syrphidae) (Macquart, 1842), restricted to the South American Andes, represents an ecologically important but poorly understood group of pollinators. This study compiles 758 occurrence records from multiple sources (iNaturalist, previously published literature, our field recordings, Naturalis museum collection) and applies MaxEnt modelling to assess current and past (Last Glacial Maximum and Middle Holocene) distributions. Results show that *Dolichogyna* is closely associated with Andean ecosystems across a broad latitudinal gradient, from tropical páramo to the temperate southern Andes, with little presence in adjacent lowlands. The most frequently recorded species, i.e. *D. chilensis* (Guérin-Méneville, 1835), *D. nigripes* (Bigot, 1884), and *D. reynoldsi* (Shannon & Aubertin, 1933), exhibit relatively continuous distributions, whereas others remain poorly characterised. Model performance was high (AUC ≈ 0.95; TSS ≈ 0.83-0.85), with temperature of the wettest quarter and precipitation seasonality identified as key predictors. Hindcasting indicates a more fragmented distribution during the Last Glacial Maximum, likely due to climatic constraints and reduced habitat connectivity. These findings align with broader Andean biogeographical patterns in ecosystem connectivity shaped by Quaternary climatic changes. Overall, this study highlights the importance of climatic stability and humidity in structuring *Dolichogyna* distribution and demonstrates the value of ecological niche modelling for poorly documented montane taxa.

Pollinators of beaver territories: How the return of beavers affects the pollinator spectrum

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Keywords: Diptera, ecosystem engineer, European beaver rewilding, Syrphidae

The European beaver (*Castor fiber*) has been absent from central Europe for many decades. Over the past 40 years, we have observed its return to its original habitats and the consequent effect it had on local river ecosystems. Many syrphids are known to have aquatic or semi-aquatic larvae, while others breed in decaying wood. The aquatic larvae also differ in their requirements regarding various types of water, including stagnant or flowing water, and water that is either deep or shallow. All these conditions are present in beaver territories. The areas cleared near the beaver dams also provide a suitable environment for many species of flowering plants. The aim of this preliminary study is to investigate the diversity of hoverflies and other pollinators in beaver territories and the impact of beaver activity on the composition of local pollinator communities and plant-pollinator networks. Fieldwork involves transect monitoring of pollinators in the vicinity of beaver territories as well as collection of aquatic invertebrates from the substrate of various aquatic microhabitats (deep water, shallow water, submerged wood, flowing water). Expected outputs include characterization of the composition of pollinator and aquatic invertebrate communities, reconstruction of plant-pollinator networks, and further comparison to pollinator communities and networks previously studied outside of beaver territories.

Safeguarding veteran trees and their hoverfly associates: evidence and expert perspectives on effective conservation practices

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Keywords: conservation, microhabitat, practices, retention forestry, saproxylic, veteranisation

Veteran trees are biodiversity hotspots in European landscapes, providing irreplaceable microhabitats such as cavities, rot holes, sap runs, and decaying wood. These structures support specialised saproxylic organisms, including threatened hoverfly species. A key challenge is translating ecological knowledge into practical habitat management. In this context, the central question is: which evidence-based management practices most effectively support saproxylic hoverflies associated with veteran trees in European landscapes? To address this knowledge gap, we conducted a systematic literature review complemented by an expert survey to identify management practices benefiting saproxylic hoverflies. Using the Scopus database, we searched for studies linking hoverflies, veteran trees, and woodland management, yielding 321 publications. Studies were retained if they were conducted in Europe, focused on saproxylic hoverflies, and provided empirical evidence based on field data, environmental datasets, or experimental studies. After screening titles, abstracts, and full texts, 31 studies met these criteria. From these studies, 35 management practices were extracted and grouped into eight management categories. To complement the literature review, a survey of 35 hoverfly experts was conducted to rank the management practices extracted from the reviewed studies, thereby directly linking expert prioritisation to the evidence base identified in the literature. Expert rankings highlighted retention forestry and veteranisation techniques as the most important practices in managed forests, emphasizing the value of maintaining habitat trees and deadwood and creating veteran-like structures that accelerate the formation of key microhabitats. These findings emphasize the importance of protecting existing veteran trees and maintaining the long-term continuity of deadwood habitats for the conservation of saproxylic hoverflies.

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Action Plans for conservation of threatened pollinator species in the EU - IUCN project

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Responding to ongoing pollinator declines, the European Commission launched three targeted Species Action Plans across the European Union, marking a key step toward advancing European biodiversity objectives. Developed by the International Union for Conservation of Nature (IUCN) and partners, these plans focus on pollinators of the Canary Islands, teasel-associated bees, and hoverflies associated with veteran trees. Each plan combines species assessments with prioritised actions, indicators, timelines, and responsible actors. Their successful implementation relies on coordinated cross-sectoral collaboration and alignment with key EU policy frameworks, including the Nature Restoration Regulation and the EU Pollinators Initiative. The Action Plan *Hoverflies specialised in veteran trees in Europe – Conservation Action Plan 2023–2030* targets six threatened species dependent on veteran trees and wet, decaying wood. These saproxylic hoverflies provide key ecosystem functions and act as indicators of habitat quality. The removal of veteran trees, replacement of key tree species, and unsuitable woodland management are major threats. The plan includes governance structures, strengthened legal protection, habitat restoration, targeted research, development of best-practice guidelines, and standardised monitoring integrated into EU frameworks. It also promotes improved habitat connectivity, adaptive forest management, and stakeholder and citizen engagement. Successful implementation requires coordinated cross-sectoral engagement, supported by monitoring frameworks enabling adaptive management and long-term conservation outcomes across the EU.

Determination of acute contact LD_{50} and sublethal effects of cypermethrin in *Eristalinus aeneus* (Scopoli, 1763) (Diptera: Syrphidae)

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Keywords: hoverflies, non-target insects, paralysis, pollinator risk assessment, probit analysis

Pollinator populations are declining worldwide, with pesticides being a major factor. Hoverflies are still underrepresented in ecotoxicological risk assessment studies [1]. In this study, we investigated the acute contact toxicity of cypermethrin in *Eristalinus aeneus* adults by determining LD_{50} values and assessing sublethal effects. LD_{50} values were calculated at 4, 24, 48, 72, and 96 h, while sublethal effects (paralysis, abnormal behaviour, reduced coordination) were recorded at 4, 24, and 48 h. Seven doses of cypermethrin were tested (0.189–0.003 µg/fly) with 34–36 individuals per treatment group. Males and females were tested separately with 2 µL applied to the dorsal thorax. LD_{50} values were estimated using a probit regression model in R. The worst-case LD_{50} derived from the 24-, 48-, and 72-hour assessments for both sexes was approximately 0.036 µg/fly (0.84 µg/g). Paralysis was the predominant sublethal effect in both sexes, reaching 100% at 4 h and showing a declining trend over time and with lower cypermethrin concentrations. Compared with *Apis mellifera* (0.023 µg/bee; ~0.2 µg/g) [2] and *Bombus terrestris* (0.96 µg/bee; 4.72 µg/g; unpublished data, University of Mons, WildPosh project), *E. aeneus* showed intermediate sensitivity to cypermethrin when body weight–adjusted doses were considered. These results suggest that *E. aeneus* is less sensitive than honey bees but more sensitive than bumblebees. These findings highlight the importance of including multiple pollinator taxa in pesticide risk assessment, as insecticide sensitivity can vary substantially among pollinators. Further research on non-target insects is needed for their inclusion in risk assessment frameworks.

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Radenković S.

A contribution to the *Eumerus* Meigen, 1822 (Diptera: Syrphidae) fauna of South Africa

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Keywords: Afrotropical fauna, checklist, hoverflies, taxonomy

The genus *Eumerus* Meigen, 1822 is widely distributed across the Palaearctic, Afrotropical, Oriental and Australasian regions, and currently comprises approximately 300 described species. Taxonomic work on the Afrotropical fauna remains limited with most available publications dating from the early to mid 20th century. Recent studies have focused primarily on the description of new species [1] or on particular species groups (e.g. *E. triangularis* group) [2]. During field investigations carried out in the Republic of South Africa from 2015 to 2017 within the "Fly High" project (EU Horizon 2020 RISE programme), numerous specimens of *Eumerus* were collected. The material was determined using Leif Lyneborg's (1932–2006) unpublished identification key for Afrotropical *Eumerus* species and through examination of several museum collections (KwaZulu-Natal Museum, Pietermaritzburg, South Africa; Bloemfontein Museum of South Africa, Bloemfontein, South Africa; Iziko Museum of South Africa, Cape Town, South Africa; Royal Museum for Central Africa, Tervuren, Belgium). To improve taxonomy and aid in species identification, Jordaens *et al.* [3] created a reference database of 523 DNA barcodes for 98 Afrotropical hoverfly species. As their results showed that the database remained largely incomplete, we expanded it with additional barcodes from 40 *Eumerus* species. Here we present a preliminary checklist of *Eumerus* species from South Africa, comprising about 60 taxa, more than one third of which are new to science.

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SPAS - Serbian Pollinator Advice Strategy

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Established within the EU Pollinators Initiative, the European Pollinator Monitoring Scheme (EUPoMS) aims to tackle the decline in insect pollinators, which could seriously affect ecosystem functioning and food security by disrupting pollination services. Previously, the Republic of Serbia lacked a long-term, systematic inventory of pollinators, as well as a national pollinator initiative or strategy. During the national project SPAS (Serbian Pollinator Advice Strategy – for the next normal), three groups of pollinators (hoverflies, wild bees, and butterflies) were monitored from 2022 to 2024. The project was financed by the Science Fund of the Republic of Serbia (300,000 Euros). A team of 14 scientists performed the following project tasks: 1. Monitoring pollinators at the species level across 30 sites during spring, summer, and autumn using transect walks, pan traps, and Flower-Insect Timed (FIT) Counts for broad insect categories, alongside environmental parameters influencing pollinator occupancy, diversity, and abundance; 2. Establishing a database and reference collections; 3. Statistical analysis of the data; 4. Genetic analysis of pollinators, including DNA barcoding for species lacking records in relevant databases, environmental DNA (eDNA) metabarcoding of flowers to assess visitor diversity along transects, and genomic diversity analysis (ddRADseq) for selected hoverfly group of species; 5. Dissemination regarding the importance of pollinators and training courses for monitoring and identification (resulting in published field guides for hoverflies and bees). Approximately one-third of the nationally known fauna of hoverflies and bees, and half of the butterfly fauna, were registered, with some records being new to Serbia. Bees were the most abundant in spring, while hoverflies and butterflies peaked in summer. Pan traps proved to be a less effective method than transect walks. According to our data, the environmental factor that most influenced the species richness and abundance of hoverflies is air humidity, for bees it is flower cover, and for butterflies, it is temperature. While the number of species remained almost consistent across the years, abundance varied significantly, highlighting the necessity of long-term monitoring —including environmental parameters, land-use changes, and pesticide usage—to detect the causes and trends of these changes.

Acute contact toxicity and sublethal effects of acetamiprid and tebuconazole on *Eristalinus aeneus* (Scopoli, 1763) (Diptera: Syrphidae)

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Keywords: behavioural effects, hoverflies, mortality, pesticide exposure, pollinators

Pesticides pose a significant threat to declining pollinator populations, and hoverflies are often overlooked in ecotoxicological studies [1]. This study evaluated the acute contact toxicity of acetamiprid, tebuconazole, and their combination on *Eristalinus aeneus* adults by measuring mortality and sublethal effects at 4, 24, and 48 hours. Individuals were treated with 2 µL of pesticide solution applied to the dorsal thorax. Two experimental setups were conducted. In the first experiment, doses were calculated based on the LD_{50} for *Bombus terrestris*, adjusted to the average body mass of *E. aeneus* (17.43 µg/individual; 405.35 µg/g). In the second experiment, a lower dose was applied only for acetamiprid (0.35 µg/individual; 8.14 µg/g). The number of individuals per treatment group was 30 in the first experiment and 51 (acetamiprid), 71 (tebuconazole), and 70 (combination) in the second. After 48 h, mortality in the first experiment reached 100% for acetamiprid and the combination, and 23.3% for tebuconazole. In the second experiment, mortality was 35.3%, 11.3%, and 55.7% for acetamiprid, tebuconazole, and their combination. Paralysis was observed within 4 h in the first experiment, whereas in the second, individuals showed unusual behaviour, reduced coordination, and paralysis. Compared with *B. terrestris* (~408 µg/g; unpublished data) and *Apis mellifera* (~80.9 µg/g) [2], E. aeneus showed high sensitivity to acetamiprid and lower to tebuconazole, with a possible additive effect. In the second experiment, relatively low doses of acetamiprid still caused high mortality. Differences between species are likely related to metabolic processes. These results highlight the need for further research.

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INC-STEP: Instigating a national reference collection for Spain's threatened pollinators, 3PP TETTRIs

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Entomological collections are critical to knowledge and conservation of declining pollinators in a context of global change. Consequently, TETTRIs initiatives such as the INC-STEP emerged to evaluate, both in curatorial and technical terms, the cost of creating a national reference collection of pollinators in Spain. INC-STEP involved five major DiSSCo-ES collection centres (see acknowledgments: MNCN-CSIC, UCM, MCNB, UNAV, UV) and targeted pre-existing dry-preserved specimens of Eristalinae (Diptera: Syrphidae), amongst other pollinator groups. Experts in all these groups were hired for taxonomic revision and collection validation. Regarding Eristalinae, over 2500 specimens were identified of 154 species, of which three were new to Spain. Revision of specimens rendered data to complete six papers on Eristalinae taxonomy and fauna. Sheets for easy identification of seven Eristalinae species were also produced as a pilot experience. Three quarters of the time invested in the project as a whole was devoted to curatorial or technical tasks. The remaining quarter of the time was devoted to taxonomic revision. Creating the reference collection relying on pre-existing specimens was far less time-consuming and costly than starting from scratch (collecting, preparing, etc.). This demonstrates the vital importance of preserving and protecting existing natural history collections, and taking full advantage of them by validating their taxonomic identity, digitising the information, and making it accessible. INC-STEP reveals how taxonomic expertise and the professional experience of collections curators can overcome limitations to the accessibility of entomological collections, mobilising information and resources to support insect monitoring and conservation.

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Rojo

First record of the *Eumerus tricolor* species group (Diptera: Syrphidae) in the Canary Islands, revealing a previously overlooked phytophagous association with holoparasitic broomrapes (Orobanchaceae)

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Keywords: broomrape, Canary Islands, *Eumerus*, phytophagy

The phylogenetic relationships within the diverse genus *Eumerus* Meigen, 1822 are still not fully resolved. However, the *tricolor* species-group has been recovered as monophyletic based on both molecular data and adult morphological characters. Larval morphology and life cycle traits also support the distinctiveness of this group, showing phytophagous traits more similar to those of *Merodon* larvae than to other *Eumerus* species with phyto-saprophagous habits. However, information on plant–host interactions within the *tricolor* species group remains scarce. For example, an interaction between a member of this group and holoparasitic broomrapes (Orobanchaceae) in Europe is known and resulted in the description of *E. larvatus* Aracil, Grković & Pérez-Bañón, 2023 [1]. During recent sampling in the Canary Islands, *Eumerus* larvae were found feeding on broomrape plants (*Cistanche* spp.) in a manner similar to that observed in mainland Spain. The larvae were reared to the adult stage, providing the first data on the life cycle and larval morphology associated with this interaction in the Canary Islands, and confirming the presence of the *tricolor* species-group in Macaronesia for the first time.

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Syrphidae of Armenia

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Keywords: Armenia, Caucasus, checklist, faunistics, Syrphidae

Armenia is a small landlocked country placed in the mountainous area of the Lesser Caucasus. About 90% of the country is above 1000 m elevation, the highest peak reaching 4090 m. Due to its geographical position at the crossroads between eastern Europe, the Mediterranean Basin, the Middle East and central Asia, combined with its rugged topography, a high level of biodiversity is expected. However, concerning syrphids, the southern Caucasus remains severely data deficient in both faunistic and taxonomy when compared to, for instance, the Alps or the Balkan Peninsula. Moreover, previous data, mostly gathered during the Soviet period, are scattered and difficult to access for the international research community. We therefore compiled and published a checklist of the hoverflies of Armenia, serving as baseline data and stimulus for future research. Taking a conservative approach, we included 263 species which were either examined by the authors (specimens from recent surveys by the authors or from accessible historic collections) (n=176), or were explicitly reported in previous publications to originate from localities within Armenia. Records only mentioning the broader region (e.g., “Caucasus” or “Transcaucasia”) were excluded. A remarkable 22% of the 263 species were either new records for the country (n=38) or were explicitly confirmed for Armenia for the first time (n=21). In addition to the checklist, the presentation focuses on the brief description of exemplary habitats of little-known species, mainly of the genera *Cheilosia* and *Merodon*.

Genome-wide data analysis resolved taxonomic confusion within the *Merodon bessarabicus* subgroup (Diptera, Syrphidae)

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Keywords: COI gene, cryptic species, ddRAD, hoverfly, species complex

Cryptic species poses a special challenge for taxonomy and often depends on genomic data to be distinguished. This research focuses on the *Merodon bessarabicus* subgroup of the *M. aureus* group of the species of the *Auremerodon* subgenus which are known for high cryptic speciation. Using genome-wide ddRAD data, we aimed to clarify the taxonomy of the *M. bessarabicus*, *M. sapphous*, and *M. ambiguus* species complexes and the nominal species *M. quercetorum* Marcos-García, Vujić & Mengual, 2007 and *M. legionensis* Marcos-García, Vujić & Mengual, 2007. Since species complexes and nominal species could not be unambiguously resolved using mitochondrial COI gene sequences, we selected a subset of 28 genomic DNA samples extracted from adult hoverflies to be analysed using ddRAD sequencing. We have generated 5131 loci which were further used to generate a Maximum likelihood (ML) tree and a coalescence-based species tree. Additionally, we performed Bayesian species delimitation analysis under a multispecies coalescent model to test species boundaries using the ML tree as a fixed guide tree, and to infer joint species delimitation and a species tree using unguided species delimitation. Unlike COI gene analyses, both the ML tree and the species tree generated using ddRAD data resolve species complexes as monophyletic with strong support values, and *M. quercetorum* and *M. legionensis* as separate from each other and from the other studied species. Bayesian species delimitation analyses support all tested species as separate from each other and the tree topology of the ML tree as the most optimal. Genome-wide data successfully disentangle confusing mitochondrial COI gene relationships among the species of the *M. bessarabicus* subgroup as a powerful tool in molecular taxonomy of closely related and cryptic species.

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Schwender

Hoverflies in Austria: How habitats shape diversity

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Keywords: Austria, *Brachyopa*, hoverflies, land use, monitoring, new records

Syrphidae, which are among the most important pollinator groups, are declining worldwide. At the same time, there are knowledge gaps on both their distribution and ecology. Here, we systematically investigated hoverflies across Austria to establish a baseline for long-term monitoring. Hoverflies were recorded at 50 sites in agricultural areas with ten randomly selected cross-transects (40x40x2m) per site. Each site was surveyed in a single year (40 in 2024, 10 in 2025) and sampled two or three times between April and August, depending on altitude. Within a sampling site, additional patches that seemed favourable for hoverflies (e.g., rich in flowers or structures) were studied. Furthermore, we investigated hoverflies, focusing on threatened and rare *Brachyopa* species and the potentially extinct *Hammerschmidtia ferruginea* at five protected sites. Overall, we found almost 50% of the hoverfly species that are currently known to occur in Austria. The most common hoverfly species at the agricultural sites were *Episyrphus balteatus*, *Sphaerophoria scripta* and *Eristalis tenax*. The species *Neocnemodon brevidens* was newly recorded for the country and further 48 records were new for some federal states. Differences in species diversity and abundances were found depending on the habitat: e.g. field margins and montane and subalpine meadows were rich in hoverfly individuals and species, whereas only few hoverflies were recorded in insect- and wind-pollinated cropland. Eight of the 13 *Brachyopa* species known for Austria were observed, but we did not record *H. ferruginea*. These results identify key habitats and priorities for hoverfly conservation.

Somà

Pollinator diversity along an altitudinal gradient in Costa Rica

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Keywords: altitudinal gradient, bee, Costa Rica, Diptera, Hymenoptera, hoverfly, pollinators

The change in abiotic conditions along an altitudinal gradient influences the composition of pollinator communities. In our study we evaluated the variation in pollinator species richness and diversity in a high-intensity agricultural area near the Irazú Volcano in Costa Rica. Pollinator communities were assessed ranging from 1,600 to 2,650 m a.s.l. The survey was conducted over a short period at the beginning of the dry season (December 2025 – February 2026). We established eight transects (250 m x 4 m) coupled in four pairs. Transects belonging to the same pair were placed at the same altitude and separated from the others by an elevational interval of 350 m. Along each transect all flowers-pollinators interactions were recorded. Moreover, all Diptera and Hymenoptera, excluding *Apis mellifera*, were collected for further laboratory identification. Land use was analysed considering a 500 m buffer around the midpoint of each transect. The four intermediate transects were surrounded by a simplified landscape with a higher prevalence of cultivated fields, while the lowest and highest transects were characterized by higher percentages of pasture and forest, respectively. The lowest percentage of (semi) natural habitats was therefore reached at medium altitudes. Considering counted and sampled specimens, we recorded 168 hoverflies, 257 other Diptera, 465 bees, 29 other Hymenoptera, 57 Coleoptera, 55 Lepidoptera and 4 Heteroptera. Preliminary taxonomic identification revealed 18 hoverfly species, 32 species of other Diptera, 28 bees species and 11 species of other Hymenoptera. Species richness declined, moving from the lowest to the highest transects for all the groups considered, without noticing an important decrease of their abundance.

Sommaggio

Old data, new information: *Syrphidae of Italy*, one tool to rule all knowledge of Italian hoverflies

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Keywords: biological data, Italian fauna, museum collections, species distributions, TaxonWorks

The limited accessibility and interoperability of biodiversity data continue to hinder our ability to document species distributions and understand regional fauna. This issue is particularly evident in diverse insect groups, where historical records, modern surveys, and museum holdings are often dispersed across institutions and data formats. Although Italy is the second European country in terms of recorded species richness, knowledge of its hoverfly fauna remains incomplete. Research on Italian Syrphidae advanced significantly in the second half of the nineteenth century thanks to authors such as C. Rondani and M. Bezzi, but—with few exceptions—was largely neglected for decades and has only recently regained momentum. In recent years, new faunistic surveys, ecological studies, and targeted collecting efforts have increased available data. Nevertheless, these data remain scattered across publications, private datasets, and museum collections, limiting their accessibility and reuse. The *Syrphidae of Italy* project, hosted in TaxonWorks, aims to overcome this fragmentation by aggregating all available information on Italian hoverflies into a single, unified platform. By mobilizing georeferenced occurrence data that are automatically shared with GBIF, the system contributes to reducing distributional knowledge gaps at both national and global scales. In addition to occurrence data, *Syrphidae of Italy* compiles information on species biology, habitat preferences, and ecological traits, and provides essential identification tools, including interactive keys specifically developed for the Italian fauna. Designed as a territory-focused, bilingual resource, it contextualizes global knowledge within the Italian framework. By integrating historical legacy data with modern research outputs, it offers a comprehensive and dynamic tool for current and future studies on Syrphidae.

Beyond genomics: Why morphology remains essential for syrphid phylogenetics

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Keywords: evo-devo approach, evolutionary trends, functional morphology, integrative taxonomy

The rapid expansion of molecular and genomic datasets has transformed Syrphidae systematics, resolving many long-standing relationships among major lineages. Within this framework, integrative taxonomy has become a central approach, although fundamental questions—such as how to weigh conflicting morphological and molecular evidence—remain unresolved. At the same time, the role of morphology in higher-level phylogenetic reconstruction appears to be diminishing, despite the long-standing use of a substantial set of structural characters. Yet our understanding of many morphological traits remains surprisingly incomplete. Critical aspects of internal anatomy, preimaginal stages, and the developmental pathways of major characters are still poorly investigated. This gap affects even widely accepted synapomorphies whose function, ontogeny, and variability have never been rigorously examined. A first emblematic case is the spurious vein, the presence of which is a hallmark of Syrphidae. Its evolutionary nature and developmental positioning within the anteroposterior wing compartments have been only marginally explored, leaving fundamental questions about its evolutionary origin within Diptera and phylogenetic significance unresolved. A second example concerns the basifemoral setal patches in Eristalini, traditionally treated as a defining synapomorphy. Despite their taxonomic relevance, their fine structure, functional role, and developmental basis remain largely unstudied. Moreover, their broader comparative context is poorly known, as similar structures in other Diptera have seldom been examined in detail. Addressing these gaps is essential for interpreting the evolutionary patterns emerging from increasingly detailed phylogenomic trees. Thus, even in the genomic era, morphology remains indispensable for integrating, validating, and contextualizing higher-level phylogenetic hypotheses in Syrphidae.

Ssymank

A German book project on European hoverfly genera: "Die Schwebfliegen Europas - Gattungen kennenlernen und bestimmen"

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Keywords: biology, conservation, Diptera, EUNIS habitats, EU pollinators, Europe, flower-visiting, Syrphidae genus key

Hoverflies are represented with 102 genera in Europa and a well-illustrated book on the genera, including keys in an up-to date version, both for beginners and for more advanced hoverfly specialists was so far missing. A German editor (Quelle & Meyer) contacted us already in 2019 to start working on this book and we now have a complete manuscript in the layout stage, publishing being planned in 2027. What are the main features, the focus of the book and experiences to share? A first general part sets a special focus on biology and ecology (life cycle, flower visiting, activity patterns, migration, etc.), with a systematic overview of the main habitats of hoverflies in Europe based on EUNIS habitats classification, as well as a dedicated part on observation, photography, collecting methods, with final chapters on conservation and recent developments in EU pollinator policy. The main part of the book includes two keys to the genera, a simplified one for beginners and a concise key, where all diagnostic features are illustrated. Then every genus is described in standardized fact sheets to cover systematically morphological characters, diagnostic features, ecology, and more. These fact sheets include live nature photos of a selection of hoverflies to well represent the variation within the genus. Maps are provided for each genus based on checklists and additional expert knowledge. Our poster will show the contents of the book, illustrate a genus factsheet, and give insights in the work and challenges encountered to accomplish this first German edition.

National Initiatives - Germany

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Germany is federally organized, it has 16 Federal States ("Länder") which are largely independent in implementation of nature conservation measures and management of protected areas, and a double legal implementation first at national and then at Länder level. Therefore, good national preparation and implementation examples are essential for success in pollinator monitoring and to stop pollinator decline. Some legal changes were implemented to address insects decline ("Insektenschutzgesetz"), and a new National Biodiversity Strategy is under way. At national level scientific background and methods are prepared to ease the way for Länder-implementation. A full revision of the German Habitat Manual under the EU Habitats Directive lists typical pollinator species for each Annex I habitat to be protected. In addition, we commented in detail on the EU Habitat Condition guideline both as part of the European Topic Centre and as German National Authority. EU Epic Fly expert training is planned to carry on later by the Environment Academies of the German Länder as a continuous education program in future. Other scientific work is in preparation to close gaps in hoverfly knowledge: A revision of the German checklist including literature review in 2027/2028 has started and a first German book on European hoverfly genera is almost ready to be published (poster). At the same time the National German Red list of hoverflies, published in 2011 is outdated and meanwhile incomplete and shall be renewed within the next two to three years, including a revision of selected museum collections. In conjunction with this large project we plan to close the gap of missing or difficult to find dispersed distribution data of hoverflies with a new German Mapping portal for Pollinators, namely hoverflies and wild bees. This mapping and observation portal is currently under way, programmed to fit to other German data portals by the German Red List Data Center, while scientific coordination is done by hoverfly experts. In parallel several national research projects are running or were recently launched to address 1) methodical standardization of bulk metabarcoding, 2) to optimize buffer zones against pesticide spill over into protected areas from adjacent arable crops and 3) to prepare the sampling sites for the EU Pollinator monitoring and conduct the first two years of EU pollinator monitoring at national level before the Länder take it over. Despite many new chances and a legal implementation of pollinator protection and monitoring under the EU Nature Restoration Regulation, the political ambitions to enlarge existing protected areas or to make urgently needed major changes in agricultural land-use happen are low and implementation will be a long-term challenge.

Taxo-Fly –Taxonomic resources for European hoverflies

Gunilla Ståhls

Finnish Museum of Natural History Luomus, University of Helsinki, Finland

The Taxo-Fly project (2021-2024) generated Taxonomic Resources for European hoverflies being made openly available on a public web platform. The Taxo-Fly team members generated descriptions and diagnoses, and compiled information on ecology and distribution for 927 hoverfly species of Europe. The data will be available as species and genus factsheets including high-quality digital images and distribution maps.

Taxonomic problems in the genus *Chrysotoxum* (Diptera: Syrphidae) in Europe

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Keywords: integrative taxonomy, hoverflies, mtDNA COI gene, nuclear ITS2 region

The genus *Chrysotoxum* (Diptera, Syrphidae) represents a widely distributed group of hoverflies, with 20 species recorded in Europe. Some currently recognized names likely encompass more than one species. The aim of this presentation is to highlight these taxa and address key taxonomic issues. The previously observed variability in *C. lunulatum* Brullé, 1833 suggests the presence of more than one species. Furthermore, as the result of our recent research, morphological differences have been observed between populations of *Chrysotoxum festivum* (Linnaeus, 1758), *C. vernale* Loew, 1841, and *C. elegans* Loew, 1841 from the Iberian Peninsula and those from the rest of Europe. Additionally, the Balkan endemic *C. orthostylus* Vujić in Nedeljković et al., 2015 shows variability across different parts of the peninsula. A similar pattern is found in *C. montanum* Nedeljković & Vujić in Nedeljković et al., 2015, when comparing populations from the Balkan Mountains, the Alps, and Central Europe. However, the previously published morphological diagnostic characters between *C. bicinctum* (Linnaeus, 1758) and *C. volaticum* Séguy, 1961 remain unclear. Thus, in order to gain a more comprehensive understanding of the diversity within this genus, molecular data including both 3′ and 5′ ends of the mitochondrial COI gene as well as the nuclear ITS2, were incorporated into cluster analyses, particularly addressing taxonomic challenges associated with *C. festivum*, *C. vernale*, *C. elegans*, *C. lunulatum*, and *C. bicinctum*.

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Revision of Western Palaearctic species of *Merodon geniculatus* group (Diptera: Syrphidae)

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Keywords: ITS2, molecular taxonomy, morphology, mtDNA COI gene, new species, nuclear 28S rRNA gene

The phytophagous hoverfly genus *Merodon* Meigen, 1803 (Merodontini) distributed in the Palaearctic and Afrotropical Regions, includes multiple species groups that harbour high levels of hidden diversity. The species group of *Merodon geniculatus* Strobl, 1909 currently comprises seven known Western Mediterranean and four species with Eastern Mediterranean distribution. Using an integrative taxonomic approach, combining four molecular markers (3′ and 5′ ends of the COI gene, 28S rRNA and ITS2), morphological and morphometric methods, we discovered five new species occurring in the West Mediterranean. Results revealed the presence of three additional closely related species to *M. geniculatus,* established here as *M. geniculatus* complex: *Merodon* sp. 1 (Balearic islands), *Merodon* sp. 2 (African Region Magreb), *Merodon* sp. 3 (Malta). One species related to the North African, previously cited as *M. eques* (Fabricius, 1805) in Europe and presented here as *Merodon* sp. 4. Additionally, one endemic species was found on Sicily and described here as *Merodon* sp. 5. The previously unknown female of *M. longispinus* Marcos-García, Vujić & Mengual, 2007 is found, while *M. amaryllidis* Villeneuve, 1934 is recognized as a junior synonym of *M. eques*. The distribution of the species of *M. geniculatus* group is discussed, and an identification key to males of all species of *M. geniculatus* group is created.

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Toselli

Evaluation of hoverfly (Diptera: Syrphidae) communities in contrasting agricultural landscapes using three different sampling methods

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Keywords: agriculture, entomological net, hoverflies, landscape, Malaise traps, Northern Italy, pan traps, transects

Hoverflies (Diptera, Syrphidae) are considered a key group, serving not only as pollinators but also as biological control agents and bioindicators. Although various monitoring techniques have been proposed, comparative studies evaluating their effectiveness in assessing hoverfly diversity across different levels of landscape complexity remain scarce. This research aims to compare hoverfly communities across two study areas in the Po Valley: the Partecipanza Agraria of Nonantola and the area of Staggia (San Prospero), both located in the province of Modena. The Partecipanza Agraria is characterized by a greater landscape complexity due to the presence of the Torrazzuolo ecological rebalancing area. The survey was conducted over seven months, employing three different sampling methodologies: Malaise traps, pan traps and entomological net transects, all applied monthly (except August) in both study areas. In total, 2,874 hoverflies belonging to 69 species were sampled. Malaise traps proved to be the most effective method for describing species richness, capturing 94.2% of the total species, whereas transects (50.7%) and pan traps (18.8%) were significantly less effective. The Partecipanza area showed higher species richness (65 species) compared to Staggia (46 species), however, this difference emerged clearly and significantly only through Malaise trap sampling. In addition, differences between Partecipanza and Staggia sites show that hoverfly communities are greatly affected by small-scale landscape. Particularly noteworthy, *Mallota fuciformis* and *Microdon mutabilis/myrmicae* were recorded, two species of conservation interest and new for the east Po Valley.

Tot

First record and morphological notes on the female of the rare and endangered species – *Paragus medeae* Stănescu (Diptera: Syrphidae)

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Keywords: diagnostic characters, female morphology, hoverflies, *Paragus medeae*, related species, steppe habitats

Paragus medeae Stănescu, 1991 (Diptera: Syrphidae) was previously known only from males. This rare species is considered endangered due to its very limited distribution and habitat specificity. It is currently known only from a few localities in Hungary, Romania and Serbia. The species inhabits open sandy steppe habitats with low grassy vegetation, typically found on dry, dune-like terrains of the Pannonian region, and is increasingly threatened by agricultural intensification, afforestation and habitat degradation. In this study, we report the first female of *P. medeae* from the Selevenjske pustare (northern Serbia), collected using yellow pan traps in September 2024 and provide morphological characters that distinguish it from related species. The female of *P. medeae* is characterized by a short and robust, predominantly orange abdomen bearing a pair of black spots on the tergites. Its overall habitus closely resembles *P. strigatus* Meigen, 1822, and *P. oltenicus* Stănescu, 1977. However, it can be distinguished from *P. strigatus* by its entirely yellow femora (partially black at base in *P. strigatus*) and from *P. oltenicus* by the black hind tarsi and the presence of a black band at the posterior margin of sternite 3 (all tarsi and sternites yellow in *P. oltenicus*). This study provides the first information on the female morphology of *P. medeae* and enhances our understanding of its diagnostic characters, distribution and ecology.

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Tot

TETTRIs - Digitizing Balkan pollinator diversity: The Balkan PolliS project

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The Balkan Peninsula is recognized as one of Europe's biodiversity hotspots, but data on pollinators—hoverflies and wild bees— have been limited due to fragmented regional records. The Balkan PolliS project, developed within the Horizon Europe TETTRIS framework, addresses this gap through integration and digitization of nine pollinator sub-collections held by national and academic institutions across Serbia, Greece, Slovenia, and Montenegro. Through this initiative, a comprehensive dataset comprising 618 hoverfly species and over 938 wild bee species has been digitally indexed and made available in GBIF-compatible formats. To support taxonomic research, the project established a high-resolution virtual reference collection of type material for hoverflies occurring on the Balkan Peninsula, together with a regional DNA barcode library designed to support species identification. The project's results strengthen the network of regional institutions and provide a basis for long-term monitoring and conservation of pollinators, both in the Balkans and across Europe.

Uhler

From design to implementation: Insights from six years of hoverfly (Diptera: Syrphidae) monitoring

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Keywords: automated monitoring, Malaise trap, orchard meadows, pan trap, Syrphidae

Recent reports of widespread insect declines have emphasized the need for standardized, long-term monitoring programs capable of providing reliable estimates of population trends, identifying potential drivers of declines, and designing conservation strategies. In this context, particular attention is given to taxonomic groups that contribute to key ecosystem services in agricultural landscapes. The MonViA project (Monitoring of Biodiversity in Agricultural landscapes in Germany; https://www.agrarmonitoring-monvia.de/en/) was established to address these challenges by developing and implementing a comprehensive, large-scale monitoring framework. Within this initiative, the subproject “nützLink” focuses on hoverflies (Syrphidae) as indicator organisms to assess the ecological condition of agricultural systems across broad spatial scales. Over the first six years, a standardized monitoring approach was developed and implemented using meadow orchards as stable habitat patches embedded within the surrounding agricultural landscape matrix. Sampling of hoverfly communities began in 2020 and combined conventional insect sampling methods, including Malaise traps, pan traps and sweep netting, to ensure broad and complementary coverage of the community. In addition to species identification, selected trait-based parameters were assessed, including body size as a proxy of fitness in two aphidophagous species. This trait-based component aimed to complement community-level data with insights into potential functional responses to environmental conditions. Here, we present the conceptual framework and implementation of the monitoring program, including the evaluation of sampling methods and their capture characteristics. We further provide an overview of the first six years of monitoring, highlighting seasonal and multi-year dynamics and the ongoing integration of new methodological approaches to enhance future monitoring.

Acknowledgements: We would like to thank all owners and managers of the orchard meadows for kindly allowing us to work on their property.

New data on Syrphidae from Velebit Mountains, Croatia

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Keywords: Croatia, new species, Syrphidae, Velebit

The Velebit is the largest mountain range in Croatia stretching 145 km along the Adriatic Coast from Senj to the source of the Zrmanja river northwest of Knin. It includes the National Park North Velebit (NP Sjeverni Velebit) and the National Park Paklenica in the south. It is a calcareous mountain range with several peak above 1500 meter of altitude, up to 1758 meter of the Vaganski vrh. The highest parts of the Velebit are covered with pine, beech and spruce forest alternated with (sub)alpine grasslands and at low altitudes Mediterranean pine forest and common and oak-hornbeam forest. Despite the presence of such a diversity of habitats, and its accessibility throughout the national parks, its hoverfly fauna remains remarkably understudied. The first author visited the Velebit in the second half of June in 2024 and 2025 and the second author in early August 2022. In total, we collected 101 species of hoverflies including 19 previously unrecorded taxa for Croatia according to the European country-species list provided by Reverté *et al*. [1]. A detailed list of species will be presented.

References

[1] S. Reverté *et al.* (2023) National records of 3000 European bee and hoverfly species – a contribution to pollinator conservation. Insect Conservation and Diversity, 16: 758–775. https://doi.org/10.1111/icad.12680 [Species-country list of hoverflies and bees in Supplementary Material 2]

Drinking site surveys yield a distinct hoverfly assemblage enriched in arboreal species

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Keywords: arboreal Syrphidae, community composition, drinking behaviour, monitoring

Effective pollinator monitoring has become an established policy priority across Europe, with community sampling — whether by transect walks or trapping methods — expected to be as much as possible both inclusive and taxonomically unbiased. Forest habitats, which support over 60% of European hoverfly (Syrphidae) diversity, pose a particular challenge in this regard, as canopy-dwelling behaviour is likely widespread among hoverflies, rendering a poorly known proportion of this fauna likely difficult to access using standard sampling methods. Here we evaluate whether sampling at water sources used for drinking provides access to this elusive arboreal fauna, and could affect monitoring results. We compare the species composition of hoverflies attracted to drinking sites with those recorded by concurrent transect walks and Malaise trapping in the area surrounding the drinking site. Drinking site surveys yielded a compositionally distinct assemblage, with a substantially higher proportion of presumed arboreal species than either conventional method. This pattern is consistent with the hypothesis that arboreal and canopy-dwelling species are systematically undersampled by ground-level techniques, with potential consequences for trend monitoring in forests. We advocate that pollinator monitoring in forests should explicitly account for potential sampling biases arising from drinking behaviour, by documenting the presence of suitable drinking sites and recording pollinator visits to these resources where observed. Ideally, these practices would be formalised into a standardised, reproducible protocol.

Van de Meutter

A review of the West-Palaearctic species of the *Myolepta vara* subgroup (Diptera: Syrphidae) with description of four new species

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Keywords: DNA barcoding, high genetic variability, new species, Syrphidae, thermophilous oak forest

An integrative approach, combining morphology and extensive DNA barcoding, is used to revise the *Myolepta* species in Europe and the Transcaucasus. The results revealed the presence of four undescribed species within the *Myolepta vara* subgroup. Besides descriptions of the new species, we provide an identification key to the European members of the *M. vara* subgroup, designate a neotype and describe *M. vara* (Panzer, 1798). The DNA barcoding study supports the morphospecies concepts, but reveals some additional highly differentiated, discrete genetic clades within *M. obscura* Becher, 1882 and *M. vara*. The inter- and intraspecific genetics of the *M. vara* subgroup correlate with the biogeographic patterns of recurrent isolation of their habitat, deciduous oak *Quercus* spp. forest, during glacial periods. All four new species occur much localized and in low numbers, and are restricted to old-growth oak forest fragments in the Mediterranean, Pontic or Hyrcanian regions. Old-growth Mediterranean oak forest faces many threats currently topped by climate change, threatening also its related *Myolepa* fauna. The type locality of two new species, the ca. 100.000 ha Dadia forest in Greece, was largely destroyed by a wildfire in 2023.

A review of the species of the *Platycheirus albimanus* subgroup in Europe, with focus on the species *P. ciliatus*, *P. marokkanus* and *P. muelleri* (Diptera: Syrphidae)

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Keywords: hoverflies, identification key, Palaearctic region, taxonomy

Within Europe, several poorly defined taxa of the *P. albimanus* subgroup — black *Platycheirus* species with silvery paired abdominal maculae and conspicuous tufts of pile on the profemur — continue to obscure the real distribution and diversity of the subgroup. The weakly diagnosed *P. muelleri* (Marcuzzi, 1941) of which the type is considered lost, has been ignored in all identification keys of the genus, yet is regularly reported without clear definition of its species concept. This is further complicated by its absence from the diagnosis of the later described, very similar *P. marokkanus* Kassebeer, 1998. Recently another very similar species, *Platycheirus ciliatus* Bigot, 1884, previously recorded from the Nearctic and the Russian Far East, has been reported from Europe. However, again for this species, a diagnosis to similar looking European species remains unclear. To resolve this accumulating taxonomic confusion, we designate and redescribe a neotype for *P. muelleri* and distinguish it from similar taxa. Our study further discloses that: 1) the type of *P. ciliatus* is still present in the Oxford Museum (OUMNH) and represents *P. albimanus*; 2) the species currently considered to be *P. ciliatus* in the western Nearctic is a distinct, already named species; and 3) the species named *P. ciliatus* from the Russian Far East likely represents an undescribed taxon. Additionally, DNA barcodes and an updated key for all Palaearctic species of the *P. albimanus* subgroup are given.

Defining local Syrphidae species richness: Insights from a unique long-term monitoring project

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Keywords: garden, long-term monitoring, species richness estimate, Syrphidae

Determining the timescale and effort required for species richness to reach saturation at a given site remains a central challenge in community ecology, but is also central in our aim to monitor and conserve pollinator diversity. We address this using a uniquely intensive long-term dataset: 20 years of standardized random-walk surveys of Syrphidae in a residential garden in Belgium, conducted across 1,300 sampling days and yielding 18,600 records. Hoverfly richness accumulated to 203 species over this period, and as yet continues to accrete. Species richness estimators applied to subsets of these data consistently and dramatically underestimated true richness, regardless of the temporal window examined. To disentangle the processes driving this continued accumulation, and possibly explaining why estimators underestimate richness, we compare local species composition with that of the broader regional fauna, analyse species-level ecological traits, and examine temporal occurrence patterns. This approach allows us to estimate the relative contributions of long-range dispersal and climate-driven range expansion and contraction to local community composition and assembly. Our results challenge common notions of the local community as a bounded, equilibrial unit, and reveal the profound combined effects of spatial and temporal dimensions underlying site-level species richness.

van Steenis W.

Relevance of observation probability for interpretation of transect counts of hoverflies (Diptera: Syrphidae)

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Keywords: monitoring, nature policy, Netherlands, pollinators

Pollinators are becoming increasingly important for nature management and nature policy in Europe. Consequently, pollinator monitoring is receiving growing attention. For hoverflies (Diptera: Syrphidae), transects are often used for such monitoring activities. However, interpreting transect data requires a thorough understanding of observation probability, that is the chance of detecting a species when it is present at the location. Transect monitoring has been carried out at Nijenrode estate in The Netherlands since 2021, yielding nearly six years of standardized data. In this presentation, I discuss several aspects of observation probability, based on total species observed per year, and on a comparison of counts within the same month. Preliminary results: each year 8-12 counts were conducted, spread unevenly over the months March-September. Per year, 49–64 species were counted, adding up to 102 species in total, with a Chao2 number of expected species of 124. So with 12 counts in a year hardly half of the expected species were recorded. Only 29 species were recorded every year. In 2026 6 counts were conducted between April 6th and May 2nd (counts continuing after submission of abstract). Per day 23–32 species were counted, adding up to 59 species. So per day hardly more than half of the observed species were counted. And, surprisingly, the Chao2 number of expected species was 122, almost identical to the before mentioned 124 species.

Policy recognition of saproxylic hoverflies (Diptera: Syrphidae) and their key habitats in Serbia

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Keywords: deadwood, forestry, hoverflies, microhabitats, old forests, veteran trees

Veteran trees provide essential resources for saproxylic insects by supporting microhabitats such as hollows, decaying wood, and sap runs. Despite their ecological importance as indicators of ecosystem quality, the recognition of saproxylic hoverflies and their habitats in Serbian legislation and policy documents has not yet been systematically evaluated. A total of 18 documents related to environmental protection, forestry, and management of protected areas were analysed using a qualitative and quantitative content analysis. The occurrence of key terms ('deadwood', 'old tree', 'veteran tree', 'hoverflies', 'saproxylic insects' and 'microhabitats') was coded based on explicitness analysis, and used to calculate a policy visibility score (VS; 0-1). In Serbia, 81 saproxylic hoverfly species have been recorded, including 15 protected and eight strictly protected species. Three species (*Chalcosyrphus rufipes, Psilota nana, Sphegina sublatifrons)* are classified as endangered on the European Red List of Hoverflies, with unsustainable forest management identified as the primary threat. Hoverflies are explicitly mentioned in three documents; the establishment of Prime Hoverfly Areas (PHAs) is recognised as a conservation measure, but has not yet been incorporated into national legislation. The overall policy visibility was low (VS=0.236), indicating limited recognition of saproxylic hoverflies and their habitats. The term 'veteran tree' appears in a biodiversity-related context in one document, but its definition remains unclear. Old forests are not recognised as priority conservation habitat type in Serbian legislation, compared to European conservation frameworks such as the Habitat Directive and the Biodiversity Strategy for 2030. Although deadwood is recognised as an indicator of forest biodiversity, it occurs in only 16.7% of biodiversity- and conservation-related contexts, and only one document specifies a minimum quantity of deadwood per unit area. These findings indicate the necessity for amending Serbian legislation and policy, highlighting the need for clearer terminology and stronger conservation measures for saproxylic hoverflies and their habitats.

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Decoding species boundaries within the subgenus *Convocheila* Barkalov, 2002 (*Cheilosia* Meigen, 1822): Molecular markers distinguishing two evolutionary lineages

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Keywords: COI, molecular taxonomy, nuclear markers, species groups

The hoverfly genus *Cheilosia* Meigen, 1822 (Eristalinae: Rhingiini) is amongst the largest genera within the family Syrphidae, comprising approximately 454 described species. The genus is currently subdivided into thirteen subgenera. In the European region, including Turkey, the subgenus *Convocheila* Barkalov, 2002 is represented by four described species: *Cheilosia cumanica* Szilády, 1938; *C. hypena* Becker, 1894; *C. laticornis* Rondani, 1857; and *C. paralobi* Malski, 1962. Our analyses reveal two well-supported species groups within this subgenus: one cluster comprising *C. hypena + C. cumanica*, and another cluster with *C. laticornis + C. paralobi + C.* aff. *laticornis.* Both mitochondrial (COI) and nuclear (28S rRNA and ITS2) sequences datasets recover two distinct clades corresponding to these groups. While COI gene sequences exhibit haplotype sharing among different species within groups resulting in ambiguous species boundaries, nuclear markers successfully delimitate species according to morphology within subgenus *Convocheila*. Furthermore, wing morphometric analyses corroborate the observed divergence between the *C.* aff. *laticornis* population from Turkey and the European populations of *C. laticornis*.

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Early adult exposure to pesticide cypermethrin increases wing fluctuating asymmetry in *Eristalinus aeneus* (Scopoli, 1763)

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Keywords: adult exposure, developmental instability, ecotoxicology, geometric morphometrics, sublethal effects

Research on Fluctuating Asymmetry (FA) in hoverflies (Diptera: Syrphidae) has primarily focused on developmental stress during their immature stages, establishing a connection between FA and developmental instability. However, the effects of environmental stressors on early adulthood have yet to be explored, and this study marks the first effort to assess these impacts in young adult hoverflies. In this study, we examined whether early-life contact exposure of adults to the pesticide cypermethrin affects wing FA and, consequently, individual fitness in *Eristalinus aeneus* (Scopoli, 1763). A total of 125 adults aged 1 to 4 days after emergence were analysed, including a non-treated control group and two treatment groups exposed to different concentrations of cypermethrin: C1 (0.095 µg/µL) and C2 (0.047 µg/µL). Two microliters of the solution were applied to the dorsal side of the thorax using an automatic pipette. Geometric morphometric analysis of wing shape revealed a statistically significant increase in FA in the higher cypermethrin concentration group (C1), while the lower concentration group (C2) exhibited slightly elevated FA compared to the control, although not statistically significant. Interestingly, centroid size analysis showed that individuals in the C1 group had significantly larger wings than those in both the C2 and control groups, which did not differ from each other. These results indicate that pesticide exposure during early adult life can negatively affect wing shape and size, as reflected by increased FA, potentially impairing flight performance and other fitness-related traits. Our findings highlight the importance of considering adult-stage exposure in ecotoxicological studies and support the use of FA as a sensitive biomarker of environmental stress in hoverflies.

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Vujadin

A new deal for pollinators for the EU: Knowledge, actions, monitoring

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A dramatic decline of European wild pollinator populations in recent decades, including hoverflies, has prompted urgent calls, in particular by scientists and civil society, for a decisive EU action to tackle and reverse the decline by 2030. In 2018, the European Commission adopted the first-ever EU strategy to tackle this problem – the EU Pollinators Initiative – with an objective to coordinate and strengthen actions across EU Member States. This policy instrument has since aimed at improving knowledge about the decline, tackling its causes and mobilising the society-at-large. Building an actionable knowledge base – i.e. knowledge underpinned by high-quality data of adequate spatial and temporal resolution that enables effective policy actions - has been the cornerstone of the Initiative. This effort has manifested itself primarily through an integrated monitoring framework – a systematic approach to collect data on i) the state of key pollinator groups, ii) causes of their decline and iii) the impacts of policy actions. More impactful research and assessment initiatives could then build up on this knowledge base, such as projects launched under the EU framework programmes for research, in particular the Horizon Europe, or the European Red List. In 2024, the Initiative's target to reverse the pollinator decline by 2030 has been enshrined in the EU law through the Nature Restoration Regulation. The Regulation also stipulates obligatory monitoring of pollinator populations to ensure a reliable assessment of the target. For this purpose, in 2025 the Commission established a scientifically robust, standardised monitoring method – EU Pollinator Monitoring Scheme – which EU Member States are set to deploy on the ground by Spring 2027.

Review of genus *Sphaerophoria* (Diptera: Syrphidae) from the Balkan Peninsula

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Keywords: diagnostic character, identification, illustration, male genitalia

Sphaerophoria species are known to be difficult to distinguish as they share a common external morphology. In many cases, the only reliable diagnostic characters are the structures of the male genitalia. Therefore, illustrations of these structures are essential tools for the identification of most *Sphaerophoria* species. According to recent literature, the genus *Sphaerophoria* comprises 21 species in Europe, 13 of which have been recorded from countries of the Balkan Peninsula. While some of the most comprehensive identification keys include illustrations of male genitalia, presently there is no published identification key that includes illustrations of male genitalia for all Balkan and European *Sphaerophoria* species. This study represents the first step towards a comprehensive revision of the genus in Europe, aiming to provide standardized illustrations of male genitalia for all European species, beginning with those from the Balkan Peninsula. We present genitalia illustrations for 12 species.

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Species delimitation in *Eumerus etnensis* and *E. purpurariae* (Diptera: Syrphidae): An integrative approach

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Keywords: hoverflies, integrative taxonomy, molecular data, wing morphometrics

The genus *Eumerus* (Diptera, Syrphidae, Eristalinae: Merodontini) is a widely distributed group of hoverflies with numerous unresolved taxonomic issues. One of these concerns the distinction between *Eumerus etnensis* van der Goot, 1964 and *E. purpurariae* Báez, 1982. Both species are reported from the European fauna, although their status as separate species has been questioned; for example, larval morphology attributed to the former was originally described under the name of the latter. *E. etnensis* occurs in the south-west Mediterranean region, while *E. purpurariae* is endemic to the Canary Islands. Adult morphology is highly similar in both taxa, with only subtle differences noted by Smit *et al.* [1], who reinstated *E. purpurariae* as a valid species. However, a detailed examination of multiple specimens of both taxa revealed variability in the diagnostic characters. To better understand the relationship between Mediterranean and Canarian populations, we applied an integrative approach combining morphological, molecular, and wing morphometric data. The results support the recognition of two distinct, closely related species. Additionally, the status of *E. lunatus* (Fabricius, 1794) is addressed, and its potential synonymy is discussed.

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Safeguard - Safeguarding European wild pollinators

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Safeguard (September 2021 – February 2026) was a Horizon 2020 project addressing the decline of wild pollinators in Europe through an integrated research framework combining empirical studies, cross-scale analyses, and policy-relevant perspectives. The project aimed to improve understanding of the drivers and impacts of pollinator decline and to support evidence-based conservation and management. Key components included the reassessment of pollinator status and trends, analysis of multiple and interacting environmental pressures, and evaluation of conservation interventions across habitats and spatial scales. Standardized field studies were implemented across a network of sites in multiple European countries, applying harmonized sampling protocols to enable cross-site comparisons of pollinator communities and their responses to environmental conditions. Within this framework, different sampling campaigns addressed specific objectives, including baseline assessments, the effects of emerging pressures such as traffic, and pollinator responses in urban systems. In northern Serbia (Vojvodina), pollinators (including hoverflies) were sampled across these study components, with environmental and habitat variables recorded in parallel. These efforts contributed to a more comprehensive understanding of pollinator dynamics and provided a basis for more effective and coordinated responses to pollinator decline across Europe.

A world list of Syrphidae genera (Insecta: Diptera)

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Keywords: etymology, genus gender, Greek, ICZN rules, Latin

A world list of Syrphidae genera is presented. The list is based primarily on data from Diptera.org [1], supplemented and corrected using unpublished material. Genera are arranged alphabetically, and each entry includes taxonomic placement, etymology, gender, biogeographic distribution, estimated species numbers and synonyms. Following publication, the final list will be made available on https://syrphidae.com/ and will be continuously updated. In total, 304 valid genera are presented, together with 80 supposed subgenera and species with possible incorrect gender endings.

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Hoverflies of Hong Kong

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Keywords: *Eristalinus*, faunistic study, Hong Kong, species distribution modelling, *Spheginobaccha*

The faunistic data on the hoverfly fauna of Hong Kong, including checklist and distribution, have not been previously researched in detail. In this study, the literature, biodiversity surveys, museum specimens, amateur observation records and personal photographic records were reviewed. Field surveys were conducted from 2021 to date to record occurrence throughout the territory and collect specimens, using hand-nets and various types of traps. Preliminary results revealed that around 70 hoverfly species occur in Hong Kong. More than half of the species belong to the subfamily Eristalinae, with a substantial proportion (11 out of 40) from the genus *Eristalinus,* although some identification issues remain. Approximately one-third of species belong to the Syrphinae, displaying higher diversity during the colder months from November to January. Field surveys revealed more than 10 species previously unrecorded in Hong Kong, including an unidentified member of tribe Cerioidini exhibiting diagnostic characteristics of both *Monoceromyia* and *Sphiximorpha*. The life cycle of the primitive hoverfly species *Spheginobaccha macropoda* is poorly documented, even though it is one of the commonest of Hong Kong's hoverflies. Observations in this study suggest a univoltine life cycle, with adult emergence occurring in late spring over the whole territory of Hong Kong and preferred oviposition sites in leaf litter. Species distribution modelling via the Maxent algorithm was used to understand the pattern of geographical distribution in relation to environmental factors. Nearly 5,000 observation records from field surveys and iNaturalist observations since 2006 were consolidated. Distribution models for each species were created. Some congeners, for example *Phytomia errans* and *Phytomia zonata*, showed distinct environmental preferences, particularly in relation to temperature and altitude. Key environmental variables influencing species distribution were assessed.

Zavatta

Differential compatibility of essential oil nanoemulsions with aphid predators: High selectivity towards Syrphidae compared to Ladybugs and Lacewings

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Keywords: *Adalia bipunctata*, biopesticide, *Chrysoperla carnea*, IPM, *Myzus persicae*, predators, *Sphaerophoria rueppellii*, toxicity bioassay

Control of aphid pests for the defence of commercial crops is crucial, as their demand increases over the years. Since traditional pesticides have been widely demonstrated to have critical effects on humans and the environment, great attention should be paid to alternative methodologies. Integrated Pest Management (IPM) combines biological, physical, and chemical methods sustainably, emphasizing biological and low-impact approaches such as biopesticides and natural predators. We tested four essential oils (EOs): *Laurus nobilis* L. *Cupressus sempervirens* L., *Pinus halepensis* Mill. and *Santolina chamaecyparissus* L. against the green peach aphid *Myzus persicae* (Sulzer, 1776) and three natural enemies: *Sphaerophoria rueppellii* (Wiedemann, 1830), *Adalia bipunctata* (Linnaeus, 1758), and *Chrysoperla carnea* (Stephens, 1836). Mortality rates highlighted *L. nobilis* as the most effective EO against the aphid, while the syrphid *S. rueppellii* was proved to be immune to all EOs. After identifying the most effective EO and the most resistant predator, a second assay was carried out on plants. Laurel and pine EO nanoemulsions were sprayed on leaves of aphid-infested *Capsicum annuum* L. plants, and *S. rueppellii* larvae were subsequently introduced to assess the combined effects on the predator over time after treatment. The results showed that EO nanoemulsions alone reduced the aphid population to zero in only a small fraction of plants (15%), while this rose to 60% when combined with the predator. Furthermore, our findings suggest the potential to further increase mortality rates by optimizing the timing of predator introduction following the nanoemulsion treatment. These results are promising for identifying optimal timing of product application and predator release in the framework of an IPM strategy.

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Dutch experiences with monitoring hoverflies (Diptera: Syrphidae) and bees (Hymenoptera: Apoidea)

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Keywords: Diptera, European, Netherlands, Syrphidae, transect

In anticipation of the European monitoring program, The Netherlands already started a monitoring scheme for bees and hoverflies in June 2025. Professionals from EIS Kenniscentrum Insecten surveyed 78 sites monthly for two hours (June – August), of which 34 were selected according to the stratified randomized LUCAS protocol. During each visit, the number of specimens per species was counted along transects. The transects were limited in time (one hour in total), not in length, and were walked once, counting both bees and hoverflies. Hence, the registration protocol used differs in some details from the European protocol. In the remaining time, an attempt was made to record as many species as possible. In total, we recorded 159 bee species and 119 hoverfly species. At the LUCAS sites, 97 species were recorded for both groups each. Based on the results from three rounds covering 34 LUCAS sites, we estimate that at 50 LUCAS sites over five monthly sampling rounds, 28 bee species and 33 hoverfly species would be represented by at least 25 specimens each. This corresponds to less than 10% of the total Dutch fauna. These low numbers reflect the very limited biodiversity in Dutch agricultural landscapes, which accounts for 70% of the LUCAS points. Other complicating factors for the analysis, such as the influence of weather, time of day, the choice for fixed transect locations throughout the season, are discussed. The efficiency of this elaborated monitoring scheme in establishing trends per species is low. Application of the formal European protocol will lead to even poorer results and much higher expenses.

Notes